Mapping the South Atlantic Continental-Oceanic Boundary: Rift to Early Drift along Extensional and Transform Margins

Steven G. Henry [1], Naresh Kumar [2], Al Danforth [2], Peter Nuttall [3], and Sujata Venkatraman [3]
[1]RIFTT, Las Cruces, NM.
[2]Consultant to ION/GXT, Houston, TX.
[3]ION Geophysical -GX Technology, Houston, TX.

Defining the geometry of continent-ocean boundary (COB) is critical for establishing the deep-water exploration potential of the continental margins. Existing models for COB in South Atlantic suggest a wide (100 -500 Km) zone of "transitional crust", based on gravity, magnetic, and refraction data. However, seismic imaging of the transition between continental and oceanic crust, especially in depth, is relatively rare. Newly acquired (10 km offset, 18-sec record length) and Pre-Stack Depth Migrated (PSDM to at least 25 Km) data have imaged the COB along conjugate margins of South Atlantic which is providing insights into the geologic setting of transition from rift to drift. We have interpreted almost 80,000 km of such in the South Atlantic, almost 40% of which is located along the Brazilian margin.

Data in the "salt basins" of Brazil and West Africa have identified failed rifting events of Valanginian age that resulted in the development of sag basins containing rich source rocks (Brazil: Lagoa Feia, Africa: Bucomazi, Falcão). Later, in the Barremian, the successful rifting initiated sea-floor spreading and formation of oceanic crust.

During the early rifting, continental crust landward of the COB is thinned to 10 to 20 km, and the oceanic crust seaward of the COB is generally less than 10 km thick but displays local variation. Reflector packages deposited during the Barremian have been interpreted as volcanics, volcanoclastics and evaporites. The early drift sediments (Aptian-Albian) on both sides of the South Atlantic were deposited in restricted environments and are considered to have source potential.

Data to the north and south of the South Atlantic salt basins have imaged zones of crustal transition that are narrower than in the salt basins. By consistently noting the seaward limit of the continental crust, features have been identified that can be used to reconstruct the pre- and early drift geometry of continents. The continent-ocean transition zone is considerably narrow along the equatorial transform margins as well. New data show distinct crustal geometry in parts of the margin that are located along extensional segments of major oceanic fractures zones. South of the salt basins, the data image a "typical" volcanic margin with well-developed seaward-dipping reflectors (SDR). All of these recognized geometries need to be incorporated in any analysis of the South Atlantic continental margins.