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Using Subsidence Analysis to Test whether the Eastern USA and Northwestern Africa Conjugate Margins are Upper Plate and Lower Plate Rifted Margins

Emily Stibbe[1] and Paul Mann[1]

[1]Department of Earth and Atmospheric Sciences, University of Houston, Science & Research Bldg. 1, 3507 Cullen Blvd., Houston, Texas

ABSTRACT

Early workers assigned upper plate-lower plate designation to the central Atlantic conjugate margins in the eastern U.S. and northwestern Africa. Upper plates are recognized from: (1) their thicker and higher-standing, unthinned area of continental crust; (2) their narrow zone of thinned, seaward-dipping continental crust with more restricted hydrocarbon fairways; (3) their fewer and higher-dip, syn-rift normal faults; (4) their lack of post-rift, salt-filled sag basins; and (5) their cross-sectional asymmetry when compared to their conjugate margin. Lower plates, in contrast, are commonly identified by: (1) their thinner and lower-standing crust; (2) their broad area of thinned continental crust commonly overlain by post-rift, salt-filled sag basins; (3) their more expansive, hydrocarbon fairways; (4) their pervasive, lower-dip, syn-rift normal faults; and (5) their cross-sectional asymmetry when compared to their conjugate margin. Various geometries of alternating upper and lower plates have been proposed based on topography, margin curvature, and crustal structure. In general the eastern U.S. margin has the crustal and topographic character of a single, lower plate margin. To test which plate is the more thinned lower plate vs. the less thinned upper plate, we have compiled well subsidence data from from the deepest penetrating wells on both margins and by using pseudo-wells based on deep-penetrating seismic reflection data. Subsidence data support the eastern margin of the U.S. as a lower plate margin due to much greater, observed subsidence than observed in northwest Africa. A challenge in northwest Africa is removing the effects of Cretaceous and Cenozoic hotspot activity on the longer term subsidence pattern.

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