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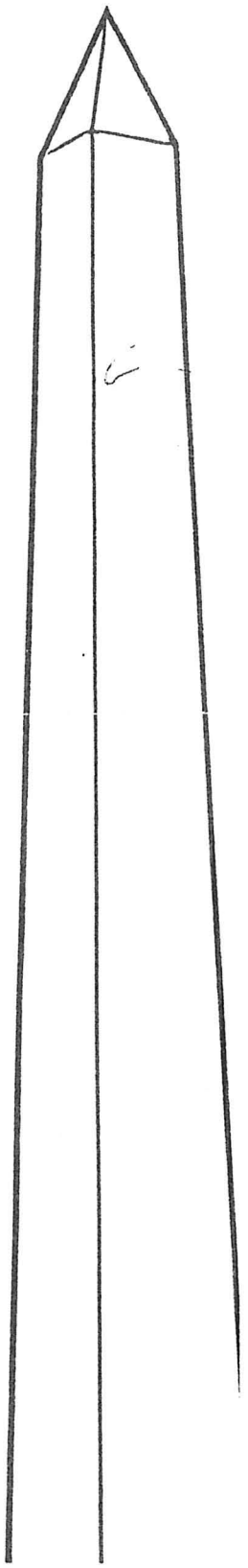

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Archean Early Proterozoic Crustal Evolution of Amazonian Craton, Brazil

This review deals with the interpretation of the main geochronological results obtained during the activities of the IGCP Project 204 (1983–1987), with emphasis to the study of the Archean and Early Proterozoic continental crust of the Amazonian Craton, Brazil.

The Amazonian Craton (Fig.) located in the north of South America, is a large stable unit which acted as a stable foreland in Late Proterozoic times. In a few words, this unit is composed by an Archean cratonic domain (Central Amazonian Province) which is surrounded by mobile belts of Early- to Mid-Proterozoic ages: Maroni-Itacaiúnas (2.25–1.9 Ga); Rio Negro-Juruena (1.75–1.65 Ga); Rondonian (1.55–1.3 Ga) and Sunsás (1.25–0.95 Ga).

The present geochronological knowledge of the investigated area is mainly based on Rb-Sr whole rock isochrons and K-Ar mineral determinations, although Pb-Pb whole rock isochrons, U-Pb Concórdia zircons ages and Sm-Nd data are also available for some areas. Concerning the Archean and Early Proterozoic ages, these are found within the Amazonian and Maroni-Itacaiúnas (MI) provinces, in the north-eastern portion of the Craton.

The Central Amazonian (C.A.) province, which is surrounded to the north an northeast by the Maroni-Itacaiúnas province, comprises granodioritic-throndjemitic granite-greenstone assemblages in association with high-grade metamorphic terranes. The Archaen province is partially overlain by unfolded and unmetamorphosed volcanic-sedimentary sequences (1.9–1.5 Ga old), as well as intruded by cratogenic-type granites (1.9–1.3 Ga old) and mafic dykes.

The available geochronological data on metemorphic terranes from the C.A. province, are concentrated in the Carajás ridge (Fig.). According to them, three rock-forming events are identified for the Late Archean time (3.1–2.5 Ga). The most representative results are in the 2750–2650 Ma time interval, and the younger (2.5 Ga) seems to be related to partial melting process of pre-existent continental rocks as suggested by high values of the Sr initial ratio (0,7072).

So, the primitive continental crust in the Carajás area was probably formed about 3.1 Ga ago, but the main tectonic-magmatic event occurred around 2.65 Ga ago, just after the supracrustal assemblages that possibly developed along the period 2.8–2.7 Ga.

