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Sr, Nd and Pb isotopic signatures of intrusive granitoids of the Paleoproterozoic Mineiro magmatic arc, southern São Francisco craton, Brazil

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The Mineiro Belt (MB) lies in the southern end of the São Francisco craton surrounding an Archean platform stabilized between 2700 and 2600 Ma[1,2]. It comprises a large area of Archean basement including TTG gneisses and migmatites, greenstone assemblages and high-grade gneisses, reworked during the Transamazonian orogeny. In addition the MB evolution includes many intrusive granitoid bodies, mafic dikes and pegmatites, as well as supracrustal sequences. These are restricted to the Quadrilátero Ferrífero region and to a narrow N-NE belt linking the southwestern tip of the Quadrilátero Ferrífero to the Bonsucesso ridge.

Early stages of the MB evolution are related to sedimentation of the Minas Supergroup. This sequence records the change from platformal to synorogenic sedimentation of the belt; the basal Moeda Formation contains zircons with $^{207}Pb/^{206}Pb$ minimum ages of *ca.* 2600 Ma[3], and marbles of the Gandarela Formation have a Pb-Pb whole rock isochron deposition age of *ca.* 2420 Ma[4]. The upper Sabará Formation contains 2125 Ma zircon and the overlying Itacolomi Group contains zircon of *ca.* 2.06 Ga, identical to the ages of the regional metamorphism (Transamazonian orogeny)[3,5]. These units may represent a flysh-molasse deposit of the belt.

Tectonism within the MB has overprinted the Archean crust inducing isotopic resetting and giving rise to gneissic domes[1,3,5,6]. U-Pb ages in sphenes from Quadrilátero Ferrífero gneisses define the peak of the Transamazonian metamorphism of the belt at 2065-2035 Ma[2,5]. Metamorphic grade increases eastwards from the Bonfim complex, where sphene ages are Archean[7], to the Bação Complex where sphene U-Pb dates are concordant at 2059 Ma[2]. In the Belo Horizonte complex, sphene dates plot in a discordia line between 2860 Ma and 2041 Ma[5]. East of the Quadrilátero Ferrífero the Transamazonian metamorphism reached granulitic grade at *ca.* 2000 Ma, as evidenced by concordant Rb-Sr and Pb-Pb whole rocks isochron ages[8]. Generation of tholeiitic dikes, most of them intrusive into the Archean continental margin, indicates the cratonization stage of the MB. K-Ar amphibole ages in the MB range from 2.1 to 1.9 Ga and must have resulted from progressive uplift accompanying the tectonic stabilization. The majority of K-Ar biotite dates of the MB, however, shows variable resetting due to younger tectonothermal episodes enabling delineation of its original paleogeography. These episodes reflect the effects of the Mesoproterozoic Espinhaço intracratonic rift evolution and the Neoproterozoic collision belts that developed marginal to the Craton.

Granitoid intrusions form a string of bodies that extend nearly 300 km westwards from the southern border of the Quadrilátero Ferrífero (Fig. 1), and have isotopic ages between 2.2-1.9 Ga. The plutons are syn- to postectonic in relation to the MB evolution and constitute tonalitic and granitic calc-alkalic suites. A number of alkalic plutons occurs to the east and south of this belt, within the Neoproterozoic domain marginal to the craton[9]. The plutons and the available isotopic data are:

1.*Alto Maranhão*: The pluton has a predominant tonalitic composition and is foliated. U-Pb zircon and sphene analyses yielded an intrusion age of 2124±2 Ma[5] and a t_{DM} age of 2.20 Ga. The calculated ε_{Nd} value for the age of emplacement is +2.45.

2. *Ressaquinha*: This intrusion is composed mainly of weakly foliated rocks of granodioritic to tonalitic composition[10]. A previous Rb-Sr whole-rock isochron[10] was recalculated by adding new data and yielded 2010±52 Ma (MSWD=9.43) with initial $^{87}Sr/^{86}Sr$=0.7086±0.0006. Sm-Nd analysis defined a t_{DM} age of 2.25 Ga and the calculated ε_{Nd} value is slightly negative (-1.66).

3. *Campolide*: A weakly foliated and locally porphyritic pluton with a Rb-Sr whole-rock isochron of 1998±97 Ma (MSWD=1.91) and high initial $^{87}Sr/^{86}Sr$=0.7157±0.0018.

4. *Ritápolis*: This body is chiefly composed of a highly fractionated peraluminous granite with well preserved igneous texture[11]. A preliminary Rb-Sr errorchron (MSWD=18.3) yielded 1863±44 Ma with a very high initial $^{87}Sr/^{86}Sr$ ratio (0.7584±0.0087). Sm-Nd model ages t_{DM} are between 3.30-3.10 Ga, and two calculated ε_{Nd} values are -5.95 and -6.95.

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5. *Itutinga*: A small intrusion similar to the Ritápolis granite. Similarly to this granite, the Itutinga body presents a very old t_{DM} age of 3.48 Ga and a strongly negative calculated ε_{Nd} value (-7.35).

6. *Alto Jacarandá*: A postectonic granitic intrusion cutting Archean high-grade gneisses[12] A Rb-Sr whole-rock isochron for this rock yielded 1900±108 Ma (MSWD=3,95) with initial $^{87}Sr/^{86}Sr$ = 0.7096±0.0018[1]. Two t_{DM} ages are between 2.71 and 2.80 Ga, and the calculated ε_{Nd} values are -8.82 and -10.97, indicating the nature of the protolith.

