Mega-Regional Scale, Decision-Tree Analysis for Hydrocarbon Prospecting on Passive, Conjugate Margins of the Circum-Atlantic and Gulf of Mexico

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ABSTRACT

We use an integrated 4 terabyte, GIS database of geologic and geophysical information gathered from the passive, conjugate margins of the circum-Atlantic and Gulf of Mexico to determine the most favorable settings for discovering future hydrocarbons in slope and deepwater settings. Decision tree elements are subdivided at two scales: regional and basin-specific. Regional decision tree elements include: (1) presence of upper plate versus lower plate margins in areas of asymmetrical rifting of the conjugate margins; (2) presence of mirror-type conjugate margins in areas of symmetrical rifting; (3) presence of seaward limit of documented continental crust known from refraction, reflection, and satellite gravity maps; (4) presence of volcanic margins characterized by outpourings of syn and post-rift volcanic areas over broad regions known from refraction, reflection and gravity studies; (5) non-volcanic margins characterized by absent or localized rift-related magmatism; (6) presence or absence of massive evaporites deposited in large sag basins overlying the rifted continental crust and predating the formation of oceanic crust; (7) documented presence of a major oceanic anoxic event (OAE), or intervals of enhanced deposition of marine source rocks, especially during the Aptian (about 120 Ma) and/or the Cenonmanian-Turonian (about 93.5 Ma); (8) presence or absence of major deltas characterized by increased burial, enhanced maturation, and concentration of sandstone fairways; and (9) presence or absence of passive margin fold belts characterized by enhanced hydrocarbon trapping associated with either updip extensional zones, or downdip fold and thrust belts. Basin-specific decision tree elements include the standard petroleum system elements that previous workers have established from certain basins such as more local sources, reservoirs, seals and thermal history. Overlaying regional decision tree elements with the more basin-specific elements yields areas of overlap which are assumed to represent the most favorable areas for future hydrocarbon discoveries. These areas of maximum overlap are then overlain with maps of producing wells and natural seeps to show support for the decision tree elements used.

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