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# THE RIO CRESPO INTRUSIVE SUITE: GEOLOGICAL U-Pb AND Sm-Nd ISOTOPIC EVIDENCE FOR A MAJOR 1.43 GA ARC-RELATED MAGMATISM IN THE RONDÔNIA STATE, SW AMAZONIAN CRATON, BRAZIL

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## INTRODUCTION

On the basis of geological, petrological, U-Pb, and Sm-Nd 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) (Fig. 1) (Payolla et al., subm.). The fine-grained granitic gneiss and charnockitic granulite association embraces the minor areal expression within the study area.

However these rocks are widespread further south and west, and provide the first evidence of arc-related magmatism referred to the Rondonian-San Ignacio time, in Rondônia state (Payolla et al., subm.).

In this paper, new data on the geology, geochemistry and an additional U-Pb zircon age, obtained from a sample of charnockite granulite, will be presented. Also a formal designation, “Rio Crespo Intrusive Suite”, for the fine-grained granitic gneiss and charnockite granulite association is herein proposed.

## PETROGRAPHY AND GEOCHEMISTRY

These rocks are pink and greenish to creamy, fine- to medium-grained, quartz-feldspatic banded gneisses of granitic composition, which were metamorphosed at granulite facies grade. Banding is defined by alternating quartz + plagioclase + K-feldspar layers and hornblende + garnet + magnetite + titanite  $\pm$  hyperstene  $\pm$  diopside  $\pm$  epidote layers or lines. Banding is enhanced by concordant, locally folded granitic veins. Xenoliths of meta-charnockite (1560 Ma) and mafic granulites (~1730 Ma) support an intrusive origin for the protolith of the fine-grained gneisses and granulites. Amphibolites are important associated rock types, occurring as 30- to 100 cm-wide bands and rootless folds, some partially disaggregated, suggesting hybrid zones.

SiO<sub>2</sub> contents of the fine-grained granitic gneiss and charnockitic granulite range from 72 to 68 wt%. Positive DF (discrimination factor; Shaw, 1972) values ranging from +2.8 to +1.2 indicate igneous parentage for the protoliths. The rocks are metaluminous to marginally peraluminous in composition (A/CNK between 0.91 and 1.04), and are characterized by high Fe/Mg ratios (mg# = 5 to 23) and K<sub>2</sub>O contents (5.0 to 6.8%).

