

The 'Helmut' geophysical anomaly: a regional transfer zone connecting Santos and Campos basins, southeastern Brazil

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In the ultra-deepwater of Santos and Campos basins, eastwards from the area of present-day pre-salt exploration in southeastern Brazil, there is a nearly 1000 km long curved magnetic anomaly named 'Helmut'. On a magnetic map, the anomaly orientation switches from NE-SW in Santos Basin to nearly N-S in Campos, mimicking the curved Neoproterozoic shear zone pattern of the basement exposed onshore. From the comparison between the position of such anomaly and gravity-derived modeling and residual maps, it is suggested the magnetic anomaly also corresponds to a major gravimetric boundary separating different crustal domains. This boundary is slightly oblique to the rift-related normal fault trend in Santos Basin. Based on interpreted 3D seismic data, the NNE-trending normal faults are dragged to the NE direction close to the magnetic anomaly in southern Santos Basin, where an *en echelon* array of oblique magnetic anomalies occurs that resulted mainly from the left lateral component of an overall transtensional displacement field.

In regional 2D deep reflection seismic profiles, the 'Helmut' anomaly is correlated with major eastward-dipping, down-to-the-basin stepped faults in some places arranged in a fan-like fashion in Santos Basin, and as a landward dipping normal fault zone in Campos Basin north of the E-W Araruama transfer zone. In some areas, the fault zone displaces the base salt reflector and crosscuts the entire stretched continental crust. The analysis of potential field and seismic data suggests that the 'Helmut' anomaly may be interpreted as a crustal-scale, low-strain shear zone system active during and after salt deposition in the Late Aptian. Regionally, the 'Helmut' anomaly connects two approximately N-S trending branches of the South Atlantic Rift System: 1.) the northern branch that runs from Espírito Santo basin northwards up to the Camamu (south of the Recôncavo–Tucano–Jatobá aborted trough); and 2.) the southern branch running southwards from Santos basin through Pelotas basin in Brazil as far as the basins offshore Uruguay and Argentina basins southwards. We suggest that the 'Helmut' line corresponds to a major, transfer system connecting both regional rift branches.

Extensional faulting of the base salt reflector along early NNE rift-related normal faults and dextral transtension on the NW-trending fault zones are all consistent with a sinistral transtensional motion on the NE-trending 'Helmut' anomaly during the Late Aptian.