Thailand's First Ocean Bottom Seismic Survey Offers a Renewed Look at the Tectonics and Geology of the Bualuang Field

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Abstract

In early 2015, Ophir Energy acquired the first ever Ocean Bottom Node (OBN) seismic survey in Thailand. The survey was acquired on the producing Bualuang Field, situated offshore the Western Gulf of Thailand. The 3D survey took 30 days to acquire, consists of 48 km^2 of full fold data and utilised 4C receivers, which were directly placed on the seabed. The survey, which is wide azimuth by design, contains very large offsets and has a very large fold, several times higher than the original streamer survey. The survey has been processed to broadband standards which coupled with the above has resulted in a very high quality development survey which provides a step change on the imaging of the field at all levels.

At the shallow levels, the Bualuang field is a simple north-south trending faulted anticline comprising of multiple stacked fluvial reservoirs of Late Miocene age. The optimal development of the thinner sands is challenging since they were not imaged in the legacy data. The improved bandwidth of the OBN significantly increases the chance of optimising the production of these reservoirs. The deeper reservoirs are of Early Miocene age and the new OBN survey has revealed a structural fabric never imaged at this level before. A new east-west trending family of faults has been identified and these appear to be conjugated faults related to an old basement fabric. The new interpretation indicates that these sands have higher dips than previously recognized and lie unconformably below the shallower reservoirs. We postulate that this boundary is the Mid-Miocene Unconformity. This new and improved interpretation of the reservoir, affects how it should be modeled and developed.

The wide azimuth nature of the OBN provides an unrivaled illumination of the thrust fabrics hidden within the Pre-Tertiary sequences. The thrusts are large, with hundreds of meters of relief and display clear duplexes and overhangs. This results in older rocks often appearing juxtaposed or above sequences of younger age. The OBN clearly illuminates various unconformities within the Pre-Tertiary itself revealing a complex history of thrusting and fault reactivation, which precedes the Tertiary rifting. Therefore, the thrust fabrics must be the result of large compressional forces, which occurred following the collisions of the Indochina, Sibumasu and other terrains throughout the Mesozoic and Earliest Paleogene.

Finally, the new survey further confirms that the Tertiary sequences are clearly extensional in nature and the faults appear to have preferentially used the weakened old Pre-Tertiary thrust faults during the extension. As a result, it is common to see younger faults slotting into those fabrics clearly influencing the structural style above. Therefore, understanding of these older fabrics is key in properly mapping and characterising the younger reservoirs directly overlying them.