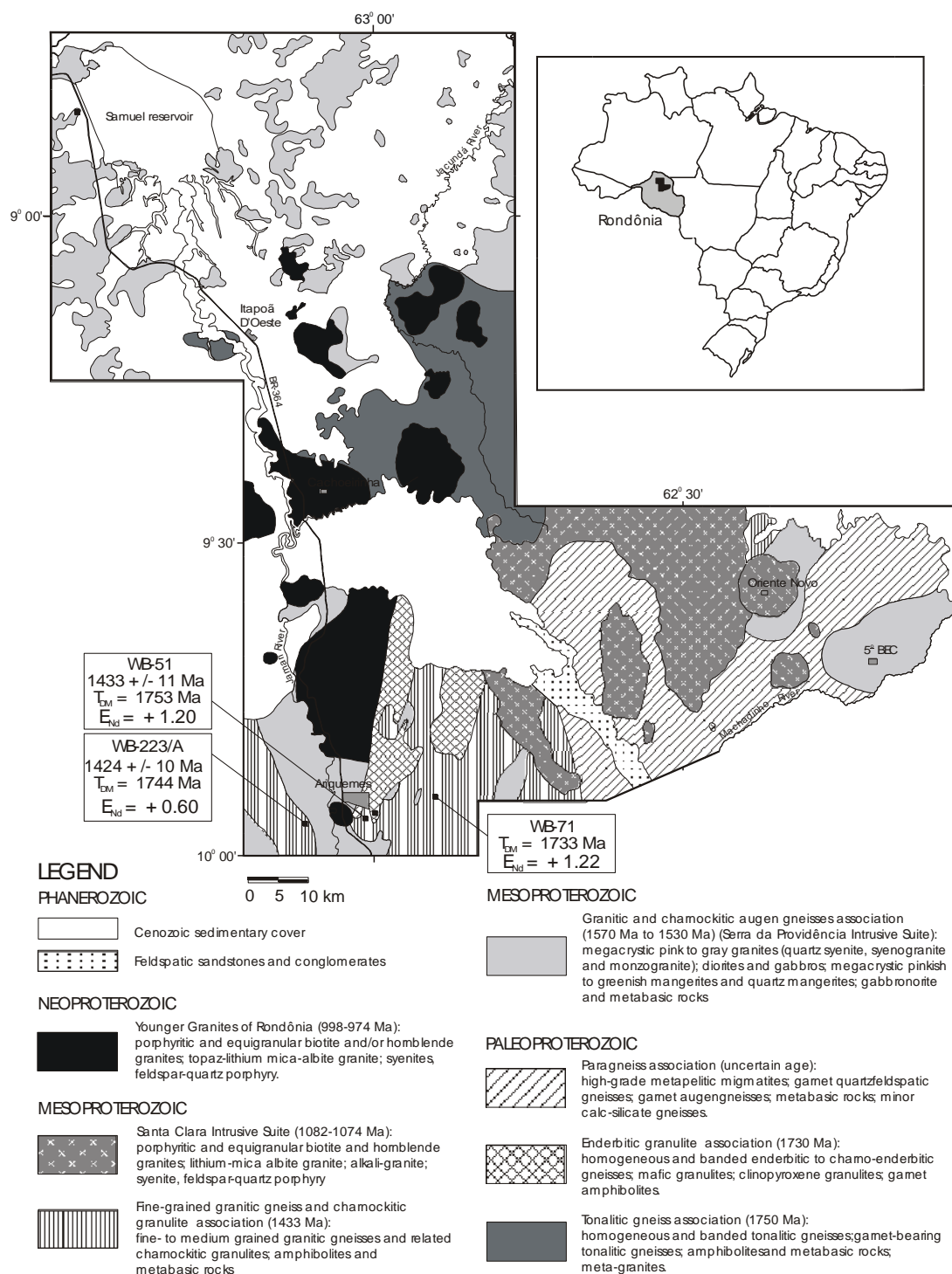


Figure 1. Lithological associations map of the central-eastern part of the Rondônia tin province (Payolla et al., 2001) showing the locations of sampling sites of the Rio Crespo Intrusive Suite and U-Pb zircon ages and Sm-Nd data determined in this and previous studies (this study: boxed; (1) Payolla et al., 2001).

They also show geochemical features of A-type and within plate granites, marked by high Rb, Zr, Y, Nb and LREE and low Sr contents (< 100 ppm), but anomalously high Ba (870 to 540 ppm).

## U-Pb ZIRCON DATA

The U-Pb age determination was completed at the Geochronological Research Center of

University of São Paulo (CEPEGEO-USP). The U-Pb zircon analytical data are presented in Table 1. Five zircon fractions separated from a charnockitic granulite (sample WB-223/A) define an age of  $1424 \pm 10$  Ma (Figure 2), interpreted as the crystallization age of the granitic protholith. This age coincides with  $1433 \pm 11$  Ma protolith age for the granitic gneiss (sample WB-51: Figure 3), reported by Payolla et al., (subm.).

SPU	magnetic fraction	207/235#	error (%)	206/238#	error (%)	206/204*	Pb (ppm)	U (ppm)	weight (mg)	207/206 age (Ma)
Sample WB-223/A – charnockitic granulite										
818	M (-5)	2.8788	0.806	0.23346	0.803	2988.09	80.75	345.4	0.0861	1413±03
810	M (-4)	2.86235	0.861	0.230264	0.842	400.48	121.8	463.8	0.0778	1429±03
831	M (-1)	2.88992	0.555	0.233399	0.549	3341.42	78.99	337.9	0.0745	1421±02
832	M (-2)	2.89074	0.517	0.232176	0.512	989.88	88.17	363.98	0.0631	1431±01
833	M (-3)	2.89745	0.548	0.23383	0.542	2166.85	106.74	454.98	0.0524	1423±02
Sample WB-51 – garnet-bearing granitic gneiss										
	NM(-1)	3.0131	0.67	0.24301	0.65	1344	72	296	0.007	1424±03
	M(-1)	2.9087	0.60	0.23600	0.56	3041	91	393	0.010	1412±04

