

POSSIBLE KOMATIITIC AFFINITY AND POTENCIAL PGE MINERALIZATION OF THE ARCHEAN RIBEIRÃO DOS MOTAS LAYERED SEQUENCE, BRAZIL

Maurício Antônio Carneiro*, **João Henrique Grossi Sad****, **Irneu Mendes de Carvalho Jr.***, **Hermínio Arias Nalini Jr.***, **Juliano Félix de Lima***, **José Anderson Perim Camporez*** and **Wilson Teixeira*****

* *Departamento de Geologia da Escola de Minas da Universidade Federal de Ouro Preto, Brazil.*

** *Geosol - Geologia e Sondagens Ltda, Brazil.*

*** *Departamento de Geologia Geral do Instituto de Geociências da Universidade de São Paulo, Brazil.*

ABSTRACT

The southern portion of the São Francisco Craton (SSFC), located in Minas Gerais State, underwent a long crustal development that occurred from Mesoarchean to Neoproterozoic times (Carneiro et al., 1998a; 1998b; Teixeira et al., 1996). The Archean rocks of the SSFC, which formed between 3.5 – 2.5 Ga are essentially gneisses and granitoids (TTG suite), a greenstone belt sequence (Rio das Velhas Greenstone Belt - RVGB), an intrusive ultramafic-mafic layered complex (Ribeirão dos Motas Layered Sequence - SARM), and mafic dikes swarms. Locally, the Archean rocks are covered by Proterozoic intracratonic sedimentary basin sequences containing quartzite-carbonate-shale with minor contribution of the bimodal volcanics-quartzite-arkose and volcanics-graywacke and intruded by swarms of mafic dikes and/or granitoid bodies. The SARM comprises alternate layers of main peridotitic and pyroxenitic rocks with minor gabronorite and amphibolite rocks, outcropping as several disrupted bodies (Carneiro et al., 1997). Olivine, spinel, amphibole and pyroxene (orto- and clino-) constitute the peridotite mineralogy. The pyroxenite is constituted by pyroxenes (orto- and clino-), amphibole and spinel. Besides the typical petrographic features and texture commonly found in layered complexes such as: igneous layering, euhedral crystals and cumulus textures, the studied rocks present some *sui generis* petrographic aspects such as chadacrystal of euhedral amphibole included in euhedral oikocrystal of pyroxene. Major and minor elements have been performed on 15 whole rock samples from different SARM outcrops. The SARM ultramafic rocks have MgO contents ranging from 23.8 to 34.9 wt% (MgO = 30.08 average wt%); TiO₂ = 0.182 average wt%; CaO/Al₂O₃ ratio of 0.72 (average); Al₂O₃/TiO₂ ratio of 33 (average). Analyses of REE and PGE have been performed on 6 samples. All samples are low in total REE abundance; Pt and Pd average are 28 and 10.6 ppb respectively. These chemical data suggest that SARM magmas were derived from komatiite magmas similar to siliceous high magnesian basalts (SHMB). Furthermore, the higher Pt and Pd (average ppb) suggest that magmas feeding the SARM could be carrying conspicuous amounts of PGE. Regionally, the geochemistry studies reveal great similarity between the SARM and the komatiite rocks of the RVGB (Padilha et al., 1984; Sichel et al., 1983; Schorscher et al., 1992). However, the SARM ultramafic rocks have higher average contents of MgO, Cr, Ni and lower average contents of SiO₂, TiO₂, K₂O and REE. These geochemical features suggest that the RVGB komatiite may have been generated from more evolved SARM magmas. However, it is also possible that the mantle source region for both ultramafic mag-

