U-Pb SHRIMP and Sm-Nd geochronology of the Silvânia Volcanics and Jurubatuba Granite: juvenile Paleoproterozoic crust in the basement of the Neoproterozoic Brasília Belt, Goiás, central Brazil

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ABSTRACT

U-Pb SHRIMP and Sm-Nd isotopic ages were determined for felsic metavolcanic rocks from the Silvânia Sequence and Jurubatuba Granite in the central part of the Brasília Belt. Zircon grains from a metavolcanic sample yielded 2115 ± 23 Ma and from the granite yielded 2089 ± 14 Ma, interpreted as crystallization ages of these rocks.

Six metavolcanic samples of the Silvânia Sequence yielded a six-point whole-rock Sm-Nd isochron indicating a crystallization age of 2262 ± 110 Ma and positive $\varepsilon_{Nd}(T) = +3.0$ interpreted as a juvenile magmatic event. Nd isotopic analyses on samples from the Jurubatuba Granite have Paleoproterozoic T_{DM} model ages between 2.30 and 2.42 Ga and $\varepsilon_{Nd}(T)$ values vary between –0.22 and –0.58. The oldest T_{DM} value refers to a sedimentary xenolith in the granite. These results suggest crystallization ages of Silvânia volcanics and Jurubatuba Granite are the first evidence of a ca. 2.14-2.08 juvenile magmatic event in the basement of the central part of the Brasília Belt that implies the presence of arc/suture hidden in reworked basement of the Brasília Belt.

Key words: U-Pb SHRIMP, Sm-Nd isotopic data, Brasília Belt, basement rocks.

INTRODUCTION

The Brasília Belt is a large Neoproterozoic orogen formed along the western margin of the São Francisco/Congo Craton in central Brazil. It comprises: (i) a thick Meso-Neoproterozoic metasedimentary/sedimentary pile with eastward tectonic vergence; (ii) a large Neoproterozoic juvenile arc in the west (Goiás Magmatic Arc); and (iii) a micro-continent (or exotic sialic terrain) formed by Archean rock units (the Crixás-Goiás granite-greenstones) and associated Proterozoic formations (Almeida et al. 1981, Fuck et al. 1993, 1994, Pimentel et al. 2000a, b) (Figure 1) .

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The sialic basement on which the Brasília Belt sediments were deposited is poorly understood, despite being well exposed in some areas of Goiás and Tocantins states (Figure 1). Gneiss and volcano-sedimentary units form most of this basement. Early studies have suggested that these rock units are dominantly Archean (Danni et al. 1982, Marini et al.1984). However, recent Sm-Nd isotopic studies have indicated that most of them are Paleoproterozoic (Pimentel et al. 1999a, 2000b, Sato 1998).

In central Goiás, a large part of the Brasília Belt is underlain by high-grade metamorphic rocks known as the Anápolis-Itauçu Complex, together with surrounding greenschist to amphibolite facies Meso- to Neoproterozoic cover metasediments of the Araxá Group, these rocks represent the main constituent of the internal zone of the Neoproterozoic Brasília Belt (Fuck et al. 1994, Pimentel et al. 2000b) (Figures 1 and 2). There are also volcano-sedimentary associations and granites. One of the supracrustal associations is known as Silvânia Sequence (Valente 1986); together with the Jurubatuba Granite, it is located between the Araxá Group, and the easternmost part of the Anápolis-Itauçu Complex (Figure 2).

Several high grade rock types have been recorded within the Anápolis-Itauçu Complex, the most extensive of which are felsic granulites, sillimanite-garnet gneiss, hypersthene bearing mafic-ultramafic granulites, and many granite intrusions.

In this study we investigate the age and isotopic characteristics of the Silvânia Sequence and the Jurubatuba Granite. We report U-Pb SHRIMP age determinations and Sm-Nd isotopic studies of these rock units in order to understand their nature, timing of crystallization and mantle extraction aiming their tectonic significance within the framework of the Brasília Belt (Figures 1 and 2).

NEOPROTEROZOIC BRASÍLIA BELT

The Brasília Belt in central Brazil constitutes the central/eastern part of the Tocantins province, representing a roughly N-S belt extending for more than 1000 km along the western margin of the São Francisco/Congo Craton.

The Tocantins Province resulted from collision of three major continental blocks at the end of the Neoproterozoic: the Amazon Craton, to the west, the São Francisco/Congo Craton, to the east, and the Paranapanema block, to the south, presently covered by Phanerozoic rocks of the Paraná Basin.

The westernmost part of the Brasília Belt consists of a Neoproterozoic juvenile arc (Goiás Magmatic Arc) formed by arc type volcano-sedimentary rocks and tonalite/granodiorite gneisses with ages ranging from ca. 930 to 640 Ma ago (Pimentel et al. 1991, 1997, Pimentel and Fuck 1992) .

The central part of the Brasília Belt consists of the Goiás Massif, represented by: (i) Archean greenstone belts and TTG orthogneisses; (ii) Paleoproterozoic orthogneisses largely covered by younger supracrustals; (iii) Paleo- Mesoproterozoic mafic-ultramafic layered complexes of Barro Alto, Niquelândia, and Canabrava and associated volcano-sedimentary sequences (Fuck et al. 1994, Pimentel et al. 2000b).

East of the Goiás Massif the easternmost part of the Brasília Belt is known as the external zone (Figure 1). This is largely comprised of Neoproterozoic metasedimentary units in which deformation and metamorphism decrease eastwards towards the São Francisco Craton. Northwards, these Neoproterozoic units (see Dardenne 2000 for a comprehensive review) lie unconformably over Paleoproterozoic basement units containing minor Archean contribution (Correia et al. 1997, Sato 1998, Pimentel et al. 2000a, Cruz et al. 2000). It has been suggested that these rocks may represent the western extension of the São Francisco Craton.

