

The Relationship between Thin- and Thick-Skinned Tectonics in the Papuan Fold Belt: A New Structural Concept for Hydrocarbon Exploration in Papua New Guinea

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The structural framework for parts of the Papuan Fold Belt (PFB) has been refined based on information from several hanging-wall anticlines, which include, from south to north, the prospective South East Gobe (SEG), Wasuma and Masaka anticlines. The influence of Mesozoic basement faults in the formation of the PFB has long been recognised, as well as deformation styles typical of thin-skinned fold belts, but their relationship and significance to hydrocarbon exploration is unknown.

Recent improvements in seismic processing and modelling revise former seismic interpretations. Structural modelling shows 25-30% shortening of the study area, much less than for typical thin-skinned fold belts (>40%). The faults at SEG and at Wasuma are north-dipping thrust faults at <35 degrees, whereas the fault bounding the Masaka anticline dips at >40 degrees to the north. The Masaka structure is further distinguished by: (1) an increase in both TST thickness and shaliness of Mesozoic sequences which is also shown by airborne gravity; (2) significantly higher formation pressures; and (3) the occurrence of Late Cretaceous sandstones and hydrothermal activity.

The Masaka structure is interpreted to have formed by basin inversion along a reactivated basement fault, whereas Wasuma and SEG are the result of footwall cut-off thrusts – thrust faults linked to and restricted by the basement fault. This structural concept has been postulated for other areas including the Western PFB, the Mahakam delta in onshore Borneo and is likely for the oil producing fields and some of the non-tested structures in the PFB. The recognition of this structural framework is significant for seismic interpretation, in particular where seismic imaging is poor, as well as for undertaking an exploration program in difficult terrains such as the PFB.