mas had been depleted during a melting episode that caused extraction of the RVGB komatiite magma. Thus, in spite of the lack of unequivocal geological relationships between SARM and the komatiite rocks of the RVGB, the two sequences referred to above may have had the same magmatic source and, as a consequence, been tectonically related. Assuming that this is true, the SARM rocks are a fraction of the komatiite magma that was encapsulated in the lower crust forming a layered ultramafic-mafic complex. Another portion of the komatiite magma would have reached the surface forming ultramafic volcanic supracrustal sequences of the SGRV. Finally, the SARM geochemical data when compared with those of the Archean Australian layered complexes (Sun et al., 1991; Hoatson et al., 1992) exhibit higher average Pt, Pd, Al₂O₃/TiO₂ ratio, Cr and Ni, while Ti/Sc ratio, Ti, SiO₂ and K₂O average (wt%) are lower. The higher Pt and Pd values in comparison with those values of the Archean Australian layered complexes, which were presented by Sun et al. (1991) and Hoatson et al. (1992), are suggestive of a potential PGE mineralization in the SARM.

REFERENCES

- Carneiro M.A., Teixeira W., Carvalho Jr. I.M.de, Oliveira A.H.de and Fernandes R.A., 1997. Archean Sm/Nd isochron age from the Ribeirão dos Motas layered rocks sequence, Southern São Francisco Craton Brazil. In: South-American Symposium on Isotope Geology. Campos do Jordão. 1997. Anais. Campos do Jordão, SBG, p. 63-64.
- Carneiro M.A., Teixeira W., Carvalho Jr. I.M.de and Fernandes R.A., 1998a. Sialic crust as a part of the Archean greenstone belt basement, evidence from the Bonfim Metamorphic Complex, Quadrilátero Ferrífero, Brazil. *Revista Brasileira de Geociências*, 28: 71-82.
- Carneiro M.A., Nalini Jr. H.A., Teixeira W., Oliveira A.H. De, Costa P.C.C. Da, Carvalho Jr. I.M.De, Franco A.S.P. and Camporez J.A.P., 1998b. The tectonic assembly of the southern São Francisco Craton, Brazil: Facts, fictions and new approaching. In: International Conference on Basement Tectonics, 14. Ouro Preto, 1998. Abstracts, p. 149-151.
- Hoatson D.M., Wallace D.A, Sun S.-S., Macias L.F., Simpson C.J., Keays R.R., 1992. Petrology and Platinium - Group-Element Geochemistry of Archean Layered Mafic- Ultramafic Intrusions, West Pilbara Block, Western Australia. *AGSO Bull.*, 242, 319 pp.
- Padilha A.V., 1984. Formação Córrego dos Boiadeiros - Uma Sequência Komatiítica na Base do Grupo Nova Lima- Supergrupo Rio das Velhas- Quadrilátero Ferrífero, Minas Gerais, Brasil. In: Congresso Brasileiro de Geologia, 33. Rio de Janeiro, 1984. Anais., 6: 2,668-2,678.

- Sun S.-S., Wallace D.A., Hoatson D.M., Glikson A.Y. and Keays R.R., 1991. Use of geochemistry as a guide to platinum group element potential of mafic-ultramafic rocks: examples from the west Pilbara Block and Halls Creek Mobile Zone, Western Australia. *Precambrian Research*, 50: 1-35.
- Shorscher H.D., 1992. Arcabouço petrográfico e evolução crustal de terrenos precambrianos do sudeste de Minas Gerais: Quadrilátero Ferrífero, Espinhaço meridional e domínios granito-gnáissico adjacentes. São Paulo, 2v. (Tese de Livre docência - Instituto de Geociências / USP).
- Sichel S.E., 1983. Geologia do Arqueano da Região de Santa Bárbara, Quadrilátero Ferrífero, Minas Gerais. In: *Simpósio de Geologia de Minas Gerais*, 2, Belo Horizonte, Anais, p. 197-198.
- Teixeira W., Carneiro M.A., Noce C.M., Machado N., Sato K. and Taylor P.N., 1996. Pb, Sr and Nd isotope constraints on the Archean evolution of gneissic-granitoid complexes in the southern São Francisco Craton, Brasil. *Precambrian Research*, 78: 151-164.