A New Depth-to-Basement Model of Myanmar: Insights from a Study of Basement Terranes

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Abstract

FROGTECH has recently completed an integrated study to understand the geodynamic evolution of basement and basin systems of onshore and offshore Myanmar. Results of this study include a structurally enhanced depth-to-basement map called SEEBASE™ - a unique model based on gravity and magnetic datasets integrated with other geological data, especially those that provide calibration on basement depth. Critical features of the SEEBASE™ workflow include geophysical processing and enhancements of potential field data (gravity and magnetics), and the spatial integration and interpretation of many geological and geophysical datasets. The SEEBASE™ workflow starts from the bottom-up and is built from an interpretation of the basement character including composition, terranes, structures, thermal history and tectonic models. The interpretation is calibrated with surface geology, wells and seismic data along with published maps and cross sections. The final interpretation provides insights into basin architecture and development, as well as a basis for predicting the extent and nature of petroleum systems elements (reservoir, source and seal) in both mature and frontier regions.

Myanmar basement is an amalgamation of accreted terranes that originated on the northern margin of Gondwana. Since Devonian time, these terranes successively rifted away and migrated with the Tethys Oceans, finally colliding with Indochina. Using potential field data, it is possible to delineate individual terranes and interpret the internal fabric and composition of each terrane as well as crustal thickness. These basement characteristics can then be used to assess basement rheology. Satellite gravity data can also shed light on reconstruction models of SE Asia. Regional tectonic events controlled the stresses acting on basement, while basement rheology controlled the response to those stresses and subsequent basin formation. Basin compartmentalisation can be directly related to the interaction of underlying basement with regional stress fields, with neotectonic events being largely responsible for the present-day distribution of basins.

Terranes in northern Myanmar and east of the Sagaing Fault are mainly composed of Gondwana-drifted orogenic belts with relatively hard Proterozoic gneiss complexes, overprinted by intrusive rocks generated during the successive collisions. Basement is generally shallow or outcropping with very limited and localised basin formation. West of the Sagaing Fault, penetrative N-S to NW-SE trending basement fabric, most likely developed during SE Asian collision, has controlled the location and geometry of the main petroleum basins of central Myanmar. The geometry, extent, and depth of these basins are reflected in gravity data, as are major structures. The suture between the West Burma and Bengal Terranes is structurally complex and creates a boundary between the basins of central Burma and the Bengali Rakhine Basin. The nature of the crust beneath the Rakhine Basin is controversial but is interpreted to be transitional crust based on potential field character and the structural interaction with onshore terranes. Plate coupling between the Indian Plate and West Burma, north of the Andaman Islands, has led to the northward extension and opening of the Andaman Sea to the south of the coupling, with compression and resultant folding to the north in the Ayeryarwady Basin and Pyay Embayment.