Table 1. U-Pb analytical data for zircons from samples WB-223/A (this study) and WB-51 (Payolla et al., submitted) of the Rio Crespo Intrusive Suite. SPU: laboratory number. Magnetic (M) or non magnetic (NM) fractions: number in parentheses indicated the tilt used on Frantz separator at 1.5amp. current. #: radiogenic Pb corrected for blank and initial Pb, U corrected for blank. \*: not corrected for blank or non-radiogenic Pb. Total U and Pb concentrations corrected for analytical blank. Ages: given in Ma using Ludwig Isoplot/Ex program (1998), decay constants recommended by Steiger and Jäger (1977).

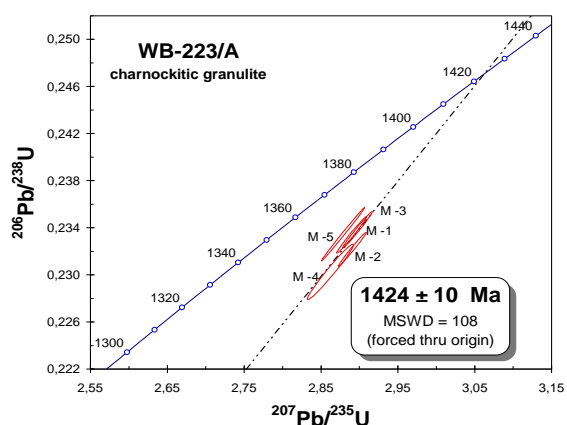


Figure 2. Concordia diagram for sample WB-223/A

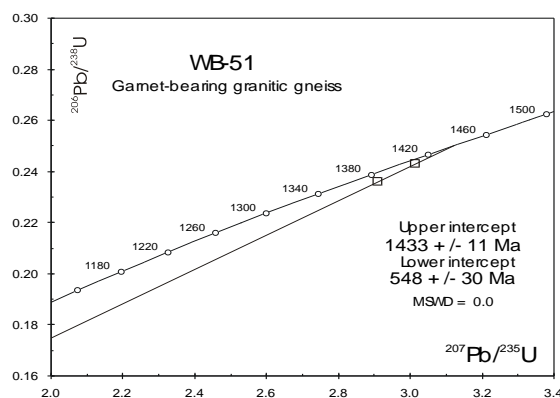


Figure 3. Concordia diagram for sample WB-51 (Payolla et al., submitted)

## DISCUSSION AND CONCLUSION

The protolith crystallization ages of the granitic and charnockitic gneisses between 1433 Ma and 1424 Ma provide evidence of a major arc-related magmatism at Rondonian-San Ignacio time in Rondônia. We herein propose the formal designation Rio Crespo Intrusive Suite for the rocks related to this magmatism. Three samples of this suite yield slightly positive  $\epsilon\text{Nd}$  (T) (+1.22 to +0.60; Payolla et al., *subm.*), and narrow range  $T_{\text{DM}}$  between 1733 and 1753 Ma.. These Nd data indicate that the original granitic magma was neither typically juvenile in composition nor a direct melt product from the surrounding older crust, and appear to represent a mixture of these materials. The geochemical and Nd signatures of these rocks are very similar to the correlatable most evolved granites of the calc-alkaline Santa Helena batholith (Geraldes, 2000) situated further southeast in the Mato Grosso state. This implies in an almost continuous magmatic arc along the SW margin of Amazonian Craton in the time interval 1.45-1.42 Ga, related to the Rondonian-San Ignacio orogeny.

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