

CAUARANE - COEROENI BELT- THE MAIN TECTONIC FEATURE OF THE CENTRAL GUYANA SHIELD, NORTHERN AMAZONIAN CRATON

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Abstract - New geological data allied to a review of the information made available by pioneering work on the shield led to the proposition of the Cauarane-Coeroeni belt, a sinuous NW-SE/NE-SW/NW-SE mega structure connecting amphibolite to granulite facies metamorphic supracrustal rocks of the Coeroeni Group (Surinam), Kanuku Complex (Guyana) and Cauarane Group (Roraima State, Brazil). The belt divides the shield into two contrasting domains and represents a major tectonic feature evolved in response to the amalgamation of Orosirian magmatic arcs and pre-existing Rhyacian juvenile continental blocks at around 1.995 Ga (?). The Cauarane-Coeroeni belt is bordered to north by post-collisional 1.98-1.96 Ga high-K calc-alkaline I-type and also A-type volcano-plutonic rocks, and to south by 1.95-1.93 Ga A-type foliated granites and charnockites and high-K, calc-alkaline, I-type granitoids and augen-gneisses.

Introduction - The Guyana Shield, northern Amazonian Craton, is one of the least studied Precambrian areas in the world and its tectonic evolution remains a matter of discussion. New geological mapping and geochemical and geochronological data allied to a review of the information made available by pioneering work on the shield, led to the proposition of the Cauarane-Coeroeni belt, a sinuous NW-SE/NE-SW/NW-SE mega structure characterized by high grade supracrustal rocks (Fraga et al., 2008) (Fig.1). The belt divides the shield into two contrasting domains. Preserved juvenile Rhyacian (2.22-2.08 Ga) granite-greenstone terrains and Archean blocks and Rhyacian terrains partially recycled at around 2.07-2.03 Ga, occur in the northern domain. In the southern domain, basement either consists of rock units younger than 1.88 Ga, or has been significantly obliterated by extensive felsic magmatism in the 1.89-1.81 Ga interval during the Uatumã Event (Fraga et al., 2009 and references therein).

Part of the Cauarane-Coeroeni belt has already been proposed by Kroonenberg (1976) as Central Guyana Granulitic Belt (CGGB) and confirmed by Berrangé (1977). However, as pointed out by Delor et al. (2003), Gibbs & Barron (1993) did not consider the link between the Kanuku and Coeroeni units as proposed by Kroonenberg (1976), and reinterpreted the CGGB as a straight NE-SW structure extending from Suriname to Roraima State in Brazil. The CGGB (Fig.1, inset) has been prolonged to southwest in the northern part of Amazonas State, Brazil (Lima et al., 1982) and interpreted as a major Paleoproterozoic tectonic feature of the shield (Gibbs & Barron, 1993; Fraga et al., 1998; Reis et al., 2003). However, Fraga (2002) pointed out that the basement rocks and the high temperature foliations that define the belt along its north-eastern, central, and south-western part, were developed during different periods of the Paleoproterozoic evolution of the shield, indicating that the CGGB is not a coherent structure.

Fraga (2002) presented a geological sketch map of the Guyana Shield illustrating a sinuous belt of high grade supracrustal rocks (named Cauarane-Coeroeni belt by Fraga et al., 2008) corresponding to the main tectonic feature of the central part of the shield. Delor et al. (2003) has also mentioned a sinuous structure, named Roraima-Kanuku-Coeroeni belt, including not only high grade supracrustal rocks, but also charnockites. However, the use of the term Roraima to denominate the belt as proposed by Delor et al. (2003) is not recommended as it refers to the Roraima Supergroup, including Paleoproterozoic sedimentary rocks.

The Cauarane-Coeroeni belt - The Cauarane-Coeroeni Belt corresponds to a NW-SE/ENE-WSW/NE-SW tectonic feature connecting continuous exposures of amphibolite to granulite facies metamorphic supracrustal rocks. The NW-SE oriented Coeroeni Group to east, in Surinam, prolongs to the Kanuku Complex disposed in an ENE-WSW to NE-SW direction, in Guyana, which in turn connects to the NE-SW to NW-SE Cauarane Group to west, in Roraima State, Brazil. The belt can be traced farther northwest into the Parima region, where discontinuous exposition areas of the Aracaça paragneiss disposed in the NW-SE direction are tentatively correlated to Cauarane-Coeroeni belt. The

NW-SE/ENE-WSW/NE-SW trend of the high grade supracrustal belt largely fits to the major lineaments as observed from aero-magnetic and radar imagery.

