GEOPHYSICAL EVIDENCE FOR NEAR EAST-WEST SEA FLOOR SPREADING AND THE FORMATION OF THE GRENADA BASIN

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ABSTRACT

Models for the formation of the Grenada Basin vary from extension oriented north-south, to northeast-southwest, to east-west. East-west extension appears to be supported by seismic refraction and gravity data. Although these data and the physiography of the region suggest that the basin formed simply by east-west extension, other geophysical information such as seismic reflection and magnetic data suggests a more complex evolution. Previous interpretations for north-south and the northeast-southwest extension did not require sea floor spreading in the northern part of the basin, but instead relied on stretched island arc material. The sea floor in this part of the basin is rugged and shallow relative to deeper, flat-lying sediments to the south. Magnetic anomalies over the basin exhibit predominantly long wavelength, high amplitude east-west trends previously interpreted as evidence against east-west opening.

Rigorous analyses of magnetic data over the Grenada Basin show subtle linear anomalies, sub-parallel to the Lesser Antilles island arc which support near east-west extension. Similar analyses of gravity and seismic data also support this orientation. Calculated Bouguer anomaly maps show a broad gravity high over the basin indicating crustal thinning with no dramatic change in thickness between the northern and southern parts of the basin. The velocity structure of the crust is defined reasonably well in the south but is unclear in the north. Reflection data collected over the southern part of the basin show smooth, undisturbed horizons while data over the northern part show recent deformation involving basement. The Grenada Basin is interpreted to have formed by near east-west extension in early Tertiary time. In late Tertiary time the tectonic event responsible for bifurcating the Lesser Antilles island arc also disrupted the crust and overlying sediments in the northern part of the basin. Two- and three-dimensional forward models, incorporating gravity, magnetic, refraction and reflection data support this interpretation.