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THE CONTINENTAL SCALE SHEAR ZONES SYSTEM OF NE-BRAZIL, AN EXEMPLE OF PANAFRICAN INTRAPLATE TECTONICS

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A general reconstitution of the Brazilian and African cratonic blocks before the opening of the South Atlantic Ocean points to huge continental-scale shear zones that boarder the cratons. Theses cratons, composed of late Archean to Early Proterozoic crystalline basement rocks, are more or less undeformed and stabilized since the end of the Transamazonian/Eburnean event; they are separated by Brasiliano/Pan-African mobile belts that involve basement rocks and Early to Late Proterozoic supracrustals. The Borborema Province of NE-Brazil lies between the West-African, Amazon, and Zaire-São Francisco cratons, at a place where "E-W"-trending shear zones, which are 1000 kilometers-long from NE-Brazil to Cameroon, merge into "N-S"-trending shear zones that run about 3000 kilometers from Hoggar to central Brazil.

In the Borborema Province, during the Late Proterozoic orogeny, a complex system of intracontinental mobile belts was developed over an area larger than 200,000 km^2 (Figure 1), in close association with high grade metamorphism, crustal melting and magma emplacement. This system consists of EW- and NE-trending dextral shear zones (both types may reach some kilometres to some tens of kilometres in width and some hundreds of kilometres in length), and N- to NE-trending transpressional belts where folding is associated with strike-slip faulting and stretching parallel to the belt. Preliminary results allow to distinguish two domains displaying contrasting structural and metamorphic characteristics.The western and northwestern domain (Ceará State) is characterized by linear NE-trending continental-scale shear zones (Granja SZ, Senador-Pompeu SZ, Sobral SZ) with a steeply dipping mylonitic foliation bearing a

subhorizontal mineral stretching lineation. Detailed study of meso- to microscopic kinematic indicators consistantly suggests a dextral sense of movement. The most obvious activity of these shear zones was under amphibolite facies metamorphism conditions, however, some recent observations performed in two of them (Granja SZ and Senador-Pompeu SZ; Caby & Arthaud 1990, Gama Junior et al. 1990) support that strike-slip motions were iniated under granulite facies (HP-HT) metamorphism conditions. This high pressure metamorphism is strongly indicative that a significant crustal thickening occurred in association with transcurrent motions. Several nappe units of probable Brasiliano age have been described in the same area; their emplacement seems to be synchronous with the late motions along the main ductile strike-slip faults acting as lateral ramps.

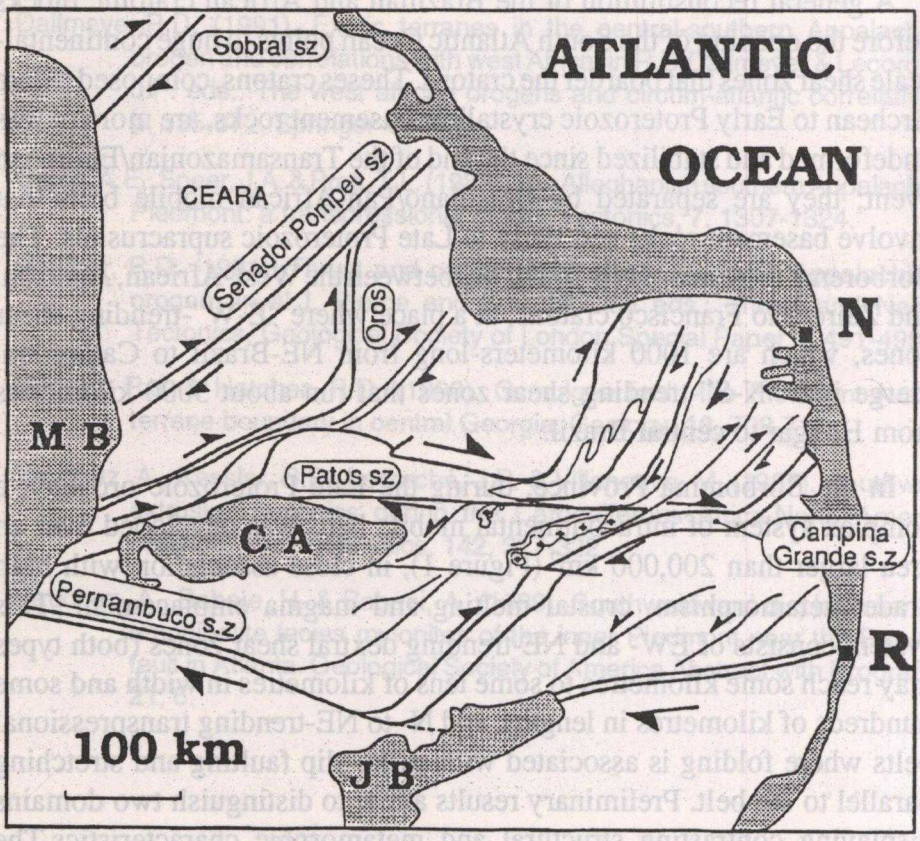

Figure 1: The continental - scale shear zone system of the Borborema Province
CA= Chapada de Araripe; JB= Jotobá basin;
MB= Maranhão basin; N= Natal; R= Recife