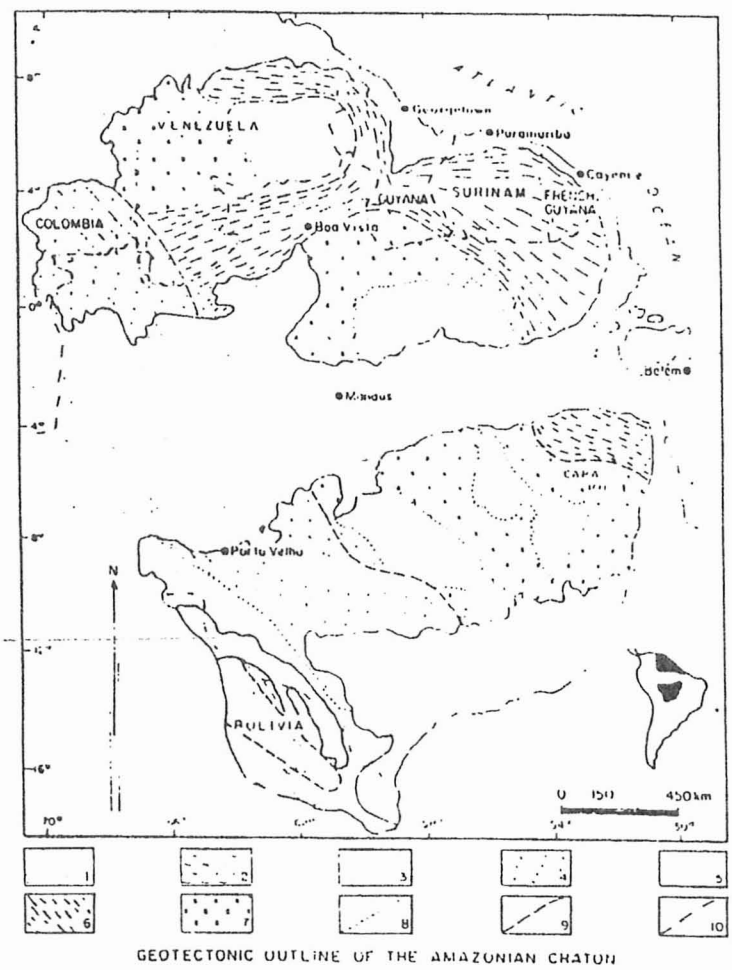
The Maroni-Itacaiúnas (M.I.) province is characterized by a large exposure of metavolcanic and metasedimentary sequences, deformed and metamorphosed at greenschist to amphiobolite faces, as well as by granulites and gneissic mesozonal terranes.

The geochronological pattern of this province is very complete, including U-Pb, Rb-Sr, Sm-Nd and Pb-Pb radiometric data. In general, these ages are very concordant along the province, so demonstrating that its evolution took place during a major event of the Early Proterozoic (Transamazonian Orogeny; 2.2–1.9 Ga). Indeed, Rb-Sr, Pb-Pb and Sm-Nd isochrons on granulitic and gneissic rocks indicated ages in close agreement, around 2.0 Ga, with coherent $^{87}Sr/^{86}Sr$ i.r. (0,7018–0,7024); Pb μ_1 values (8,09) and $\epsilon_{Nd} = +2,1$. In special, the Nd model age (TDM) suggests that the primitive crust was separated from the upper mantle about 2.25 Ga ago. Therefore, according to the geological control, the coherent structural trends, and the agreement of radiometric ages, a model based on a mantle-derived magmatic arc can be considered for a significant part of the M.I. province.

In turn, remnants of some old basement (Archean) rocks within the Maroni-Itacaiúnas belt have been identified. They generally consist of high grade polimetamorphic rocks, such as the Imataca Complex in Venezuela and the Amapá region in Brazil, where radiometric ages (around 2.9 Ga) were found. In the southernmost portion of this province, below the Amazonas phanerozoic sediments, Rb-Sr ages obtained on mesozonal rocks yielded results around 2.9 Ga, but with high values for the Sr initial ratios (0,710). These data are suggestive of reworking of pre-existing continental crust during the Transamazonian Orogeny, so indicating that part of the M.I. province was also of ensialic character.

In the same way, other nuclei of old basement rocks occur within the Amazonian Craton, such as in Bolivia (Lomas Manèches granulites) and in Brazil (Jauru-Mato Grosso area). In both areas, Early Proterozoic and Archean ages were found, although not well established analytically. Such nuclei include many kinds of migmatites, granlites and greenstone belt sequences, and probably represent an old fragment added to the Amazonian Craton during its Mid-Proterozoic evolution (around 1.5 Ga).

In conclusion, based on the integrated isotopic, geophysical evidences and geological informations it is possible to make an estimative of the Archean and Early Proterozoic continental crustal growth for the Amazonian Craton. In our view, considering the whole primitive cratonic area, about 45% of the crust was differentiated during the Archean time, followed in the Early Proterozoic by more 15% of continental crust accretion. However, the Early Proterozoic evolution was also responsible by the reworking of significant part of the Archean domains. Later on, during the Middle Proterozoic evolution of the Amazonian craton, the estimated growth of the crust was approximately 40%.



GEOTECTONIC OUTLINE OF THE AMAZONIAN CRATON

Figure 1—Geotectonic outline of the Amazonian Craton. Key: 1. Phanerozoic sediments; 2. Sunsás mobile belt (1.25–0.95 Ga); 3. Rondian mobile belt (1.55–1.3 Ga); 4. Rio Negro-Juruena mobile belt (1.75–1.6 Ga); 5. Proterozoic platform covers (1.9–1.5 Ga); 6. Maroni-Itacaiúnas mobile belt (2.25–1.9 Ga); 7. Central Amazonian province (> 2.3 Ga); 8. Transition zone between belts; 9. Approximate contacts between belts; 10. Country limits.