To the southeast of Goiás Massif is the metamorphic complex of the internal zone of the Brasília Belt. This part of the belt comprises mainly the Araxá Group metasediments including an ophiolite mélange (Drake Jr. 1980, Strieder and Nilson 1992) and intensively deformed intrusive granites. The internal zone also includes the high grade rocks of the Anápolis-Itauçu Complex. The age and tectonic significance of the Anápolis-Itauçu Complex is still a matter of debate. It has been traditionally interpreted as Archean basement within the Brasília Belt (Danni et al. 1982, Marini et al. 1984, Wolff 1991, Lacerda Filho and Oliveira 1995, Winge 1995). However, recent isotopic data have challenged this model (Fischel et al. 1998, 1999, Pimentel et al. 1999a). T_{DM} model ages of granulites and metasediments

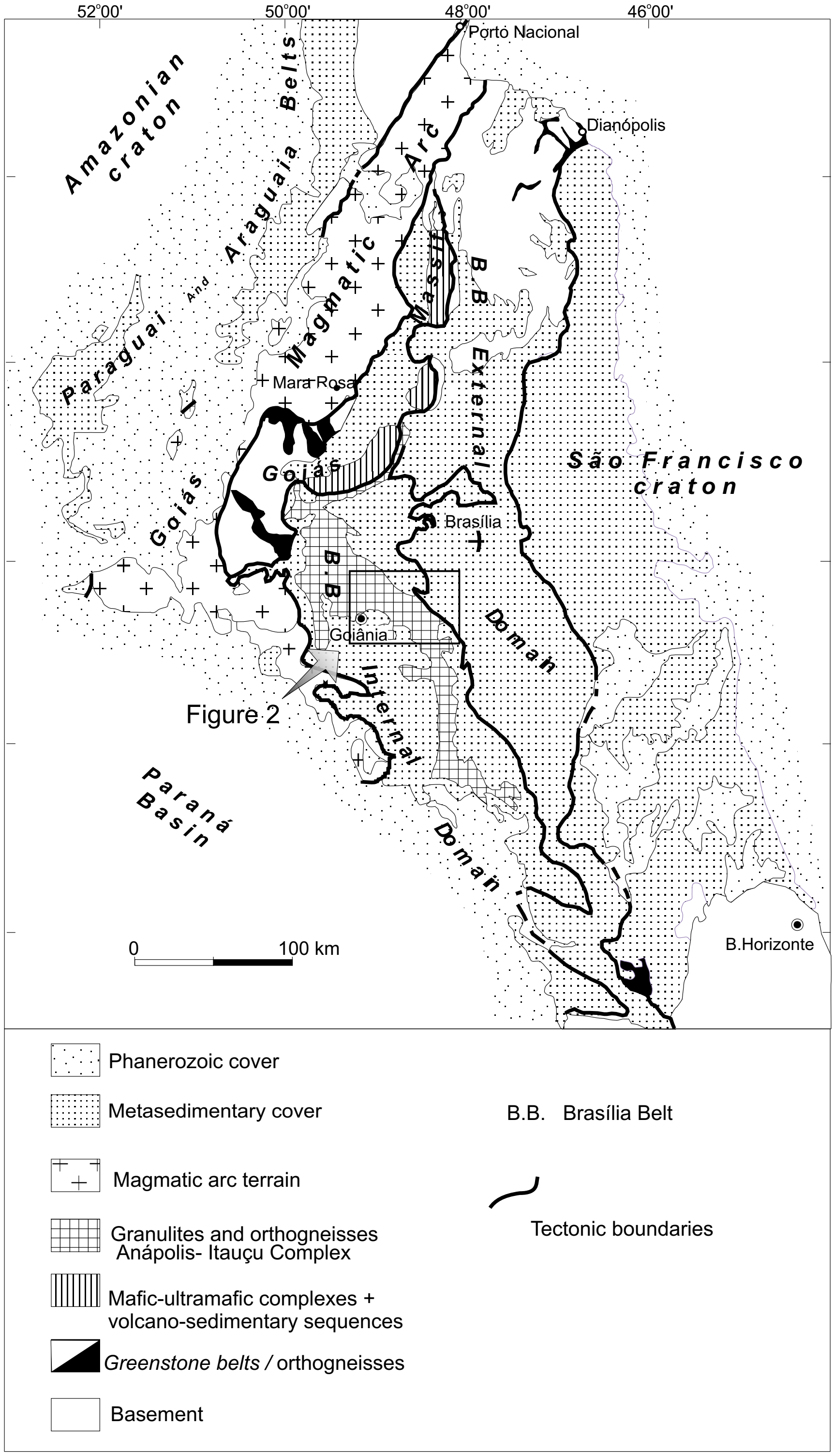

Fig. 1 – Geological sketch of the Brasília Belt. Modified after Fuck et al. (1994).

