

Synrift, Postrift, and Salt-Related Deformation on the 'Passive Margin' of Nova Scotia and Southern Newfoundland, Canada: Is it Really Passive?

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We have used recently acquired and newly reprocessed 2D seismic-reflection data (12,500 km²) to better define the tectonic evolution of the synrift Orpheus and postrift Scotian basins of offshore Nova Scotia and Newfoundland, Canada. These data, together with offshore well data and field data from onshore Nova Scotia, show that the Orpheus and Scotian basins underwent several stages of deformation during the Mesozoic and Cenozoic: 1) Rifting occurred during the Late Triassic to Early Jurassic, producing a series of south-dipping basement-involved extensional faults that border the Orpheus basin on the north. Thick sequences of evaporites (Argo Formation) deposited during rifting began to flow soon after deposition, producing salt pillows, walls, and overhangs. Massive igneous sheets associated with the Central Atlantic Magmatic Province (CAMP) intruded the synrift strata during the earliest Jurassic. 2) Shortening occurred soon after rifting during the Early to Middle Jurassic, reactivating many of the basement-involved extensional faults as reverse faults or oblique-slip faults. In response, salt-cored detachment folds and thrust faults formed above the Argo salt. The shortening also produced uplift and erosion of the northern margin of the basin. 3) Salt structures continued to develop during the Middle to Late Jurassic, producing localized basins and salt-cored highs. 4) During the earliest Cretaceous, regional uplift and erosion produced the widespread Avalon unconformity. Soon after, igneous sheets associated with a second magmatic event intruded the earliest Cretaceous and older strata. Cretaceous strata directly above the Avalon unconformity show only minor thinning over the crests of salt-cored anticlines. Higher in the section, however, strata show greater thickness variations. 5) Significant anticlinal growth occurred during the late Cenozoic and is associated with uplift and erosion. Faults with normal separation cut the crests of many of the anticlines.

The complex tectonic history and the presence of thick synrift Argo salt strongly influenced the hydrocarbon potential of the Orpheus and Scotian basins. Deep-seated deformation associated with extension during rifting and shortening after rifting produced a variety of basement-involved structural traps below the salt and detached structural traps above the salt. Also, salt movement significantly influenced depositional patterns, migration pathways, and heat flow during and after rifting.