Regional Thermal Maturity Modeling along the Campeche Salt Basin, Southern Gulf of Mexico

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ABSTRACT

The Campeche salt basin along the southern Gulf of Mexico remains one of the least explored areas of the Gulf of Mexico Basin. The objectives of this study include: (1) to image the morphology of the top of Paleozoic crystalline basement; (2) to understand the role of Paleozoic orogenic basement architecture on total sediment thickness; and (3) to determine crustal thickness and its related heat flow variations for the thermal maturity of source rocks within the basin. We integrate a grid of 23,600 line-km of 2D seismic reflection profiles with published wells and potential fields data. The potential fields data was processed to provide an improved image of the subsalt top basement surface at a depth of 6–15 km. The top basement morphology is a northward-dipping, subsalt surface. The top basement map reveals the 40–55 km wide Campeche segment of the 670 km long Gulf of Mexico marginal rift, formed by necking of continental crust prior to the formation of oceanic crust. The elongate and fault-bounded basement depression of the marginal rift combined with the presence of "step-up fault" on its seaward edge onto more elevated Jurassic oceanic crust is imaged in high resolution using the tilt derivative of the Bouguer anomaly. A crustal thickness model of the Campeche salt basin from gravity inversion indicates a thickness of ~10–20 km in the thinned continental crust beneath the marginal rift and ~20–35 km in the less extended continental crust underlying the Yucatan carbonate platform. We present basin models in various sub-basins of the study area that takes into account the thickness variations of the Tithonian and Cretaceous source rocks along with heat flow variations related to crustal thickness variations in the marginal rift and its adjacent, rifted, continental crust. We support our proposed areas of maturity with a compilation of direct hydrocarbon indicators from these sub-basins.

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