BASIN ANALYSIS AND NUMERICAL MODELLING OF SOUTH ATLANTIC CONJUGATE PASSIVE CONTINENTAL MARGINS

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The main objective of this study is proposing a seismo-sequence stratigraphy model for the sedimentary successions deposited in key segments of the passive Brazilian and Uruguayan continental margins of the South Atlantic region.

Three seismic transects which are currently under investigation are located in the Campos, Santos and Pelotas basins with an approximate orientation N40W. They are between 340 and 320 km long.

Based on the available well data, logs and previous stratigraphic studies, as well as the resolution of the 2D seismic data, twelve key seismic reflectors along the three seismic profiles were chosen. The seismo-stratigraphic analysis of these profiles in the Campos and Santos Basin shows that the sedimentary succession, from the Neocomian until the Holocene, has a total thickness of around 1500 m below the current coastline and a maximum of 5000 m in the slope-basin area. In the Pelotas Basin, in the Uruguayan margin, a similar thickness of sediments is observed in the proximal region, but the slope-basin succession reaches approximately 8000–9000 m thickness. Regionally, the basement is formed by tholeitic basalts of Hauterivian – Barremian age, underlying the first continental sediments of Barremian age, which onlap the top of the basement towards the South American Craton. The top of the rift sequence is marked by a clear and continuous reflector along the profiles, which underlies the Aptian – Albian rocks. Both in the basement and the rift sequence the internal reflectors are not clear and anomaly zones are common, due to the high impedance of the overlying salt succession.

During a period of relative tectonic quiescence, along the initial ocean opening stage, the syn-rift Aptian-Albian salt sequence was deposited, which has varying thicknesses as a consequence of halokinetic structures, produced by subsequent sediment and water load. The thickness varies from 10 to 2000 m, but initially, during deposition, should have comprised between 1000 and 2000 m. In the Pelotas Basin, these salt deposits are absent, as well as diapirs and salt domes. Siliciclastic sediments deposited on shelf to slope environments compose most of the rocks deposited during this time. However, some authors report that an evaporitic succession is present, but restricted to the northern part of the Pelotas Basin. An indistinct reflector interrupted by diapiric anomaly zones marks the top of this syn-rift succession in the Santos and Campos basins. The salt movement occasionally associated with growth faults and rollovers structures, affects the complete sequence up to the Miocene rocks. It controls the late Cretaceous and Tertiary facies distribution and contributes to the trapping of the major hydrocarbon accumulations. Within these salt structures and commonly along the succession, the internal reflectors are hard to trace. In the Campos Basin, it is equally difficult to follow the other reflectors, because of the severe deformation and anomalous reflections.

In the post-rift phase distinct depositional conditions caused obvious differences in the stratigraphy of these three basins. From the Albian until the Turonian regional sea-level rise, thermal subsidence and an abundant sediment influx, higher in the Santos Basin, caused a regional transgressive pattern, with sediment thicknesses between 1000 and 2000 m. This interval is marked by a uniform horizontal retrogradational reflection pattern. From the Turonian until the Paleocene, in the Santos Basin the sediment input increased and a major shelf progradation occurred. About 1500 m of rocks with a horizontal progradational reflection pattern are observed along platform and slope, while the Campos Basin maintains transgressive conditions. Here, the sedimentary succession is thinner, and the regional retrogradational trend shows only intermittent episodes of shelf progradation with downlap. Contrastingly, in the Pelotas Basin, the continuous horizontal retrogradational and aggradational patterns are intercalated with some episodes of shelf progradation. This suggests relatively constant sea level, sediment input and continuous subsidence rates in comparison to the other two basins located northward. This trend was maintained until the Holocene, when a 4000 to 6000 m thick succession was deposited.

The Tertiary, from the late Paleocene onwards, is characterized in the Santos Basin by a widespread and continuous progradational succession, with marked turbiditic deposition in the lower-slope and basin areas, evidenced by a thickening of the sedimentary succession. In the Campos Basin, the increase in sediment input led to deposition of a relatively thick sequence on the shelf and top-slope (around 2500–3500 m) area. It thins progressively towards the basin (1500–2000 m), which is characterized by discontinuous reflectors interrupted by salt structures and turbiditic fans associated with submarine erosion surfaces.

Currently, the quantitative basin modeling is under elaboration and will provide rates of subsidence, crustal flexure, sea-level changes, geometry and deposition of these three basins through the time.