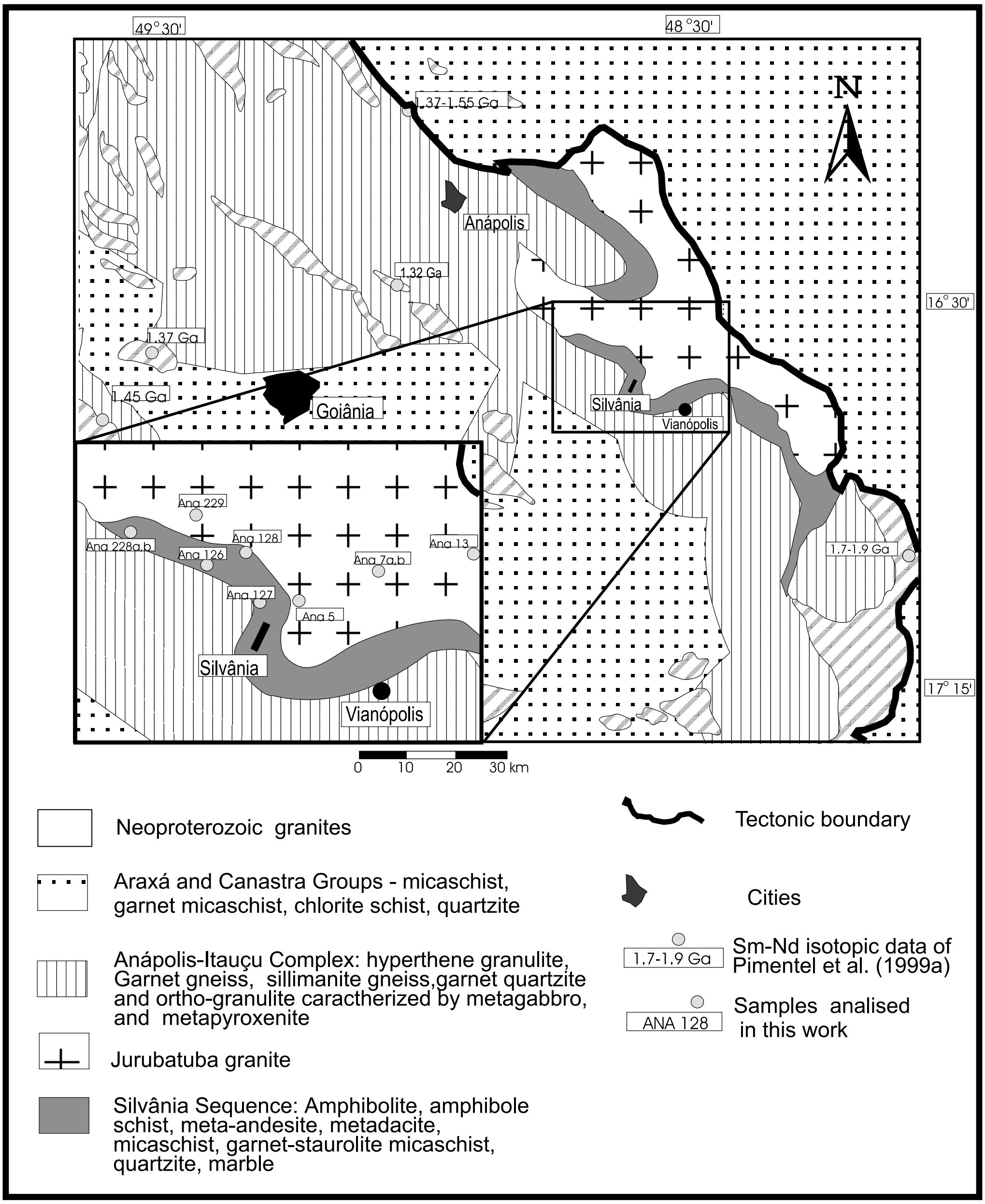

Fig. 2 – Geological sketch of the study area. Modified after Araújo (1994) and Lacerda Filho and Oliveira (1995).

fall within the interval between 1.9 and 1.2 Ga. These model ages are interpreted as the approximate upper limit for the age of the protoliths. The similarity of Nd isotopic composition of felsic granulites and metapelites of the Araxá Group led to the suggestion that at least some of the felsic granulites could represent high grade equivalents of the Araxá Group metasediments (Pimentel et al. 1999a).

Metasediments of the Araxá Group surrounding the Anápolis-Itauçu Complex (Figures 1 and 2) show bimodal distribution of T_{DM} model ages. A group of samples displays T_{DM} values between 1.8 and 2.3 Ga and another group shows younger model ages, between ca. 1.0 and 1.3 Ga (Pimentel et al. 1999b, 2000b, Fischel et al. 1999).

Granite intrusions in the Anápolis-Itauçu Complex were metamorphosed under high grade conditions at ca. 630 Ma ago (Sm-Nd whole rock-garnet isochron, Fischel et al. 1998). The same age was established with U-Pb SHRIMP data on metamorphic zircons from the Hinterlândia quarry granulite (Tassinari et al. 1999).

To the east of the high grade terrains the sediments of the Araxá Group were overthrusted on top of the thick metasedimentary/sedimentary pile of the external zone of the Brasília Belt. These rocks display tectonic vergence to the east, and constitute the Neoproterozoic Paranoá, Canastra, Ibiá and Vazante groups (Fuck et al. 1993, 1994, Dardenne 2000) (Figure 1). Nd isotopic composition of the Paranoá and Canastra groups indicate that these sediments were derived from a Paleoproterozoic source, probably from the São Francisco continent (Pimentel et al. 2000b). However, several rock samples of the Araxá and Ibiá groups have very young model ages, suggesting contribution from Neoprotezoic juvenile source areas, such as the Goiás Magmatic Arc.

GENERAL GEOLOGY

The Anápolis-Itauçu Complex

The Anápolis-Itauçu Complex consists of a NW-SE elongated zone (approximately 250 km long, 70 km wide) within the internal domain of the Brasília Belt (Figure 1). It is a complex association of high-grade rocks including mafic-ultramafic intrusions, charnockites, enderbites, granites, as well as Al-rich granulites of sedimentary origin, associated with marbles and quartzites. Part of the para-granulites are believed to represent the products of high grade metamorphism of pelites and graywackes (Wolff 1991, Araújo 1994, Winge 1995). The Anápolis-Itauçu Complex is separated by low and high angle shear zones from the Araxá sediments which comprise a turbiditic sequence of paragneiss, micaschist, quartzite, carbonate-bearing schists with minor carbonaceous schists, metacherts (Lacerda Filho and Oliveira 1995), and small alpine-type mafic-ultramafic bodies tectonically interlayered with the sedimentary rocks (Drake Jr 1980, Strieder and Nilson 1992). A number of peraluminous granite bodies is exposed within the Anápolis-Itauçu Complex (Figure 2). Some are strongly deformed and metamorphosed under high-grade conditions and are now represented by sillimanite and garnet-bearing rocks.

The Silvânia Sequence and the Jurubatuba Granite

The volcano-sedimentary Silvânia Sequence (Valente 1986) forms a ca. 70 km long NW-SE strip limited to the southwest by felsic granulites of the Anápolis-Itauçu Complex and to the northeast by the Jurubatuba Granite. The Silvânia Sequence and Jurubatuba Granite are strongly deformed, displaying a NW-SE foliation, typical of the central and southern parts of the Brasília Belt.

The Silvânia Sequence comprises two units: (i) a metavolcanic unit of garnet-rich amphibolite, metabasalt, meta-andesite, and felsic metavolcanic rocks and (ii) a metasedimentary unit of quartzite, garnet quartzite, micaschist, and garnet micaschist. Lithogeochemical data indicate tholeiitic to calc-alkaline signatures for the metavolcanic unit (Oliveira 1994, Freitas and Kuyumjian 1995).

The 65 km long, NW-SE trending Jurubatuba granite crops out to the northeast of the Silvânia Sequence and the contact is of tectonic nature striking N50W and dipping 70° to NE. The northern margin of the granite is charactherized by a faulted contact with metasediments of the Araxá Group. The granite body is homogeneous and is composed essentially of a white to pink, foliated biotite granite with hypidiomorphic K-feldspar, plagioclase, quartz, and reddish biotite in thin section. Xenoliths of mafic and metasedimentary rocks (quartz-garnet-biotite schist) are common.

