GEOLOGICAL EVOLUTION OF THE BASEMENT ROCKS IN THE CENTRAL-EASTERN PART OF THE RONDÔNIA TIN PROVINCE, SW AMAZONIAN CRATON, BRAZIL: U-PB AND SM-ND ISOTOPIC CONSTRAINTS

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On the basis of geological, petrological and U-Pb geochronological data the basement rocks in the central-eastern part of Rondônia tin province (SW Amazonian Craton) are included into five lithological associations. (1) tonalitic gneiss (1.75 Ga); (2) enderbitic granulite (1.73 Ga); (3) paragneiss; (4) granitic and charnockitic augen gneisses (1.57-1.53 Ga); and (5) fine-grained granitic gneiss and charnockitic granulite (1.43 Ga).

The 1730±22 Ma protolith age for the enderbitic granulite coincides with 1750±24 Ma protolith age for the tonalitic gneiss reported by Tassinari et al., (1996). These ages constraint the oldest magmatic episode recorded in the central-eastern part of the RTP, and has been related to the development of an 1.80-1.70 Ga magmatic arc in the Rio Negro-Juruena province (Tassinari et al., 1996). Sm-Nd isotopic compositions of these rocks [$\varepsilon_{Nd}(T)$= –1.51 to +0.18; T_{DM}= 2.10 to 2.20 Ma] suggested that the parental calc-alkaline tonalitic magmas were derived from depleted mantle sources with significant contributions of an older crustal component. The tectonic setting that better accounts for the nature of these calc-alkaline magmas is an Andean-style continental margin, with subduction towards the northeast (present co-ordinates) underneath Ventuari-Tapajós continental crust.

Paragneisses are here individualized as an important lithologic element in the central-eastern part of RTP. The depositional age of the original sediment is not well known yet. However, an upper limit can be inferred by detrital zircon age of ca.1957 Ma, and a lower limit by an intrusive meta-granite (1570 Ma; Tassinari et al., 1996). Furthermore, it is herein suggested for further investigation that the paragneisses probably represent high-grade metamorphic equivalents of the Beneficente Group exposed just to southeast. Paleoproterozoic source represented by the Ventuari-Tapajós crust is suggested by detrital zircon age of 1957 Ma and the T_{DM} values between 2.2 and 2.1 Ga.

The 1570 to 1530 Ma granitic and charnockitic augen gneisses (almost 50% of the study area) shown A-type granite, and within-plate granite and sometimes volcanic arc granite geochemical signatures, and have been also identified further south (Rizzoto et al, 1996; Bettencourt et al., 1999). These rocks intrude Paleoproterozoic ortho- and paragneisses, and are correlated with well-preserved megacrystic granites and charnockites of the Serra da Providência Intrusive Suite (1.60-1.53 Ga U-Pb ages, Bettencourt et al. 1999; T_{DM} = 1.87 to 1.76 Ga, Bettencourt et al., in press). This suite is an MCG association (Rizzotto et al., 1996), and shows evidences of magma mingling and mixing (Bettencourt et al., 1997). In this scenario, a preferred interpretation to account for the observed Sm-Nd isotopic compositions of the megacrysts granites and charnockites and related augen gneisses [$\varepsilon_{Nd}(T)$= –0.62 to +2.00; T_{DM}= 1.76 to 1.89 Ma] is a mixture of magmas derived from depleted mantle and older crustal sources. Geological, geochemical and geochronologic integration suggested that four

distinct intrusive episodes comprise the Serra da Providência Intrusive Suite: (i) 1590-1570 Ma (megacrystic granites of the Serra da Providência batholith); (ii) 1570-1560 Ma (mangerites and charnockites of Ouro Preto/Ariquemes region); (iii) 1550-1540 Ma (gray granites of the Samuel region); (iv) 1530 Ma (quartz mangerites and granites of União massif). In the southwestern Amazonian Craton scenary, the Serra da Providência Intrusive Suite has been interpreted as a probable inboard expression of the subduction-related magmatism of the Cachoeirinha orogeny, situated further southeast in the state of Mato Grosso (Tassinari et al., 2000).

The fine-grained granitic gneiss and charnockitic granulite association embrace the minor areal expression within the study area. However these rocks are widespread further south and west. The protolith crystallization age of 1433±11 Ma for granitic gneiss provides the first evidence of arc-related magmatism at Rondonian-San Ignacio time in Rondônia. This age has been confirmed by an U-Pb zircon age of 1424±10 Ma from a related charnockitic granulite (J.S. Bettencourt & M.A.S. Basei, personal communication, 2000). Subduction-related magmatic events in the Rondonian-San Ignacio Province include calc-alkaline 1.48-1.42 Ga (U-Pb zircon ages) granitoids of the Santa Helena batholith (Geraldes, 2000) and their correlatable Pensamiento Granitoid Complex in Bolívia (Rb-Sr isochron ages of 1.40-1.25 Ga; Litherland et al., 1986), both derived largely from juvenile sources with variable contributions of older continental material (Geraldes, 2000; Darbyshire, 2000). In this context, the 1.43 Ga rocks recorded in the study area are here correlated to the most evolved granites of the calc-alkaline Santa Helena batholith situated further southeast in the Mato Grosso state. This implies in an almost continuous magmatic arc along the SW margin of Amazonia. However, additional works are required to confirm this hypotesis.

Our present U-Pb and Sm-Nd data indicate clearly that at least one high-grade tectonometamorphic episode at upper-amphibolite conditions affected the central-eastern part of RTP. The P-T conditions established for this metamorphism (770-720°C and 900-700 Mpa; Tohver et al., 2000; Payolla, unpublished data) are similar to the closure conditions of Pb in monazite (~725°C). Thus the crystallization or complete resetting of monazite at 1330 Ma and the crystallization of garnets at 1310-1300 Ma showed here indicate that 1330-1300 Ma should be interpreted as the time of metamorphic peak related to this episode. Tassinari et al. (1999) interpreted an metamorphic zircon of 1330 Ma as the time of metamorphic peak of the Rondonian-San Ignacio orogeny. On the other hand, the poorly constrained zircon lower intercepts at 1200 Ma provide evidences for another high-grade tectonometamorphic episode in the study area. A similar age (~1211 ± 18 Ma) has been reported in detrital zircons from a paragneiss in southern Rondônia and is interpreted as the maximum age of the Nova Brasilândia sedimentation (Rizzotto, 1999). However, additional geochronological studies must be carried out to confirm this second high-grade metamorphic episode in northern Rondônia.

Although not well understood, the hornblende and biotite $^{40}Ar/^{39}Ar$ ages between 1200 and 1100 Ma (Bettencourt et al., 1996; Tohver et al., 2000) may be readly interpreted as related to cooling as the high-grade tectonometamorphic episode waned. Biotite $^{40}Ar/^{39}Ar$ ages between 1001 and 912 Ma recorded in the basement of the central-eastern part of RTP (Bettencourt et al., 1996) are interpreted as the thermal effects related to the emplacement of the Younger Granites of Rondônia (1.00-0.97 Ga), interpreted as the product of an inboard magmatism related to the collisional stage of the Sunsas orogeny (Bettencourt et al., 1999).

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