28º Simpósio de Geologia do Nordeste

4º Simpósio Sobre o Cráton do São Francisco e Orógenos Marginais

THE EQUATORIAL ATLANTIC MAGMATIC PROVINCE: A NEW CRETACEOUS LIP IN SOUTH AMERICA

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This work is part of an ongoing project recently started that deals on the characterization of a hitherto unknown large igneous province in NE South America. The formation of the Equatorial Atlantic Magmatic Province (EQUAMP) was related to the disruption of the Gondwana and resulting opening of the Atlantic Ocean during the Early Cretaceous. EQUAMP comprises only intrusive bodies, which are mafic sills and dike swarms intruding, respectively, Paleozoic sedimentary rocks of the Parnaíba basin and the Precambrian basement of the Borborema Province. En-echelon dikes form the main products of EQUAMP. They constitute a 1,000 km-long arcuate swarm parallel to the present-day continental E- and NE-trending Atlantic margins, and at least two other sub-sets of about 250-300 km in length, also extending parallel to the Atlantic coastline. Sills, in turn, occurs exclusively along the eastern side of the Parnaíba basin. Mafic dikes and sills are mainly represented by medium- to fine-grained diabases. In a few sites, coarse-grained rocks (leucogabbros) are spatially associated with the diabases, and are characterized by centimeter-sized acicular crystals of augite in a plagioclase-rich groundmass. All studied rocks are silica-oversaturated tholeiites, grouped into (1) subalkaline, low TiO_2 (< 2 wt.%; P_2O_5 < 0.2 wt.%) basaltic andesites, and (2) subalkaline to transitional high TiO_2 (= 2.1–4.5 wt.%; P_2O_5 > 0.2 wt.%) magmas including basalts to (trachy)dacites. Fractional crystallization was an important process in controlling the geochemical variability of the high-Ti tholeiites, especially the progressive removal of olivine and Ca-rich (augite) pyroxene, magnetite and ilmenite. Plagioclase and apatite are not critical fractioning phases in these magmas. Contrarily, ilmenite and magnetite (and also apatite) do not fractionate during crystallization of the low-Ti magmas, their chemical characteristics being mainly controlled by discrete fractionation of plagioclase, Ca-rich pyroxene and olivine. As a whole, the trace element patterns are featured by depletion in Nb(-Ta) relative to La (Nb/La ~0.61) and other lithophile elements (such as Th, U, Ba). The high-Ti tholeiites are more enriched in incompatible elements (100 times CHUR; La_N/Yb_N > 11) when compared with the low-Ti magmas, while these latter clearly experienced some extent of crustal contamination. High and low-Ti tholeiites also differentiate by their isotope compositions, mainly concerning to Nd. The high-Ti tholeiites have less radiogenic compositions ($\varepsilon Nd_{t=130}$ from ~ -3.4 to -2.1) than the low-Ti (from ~ -2.3 to -1.1), while the initial $^{87}Sr/^{86}Sr$ ratios of the uncontaminated samples (regardless the Ti content) are usually lower than 0.706300. All these data indicates that the sub-continental lithospheric mantle have participated as a major source for generation of the EQUAMP magmas instead of OIB-type convective mantle.

KEYWORDS: EQUATORIAL ATLANTIC OPENING, LIP, CRETACEOUS

SGNE-00
17/494