The Coeroene, Kanuku, Cauarane and Aracaça supracrustal sequences comprise pelitic and quartz-feldspathic migmatitic paragneisses, with subordinate calc-silicate rocks, amphibolites, metacherts, quartzites, BIFs and metamorphosed mafic and ultramafic rocks (plus dolomitic marble in the Coeroene Group). The rocks are polyfolded and were syn-kinematically metamorphosed under high grade conditions and low to moderate pressures (Berrangé, 1977; Kroonenberg, 1976; Luzardo & Reis, 2001; Riker et al., 1999). A subsequent static high grade metamorphic phase has been also characterized (Berrangé, 1977; Kroonenberg, 1976) and related to extensive granitic plutonism.

The 2.038 Ga U-Pb SHRIMP age reported for detrital zircon of a Cauarane paragneiss constrains the maximum age for the sedimentation of the unit (Santos, 2003). In Roraima the polyfolded supracrustal rocks occur as xenoliths inside non deformed I-type granitoids dated at 1.98, constraining the minimum age of the supracrustal unit. Concerning the age of metamorphism, the available data do not support a definitive proposition. A recently obtained 1995 ± 4 Ga (U-Pb SHRIMP age on monazite) of an S-type granitic body, related to the migmatitic paragneisses is preliminarily interpreted as the metamorphic peak of the syn-kinematic metamorphism (Fraga et al. 2008). An age of 1.969 ± 4 Ga (U-Pb SHRIMP, Santos, 2003) for a migmatitic paragneiss of the Cauarane Group is tentatively interpreted as reflecting the static metamorphism.

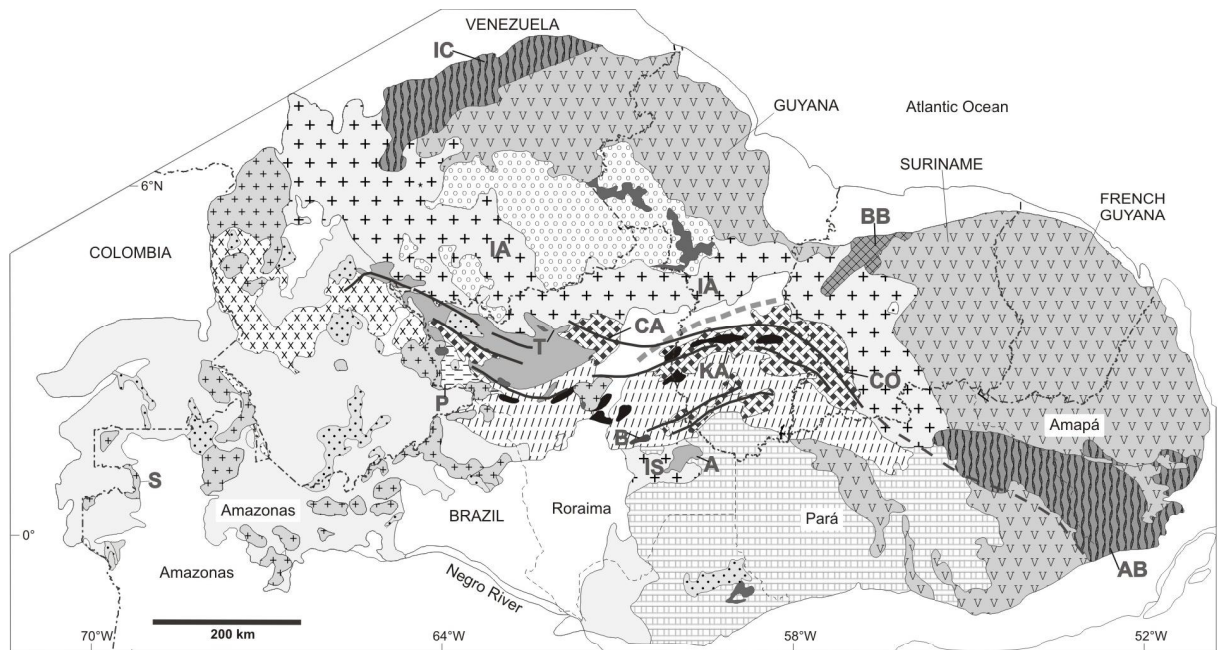
Extensive high-K calc-alkaline I-type and also A-type volcano-plutonic rocks, with ages mainly in the 1.98-1.96 Ga interval, border the Cauarane-Coeroene belt to the north and lack the deformation and high grade metamorphism recorded in the belt. 1.97-1.96 Ga high-K calc-alkaline I-type and S-type granitoids (Almeida et al., 2007) also occur far south of the supracrustal belt. The Cauarane-Coeroene belt is bordered southward by 1.95-1.93 Ga A-type foliated granites and charnockites recording syn-kinematic emplacement in deep crustal levels and also high-K, calc-alkaline, I-type granitoids and augen-gneisses. A lens of orthogranulite dated at 1.94 Ga (Santos, 2003) also occurs south of the Cauarane-Coeroeni belt. In Roraima, fragments of a 2.03 Ga old crust corresponding to TTG associations and dominantly low-K calc-alkaline rocks of the Anauá Complex and Trairão Suite, have recently been identified in the proximities of the Cauarane-Coeroeni belt and in the block south of the belt and have been interpreted as remnants of magmatic arcs (Fraga et al., 2009 and references therein). It is accepted that these 2.03 Ga terrains prolong to the western Roraima state.

