Maria Helena B. M. HOLLANDA, Carlos J. ARCHANJO, Paul R. RENNE, Donald E. NGONGE, David L. CASTRO, Diógenes C. OLIVEIRA and Antomat A. MACÊDO FILHO, 2016. Evidence of An Early Cretaceous Giant Dyke Swarm in Northeast Brazil (South America): A Geodynamic Overview. *Acta Geologica Sinica* (English Edition), 90(supp. 1): 109-110.

Evidence of An Early Cretaceous Giant Dyke Swarm in Northeast Brazil (South America): A Geodynamic Overview

Maria Helena B. M. HOLLANDA[1], Carlos J. ARCHANJO[1], Paul R. RENNE[2], Donald E. NGONGE[1], David L. CASTRO[3], Diógenes C. OLIVEIRA[4] and Antomat A. MACÊDO FILHO[3]

1 Universidade de São Paulo, Instituto de Geociências, 05508-080, SP, Brasil
2 Berkeley Geochronology Center, CA 94709, Berkeley, USA
3 Universidade Federal do Rio Grande do Norte, Departamento de Geologia, 59078-970, RN, Brasil
4 Petrobras/UO-RNCE/EXP/ABIG, 59064-100, RN, Brasil

The Mesozoic break-up and drifting of the Equatorial Atlantic margin in the northeast Brazil (South America) is characterized by a modest magmatic activity compared with the Southern Atlantic margin, where the Paraná-Etendeka Province is accounted for eruption of millions of cubic kilometers of mafic and acid magmas (flow basalts, dyke swarms). The most significant magmatic activity in the Equatorial Atlantic margin is the Rio Ceará Mirim Dyke Swarm (CMDS), which marks the early stages of rifting in the Cretaceous. The CMDS consists of an arcuate, nearly 800 km-long mafic dykes that crosscut rocks and structures of the Precambrian basement. The swarm can be divided into two laterally continuous segments, one of E-W strike that is parallel to the southern border of the Mesozoic Potiguar basin, and one barely studied NE-SW segment which, after recent high-resolution aeromagnetic anomalies, can be traced for 300 km along the east border of the Paleozoic Parnaíba basin up to the northern boundary of the São Francisco craton.

The E-W-trending segment encompasses essentially tholeiitic basalts including plagioclase, clinopyroxene (±olivine), Fe-Ti oxides and pigeonite in their groundmass. The dykes show one- to 150-meters in width and of up to one kilometer in length; a few dykes exceeding 100 kilometers have been inferred from the aeromagnetic anomalies. The tholeiites have been subdivided into three groups: high-Ti olivine tholeiites, evolved high-Ti tholeiites ($TiO2 \geq 1.5$ wt.%; $Ti/Y > 360$), and low-Ti tholeiites ($TiO2 \leq 1.5$ wt%; $Ti/Y \leq 360$), with all exhibiting distinct degrees of enrichment in incompatible elements relative to Primitive Mantle. Negative Pb anomalies are found in all three groups, while Nb-Ta abundances similar to those of OIB-type magmas are found in the olivine tholeiites, with moderate to high depletions being observed, respectively, in the evolved high-Ti and low-Ti tholeiites. The latter exhibit some contamination with crustal (felsic) materials. The initial isotopic compositions of the olivine tholeiites show uniform and unradiogenic 87Sr/86Sr (~0.7035–0.7039) combined with (in part) radiogenic 143Nd/144Nd and 206Pb/204Pb (>19.1) ratios, which together reveal a contribution of FOZO (FOcalZOne) component in their genesis. The other tholeiite groups show quite variable Sr-Nd initial ratios with relatively consistent 206Pb/204Pb ratios clustering toward an isotopically enriched mantle (EM1) component. Taken in conjunction with the Nb-Ta anomalies, this enriched signature reflects the involvement of a subduction-modified lithospheric mantle in the source of the evolved high-Ti and low-Ti tholeiites. Hence, FOZO and EMI components might to be coexisted and contributed in varying extents to the generation of the CMDS primary melts.

Plagioclase dating of one evolved high-Ti tholeiite dyke provided two plateau ages of 127.1 ± 0.2 Ma and 128.2 ± 1.3 Ma, with an integrated mean age of 127.7 ± 0.1 Ma. Plagioclase multigrain fractions from one low-Ti tholeiite dyke provided two plateau ages of 131.6 ±0.7 Ma and 131.0 ± 0.4 Ma, with mean age of 131.2 ± 0.1 Ma. These 40Ar/39Ar ages clearly reveal that the low-Ti and high-Ti magmas encompassing the E-W segment of the CMDS were emplaced as two pulses during the Early Cretaceous.

AMS investigations of the E-W-trending segment evidenced (at least) two main feeder zones located at the intersection of the dykes with Cenozoic N-trending volcanic centers referred in NE Brazil as the Macau magmatism. Such feeder zones were characterized by vertical magnetic fabrics (via steep-plunging magnetic

* Corresponding author. E-mail: hollanda@usp.br

lineations) measured over a set of 60 dykes, including the evolved high-Ti and olivine tholeiites. This whole region is set over a large negative geoid anomaly modeled as a low density (thermal) zone situated at between 17 and 78 km in depth, which well embraces our estimates of melting depths (between 60 and 75 km) for the CMDS, in the garnet-spinel facies transition zone.

Because there is no clear geographic correlation between any known Early Cretaceous LIP and the CMDS, we suppose that the arcuate geometry of the CMDS just indicates a shift in the horizontal minimum stress along the swarm rather than nucleation from a mantle plume. If true, plate-boundary forces derived from the opening of the Equatorial Atlantic might have promoted passive rifting, melting of the lithosphere (and probably the asthenosphere) and intrusion of tholeiitic magmas. We have started a detailed AMS, petrological and geochronological study of the NE-trending segment of the CMDS to refine the magmatic and tectonic models and compare with the Cretaceous magmatism situated within the Parnaíba basin. Likewise, the initial geochronological results allow to correlate the CMDS with the emplacement of the Paraná-Etendeka Province, which suggest that break-up of the Equatorial and Southern Atlantic would be a broad and fast rupture event.