Structure of the western Cumberland Basin: implications for coalbed-methane exploration

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The Cumberland Basin of Nova Scotia, a large depocentre in the Late Paleozoic Maritimes Basin, contains a Carboniferous succession that is probably more than 6 km thick. Previous hydrocarbon exploration has focused on anticlines cored by Mississippian Windsor and Mabou groups, with targets in the underlying Horton Group. New seismic profiles in the Cumberland Basin show reflectors that can be traced to surface, allowing correlation with surface mapping. The basin is currently a target for exploration for coalbed methane.

Subsidence and tectonism in the Cumberland Basin were clearly in part controled by differential flow of Windsor Group evaporites, which may have begun as early as late Visean time, and which continued intermittently through the Namurian began and Pennsylvanian time. Non-marine clastic units were deposited in synclinal minibasins, and abut against adjacent evaporites or are truncated beneath internal unconformities.

In the western part of the Cumberland Basin, known as the Athol Syncline, the Joggins Formation, famous for preserved upright fossil trees, thins conspicuously eastward onto an evaporite-cored antiform at Springhill. To the south, a transition in the character of reflectivity suggests a lateral facies change, and map relationships indicate that coal-bearing units interdigitate with conglomerates of the Polly Brook Formation. At depth, reflectors identified as representing the Namurian Mabou Group appear to rest directly on basal Windsor Group at an evaporite weld, indicating that the entire thickness of evaporites was evacuated, mainly during Pennsylvanian subsidence. Early Westphalian evaporite withdrawal is largely responsible for the great thickness of coal-bearing Cumberland Group strata.

Contouring of reflections in the seismic profiles provides better definition of the subsurface geometries and potential extent of coal-bearing units in the Athol syncline, presented as a series of time-structure maps for selected horizons. The

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subsurface geometries also suggest a number of new exploration targets for this and similar depocentres in the Maritimes Basin. Potential traps for conventional hydrocarbons may be located where thick fluvial sand units abut against salt walls at the margins of minibasins. Coal distribution was strongly influenced by both tectonism and differential withdrawal of evaporites.

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