Tectonic discussion - The evolution of volcanic arcs and active continental margins prevailed in the domain north of the Cauarane-Coeroeni belt in the 2.11-2.22 Ga period. In the Amapá block collision related granulite-facies metamorphism occurred at about 2.10-2.09 Ga, and migmatization at about 2.06-2.04 Ga (Rosa-Costa et al, 2006). High grade metamorphism (and also charnockitic magmatism) occurred at 2.06-2.05 Ga in the Bakhuis belt (Delor et al., 2003). In the Imataca complex collision related high grade metamorphism at 2.05-1.98 Ga (Tassinari et al., 2004) have been characterized. We propose that the ongoing of the collisional process recorded in the Imataca Complex resulted in the switch of the site of the subduction zones and orogenic processes to south. At this stage, the Orosirian (2.03-2.02 Ga) Anauá and Trairão magmatic arcs developed at the border of recently built Rhyacian blocks and were then subsequently amalgamated. It is proposed that the Cauarane-Coeroeni belt records this process of amalgamation, represented by high grade metamorphism and polyfolding of the supracrustal rocks and generation of syn-collisional S-type granites (at around 1995 ± 4 Ga?). The evolution of Cauarane-Coeroeni "basin" is assumed to be related to an active continental margin. Riker et al. (1999) admitted a back arc setting for the Cauarane Group. After the collisional stage the Cauarane-Coeroeni belt was submitted to rapid exhumation, and 1.98-1.96 Ga post-collisional I-type and A-type plutono-volcanism took place northward. The 1.97-1.96 Ga I-type and S-type granitoids cropping out far south of the belt were interpreted as syn-collisional (Almeida et al. 2007) suggesting that the collision has not been synchronous along the shield. At 1.95-1.93 Ga I- and A-type and charnockitic magmatism, coeval to high grade metamorphism in subordinate areas took place immediately south of the belt, in a probably transpressional post-collisional site.

Concerning the geochronological models of Tassinari and Macambira (2004) and Santos (2000) and Santos et al. (2006), the provinces proposed for the Amazonian craton do not fit well to the Cauarane-Coeroeni belt suggesting that these models should be re-evaluated.

