Origin, geochemistry and petrology of the South Atlantic Aptian salt complex

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The Cretaceous evaporite complex of the South Atlantic formed at a crucial turning point in the separation of South America from Africa, after the deposition, over Early Cretaceous pre-rift flood basalts, of thick non-marine siliciclastic and carbonate sediments, the latter forming the reservoir of more than 50 billion barrels of petroleum, and before the deposition of Aptian-Albian marine carbonates. On the South American side, the evaporite complex extends from latitudes 3ºS to 26ºS along the central South Atlantic, with the depositional thickness of evaporites, predominantly halite with lesser amounts of carnallite and tachyhydrite, reaching in the south, in the Santos Basin, over 2 km. In the shallower portions of the basin, instead of these chlorides, there are hundreds of meters of finely laminated and nodular anhydrite. The evaporite complex and the underlying non-marine carbonate reservoirs were deposited in an endorheic basin bordered in the south by the Walvis Ridge – Rio Grande Rise; to the north the basin was separated from the young Central Atlantic ocean by still unopened land segments of the equatorial transform margin. There are still some fundamental questions. What is the exact age of the evaporites? To what extent did hydrothermal and continental waters contribute to their deposition? Did seawater enter the endorheic basin from the Central Atlantic in the north, along transform faults across the still closed segments of the equatorial margin, or did it come from the south, seeping through the volcanic edifice of the Walvis Ridge – Rio Grande Rise? Do the soluble salts in the shallow part of Sergipe Basin witness entry of marine waters from the north or south? What was the cause of the deposition of hundreds of meters of tachyhydrite and the absence of Mg-sulphates, in sharp contrast to most Paleozoic and Cenozoic evaporite sequences? Detailed study of the geochemistry and petrology of the evaporites in wells from the Sergipe subbasins (NE-Brasil), Espírito Santo and Santos basins by the evaporite mentoring project of Petrobras is providing some answers to these questions.