

Re-examining faults as primary and secondary salt welds in the late Paleozoic Antigonish sub-basin of Nova Scotia

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Summary

The Antigonish sub-basin, part of the late Paleozoic Maritimes Basin, extends from the Antigonish Highlands into western Cape Breton Island. Strike-slip faults inherited from the late stages of Appalachian orogenesis border the late Devonian to late Carboniferous basin-fill. Clastic sedimentary rocks dominate the contents of the sub-basin, with the exception of the marine carbonates and evaporites of the Viséan Windsor Group. Existing maps of the region show several surfaces that are mapped as faults. The largest of these is a discordant surface spanning most of the sub-basin, which was first mapped as the Antigonish Thrust. This surface was later considered to be a low-angle extensional fault and renamed the Ainslie Detachment. Closer examination and the known presence of salt and salt structures in the local stratigraphy, such as salt walls found on seismic lines through St. Georges Bay and salt diapirs exposed in coastal outcrops, lead us to suggest that these surfaces are instead salt welds. A combination of field mapping, UAV photogrammetry, core logging, and seismic interpretation was used to examine the sub-basin for evidence of salt movement and its timing. Salt movement in the salt-dominated Lower Windsor Hartshorn Formation began in the Viséan during the deposition of the Middle Windsor Group, causing lateral thickness variations. Contemporaneous salt diapirs around the sub-basin margins prevented the local deposition of Middle and Upper Windsor strata. A primary salt weld in the Hartshorn Formation is exposed in outcrop at Lakevale on Cape George. A previously unrecognized Middle Windsor salt unit (MWS) was identified in the sub-basin. Locally the MWS began to move during Upper Windsor Group deposition, but the majority of the salt remained immobile until after the deposition of the Bashkirian Mabou Group. Several structures originally mapped as faults are re-interpreted as surficial expressions of MWS diapirs. At Little Judique Harbour on Cape Breton Island, steeply dipping strata with different younging directions on either side of a breccia zone are interpreted to record a secondary salt weld. The presence of salt structures in both the previously known Hartshorn Formation and the newly recognized MWS shows that salt movement has had a larger and more complex role in the history of this sub-basin than was previously thought. Salt may also have played a similar role in the development of other regions in the Maritimes Basin.