Salt Tectonism And Sedimentation Patterns In The Cumberland Basin, Nova Scotia: New Insights From Devon Canada's Seismic Reflection Profiles

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ABSTRACT

The Cumberland Basin of northern mainland Nova Scotia is one of the larger depocentres of the Late Paleozoic Maritimes Basin and contains a Carboniferous succession that exceeds 8 km in thickness. Previous exploration efforts have focused on anticlines cored by outcrops of the 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. In the western Cumberland Basin, the thick, early Westphalian coal-bearing formations of the Cumberland Group (Joggins and Springhill Mines Formations) can be traced at depth in the Athol Syncline. Southward, they interdigitate in the subsurface with less reflective alluvial fan conglomerates of the Polly Brook Formation. The Joggins Formation thins conspicuously eastward onto an evaporite-cored antiformal structure in the Springhill area.

Beneath the Athol Syncline, reflectors identified as the Namurian Mabou Group (Middleborough, Shepody, and Claremont Formations) rest directly on a bright reflector representing the basal Windsor Group, in a structure identified as an evaporite weld. This indicates that the entire thickness of Windsor evaporites (some of which are seen at surface near Springhill) has been evacuated beneath the Athol Syncline. Early Westphalian evaporite withdrawal is largely responsible for the great thickness of coal-bearing Cumberland Group strata in this area.

East of Springhill, coal-bearing units are generally absent and a much thinner Cumberland Group overlies the Namurian Mabou Group with clear angular unconformity on the flanks of the evaporite-cored Claremont anticline. Traced to depth, the Mabou Group thickens into a synclinal 'minibasin', which subsided into evaporite-bearing Windsor Group. This basin shows a normal-fault contact on its southern margin that flattens down dip. Mabou Group reflections show an

'apparent downlap' towards this surface. The Mabou Group minibasin is truncated by a clearly resolved unconformity at the base of the overlying Boss Point Formation (Cumberland Group).

There is a strong contrast between successions in the eastern and western parts of the basin. This may have a tectonic origin, in basement faults, or in the partition of extension and strike-slip motion between different parts of the basin. Alternatively, the contrast may be of sedimentary origin, reflecting either a difference in the facies (and therefore mobility) of evaporites, or a difference in the degree of loading by Westphalian alluvial fans derived from adjacent highlands.

Overall, subsidence and tectonism in the Cumberland basin were clearly controlled by differential flow of evaporites, which began in Namurian time and continued intermittently throughout the Late Carboniferous. These interpretations suggest that the likelihood of finding tectonically uplifted Horton Group clastics within the salt-cored anticlines is less than previously inferred. However, the presence of Namurian and Westphalian clastic units in synclinal minibasins, where they abut against adjacent evaporites or are truncated beneath internal unconformities, suggests several possible new exploration targets for the Cumberland Basin that may have analogues elsewhere in the Maritimes.