U-Pb SHRIMP AND Sm-Nd RESULTS

Analytical Procedures

U-Pb SHRIMP

20 kg of each sample ANA 128 (felsic volcanic rock from the Silvânia Sequence) and ANA 5 (Jurubatuba granite) were collected (Figure 2). Rock samples were initially crushed to cm-sized fragments using a jaw crusher. The fragments were then ground, in small batches, in a tungsten carbide disk.

Each sample was sieved and heavy mineral concentrates were obtained using a DENSITEST® table. The concentrates were then passed through a Frantz isodynamic magnetic separator to obtain a pure zircon fraction. At least 100 representative zircons were hand-picked from this fraction under a binocular microscope, mounted in a one inch diameter epoxy disk with standard zircon crystals SL13 + AS3 and sectioned approximately in half. The mount surface was then polished to expose the grain interiors. The mount was then photographed at X150 magnification in reflected and transmitted light and CL images were obtained in order to reveal internal structures of the zircons.

Ion microprobe analyses were carried out using SHRIMP at the Research School of Earth Sciences, Australian National University, Canberra, Australia. SHRIMP analytical methods and data treatment follow those described by Stern (1997), Williams and Meyer (1998).

Uncertainties reported in tables and figures are given at 1σ level, and final ages are quoted at 95% confidence level. Concordia diagrams were calculated and yielded using Isoplot (Ludwig 1999).

Sm-Nd

Sm-Nd isotopic analyses followed the method described by Gioia and Pimentel (2000) and were carried out at the Geochronology Laboratory of the University of Brasília. Whole rock powders (ca. 50 mg) were mixed with ^{149}Sm-^{150}Nd spike solution and dissolved in Savillex capsules. Sm and Nd extraction of whole-rock samples followed conventional cation exchange techniques, using teflon columns containing LN-Spec resin (HDEHP – diethylhexil phosphoric acid supported on PTFE powder). Sm and Nd samples were loaded on Re evaporation filaments of double filament assemblies and the isotopic measurements were carried out on a multi-collector Finnigan MAT 262 mass spectrometer in static mode. Uncertainties for Sm/Nd and ^{143}Nd/^{144}Nd ratios are better than $\pm 0, 2\%(2\sigma)$ and $\pm 0.003\%(2\sigma)$ respectively, based on repeated analyses of international rock standards BHVO-1 and BCR-1. ^{143}Nd/^{144}Nd ratios were normalized to ^{146}Nd/^{144}Nd of 0.7219 and the decay constant (λ) used was 6.54×10^{-12}. T_{DM} values were calculated using De Paolo's (1981) model. Isochron ages were calculated using Isoplot (Ludwig 1999).

Silvânia Sequence

Sample ANA 128 contains pink elongate zircon crystals. Cathodeluminescence (CL) images of zircon grains typically show cores with fine magmatic zoning, surrounded by rims with irregular, patchy zoning (Figure 3A).

Fourteen spots in ten zircons were analysed (Table I). Ten analyses yield a nearly concordant age of 2115 ± 23 Ma (Figure 4). One rim (analysis 3.2) yielded an age of 524 ± 83 Ma for metamorphic overgrowth (Figure 4).

One felsic (ANA 128) and five mafic (ANA 126, 127a, 127b, 228a, 228b) metavolcanic rocks samples of the Silvânia Sequence yield a six-point whole-rock isochron (Table II) with a regression line (MSWD = 1.3) indicating a crystallization age of 2262±110 Ma and positive ε_{Nd}(T) = +3.0 (Figure 5).

T_{DM} age of 2.25 Ga and ε_{Nd}(T) of +3.15 of the felsic sample ANA 128 attest to the juvenile character of the magmatism (Table II, Figure 7).

Jurubatuba Granite

Zircon grains from ANA 5 are clear to yellowish and form stubby prismatic crystals. CL images (Figure 3B), show zircon crystals with typical magmatic growth zoning.

