Fault Reactivation and Hydrocarbon Preservation Potential: (Fault) Size Does Matter

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Fault reactivation represents a major risk to trap integrity. Empirical observations from the Timor Sea suggest that both the amount of reactivational (Tertiary) displacement accumulated on a trap bounding fault and its position relative to the trap crest are critical factors in controlling hydrocarbon preservation. The majority of trap bounding faults in the region have been reactivated, however the distribution of Tertiary fault displacements is heterogeneous. Preferential localisation of post-rift strain onto larger faults in the population appears to have resulted in partial protection of some fault-bound traps with favourable geometries, but promoted breaching of others. A series of numerical modelling experiments (FLAC3-D) have been performed to further investigate the mechanical interactions of simple normal fault arrays (based to those in the Timor Sea) during reactivation. One of the longer term aims of the modelling work is to provide a predictive tool for assessing the risks associated with fault reactivation for hydrocarbon preservation. The results of the numerical experiments are consistent with the field observations and demonstrate that pre-existing length, spacing, location and number of interacting faults are all important factors in controlling the distribution of fault displacements during reactivation. Complex interactions observed even within the simple fault populations modelled highlight the utility of computational geomechanical modelling techniques in trap integrity assessment. However, the numerical models require reference to the field observations and models, and therefore, a combination of empirical and deterministic approaches is considered necessary in this case.