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Fluid Flow and Trap Adequacy - Contrasting Triassic Fluvial Outcrops and Cretaceous Deltaic Reservoirs Onshore and Offshore Nova Scotia.

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Abstract

Fluid flow controlled by trap adequacy and reservoir permeability is critical in hydrocarbon production, carbon storage, hydrogeology, and environmental geology - and in many circumstances is poorly understood without detailed modelling. Diagenesis and faulting, among other factors, have recognizable impacts on the movement of subsurface fluids, with many examples from global aquifers and reservoirs.

In this study we use conventional static and dynamic geocellular modelling to assess the impact of diagenesis and faulting on fluid flow. In the first example we use LiDAR to digitally capture and build a geocellular model of Triassic braided fluvial outcrops on the southern shore of the Minas Basin (Bay of Fundy, NS). This sedimentary succession comprises laterally continuous interfluve deposits intermittently eroded by fluvial channels that are preferentially cemented by calcite. These calcite cemented channels impede the lateral movement of fluids. We contrast this inhibition of fluid flow with the effects of crestal faulting on four-way dip closures in a high net-to-gross Cretaceous deltaic section at Penobscot, offshore Nova Scotia (mapped from 3D seismic). These faults permit cross-fault leakage and reduce trap adequacy permitting upward exit of buoyant fluids into a system of sand filled estuarine channels that approach the seabed landward.

The Triassic braided fluvial deposits provide an analogue to fluid movement in local aquifers along the southwest coastal communities of Nova Scotia and in possible deep offshore reservoirs of the Fundy Basin and Atlantic Scotian margin. In the Penobscot structure we are able to explain the small low relief hydrocarbon columns penetrated by well L-30 and the absence of hydrocarbons within dip closure at well B-41. Additionally, these findings predict that larger adjacent fault dependent closures may be dominantly wet, possibly with short hydrocarbon columns.