

major temperature stages: (M1) 860-925°C, (M2) 780-810°C, (M3) 675-720°C, (M4) 565-605°C. The underlying Lapland granulites rocks of the Tanaelv belt complex were metamorphosed into on prograde stage at $T=590\pm 20^\circ\text{C}$. In Lapland granulites several groups of fluid inclusions differing in temperatures of melting (composition) and temperatures of homogenization (density) are discovered. These groups correspond to M1-M4 metamorphic stages. The first two stages were differed by a specific character of fluid with $\text{N}_2 > \text{CH}_4$ (M1) and $\text{CO}_2 > \text{CH}_4(\text{N}_2) + \text{H}_2\text{O}$ (M2). The next stages were characterized by aqueous-bicarbonate fluid with a marked predominance of CO_2 . In garnet-biotite plagiogneisses of the Tanaelv belt complex only one group of bicarbonate (with lost water) inclusions is fixed. The values $X_{\text{H}_2\text{O}}$ at metamorphism Lapland granulites at the stage M3 (0.25-0.41) and M4 (0.30-0.46) are defined. For less metamorphosed rocks of the Tanaelv belt $X_{\text{H}_2\text{O}}=0.46-0.55$.

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THE GEOCHRONOLOGICAL EVOLUTION OF THE CABO FRIO TECTONIC FRAGMENT, RIO DE JANEIRO, BRAZIL, AND ITS BEARING IN THE BRAZIL-AFRICA CORRELATION

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The coastal area of Brazil, east of Rio de Janeiro, and including the localities of Cabo Frio, Arraial do Cabo and Búzios, is referred in this work as "Cabo Frio tectonic fragment". It becomes a key region for a Brazil-Africa correlation, within because of its possible direct link with the western portion of the Congo-Angola Craton, exposed along the Angolean coast (Fonseca et al, 1979).

Two main lithological units which occur in: ortho and paragneisses (Heilbron et al., 1982) The orthogneisses have granitic-granodioritic-tonalitic compositions, with amphibolitic enclaves and intercalations. The paragneisses are metapelites, with intercalations of amphibolite, quartzites and calc-silicate rocks, metamorphosed in upper amphibolite facies, in intermediate pressure conditions. Basalt dykes and diabase and intrusive alkaline rocks related to Mesozoic tectonism also occur in the area.

Most Sm-Nd and Rb-Sr whole-rock isochrons obtained on single-outcrop samples of the orthogneisses yielded age values around 2000 Ma, suggesting an Early Proterozoic age for the emplacement of the sequence (Fonseca, 1994). The low Sr initial ratios of the isochrons could be related to a mantelic derivation, but the ϵ_{Nd} negative values (-7) indicate the contribution of crustal materials.

Sm-Nd and Rb-Sr isochron work carried out in the paragneisses (Fonseca, 1994) yielded consistent results around 540 Ma, indicating a Lower Paleozoic age for their regional metamorphism, and thus relating them to one of the last episodes of the agglutination of West Gondwana (Brito Neves and Cordani, 1991). Their T_{DM} Sm-Nd model ages are of the order of 1600-1300 Ma, and correspond to weighted mean values in relation to the ages of the different sources of the sediments. They represent always maximum values for the depositional events, and preclude the idea of the orthogneisses been their only source.

The younger tectonomagmatic episodes are also represented in the geochronological pattern of the orthogneisses, especially in their ^{40}Ar - ^{39}Ar mineral ages of about 600-500 Ma, as well as in some Rb-Sr and

Sm-Nd apparent results of intermediate age, which are probably caused by partial rejuvenation.

For the Meso-Cenozoic thermal history of the region, two thermal pulses are detected by the fission-track method applied to apatite and titanite (Fonseca, 1994). The signification of the first one, around 190 Ma, is difficult to access, and the second pulse, between 84 and 34 Ma, is deal to the alkalic magmatism which affected large areas in Southern Brazil, and specially a major tectonic zone in Rio de Janeiro State, to which belongs the Cabo Frio and many other alkalic intrusions (Fonseca et al., 1979).

The geochronological evidence allows to correlate the terrain including the orthogneisses with the western part of the Congo-Angola Craton, where the Lower Proterozoic Eburnean orogeny predominates as the main tectonomagmatic episode. However, the already mentioned rejuvenation at about 600-500 Ma indicates that the Cabo Frio tectonic fragment was part of the reactivated border of the Congo-Angola Craton, overprinted by the Brasiliano/Pan African orogeny.

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THE PHOSPHATE MINERAL ASSOCIATION OF FREGENEDA PEGMATITES (SALAMANCA, SPAIN)

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In the Fregeneda area different pegmatitic types can be distinguished. The most common type correspond to simple pegmatites with homogeneous internal structure, but Li and Sn-bearing pegmatites are also relatively widespread. The pegmatites are located north of the Lumbrales granite, most of them intruding into rocks of the Schist-Metagraywacke Complex. A limited number of pegmatites, which are located in an intermediate zone, between the barren pegmatites and the most evolved Li and Sn-bearing bodies, carry a complex association of Fe-Mn phosphate minerals. The study of these phosphates has allowed the identification of primary phases as wyllieite, graffonite, sarcopside, ferrisicklerite and triplite; and secondary phosphates as heterosite, rosemeryite, alluaudite and vayrynenite. Besides other phosphate minerals as Mn-rich apatite. In this study, their main characteristics including their chemical composition, analyzed by microprobe and their unit-cell parameters, are reported.

One of the most common transformation mechanisms in similar associations is the oxidation of the transition metal cations simultaneous with the Na-leaching in wyllieite to generate rosemeryite and the Li-leaching in triphylite (not detected here) to generate ferrisicklerite and later heterosite, so that rosemeryite, ferrisicklerite and heterosite are topotactic alteration products. The occurrence of sarcopside exsolution lamellae in ferrisicklerite and heterosite is an evidence of the replacement processes of the former by the latter. On the other hand, the Na-metasomatic replacement of the early phosphates as ferrisicklerite and graffonite, producing alluaudite is also well developed in this association. Nevertheless, the replacement of wyllieite by alluaudite can not be rejected as it has been observed in other similar associations. With regard to the vayrynenite, this is the fourth occurrence of this rare mineral, appearing closely associated to alluaudite, although its genetic relationships have not yet been established.

The occurrence of this phosphate association in these pegmatites is in agreement with the pegmatite fields zonation, so that the phosphate-bearing pegmatites are those with an intermediate degree of fractional crystallization, and besides they appear between the barren and the more evolved pegmatites with Li and Sn.