ARCHEAN CRUSTAL GROWTH OF THE IMATACA COMPLEX, AMAZONIAN CRATON: EVIDENCE FROM U-Pb, Sm-Nd AND Rb-Sr GEOCHRONOLOGY

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INTRODUCTION

The Archean Imataca Complex (IC), NW Amazonian Craton, forms a ENE-trending, fault-bounded block adjacent to the Paleoproterozoic Maroni-Itacaiúnas magmatic arc (2.2 – 2.0 Ga) (Tassinari and Macambira, 1999). The IC rocks are complexely deformed, exhibiting elongated and symmetrical domes and thrusts combined with isoclinal folds. Transcurrent faults are also important, like the Guri Fault System - a zone of multiple faulting, shearing and mylonitization – along the southeastern edge of the IC. In a pre-Pangean reconstruction using paleomagnetic data from rocks of the African counterpart, the Guri System is contiguous to the Sassandra (Ivory coast) and Zednes (Mauritaine) faults, in agreement also with the comparable geologic evolution between the NW Amazonian and the West Africa cratons, during the Archean and Late-Paleoproterozoic.

The IC mainly composed of medium- to high grade quartz-feldspathic paragneiss, exhibits extensive mortar, augen, flaser and mylonitic textures. Calc-alkaline gneiss and granitoid rocks of igneous protolith are also present in the IC, as well as dolomitic marbles, orthopyroxene and magnetite quartzites, and BIFs that include huge ore deposits of Algoma type. Moreover, migmatite injections and anatexis (devoid of metasedimentary components) are widespread in the western part of Complex, the largest migmatite mass centered in Cerro La Ceiba.

This paper reports zircon U-Pb SHRIMP, Sm-Nd and Rb-Sr isotopic data of different IC rocks in order to investigate their age and geological evolution within the tectonic framework of the Amazonian Craton.

PREVIOUS GEOCHRONOLOGICAL DATA

Previous radiometric studies performed in the IC during the 70 and 80 decades (e.g., Posadas and Kalliokoski, 1967; Montgomery and Hurley, 1978; Montogomery, 1979; Onstott *et al.*, 1989) have led to the following assesments for the crustal evolution:

(A) Rb-Sr and Pb whole rock analyses suggest that the protolith age goes back to at least 3100 Ma and might be as old as 3700-3400 Ma. The early high grade metamorphism and igneous events represented by gneisses, migmatites (including La Ceiba), and granitoid rocks took place between 2800-2700 Ma ago, followed by a second at 2150 - 2000 Ma.

(B) Rb/Sr whole rock analyses on thin-slab specimens of banded granulite sample from Guri Dam yield ages in the 2.02-1.90 Ga range ($^{87}Sr/^{86}Sr = 0.7404$). These ages record a local high grade metamorphism.

(C) A Rb/Sr whole rock isochron of ca. 2190 Ma with $^{87}Sr/^{86}Sr = 0.7010$ (data recalculated from Posadas and Kalliokoski, 1967) for the Encrucijada granite indicates the tectonic link between the plutonism and the peak of the Transamazonian orogeny.

(D) $^{40}Ar/^{39}Ar$ plateau dates on hornblende and biotite for the Encrucijada granite are 1970 and 1880, respectively, indicating the cooling took place shortly after the emplacement. $^{40}Ar/^{39}Ar$ plateau dates on hornblende and biotites from the IC gneisses vary from 1970 to 1760 Ma and record the waning stages of the Transamazonian orogeny uplift and cooling. Additional

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1.4 - 1.1 Ga $^{40}Ar/^{39}Ar$ dates on biotites and feldspars indicate that the IC central zone was isobarically cooled. These youngest dates are compatible with published K-Ar and Rb/Sr mineral dates on different rock units in the area, between 1.5 and 1.1 Ga.

RESULTS AND DISCUSSION

Zircon U/Pb isotopic data were performed at the Australian National University SHRIMP 1 instrument and the whole-rock Sm-Nd and Rb-Sr analysis were carried out at the Geochronological Research Center of the University of São Paulo.

In order to define the timing of the tectonothermal events, SHRIMP zircon U-Pb age determinations were undertaken on samples from banded granulitic rocks and high grade migmatites, which occurs respectivelly at near Upata – San Felix Cities and in La Ceiba quarry in between Guri and Ciudad Piar Cities.

The sample of a felsic component of banded garnet bearing granulites yielded some prismatic zircons, which display, in CL images, oscillatory zoning parallel to their exterior surfaces, core and rim structures. The analyses were of the dominant oscillatory zoned zircon and yielded a weighted mean $^{207}Pb/^{206}Pb$ date of 3229 ± 39 Ma (MSWD = 5. 2). These dates point to an Archean age for the igneous protolith of granulite.

Sample of La Ceiba migmatite gave a prismatic and subhedral zircons, which exhibit in CL images a dark homogeneous color (high U content) and oscillatory zones. All analysed sites of high-U sites yielded a ^{204}Pb corrected weighted mean $^{207}Pb/^{206}Pb$ date of 2787 ± 22 Ma (MSWD = 1.9). This age is in close agreement with the oldest Rb/Sr whole rock isochron age (2.78 Ga) on these rocks, and reinforces that a period of migmatitic injection produced by partial melting in high-grade metamorphic conditions, during the late-Archean.

Sm-Nd whole rock isotopic mapping of the IC yielded ages mostly between 3.23 – 3.00 Ga and 2.90 – 2.80 Ga, supporting the juvenile nature of the crust, which is associated with two major mantle-differentiation events. The younger episode includes also crust reworking of older continental rocks, in accordance with the calculated $\varepsilon_{Nd(2.78Ga)}$ values (+1.13 to – 4.93). On the other hand, protoliths as old as 3.70 – 3.40 Ga, previously suggested from conventional Pb-Pb studies of the IC granulites, were not confirmed by our U-Pb SHRIMP and Sm/Nd studies and neither by unpublished U/Pb ion probe ages on detrital zircons from the Orinoco river sands, which cluster at 2.0, 1.0 and 0.45 Ga.

The IC is also cut by a dozen of quartz-monzonite sills and granitoid plutons emplaced between 2.2 and 2.1 Ga, tectonically related to the evolution of the adjoining Maroni Itacaiúnas belt. Geographic distribution of these plutons coupled with the Nd evidence point that the southern edge of the IC is more restricted than it has been postulated, as supported by their T_{DM} ages between 2.29 and 2.21 Ga, and positive $\varepsilon_{Nd\ (2.1Ga)}$ values (+3.05 to + 0.74). Nevertheless, two of these plutons within the northern part of the IC derived from Archean protoliths, as supported by the T_{DM} ages (2.95 and 2.85 Ga) and $\varepsilon_{Nd\ (2.10Ga)}$ values of –4.20 and -4.93.

As a whole, the isotopic inferences in conjunction with the recognized polyphase tectonic framework of the Archean crust (e.g., faults, mylonites, folding, juvenile accretion vs. crust reworking) demonstrate that the IC is an allochthonous block which was juxtaposed to the Maroni-Itacaiunas belt during the Late Paleoproterozoic.

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