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Mesozoic Stretching Amounts of the Continental Margins of the Gulf of Mexico Basin Derived from 3D Gravity Inversion and Depth to Basement Mapping

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ABSTRACT

Despite decades of previous intensive geophysical and geological studies, the tectonic evolution of the Gulf of Mexico (GOM) remains poorly understood. One of the main challenges lies in the difficulty of determining the amount of thinning of continental margins of the GOM during Triassic-Jurassic rifting. In this study, we propose a crustal thickness model for the entire GOM Basin and its margins derived from 3D gravity inversion. To constrain our model, we constructed a depth to basement map using a compilation of previous seismic refraction and deep drilling results. In addition, analysis of magnetic data was performed to estimate depth to basement and the total salt thickness was calculated from gravity inversion. The Louann Salt thickness in the U.S. GOM is estimated from gravity inversion as ranging from 1.1 km to 8.3 km with an average of 3.4 km. The Campeche salt in the Mexican GOM has average thickness of 8.4 km with arange of 1.1 km to 8.4 km. The calculated thicknesses are comparable to salt intervals measured from available wells records. The similarity in average thickness for the U.S. and Mexico salt is consistent with the hypothesis that both salt bodies occupied a single sag basin that was separated by seafloor spreading into two halves. A GOM crustal thickness model was produced using Moho depths computed from 3D gravity inversion. From this model, the crust stretching from offshore Texas and Louisiana to the Ouachita Foldbelt has a mean thickness of 20 km. This estimate is significantly lower than estimated crustal thickness of both the Yucatan Block and the Florida Platform where the crust is 30 km thick on average. These large variations in Texas (30 km) and Yucatan crustal thickness (20 km) support asymmetrical, late Triassic to late Jurassic rifting between the North America Plate and the Yucatan Block. We use these thickness estimates to perform a non-rigid reconstruction of the GOM opening and an areal balancing method that restores the Yucatan Block to its original position prior to rifting.