

Scientific Drilling in the South Atlantic

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The South Atlantic is a classic example of continental breakup in which the mechanisms that drove the initial fragmentation still need to be detailed. Mantle plumes may have played a key role in this process, as implied by the Rio Grande Rise (RGR) and Walvis Ridge (WR) hot spot tracks. Their role in the South Atlantic opening is uncertain, as questions remain about their origin and relationship with the structure and dynamics of the upper mantle. Recent findings indicate that the western margin of continental South America did not behave as a rigid block but instead stretched significantly, allowing the emplacement of igneous and exhumed mantle rocks. Continental rifting may have rafted fragments of the continents into the ocean, as implied by recently dredged continental rocks from the RGR.

Unraveling the evolution of the South Atlantic is important to understand its paleoceanography and morphology as well as Earth's climate history. For instance, the RGR-WR ridge connection affected oceanic circulation in the South Atlantic, as indicated by the thick evaporite deposits in that area. Tectonic inter-

pretation of the Brazilian margin points to the existence of altered exhumed mantle that may have interacted with ocean water and released greenhouse gases.

In April, 68 scientists from Brazil, Germany, the United States, and France met for a 3-day International Ocean Discovery Program (IODP) workshop focused mainly on the origin and structure of the mantle plumes and the tectonic evolution of the South Atlantic margins. The first day provided attendees with a background of the current knowledge of South Atlantic geodynamics by addressing topics such as the geochemical and temporal evolution of mantle plumes in the western Atlantic, as well as their relationship to continental breakup; the geologic, tectonic, and landscape evolution of the southeastern Brazilian margin and surrounding areas; and the mechanisms of hyperextended continental margins and their relationship to upper mantle viscosity and subsidence.

The second day of the workshop began with presentations about the three potential drilling targets: the WR, the RGR, and the São Paulo Plateau (SPP). Speakers addressed the current geological background of these areas

and their main scientific questions. The discussion continued on the third day, when it was decided to prepare two full IODP proposals (WR and SPP) and a pre-proposal (RGR).

Drilling at the SPP would test continental breakup models based on new seismic data that indicate the presence of hyperextended crust and exhumed mantle along the South American margin and could also retrieve samples of the first oceanic crust formed after the breakup. Drilling in the RGR would test whether this area is a fragment of continental crust that was left behind during the opening of the Atlantic. Evidence of continental crust in the RGR is based on previous Deep Sea Drilling Project drill sites, new seismic data, dredging, and a recent Japanese-Brazilian diving expedition. Drilling in the northeastern part of the WR would retrieve fresh unaltered volcanic rocks, which combined with recent paleomagnetic studies of age-progressive hotspot tracks, would provide constraints on plate tectonic movements, the history of the Earth's magnetic field, and possibly proof of true polar wander.

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