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- Mesoproterozoic sedimentary cover, and greenschist to amphibolite facies metasedimentary rocks
- A- type granites (1.76-1.75; 1.52 Ga), rapakivi granites (1.55-1.53 Ga) and S-type granites (S) (~1.52 Ga),
- Anorthosite and mafic rocks (1.78-1.50 Ga)
- Felsic volcanic and plutonic rocks (<1.82 Ga)
- Undifferentiated gneisses and granitoids (1.88-1.70 Ga)
- Paleoproterozoic sedimentary cover (1.87 Ga)
- A- and I-type granitoid and volcanic rocks and charnockites (1.89-1.81 Ga)
- Charnockitic rocks of the Serra da Prata Suite (1.94-1.93 Ga, in Brazil)
- I-type (meta) granitoid and gneiss (Rio Urubu Suite) and foliated A-type granites, and Barauana Gneiss (B) (1.95-1.93 Ga)
- Greenschist facies metavolcano-sedimentary sequences (P - Parima Group) (1.95 Ga)
- I-type and A-type granitoid and volcanic rocks (IA), and I- and S-type granitoids (IS) (1.98-1.96 Ga), and undifferentiated granites
- Amphibolite to granulite facies supracrustal rocks and S-type Granites (2.00 Ga?)
- Granitoids of the Anauá (A) and Trairão Complexes (T) (2.03Ga) and granitic-gneiss terrains
- Granulites and charnockites of the Bakhuis Belt (BB) (2.06Ga)
- Granite-greenstone and granite-gneiss terrain (2.26-2.08 Ga) and undifferentiated granitoids southwest of the Amapá Block
- Archean Amapá Block (AB) and Imataca Complex (IC), partially reworked during Rhyacian
- CA - Cauarane Group; KA - Kanuku Complex; CO - Coeroene Group
- Taktutu Graben (Mesozoic) Cauarane-Coeroene Belt

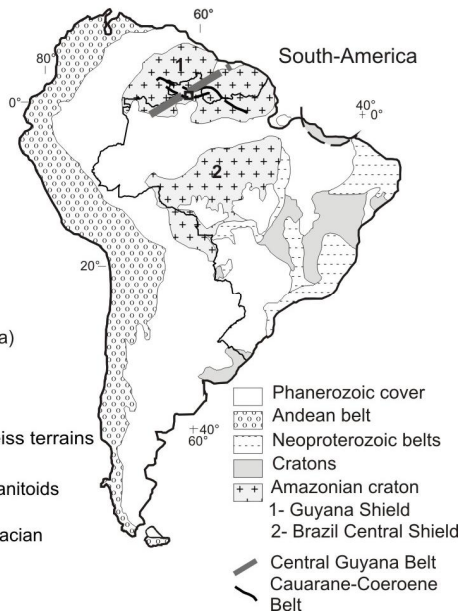


Fig. 1. Geological sketch map of the Guyana Shield (Fraga et al., 2009).

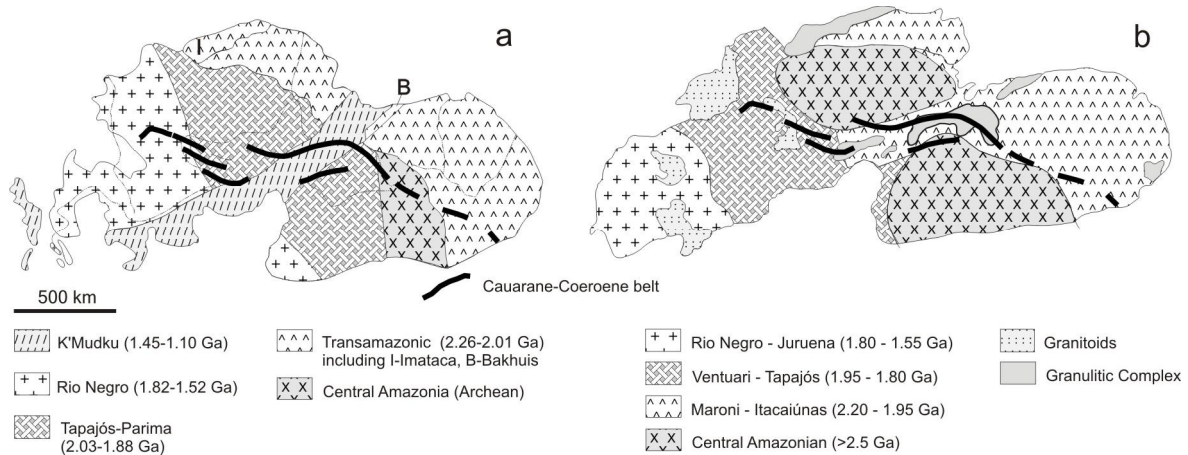


Fig. 2. Geochronological provinces for the Guyana Shield: a) Santos et al., (2000, 2006); b) Tassinari and Macambira (2004).