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Extended Abstracts

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Sm-Nd and Rb-Sr systems in part of the Vila Nova metamorphic suite, northern Brazil

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The Vila Nova Metamorphic Suite occurs in a number of irregular belts in the States of Amapá and Pará, Northern Brazil. Its age was uncertain. The identification of metaultramafic rocks as komatiites led to the attribution of an Archaean age (1,2), although a Rb-Sr whole rock isochron age of ~2.1Ga was already available (3). The general trend of the Vila Nova belts is continuous with ~2.1- 2.3 Ga metavolcanosedimentary associations in Venezuela and the Guianas, and Gibbs (4) suggested that the Vila Nova suite was part of this province. Caen-Vachette (5) demonstrated the the Guiana Shield and the West African Craton may have formed a single province in Transamazônico-Birrimian times. The West African magmaatism was a major event of crustal growth (6,7). Preliminary Nd model ages of ~2.1-2.3Ga were reported for amphibolites from a small area in the Serra do Ipitinga in one of the Vila Nova belts near the Amapá-Pará State divide (8).

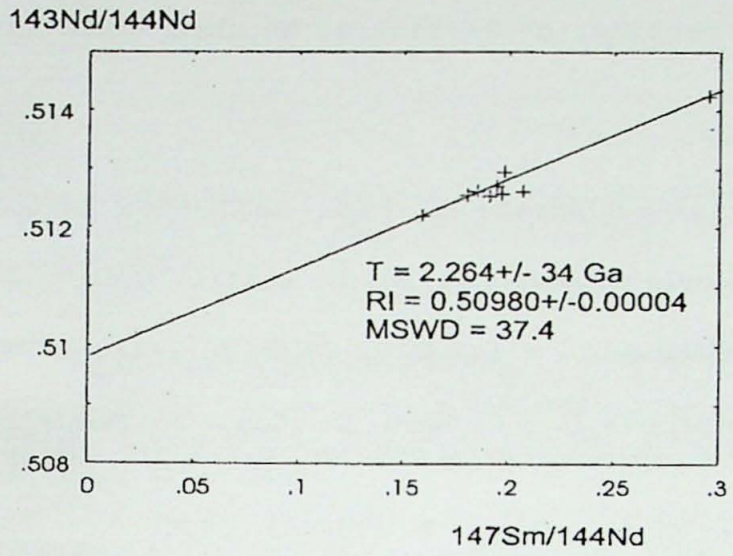
The Transamazônico-Birrimian volcano-sedimentary associations are usually composed of two units, the lower formed by predominantly tholeiitic mafic meta-igneous rocks, the upper by calc-alakline intermediate to felsic meta-igneous and meta-sedimentary rocks. In general, the metamorphic grade is low and deformation is not sufficiently strong or wide-ranging to erase all igneous textures.

The Vila Nova rocks on the other hand are more strongly metamorphosed and deformed than most possible counterparts in northeastern South America or West Africa. Metamafic rocks predominate in most of the Vila Nova belts, though small meta-ultramafic and predominantly chemical metasedimentary components are also found, as in the studied area (9). Mafic amphi-bolites have E-MORB REE patterns, but are otherwise similar to refractory MORB or IAT with low TiO_2, Al_2O_3 and Na_2O contents. Using Zr and Ti, which should be less mobile, two arrays define (i) an association which was derived by fractional crystallization of Mg-olivine±Ca-plagioclase±Ca-rich pyroxene±Ca-poor pyroxene,; and (ii) a group formed either by magma mixing or by participation of small quantities Fe-Ti oxide minerals in the fractional crystallization scheme (10).

A few actinolite schists have many basaltic komatiite geochemical characteristics (8), though most other ultramafic rocks are probably picrites or Mg-metasomatites. So far, no felsic meta-igneous rocks have been reported. Deformation frequently produced schists or strongly lineated amphibolites, but rock associations include banded tuffs, mainly quartz-chlorite schists and breccias associated with a large massive Cu±Zn±Au±Ag-bearing sulphide deposit. These are overlain by oxide, silicate and rare tourmaline-type banded iron formations. This strongly suggests that in the Serra do Ipitinga we are dealing with the upper part of a volcanic association near a submarine hydrothermal cell linked to a volcano-exhalative system.

The metamorphic history includes: (i) an early sea-floor hydrothermal low-grade metamorphism M1; (ii) a regional metamorphism to amphibolite facies M2 which partially transformed quartz-chlorite bearing rocks formed during M1 into assmeblages with cordierite±orthoamphibole±cuimmingtonite; (iii) a retrograde hydrothermal metamorphism M3 associated with thrusting and shearing, which introduced epidote into many amphbolites; and finally (iv) contact metamorphism M4 related to granite intrusion (8).

Figure 1



The basement rocks of the Jarí belt are high-grade, polymetamorphic rocks formed during or before the >2.6Ga Guriense event, an partially reworked during the Transamazônico event (11).

Sm-Nd system

Two samples of magnesian actinolite schists and seven samples of amphibolites were analysed. All samples were involved in M1 and M2. The actinolite schists lack typical basaltic komatiite chemical features, and have small quantities of zoisite or epidote and chlorite. These samples probasbly passed through only M1 and M2. The amphibolites, which individually may have been formed either at deeper crustal levels during M1, during M2, or even during M3, included a single sample with small quantities of chlorite and carbonate minerals, two with small quantities of epidote, and two with larger quantities (10-15 vol %) of epidote. From Rb-Sr evidence, the latter samples may have been involved in M3. Chondrite-normalised Sm/ Nd ratios range from slightly less than 1 to ~0.2. The latter ratios are not compatible with reasonable igneous differentiation processes, and are therefore metamorphic. Together, these samples define an errorchron (MSWD= 37.4) with T= 2.264±34Ga (Fig.1). This age agrees well with other ages in the range 2.1-2.25 Ga obtained for greenstone belts in French Guiana (12), Guiana (13) and West Africa (6,7). The inferred $I_{(Nd)}(t)$ ratio for the Vila Nova mafic rocks corresponds to that of slightly depleted mantle. Most $_{Nd}(t)$ values for West African mafic rocks are <+5.

Rb-Sr system

Of six samples analysed - three used in the Sm-Nd errorchron - none presented values of $^{87}Sr/^{86}Sr$ ratios which might be associated with mantle or sea water values at 2.26Ga. High values > 0.7100 in two samples suggest that radiogenic Sr from a continental source was introduced into these rocks, probably during M3/M4.

Discussion

The Vila Nova Metamorphic Suite is another, large member of the supracrustal associations of the Transamazônico/Birrimian Guiana Shield-West African Craton Province. In contrast with most other belts, the Vila Nova Suite is composed only of rocks from the typical lower mafic unit found in this province, and lacks the upper unit. Whether this is an original feature, or an artifact of post-deposition tectonic effects is still incertain. The Vila Nova rocks are products of submarine volcanism.

Open system metamorphisms, the first (M1) perhaps synchronous with eruption and the second (M3), associated with regional thrusting and shearing, disturbed but did not competely reset the Sm-Nd system. On the other hand, the Rb-Sr system was variably reset, and shows evidence for incorporation of strongly radiogenic Sr. This probably occurred during M3 when basin closure brought high-grade rocks of the Jari belt into contact with the metamorphosed supracrustal rocks.

Acknowledgements

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