Seismic structure of the Maranhão-Barreirinhas-Ceará margin, NW Brazil, from the MAGIC wide-angle seismic experiment

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RESUMO: The structure of the North-East equatorial Brazilian margin was investigated during the MAGIC (Margins of brAzil, Ghana and Ivory Coast) seismic experiment, a collaborative project conducted in August-September 2012 by Ifremer, Univ. Brasilia, FCUL (Univ. Lisboa) and Petrobras. This project focuses on the North-Western Brazilian margin and the Equatorial Atlantic Ocean bounded to the North by the São Paulo Double Fracture Zone and to the South by the Ceará-Potiguar and the East Ghana-Ivory Coast-Togo-Benue system well-marked by the Romanche Fracture Zone. It's main objective is to understand the fundamental processes which lead to the thinning and finally to the breakup of the continental crust in a specific context of a pull-apart system with two strike-slip borders. The survey consists of 5 deep seismic profiles totaling 1900 km of marine multi-channel seismic reflection and wide-angle acquisition with 143 deployments of short-period OBS's from the IFREMER pool. Three of the profiles were extended into land using land stations from the Brazilian pool.

The analysis of the seismic dataset reveals from SW to NE 5 distinct NW-SE-oriented domains:

a) The unthinned continental crust thickness increases from 32 km in the Borborema-Ceará to 40 km in the Barreirinhas-Parnaiba province and the Ilha da Santana Platform

b) The necking zone, where crustal thickness thins to about 10 km, is about 30 km wide at Borborema-Ceará, 50 km at Ilha da Santana, but considerably wider (>125 km) at the Barreirinhas margin at the corner of the pull-apart system, with two steps first in the upper crust then in middle/lower crust;

c) An intermediate domain, composed of the southern deep Basin II and the shallower Northern basin III, extending into the São Paulo Double Fracture Zone, with volcano-sedimentary to volcanic (lava flows) layers. Below the basement, a 2-3 km thick layer with very high velocity (7.4-7.6 km/s) and marked by reflections at the top and base is observed at Basin II. This layer is followed continuously towards the continent and joins the fourth continental layer imaged only beneath the Parnaiba-Barreirinhas province, but is absent bellow Basin III, and is interpreted as exhumed lower continental crust.

d) a 60 km-wide domain, bounded to the SW by a NW-SE volcanic line, that consists in a 5 km thick crust presenting 2 layers characterized by high acoustic velocity

and interpreted as proto-oceanic crust and overlain by 5.5 km of sedimentary deposits

e) a 5 km thick oceanic crust consisting of 2 layers and overlain by 5.5 km of sedimentary deposits, spanning between the two main fracture zones that fringe the Maranhão-Barreirinhas-Ceará segment.

We propose here an evolution of this margin and its segmentation in a geodynamical context.

PALAVRAS-CHAVE: MARANHÃO-BARREIRINHAS-CEARÁ BASIN, PULL-APART, DEEP SEISMIC STRUCTURE, SEGMENTATION.