Fourteen spots of eleven zircons from ANA

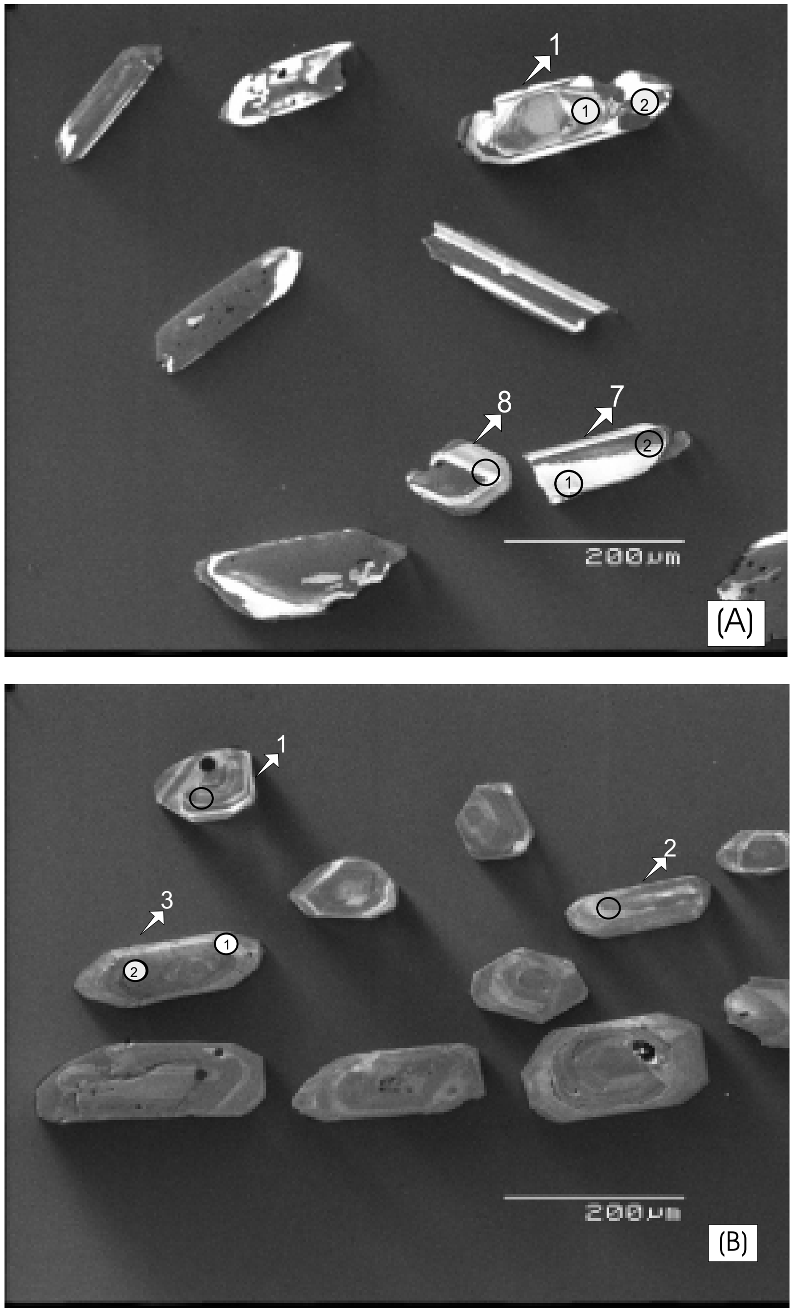

Fig. 3 – (A) CL images of zircon grains from felsic metavolcanic rock (sample ANA 128) of the Silvânia Sequence. (B) CL images of zircon from Jurubatuba Granite (sample ANA 5). Arrow indicates the zircon number and circle indicates analyzed spot.

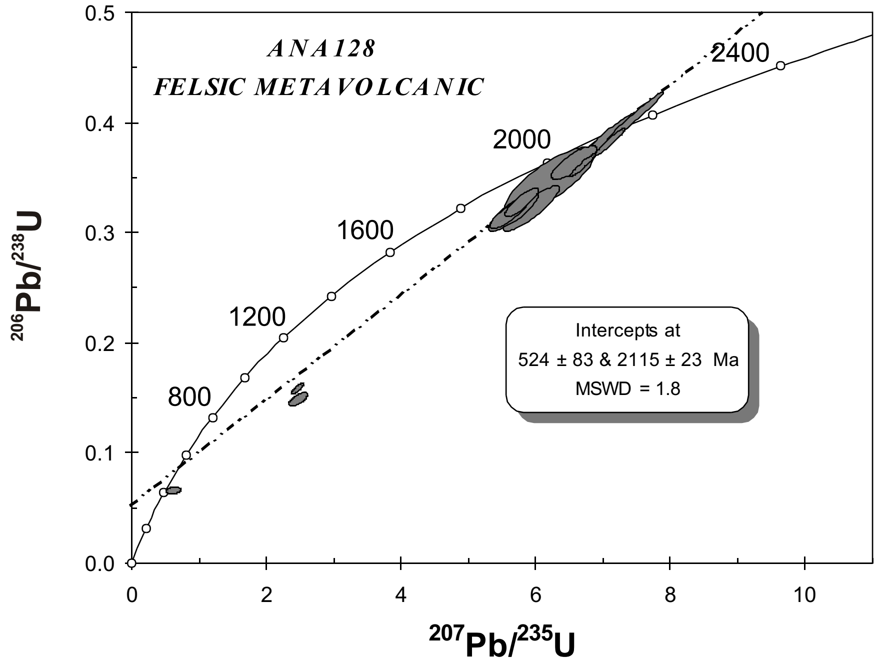

Fig. 4 – Concordia diagram of zircon analyses from Silvânia Sequence (ANA 128). Data-point error ellipses are 68.3% conf.

5 were analysed (Table III). Twelve analyses are nearly concordant and yield an age of 2089 ± 14 Ma (Figure 6). Two analyses of rims (analyses 3.2 and 6.2, Table III) yielded younger and discordant ages suggesting Pb loss at ca. 574 ± 75 Ma.

Sm-Nd whole rock analyses were performed on five samples of the Jurubatuba Granite (Table II, Figure 2). Samples ANA 5, 7a, 13, and 229 have Paleoproterozoic T_{DM} model ages between 2.30 and 2.42 Ga. The oldest T_{DM} value (2.50 Ga) refers to a sedimentary xenolith in the granite (Sample 7b). ε_{Nd}(T) values vary between –0.22 and –0.58. One sample of a diorite (ANA 229) has a T_{DM} model age of 2.30 Ga and ε_{Nd}(T) = +0.99 (Figure 7).

DISCUSSION

U-Pb and Sm-Nd isotopic data indicate that the felsic volcanic rocks of the Silvânia Sequence and part of Jurubatuba Granite (ANA 229) are Paleoproterozoic and contain a large proportion of Paleoproterozoic juvenile crustal components. They are juvenile extracts from the mantle and represent a Paleoproterozoic crust forming event (ε_{Nd} = +3.0 and +0.99 respectively). T_{DM} model age of ca. 2.25 Ga is equal within error to U-Pb crystallization age of 2.11 Ga suggesting ca. 2.1-2.2 Ga crust forming event. Geochemical data (Oliveira 1994, Freitas and Kuyumjian 1995) indicate that protholiths were formed in an island arc setting (Lacerda Filho et al. 1991, Lacerda Filho and Oliveira 1995).

The difference between 2.3-2.4 Ga Jurubatuba granite model ages and 2.09 Ga zircon crystallization age associated with slightly negative ε_{Nd} values at the time of crystallization indicate a limited but not negligible degree of crustal contamination as supported by common metasediment xenoliths, one of which displays the oldest model age (T_{DM} = 2.5 Ga) so far recorded in the study area. This suggests that the granite is either derived from re-melting of Paleoproterozoic crustal rocks, including metasediments, or is heavily contaminated with them.

TABLE I

Summary of SHRIMP U-Th-Pb zircon results for sample ANA 128.

