NUMERICAL MODELLING OF STRESS FIELD AND FAULT GENERATION IN EXTENSIONAL BASINS

MORAES, A. Petrobras/R&D Centre, Rio de Janeiro, Brazil.

Two-dimensional cross section finite-element analysis was used to simulate structural framework development of sedimentary basins in extension. Through a deterministic-mathematical approach, numerical modelling simulates the onset of fault development during extension and the mechanical interaction between basement and a pre-rift sedimentary cover. Different models were evaluated, simulating this interaction with different rheologies, pre-existing basement topography, locked and unlocked basement faults, and potential detachment surfaces at the interface basement-sediment. It was investigated the influence of the presence of layers with ductile or undrained pore-elastic behaviour associated with basement topography and basement faults reactivation. The presence of those beds seems to be a very important factor in the stress distribution, specially in models that lack unlocked faults or previous detachment surfaces. Modelling of unlocked faults and detachment surfaces provided good examples of features observed in extensional sedimentary basins. Low angle normal faults and extensional ramp-flat-ramp geometries were developed when models have an unlocked fault. Regular and smooth listric fault planes seems to be related with the presence of detachment. Pre-existing basement topography concentrates stresses, enhancing possibilities of rupture, specially if a ductile bed is present. Even though natural deformations are finite and heterogeneous, the models successfully describe the main controlling features responsible for the formation of faults and basin architecture.