7. *Tabuões*: This trondhjemitic pluton is not foliated[11]. Preliminary Rb-Sr whole-rock isochrons are: 1932±20 Ma[13] and 2248±75 Ma. One t_{DM} model age is 2.36 Ga. Both isochrons have low initial $^{87}Sr/^{86}Sr$ (0.7017), and the calculated ε_{Nd} value is +0.13.

8. *Lavras*: This granodioritic intrusion is weakly foliated[14]. A Rb-Sr whole-rock isochron for this pluton yielded 1982±134 Ma (MSWD=0.61) with initial Sr/ Sr=0.7041±0.0017[1,12], and a Sm-Nd t_{DM} model age of 2.41 Ga with ε_{Nd} value of -2.12[15].

7. *Porto Mendes*: A large and mostly undeformed granitic batholith with well preserved igneous structures. Rb-Sr and Pb-Pb whole rock isochrons yielded 2178±85 Ma with Sr/ Sr=0.7043 and 1821 +102-109 Ma with μ_1=8.05, respectively[16]. An additional Sm-Nd t_{DM} model age is 2.54 Ga with calculated ε_{Nd} value of -3.73[15].

8. Alkalic *plutons*: Two Rb-Sr whole-rock errorchrons are available: 2030±352 Ma (Matola complex) and 2159±137 Ma (Mercês-Ubaí complex). Further studies intend to ascribe the ALKALIC magmatism to specific stages of the MB evolution.

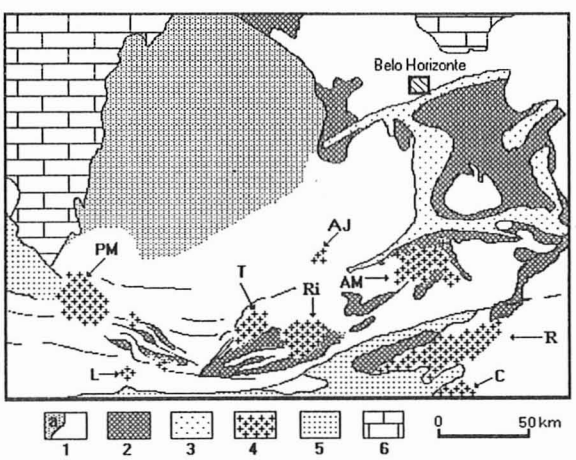

Fig. 1. The Mineiro Belt and its granitic plutons (AM-Alto Maranhão, R-Ressaquinha, C-Campolide, Ri-Ritápolis (+ Itutinga), AJ-Alto Jacarandá, T-Tabuões, L-Lavras, PM-Porto Mendes). Legend: 1.Archean gneissic complexes (a-Archean cratonic area), 2. Archean greenstone belts, 3. Minas Supergroup, 4. Paleoproterozoic granitic plutons, 5. Araxá and São João del Rei groups, 6. Bambuí Group.

The tectonic scenario for the MB evolution suggests an Archean passive margin evolving into an Andean-type margin and a continent-collisional belt. Emplacement of mantle-derived tonalitic (trondhjemitic) rocks of the MB (Alto Maranhão and Tabuões) took place from 2.25 to-2.12 Ga and are related to the consumption of the oceanic crust, marking the early stage of the Transamazonian orogeny[5]. Collision happened around 2.0 Ga and syn- to postcollisional granites, at this stage, have Sr, Pb and Nd signatures indicative of derivation from mixing of Transamazonian juvenile material and variable proportions of Archean crust (Ressaquinha, Lavras, Jacarandá, Porto Mendes). In particular, the youngest plutons (~ 1860 Ma; Ritápolis and Itutinga) derived mostly from crustal components, as evidenced by the negative ε_{Nd} values up to -7.35. This points to the presence of Archean basement under the belt during its late stage evolution.

References

1. Teixeira, W., *Tese de Doutoramento*, USP, 232pp (unpublished) (1985)
2. Machado, N. *l.*, *Geol. Soc. Am. Bull.*, **104:** 1221-1227 (1992)
3. Machado, N. *et al.*, *Earth Plan. Sci. Lett.*, **141**: 259-276 (1996)
4. Babinski, M. et al., *Prec. Research.*, 72: 235-246 (1995)
5. Noce, C.M. *Tese de Doutoramento*, USP, 128pp (unpublished) (1995)
6. Teixeira, W. & Figueiredo, M.C.H. *Prec. Research.*, **53:** 1-22 (1991)
7. Machado, N. & Carneiro, M.A. *Can. Jour. Earth Sci.*, **29:** 2341-2346 (1992)
8. Teixeira, W. *et al.*, Anais 4° Simp. Geol MG, p.58-71 (1987)
9. Viana , H.S. *et al.*, PLGB-Folha Barbacena, CPRM-DNPM, 162pp (1991)
10. Pinto, C.P. *Dissertação de Mestrado*, UFMG, 187pp (unpublished) (1995)
11. Quéméneur, J. & Garcia, D. Anais 7° Simp. Geol. MG, p.105-107 (1993)
12. Fiumari, S.L. *et al.*, Anais 3° Simp. Geol. MG, p.60-67 (1985)
13. Quéméneur, J. & Vidal, Ph.. Anais 5° Simp. Geol. MG, p.51-54 (1989)
14. Heilbron, M. *et al.*, *An. Acad. Bras. Ciên.*, **61:** 177-199 (1989)
15. Noce, C.M. & Teixeira, W. Anais 38° Congr. Bras. Geol., **v.6**, p.483-488 (1996)
16. Teixeira, W. et al., Extended Abstracts, Int. Symp. Granites and Associated Mineralizations, p.37-40 (1987)