ABSTRACTS

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CHRONOGEOLOGICAL MILESTONES IN THE EVOLUTION OF THE SOUTH AMERICAN CONTINENT

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By some reasons, the tiltle/aim of this paper is a challenge, first because the amount of available reliable geochronological data is still relatively small. Secondly, due to large continental extent into consideration, where was is common to happen different features and tectonic phenomena side by side in the same span of time, which makes difficult to set an ideal vertical representation ("layered cake"), as it is generally expected. Nevertheless, the improvement of the geochronological knowledge during this decade, with the introduction of U-Pb and Sm-Nd methodologies are encouraging factors. As the authors are awared of the above-mentioned problems, the readers should have in mind the conditions of a first attempt, which is always necessary as much it should be ephemeral in their main conclusions, depending on the advance of the geological research.

1. Direct chronogeological records of the Eoarchean (> 3.6 Ga) were not obtained up to now, but only some scarse T_{DM} ages are available. For the Paleoarchean (3.6-3.2 Ga) there are several data, determined on cratonic blocks and other "basement inliers" of Proterozoic belts. Moreover, there are inferences enough to bring us the expectations for the important role of rocks of this Era in the evolution of this continent (specially in terms of high grade terranes - "HGT"). By such reason, the values of **3.4-3.5Ga** and **3.2 Ga** that we are obtaining are the first worthy of mention up to now.

The records obtained for the Mesoarchean rocks are relatively good, in terms of age for the formation of low grade terranes (greenstone belts and alike, "LGT") and HGT (TTG suites) , and they are outstanding for the Neoarchean . The Archean processes of arc and back-arc formations, arc-arc collisions, arc-fragmentations and arc-exhumations are rather complex, and the general geological and geochronological data we have up to now are not enough to discriminate all these phenomena (and their spans of time), to which the main area of occurrences are in the Amazonia ("Xingú Block") and São Francisco ("Gavião", "Jequié" and "southern" blocks) cratons. According to the available data, it is possible to point out the following main time intervals for rock formations: **3.1 Ga** (the oldest greenstone belts), **3.0→2.8** (HGT, LGT and mafic-ultramafic intrusions)in Mesoarchean times and **2.8→2.7 Ga** ("Rio das Velhas Event", "Jequié event") in the Neoarchean. Thisis preliminar discrimination is done due to the large variety of rock assemblages, tectonic and thermodynamic events (HGT, LGT, riftes, supracrustal sucessions, regional metamorphism, etc.) that characterizes these time intervals. The end of the Archean Eon (**2.5 Ga**) has probably witnessed the formation of the first (micro) continental blocks in this continent, some of which are still recognizable in their general outlines. However for the most of them, such discrimination is not possible anymore due to the reworking effects of Proterozoic orogenic processes.

2. For Paleoproterozoic, two concurrent geological processes have predominated. The first remarkable characteristic is the almost continuous (2.5 up to 2.0 Ga) formation of sedimentary covers on and among the microcontinental Archean blocks, under stable shelf and continental margin conditions, associated with mafic-ultramafic magmatism ("Minas", "Jacobina", "Cantagalo", etc.). The second and additional characteristics were the different events of plate interactions which can be identified among the Archean continental blocks at ca. **2.3 Ga** ("Granja Massif", Luis Alves block), **2.15 Ga** (Rio Piranhas and Caldas Brandão massif, part of the Maroni-Itacaiunas belt and Mineiro belt, etc) and **2.0-1.95 Ga** (Salvador-Juazeiro belt, part of Ventuari Tapajós belt). These orogenic interactions produced important and long mobile belts, where the reworking of Archean terranes was common. Many times, the discrimination of this sucession of events has not been done, and the term "Trans-Amazonian" has been used as a generalization, which demands a revision. Particularly, this last orogenetic event (2.0-1.95 Ga), in the Orosirian period is a milestone with repercussion all over the continent, so including part of the basement of the Andean Chain. The agglutination of a supercontinental landmass (South America + Africa, *Atlantica* or alike) at that time is an well supported hypothesis which is ratified by a series of subsequent anorogenic events - granite plutonism, mafic dike-swarms and mafic-ultramafic

magmatism- at **1.9 - 1.8 Ga** in some areas as well as by the formation of several platform covers and volcano-sedimentary traps (Roraima, Iricoumé, Iriri, Espinhaço,etc.) since then.

In the last period of the Paleoproterozoic (Statherian =**1.8-1.6 Ga**), orogenic events have been recognized only in the western part of the Amazonia Craton, which is represented by the Rio Negro-Juruena Belt. This belt extends from Colombia to Paraguay, mostly with accretionary characteristics (coalescence of magmatic arcs), and it is considered a probable equivalent of the Yavapai-Mazatzal belts (USA). Excepting this part of the Amazonian Craton, the rest of the Paleoproterozoic supercontinent was submitted to a series of extensional phenomena, conspicuous felsic volcanism, anorogenic plutonism, mafic dike-swarms, etc. associated with continental rifting and clastic sedimentation, during the Statherian Period. Some of these taphrogenetic events have continued during the subsequent Mesoproterozoic Era, privileging the same areas and extending to new ones, where clastic sedimentation and anorogenic plutonism are typical features.

