

Estimating Rotation Poles and Spreading Isochrons for Gulf of Mexico Opening Models

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Abstract

The Gulf of Mexico's opening involved magma-rich (supra-hotspot) NW–SE rift extension and CCW rotational spreading phases, often called stages 1 and 2. Kinematically, stage 2 rotation began before the end of continental rifting, and the breakup was relatively magma-poor, signaling migration of the basin off the hotspot by then. Gulf of Mexico salt deposition (171–165 Ma from Sr isotopes) accompanied the stage 1–2 transition when rifting was most distal in magma-poor outer marginal troughs; none is known upon the ocean crust. Recent Atlantic reconstructions allow for the completion of the intra-continental extension during salt deposition. Spreading may have started in the late Bathonian, but seismic correlations tend to suggest the Late Jurassic, requiring investigation. The Pemex aeromagnetic map affords an interpretation of the continent-ocean transition that closely mimics seismic interpretation and indicates a jump in the rotation pole during ocean spreading. The plate motion framework and geometry of the East Mexico Transform suggest the jump was Tithonian. Spreading was ultra-slow, and its end remains best dated by the Berriasian cessation of near-pole faulting in the Florida Straits. Spreading isochrons are estimated by integrating aeromagnetic patterns and the plate motion framework. Extensional crustal fabrics are modeled with 2 stage poles for rifting and 2 stage poles for spreading. The two spreading stage poles sum to a finite ocean closure pole in western Cuba, but this finite pole is unsatisfactory for defining kinematic motions. In the hotspot reference frame, Yucatón's late stage 1 and stage 2 rotation may be due to the resistance of NE Yucatan to migrate over the Florida-Bahamas-Demerara-Guinea hotspot (FBDGH). The depth below the global sea level of rifting and early spreading is dependent upon the amount of syn-rift dynamic elevation of the extending surface and its rate of dissipation as the Gulf of Mexico migrated off the CAMP–cum–FBDGH.