

CRUSTAL ARCHITECTURE AND EVOLUTION OF RIFTS DURING THE BREAKUP OF GONDWANA IN SOUTHEASTERN BRAZIL – SANTOS, CAMPOS AND ESPÍRITO SANTO BASINS

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The rupture and breakup of an old and stable supercontinent such as Gondwana must not have been an easy and short-term process. In the case of West Gondwana, that constituted a long-lived stabilized amalgamation of thick and huge cratons, some degree of thermal weakening of the lithosphere must have occurred prior to the rifting phase that led to the opening of the Atlantic Ocean. In the southwestern margin of West Gondwana evidence of such pre-rift thermal activities can be traced back to the Permian-Triassic Choiyoi volcanism in central-western Argentina, to the Jurassic volcanism in southern Argentina (e. g.: San Julian Basin) and, most evidently, to the huge Early Cretaceous Serra Geral LIP that covered most of the southern part of West Gondwana. In all these cases rifting was partly coeval or immediately followed the volcanism, pointing to a strong relationship between thermal weakening and continental rupture. In the southern South Atlantic Ocean a predominantly volcanic passive margin filled with massive packages of SDR-type volcanic rocks was developed throughout the Argentinian continental margin to the Pelotas Basin, the southernmost Brazilian offshore basin. Immediately to the north of it strikingly different thermo-tectonic conditions were established and typical magma-poor passive margins were developed.

The Santos, Campos and Espírito Santo Basins constitute the most prolific petroleum basins of the South Atlantic Ocean and their crustal structure record a typical phased evolution from stretching, through thinning, mantle exhumation and seafloor spreading stages. In all three basins the continental-oceanic crustal boundary is marked by a continuous belt of exhumed and serpentinized mantle. Each of these basins shows different structural frameworks as related to width and taper of the continental crust underlying them. The Santos Basin overlies an extremely ample continental margin, up to 700 km of width. Its crustal profile shows moderate to low crustal taper and displays a boudinage pattern due to several necking zones, some of which showing total or partial mantle-perforated crust. The Campos Basin overlies a moderate width margin that displays a moderate taper crustal profile. The Espírito Santo Basin is a narrow margin basin with a high crustal taper. These different widths of attenuated crust and taper profiles reflect the varied nature of the Precambrian terranes, composed of alternating more rigid (small cratons or magmatic belts) and more plastic (intervening fold belts) blocks. The deduced evolution of rifting in the region shows an initial (Hauterivian to Barremian) areal concentration of stresses that gradually expanded throughout most of the three basins (Barremian to Aptian) and later diminished almost to a halt (Aptian). Prior to breakup (Latest Aptian) strong rifting took place close to the future site of the final rupture, also affecting the exhumed mantle. Breakup happened in the Earliest Albian (circa 111 Ma).