

Revisiting the Concept of “Steady State Withdrawal” in Salt Systems: Minibasin Evolution and Seismic Morphology

Leslie J. Wood

Quantitative Clastics Laboratory, Bureau of Economic Geology, Jackson School of Geosciences, University of Texas at Austin, Austin, Texas, USA

Mini-basins developed over actively mobile salt substrates exhibit a level of stratigraphic architectural complexity that often flies in the face of classic steady state salt withdrawal models. Classic fill-and-spill models, developed in the proximal, extension dominated mini-basins of the Gulf of Mexico (GOM) may not be applicable to mini-basins developed in more structurally complex or distal settings. It stands to reason that systematic changes due to deformation should be reflected in the geometry and morphology of the mini-basin fill and enable reconstruction of salt history.

Mini-basins have been examined in proximal and distal supra-salt settings of the GOM, in the supra-shale setting of northeastern South America and in the supra-salt setting of offshore Morocco. Two minibasins near the GOM Sigsbee Escarpment were found to contain an ordered pattern of tectonomorphic fill that includes four geometries; ponded, draped wedged and complex. These geometric fill packages stack in systematic and repetitive sequences. Each fill type has distinct “facies” comprising it. Interbasin debris flow processes are more prominent during the Ponded Phase and diminish in occurrence as the bathymetric relief diminishes. Extrabasinal staged gravity events can form Wedged Phase geometries. Both Ponded and Wedged tectonomorphic phases show a strong probability to contain confined fans with significant sandy reservoir potential. Basins examined over supra-shale substrates show a dominance of ponded and complex fills, lack the depth of supra-salt basins and develop more through inflation of side walls than subsidence withdrawal. Finally, mini-basins developed in offshore Morocco show all of the elements identified in the GOM with multiple cycles of fill suggesting episodic uplift of margins and apparent present day ongoing subsidence. These fills are over 4 seconds of Tertiary age channelized turbidites, mass transport deposits, slumps and deep water pelagic deposits. Current fill-and-spill models do not adequately describe the complex interaction of structure and sedimentation taking place in the mini-basins and complex, cyclic stratal fills suggests an episodic process of salt movement.