

Basin-Scale Salt Tectonic Processes and Post-Rift Basin History of the North-Central Scotian Slope and Deepwater Basin

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The contrasting salt deformation styles in the North-Central Scotian basin are the result of complex basement topography in the narrow linked rift basins, variable salt thickness, and high clastic sediment input during the Jurassic and Cretaceous. Disappointing exploration results have shown that salt tectonics concepts developed in other salt basins cannot be adapted reliably to the Scotian Margin. Consequently, new basin concepts must investigate the role of the unique basin characteristics including palaeogeography, sediment supply, and rift basin geometry on post-rift salt tectonics and basin evolution.

The Salt Dynamics Group has developed a new generation of physical experiments to support exploration in frontier salt basins. Regional ION GXT NovaSpan seismic sections of the Laurentian, Abenaki, and Sable basins constrain basin-scale physical experiments that simulate the first-order structures and depocentre evolution from early post-rift salt withdrawal basins to late post-rift allochthonous salt tongue canopy systems and salt nappes. The integration of analogue experiments with 4D strain monitoring, tectonic modelling and seismic interpretation enables the structural restoration and mechanical analysis of salt structures and depocentres and their correlation between the Scotian sub-basins.

Our study demonstrates that the Scotian basin differ strongly from the salt basins of the South Atlantic margins. Low mechanical coupling of salt and overburden due to thick original salt has favoured rapid down-building and sediment aggradation rather than progradation in the early post-rift stage. Salt extrusion started in the Laurentian basin due to progradation of the palaeo Laurentian fan in the early Jurassic and propagated in southward direction leading to diachronous deepwater salt extrusion in the North-Central Scotian Basin. The North Sable basement high influenced salt extrusion and sediment dispersal marking the structural transition from long-lived allochthonous salt nappes in the Laurentian basin towards extensive salt tongue-canopy in the Sable basin during the Cretaceous.

For the first time, the derived kinematics salt tectonics concepts and post-rift basin model explain the evolution of salt structures and related depocentres in a regional framework. Understanding the evolution of salt-withdrawal basins, salt tongue-canopy and nappe systems provide new ideas for reservoir distribution and trap formation in the deepwater Scotian basin.