							Radiogenic Ratios						Ages (in Ma)						
Grain. spot	U (ppm)	Th (ppm)		Th/U (ppm)	$^{204}Pb/^{206}Pb$	f_{206} %	$^{206}Pb/^{238}U$	±	$^{207}Pb/^{235}U$	±	$^{207}Pb/^{206}Pb$	±	$^{206}Pb/^{238}U$	±	$^{207}Pb/^{235}U$	±	$^{207}Pb/^{206}Pb$	±	Conc. %
1.1	186	65	0.3	76	0.000080	0.12	0.3876	0.0075	7.110	0.150	0.1331	0.0008	2,112	35	2,125	19	2,139	11	99
1.2	640	109	0.2	116	0.000092	0.14	0.1764	0.0030	2.516	0.055	0.1034	0.0012	1,047	17	1,277	16	1,687	21	62
2.1	323	22	0.1	118	0.000035	0.05	0.3682	0.0064	6.713	0.126	0.1322	0.0007	2,021	30	2,074	17	2,128	10	95
3.1	149	110	0.7	28	0.000397	0.68	0.1671	0.0035	1.627	0.058	0.0706	0.0018	996	20	981	23	946	54	105
3.2	330	53	0.2	27	0.001891	3.38	0.0870	0.0018	0.704	0.064	0.0587	0.0050	538	11	541	39	554	199	97
4.1	46	13	0.3	16	0.000316	0.47	0.3305	0.0135	5.963	0.289	0.1309	0.0028	1,841	65	1,971	43	2,110	38	87
5.1	191	77	0.4	84	0.000010	0.02	0.4095	0.0137	7.487	0.261	0.1326	0.0008	2,213	63	2,172	32	2,133	11	104
2.2	28	5	0.2	10	0.001091	1.62	0.3548	0.0189	6.218	0.438	0.1271	0.0051	1,957	90	2,007	64	2,059	72	95
6.1	149	33	0.2	60	0.000010	0.02	0.3926	0.0136	7.114	0.268	0.1314	0.0015	2,135	63	2,126	34	2,117	20	101
7.1	77	14	0.2	26	0.000210	0.31	0.3355	0.0081	5.817	0.174	0.1258	0.0019	1,865	39	1,949	26	2,040	27	91
7.2	140	121	0.9	25	0.000566	0.84	0.1666	0.0039	2.546	0.091	0.1108	0.0027	993	22	1,285	26	1,813	45	55
8.1	204	29	0.1	67	0.000199	0.30	0.3257	0.0083	5.629	0.183	0.1254	0.0022	1,817	41	1,921	28	2,034	31	89
9.1	46	16	0.3	18	0.000715	1.07	0.3702	0.0090	6.600	0.208	0.1293	0.0022	2,030	43	2,059	28	2,088	31	97
10.1	27	6	0.24	9	0.000452	0.67	0.3277	0.0112	5.706	0.241	0.1263	0.0027	1,827	55	1,932	37	2,047	38	89

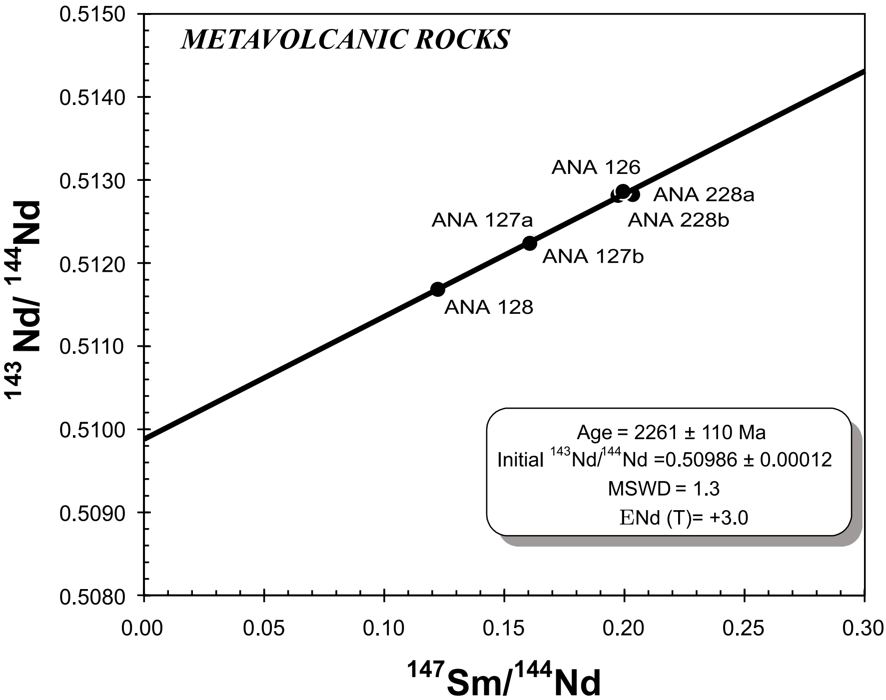

Fig. 5 – Sm-Nd whole-rock isochron of metavolcanic rocks from the Silvânia Sequence.

TABLE II

Sm-Nd isotopic data for rocks from the Silvânia Sequence and Jurubatuba Granite.

Silvânia Sequence							
Sample	Sm (ppm)	Nd (ppm)	$^{147}Sm/^{144}Nd$	$^{143}Nd/^{144}Nd$*	T_{DM}(Ga)	$\varepsilon_{Nd}(0)$	$\varepsilon_{Nd}(2115)$
Ana 126	2.89	8.593	0.203326	0.512848 (22)			
Ana 127	3.003	11.278	0.160939	0.512259 (11)			
Ana 127(b)	2.779	10.467	0.16049	0.512239 (25)			
Ana 128	1.871	9.251	0.122254	0.511686 (43)	2.25	–18.57	+3.15
Ana 228(a)	2.346	7.190	0.197242	0.512817 (27)			
Ana 228(b)	2.805	8.0503	0.199399	0.512865 (28)			
Jurubatuba Granite							
Sample	Sm (ppm)	Nd (ppm)	$^{147}Sm/^{144}Nd$	$^{143}Nd/^{144}Nd$*	T_{DM}(Ga)	$\varepsilon_{Nd}(0)$	$\varepsilon_{Nd}(2089)$
Ana 5	10.005	65.89	0.0922	0.511175 (29)	2.333	–28.54	–0.53
Ana 7(a)	6.784	36.342	0.1128	0.511471 (19)	2.367	–22.76	–0.28
Ana 13	6.116	28.477	0.1298	0.511708 (16)	2.417	–18.13	–0.22
Ana 229	9.0516	42.671	0.12890	0.511756 (18)	2.30	–17.21	+0.99
Ana 7(b) (xenolith)	6.544	32.139	0.1231	0.511555 (09)	2.506	–21.13	

*The numbers in parenteses are 1σ errors in the last two digits of the isotopic ratio.

