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Tectonic Origin of the Cariaco Basin, Venezuela: Pull-Apart, Extinct Pull-Apart or Fault-Normal Extension?

The Cariaco basin (CB) forms the largest and deepest fault-bounded, late Neogene basin along the northern shelf of Venezuela. Two previous models have been proposed for its origin: 1) pull-apart formed at stepover between the right-lateral Moron and El Pilar faults; and 2) the basin formed by a component of extension perpendicular to the strike of the Moron-El Pilar strike-slip faults.

Using 2500 km of MCS tied to 12 wells, we present a structural-stratigraphic interpretation for the basin. Merged data sets suggest that faults of the CB can divided into four groups: 1) throughgoing Moron-El Pilar fault-zone - expressed as a narrow seafloor valley overlying a negative-flower structure that diagonally crosses both deeps; 2) EW normal-faults bounding the walls of the deeps - these faults exhibit mainly down-to-basin throws and may combine both normal and strike-slip displacement; 3) EW normal-faults south of the twin-deeps – these faults are downthrown to north and south and form a large horst-structure separating the CB from a middle Miocene-recent prograding-clastic-margin along the Unare shelf; and 4) NW-striking Urica fault-zone – this fault is a large lateral-ramp formed by thrusting in the Serrania del Interior and truncates EW faults of group 3.

Correlation of well and seismic data shows that the main phase of basin subsidence was Pliocene-Pleistocene. We interpret the continuity of Moron-El Pilar fault through a blanket of Holocene deep-marine sedimentation as evidence for the process of ''pull-apart extinction'' or straightening of the fault-zone at the expense of normal-fault systems framing the stepover area.