In terms of crustal growth, for the whole South American Platform, the Paleoproterozoic is by far the most important stage. Special remark should be done for the time interval 2.3-1.9 Ga, to which it was attributed the peak of mantle-crust differentiation , about 53% in volume (Sato, 1998).

3. During the Mesoproterozoic two different (but interconnected) tectonic scenarios may be described. First, the predominance of cratogenic processes with the development of large sedimentary basins (rifts, syneclises, "tables"), of continental and epicontinental environments. Some of them were generated since the previous Statherian Period and their chronostratifraphic subdivisions are still far to be achieved. Three associated major events of anorogenic plutonism can be assigned: ca. **1.6 Ga** (Serra da Providência suite, afffecting the just-consolidated Rio Negro-Juruena Belt), **1.45-1.3 Ga** (at least four different episodes of plutonism in this time) and **1.1-1.0/0.97 Ga** ("younger granites of Rondonia). The last two groups of magmatic events should probably correspond to tectonic responses, in the cratonic area, to the lateral evolution of fold belts (San Ignacio/Guaporé and Sunsas/Aguapeí), which represent the second tectonic scenario. All the mentioned cratogenic events (basin-forming tectonics and anorogenic plutonism) kept somehow relationships with the Mesoproterozoic belts.

Regarding the San Ignacio/Guaporé (1.45-1.3 and Sunsas-Aguapei (1.1-0.95 Ga) Mesoproterozoic belts, the background of geological and geochronological data is still incomplete, but they are recognized for the most of Brazilian geologists, because they behaved as part of a cratonic fragment during the subsequent Neoproterozoic evolution. The Cariris Velhos belt, in Borborema Province, in spite of the overprint of Brasiliano events, it is been recognized since the basement of Parnaiba Basin (west) to the Atlantic coast (east), south of the Patos Lineament, following a ENE-SSW trending area, about 750 Km long, with consistent events of accretion and collision in the range of **1.1-0.96 Ga .** For the particular case of the other belts, Central Goiás -Tocantins ("Uruaçuano") and Central Bahia ("Espinhaço"), the Mesoproterozoic orogenic events are still controversial. This is caused by the lack of reliable geochronological data as well deeper geological investigation. In fact, as these two belts have diversely been reworked by the superposed Neoproterozoic/Brasiliano orogenic realms and they are source of many open questions.

The sucession of Mesoproterozoic orogeneses (**1.8-1.6 Ga, 1.45-1.3 Ga, 1.1-0.97 Ga**) were responsible for the fusion of a very large continental landmass (supercontinent *Rodinia)*, which had a very active and short life, at least according with our (South American) geological data.

4. Actually, important events of rifting, with mafic dike swarms have also characterized the end of the Mesoproterozoic (Amazonian and São Francisco cratons areas) and the beginnings of the Neoproterozoic (the whole continent). Part of them were coeval with the last Mesoproterozoic orogeneses (Sunsas, Cariris Velhos). These processes of taphrogenesis varies in time (from 1.1 up to 0.8 Ga) from a place to another, but with a common final of fission of the Mesoproterozoic supercontinet which produced several lithospheric segments (big, intermediate and small Neoproterozoic plates and microcontinents). These continental segments were separated from each other by different volcano-sedimentary realms (rifts, systems of rifts, aulacogens, small ocean basins, oceanic branches), which gave rise to the Brasiliano/Pan African basins. During subsequent Neoproterozoic times, these lithospheric segments have tectonically interacted (accretion, tranpression, collision) many times, sometimes even in the early beginning of the Neoproterozoic, in the Tonian period itself.

During the Neoproterozoic there are records of orogenetic processes (formation of TTG suite, regional metamorphism, etc.) at **0.85-0.88 Ga** (e. g. Tocantins and Dom Feliciano provinces), **0.80-0.75 Ga**, and mainly at **0.65-0.61,** when widespread events of arc-magmatism and collision took place in the majority of the Brasiliano structural provinces. The last records of orogenic processes at ca. **0.57-0.53 Ga** are only of local character, e. g. in the southeast of Brazil ("Rio Doce Orogeny") and northwest Argentina ("Pampean Orogeny"). Usually, this last span of time was dominated by varied post-tectonic events, such as formation of intradeep and foredeep basins, tectonic collapse, post-orogenic magmatism, shearing, and pull apart basins (escape tectonics) etc. Post-tectonic features like these characterized the majority of the supercontinent (Pannotia/Gondwana) formed by the end of Neoproterozoic times.

5. The first accretionary and (micro) collisional events at the western margin of this large Eo-Paleozoic continental landmass (formed by the Brasiliano structures) took place in Mid-Ordovician times (Oclóyic orogeny). Only after these events, passive margin conditions were set up, and plentiful cratonic conditions may be coonsidered for the whole supercontinent, where widespread marine Palaeozoic sedimentary cratonic sequences ("Beta" and "Gama", Silurian and Devonian in ages) started to be developed.

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