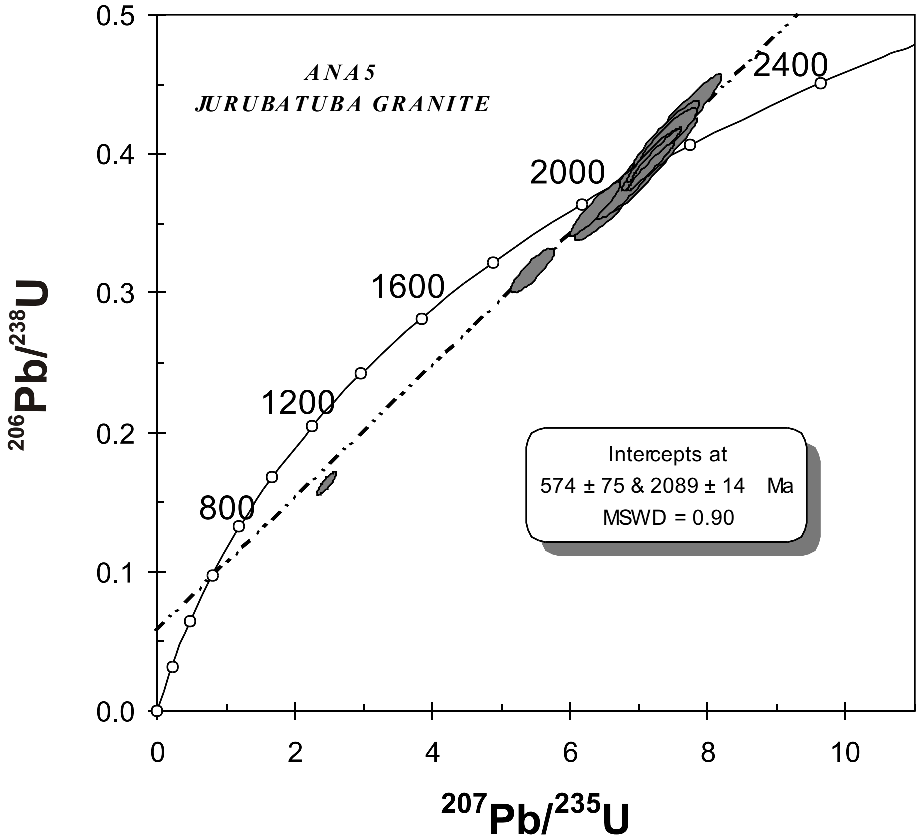

Fig. 6 – Concordia diagram for the Jurubatuba granite (sample ANA 5). Data-point error ellipses are 68.3% conf.

Paleoproterozoic rocks have been described previously in other areas of the Tocantins Province. Granite gneiss to the south and east of the Barro Alto mafic-ultramafic layered complex has been dated at 2128 ± 15 Ma (^{207}Pb/^{206}Pb) (Correia et al. 1997). Calc-alkaline granite gneiss from the Almas-Dianópolis area has been dated at ca. 2.2 Ga (U-Pb SHRIMP on zircon, Cruz et al. 2000). The latter is probably the western extension of Paleoproterozoic rocks which underlie the San Francisco Craton to the east of the Brasilia Belt.

Zircons of both lithological units also present Pb loss at 524 ± 83 Ma and 574 ± 75 Ma, related to the Brasiliano/Pan-African metamorphic event. This event is evident in different parts of the Brasília Belt: in the Goiás Massif, Queiroz et al. (1999) report ages of 590 ± 10 Ma (U-Pb SHRIMP in zircon and titanite); Fortes and Jost (1996) dated the metamorphic peak in Crixás Greenstone Belt at ca. 550 Ma (Ar-Ar and K-Ar in muscovite); K-Ar in muscovite and biotite in samples from Araxá Group and Anápolis-Itauçu Complex near Goiânia yielded ages between 580 Ma and 800 Ma (Hasui and Almeida 1970).

CONCLUSIONS

The Paleoproterozoic crystallization ages (U-Pb SHRIMP and Sm-Nd whole rock isochron) of the volcano-sedimentary Silvânia Sequence and of the Jurubatuba Granite are the first documented evidence of a ca. 2.14-2.08 Ga juvenile magmatic event in the basement of the southern portion of the

TABLE III

Summary of SHRIMP U-Th-Pb zircon results for sample ANA 5.

							Radiogenic Ratios						Ages (in Ma)						
Grain. spot	U (ppm)	Th (ppm)		Th/U (ppm)	$^{204}Pb/^{206}Pb$	f_{206} %	$^{206}Pb/^{238}U$	±	$^{207}Pb/^{235}U$	±	$^{207}Pb/^{206}Pb$	±	$^{206}Pb/^{238}U$	±	$^{207}Pb/^{235}U$	±	$^{207}Pb/^{206}Pb$	±	Conc. %
1.1	174	83	0.48	76	0.000015	0.02	0.4027	0.0123	7.205	0.238	0.1298	0.0012	2.182	57	2.137	30	2.095	17	104
2.1	113	54	0.48	49	0.000010	0.02	0.3974	0.0128	7.142	0.253	0.1304	0.0015	2.157	59	2.129	32	2.103	20	103
3.1	190	53	0.28	73	0.000181	0.27	0.3651	0.0124	6.381	0.240	0.1268	0.0016	2.006	59	2.030	34	2.053	22	98
3.2	702	154	0.22	126	0.000299	0.45	0.1762	0.0051	2.511	0.087	0.1033	0.0016	1.046	28	1.275	25	1.685	29	62
4.1	40	14	0.34	18	0.000034	0.05	0.4312	0.0184	7.666	0.358	0.1289	0.0019	2.311	83	2.193	43	2.084	26	111
4.2	202	93	0.46	88	0.000010	0.02	0.4043	0.0120	7.270	0.226	0.1304	0.0009	2.189	55	2.145	28	2.104	11	104
5.1	263	125	0.48	113	0.000010	0.02	0.3951	0.0117	7.181	0.225	0.1318	0.0009	2.146	54	2.134	28	2.123	12	101
6.1	73	36	0.49	33	0.000182	0.27	0.4171	0.0158	7.389	0.315	0.1285	0.0019	2.247	72	2.160	39	2.078	27	108
6.2	249	136	0.55	89	0.000272	0.41	0.3228	0.0100	5.465	0.206	0.1228	0.0022	1.803	49	1.895	33	1.998	32	90
7.1	49	26	0.53	21	0.000109	0.16	0.3891	0.0174	6.995	0.360	0.1304	0.0026	2.119	81	2.111	47	2.103	36	101
8.1	73	35	0.49	30	0.000010	0.02	0.3728	0.0187	6.648	0.377	0.1293	0.0027	2.043	89	2.066	51	2.089	37	98
9.1	109	86	0.79	52	0.000053	0.08	0.4165	0.0125	7.441	0.260	0.1296	0.0019	2.245	57	2.166	32	2.092	26	107
10.1	21	8	0.38	9	0.000010	0.02	0.3804	0.0139	6.793	0.291	0.1295	0.0024	2.078	65	2.085	39	2.092	32	99
11.1	44	30	0.68	21	0.000010	0.02	0.4078	0.0134	7.448	0.262	0.1325	0.0012	2.205	62	2.167	32	2.131	16	104

