PETROGRAPHY AND Nd ISOTOPES OF TWO BASALT MAGMATIC EVENTS IN THE PARNAÍBA BASIN, NORTHEASTERN BRAZIL

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ABSTRACT: Basaltic magmatism in cratonic basins are often investigated due to the amount of information that can be extracted regarding petrogenesis and mantle properties beneath such regions. The basalt occurrences of the Parnaíba Basin are still in discussion regarding their association with magmatic events from around the globe, such as the CAMP (Central Atlantic Magmatic Province) and PEMP (Paraná-Etendeka Magmatic Province). Two magmatic formations are exposed in the basin, known as the Mosquito Formation (MF) and Sardinha Formation (SF). It is generally accepted that the MF magmatism is related to the opening of the Central Atlantic Ocean at about 201 Ma, whereas the SF is associated with the opening of the South Atlantic Ocean at ca. 130-135 Ma, being coeval with basalts of the PEMP. The Parnaíba Basin is, therefore, a key area to understand differences between the two magmatic systems. In this study, sponsored by BP through its Parnaíba Basin Analysis Project, we present a few characteristics regarding field aspects, petrographic differences, mineral chemistry and Sm-Nd isotopes that characterize the basaltic magmatism in the Parnaíba Basin. The basaltic formations are exposed at the western and eastern portions of the basin as the MF and SF, respectively. The MF occurs generally as lava flows while dykes and sills dominate the SF. Both formations comprise basaltic rocks, but mineralogical differences are recognized and allow a proper separation. MF basalts comprise rocks with two pyroxenes (augite and pigeonite), plagioclase, magnetite, volcanic glass and vesicles/amygdules (filled by calcite, quartz or zeolite). In contrast, basaltic rocks of the SF are composed of olivine, clinopyroxene (diopside/augite with scarce pigeonite), plagioclase and magnetite. Mineral chemistry yields distinct pyroxene composition in these formations. Clinopyroxene crystals from olivine-bearing basalts of the SF show higher wollastonite contents (i.e. 29.85–49.02% for augite and 4.19–15.74% for pigeonite) then those of olivine-free basalts of the MF (i.e. 23.44–39.15% for augite and 7.66–12.35% for pigeonite). Phenocrysts showing strong zonation may cause high variation in wollastonite contents, from core to rim, explaining, therefore, the large compositional range. ε_{Nd}(130Ma) values for the SF vary from negative to positive, ranging from -22.36 to -0.26 and +0.48 to +6.21. We have no isotope data regarding the MF. Ascribed differences are probably caused by different characteristics of the sources of their parental magmas. These magmas differ in geological context and evolved in different ways regarding mantle source and ascent through the continental crust. In summary, two magmatic events may be recognized in the Parnaíba Basin. These events provide different information on the subcontinental lithospheric mantle of each source region, during the opening of the Atlantic Ocean. The most important difference could have been the participation of a mantle plume for the SF magmatism, since the Tristan da Cunha Plume played an important role in the evolution of the South Atlantic-related magmatism. The plume-derived magma of the SF contrasts with the typical MF composition, suggesting that a diverse evolution of the mantle took place beneath the Atlantic Ocean rift between the Central and Southern segments.

KEY-WORDS: PARNAÍBA BASIN, BASALTIC MAGMATISM, ATLANTIC OCEAN RIFT.