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John Londono[1], Juan Lorenzo[1], Geoff O'Brien[2] (1) Louisiana State University, Baton Rouge, LA (2) Australian Geological Survey Organization, Camberra, Australia

Geodynamic Analysis of the Miocene Northwestern Australian Foreland Basin: Constraints from Seismic and Well Data

Since late Miocene to Early Pliocene, partial subduction of the northwestern Australian continental margin beneath the Eurasian plate produced an early stage peripheral foreland basin in the Timor Sea. The geodynamic evolution of the basin may be constrained using 2D flexural models. Initial studies indicate that the effective elastic thickness of the Australian lithosphere varies between 43 and 76 km. These models predict the basin width (~ 220 km), the basin depth (~ 2500 m), the amount of the tectonic load (~ 10^13 N/m), the position and elevation of the forebulge (between 285 to 321 km, and ~ 235 m high) and the position of the deformational front. The position of the Cartier Trough coincides with the forebulge location predicted by the geodynamic model. A combination of pre-collision stretching and salt tectonics is responsible for this paradox. Over 500 kilometers of 2D seismic data and well information were analyzed. Flexural surfaces are identified as seismic reflectors and assumed to be synchronous time lines along the basin. Seismic facies produced during the flexural period in the foredeep, forebulge and back-bulge depozones are also analyzed within a sequence stragraphic framework. Accordingly, the essentially carbonate depositional sequence is coevaly controlled by eustatic fluctuations and flexurally-induced changes in the dynamic of the basin such as sediment supply, depocenter mobility and accommodation space. Carbonate buildup patterns and locations are used as indicators of geodynamic evolution of the basin. Post-Pliocene sequences exhibit different reflector geometry, typical of platform deposits driven only by eustasy.