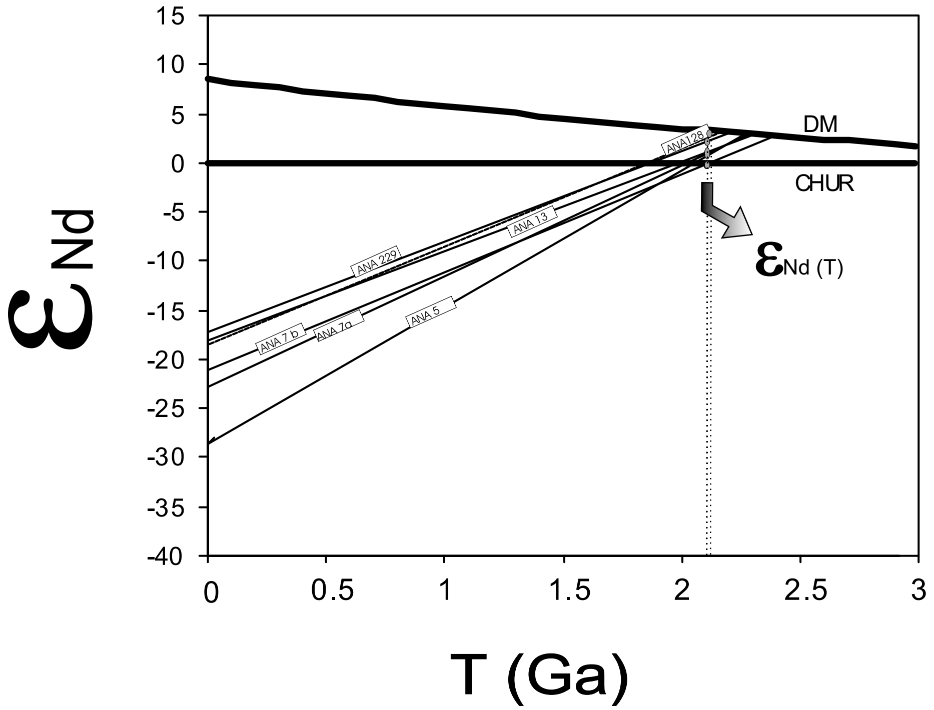

Fig. 7 – Nd isotopic evolution diagram for samples of Jurubatuba granite and felsic volcanics from the Silvânia Sequence.

Brasilia Belt. U-Pb SHRIMP zircon ages of the Silvânia dacite and Jurubatuba granite are similar: 2115 ± 23 Ma and 2089 ± 14 Ma respectively and rim overgrown in zircon of both lithological units indicate recrystallization during the Brasiliano/Pan-African metamorphic event.

Isotopic, litogeochemical, and field data suggest a Paleoproterozoic magmatic arc setting which we named Silvânia Magmatic Arc with juvenile magma as indicated by positive ε_{Nd} at the time of crystallization. The homogeneous and slightly negative Sm-Nd model ages and ε_{Nd} values at the time of crystallization of the Jurubatuba Granite suggest crustal contamination. The oldest T_{DM} (2.5 Ga) in the study area is from a xenolith within the granite body. These data suggest that the original granitic magma was derived by the remelting of crustal rocks, including sedimentary sources similar to the enclave or was heavily contaminated by it.

The Silvânia Magmatic Arc probably represents the westernmost autochthonous exposure of Paleoproterozoic rocks belonging to the São Francisco continent involved in the Neoproterozoic orogeny. During the Neoproterozoic the Silvânia Magmatic Arc was juxtaposed with the Anápolis-Itauçu Complex and Araxá Group.

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RESUMO

Idades isótopicas U-Pb SHRIMP e Sm-Nd foram determinadas em rochas metavulcânicas félsicas da Seqüência de Silvânia e Granito Jurubatuba na porção central da Faixa Brasília. Grãos de zircão da rocha metavulcânica da Seqüência de Silvânia e do granito forneceram, respectivamente, as idades de 2115 ± 23 Ma e 2089 ± 14 Ma, interpretadas como idades de cristalização destas rochas. Amostras da Seqüência de Silvânia resultaram em isócrona Sm-Nd em rocha total, indicando idade de cristalização de 2262 ± 110 Ma e $\varepsilon_{Nd}(T)$ = +3.0 interpretada como representativa de evento magmático juvenil para estas rochas.

Análises isótopicas de Nd em amostras do Granito Jurubatuba resultaram em idades modelo T_{DM} entre 2.30 e 2.42 Ga e valores de $\varepsilon_{Nd}(T)$ variando entre –0.22 e –0.58. O valor mais antigo de idade modelo T_{DM} refere-se a xenólito de rocha metassedimentar no granito. As idades de cristalização paleoproterozóicas da Seqüência de Silvânia e do Granito Jurubatuba são a primeira evidência de evento magmático juvenil ocorrido entre 2.14-2.08 Ga no embasamento da porção central da Faixa Brasília.

Palavras-chave: U-Pb SHRIMP, dados isotópicos Sm-Nd, Faixa Brasília, embasamento.

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