Structural Evolution of the Samarang Reactivated Shale Diapir, Offshore Sabah, Malaysia: New Analysis of a Mature Oil Field

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The >250 mmbl Samarang anticline lies within the 100 km long Champion-Padas trend offshore Sabah, along strike to the well-studied giant Champion oilfield offshore Brunei. The Samarang anticline is adjacent to the shallowly NW dipping Morris Fault which is along strike to the well studied Jerudong anticline, onshore Brunei. These structural analogues, together with improvements in 3-D seismic interpretation of mobile shale diapirs greatly increase our understanding of the Samarang structure. Here an interpretation of a 26 km seismic section across the structure has been restored to show its structural evolution.

The hangingwall restoration reveals that the section was extended ~6 km during the latest Late Miocene to Pliocene (post SRU) and then compressed ~400m in the Pleistocene to Recent. This model suggests that a mobile shale ridge formed during emplacement of the late Miocene delta sequence to the southeast and was largely dewatered. The mud ridge was then cut by a large Pliocene extensional fault system and buried, generating hydrocarbons that locally reactivated the diapir intruding sills and dykes into the newly deposited roof rocks. Most of the hangingwall deformation is best modeled as extension and minor compression along a large, deep regional expansion fault as commonly observed in the Gulf of Mexico.

The only real evidence of shale diapirism is intrusion of shale dykes and possibly sills and minor, but important, crestal extensional faults interpreted to be associated with shale diapir collapse. In this interpretation the small scale Pleistocene inversion is vital to prospectivity. Not only did it create the current anticlinal trap, but it also placed the crestal collapse faults into compression so that they are more likely to seal before production.