The central and eastern domain (Paraíba, Pernambuco and Rio Grande do Norte states) is characterized by a complex structural system consisting of: 1) two major EW movement zones separated by a distance of about 200 km : the Patos-Campina Grande system and the Pernambuco system, and 2) NE-trending transpressional belts: the Seridó and the Cachoeirinha-Salgueiro belts in which folding was closely associated with the development of strike-parallel dextral and sinistral shear zones. Satellite imagery and field data together suggest that the main EW-trending shear zones, although they may be mapped over several hundreds of kilometres, are not continuous, but consist of several segments -sometimes displaying an en-échelon pattern- without direct connection (Corsini et al. 1991). The termination of each segment is marked by a progressive transition from an EW-trending dextral shear zone to either a NE-trending dextral shear zone or transpressional belt, a pattern strongly suggesting a mechanical continuity and interlinkage. NE-trending zones usually display a partition of strain into domains where non-coaxial strain dominates and domains where coaxial strain dominates. The development of this complex deformation system was coeval with regional high-T, low-P (>600 °C, ≤5 kb) peak metamorphism and widespread crustal melting (either in the shear zones and the transpressional belts). Granite bodies emplaced at the vicinity of the main shear zones display a magmatic fabric suggesting transcurrent viscous deformation. Involvement of the upper mantle and extensive melting of the crust occurred in connecting segments between EW and NE-SW structures and in bridges between en-échelon segments of EW shear zones, suggesting that the entire lithosphere contributed to strain transfer processes.

The activity of this shear system outlasted the peak metamorphism. The shear zone system has been subsequently reactivated under decreasing temperature condition, resulting in the development of localized greenschist facies mylonite and cataclasite.

The Brasiliano magmatism mainly consists in two plutonic groups (Sial 1987; Leterrier et al. 1990): (1) differentiated suites of pre- to syn-tectonic (765-550 Ma) gabbro-diorites to quartz monzonites, and (2) syn to late-tectonic (660-515 Ma) granite by far the most voluminous types. The diorite suites suggest a complex association of crystal fractionation and wallrock assimilation; the most primitive samples display a potassic transitional magmatic affinity of shoshonitic type and an orogenic-type geochemical signature. The largest granitoid intrusions display different plutonic suites that cannot be referred to a single magmatic trend; they

associate syeno and/or monzogranites with subsidiary leucogranites and are probably derived from a basic to intermediate igneous protolith of possible Archaen age, with an increasing contribution of supracrustal material.

According to the clear orogenic geochemical signature of Brasiliano diorite and granitoid series, a geodynamic setting of the Borborema Province shear zone system on an active margin progressively evolving to a collision zone could be considered. Nevertheless evidence of collision tectonics (suture zone, remnants of oceanic crust or high P-low T metamorphism) are totally lacking. Geological data rather suggest that: (1) the Borborema Province became part of a continental plate since the end of the Transamazonian tectonothermal event (*ca.* 2.2 Ga) and (2) the continental crust was subsequently affected by extensional deformation responsible for the opening of large intracontinental basins and for synsedimentary volcanism between 1.8 Ga (Sá et al. 1990) and 1.1 Ga (Brito Neves et al. 1990).

Finally, a geodynamic model is proposed for the Brasiliano/Pan-African orogeny of northeast Brazil. HP-HT mylonites formed in shear zones of the central and northwestern Ceará state, together with the similarities between this domain and the Benin-Nigeria Province in Africa (see review by Caby, 1989) suggest that a continental collision may have taken place northwestward, between the Borborema-Nigeria Province and the West African craton. During this collision, the whole Borborema -Nigeria Province, squeezed between the West African and the Zaire-São Francisco craton, was submitted to a general transpressional deformation; lithospheric-scale shear zones propagated into a highly heterogeneous continental crust, and the intersection of EW-trending shear zones with preexisting NE-trending basins may explain the uncommon deformation pattern displayed in this area.

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