Geophysical Investigation of Salt Tectonics and Deeper Structure in the Eastern Magdalen Basin, Atlantic Canada

Nathan Hayward, Alan Grant, Sonya A. Dehler*
Geological Survey of Canada (Atlantic)
Nova Scotia B2Y 4A2
dehler@agc.bio.ns.ca

Paul Durling
Corridor Resources Incorporated
301 Cornwallis House, 5475 Spring Garden Road,
Halifax, Nova Scotia B3J 3T2

Investigation of the eastern Magdalen Basin has revealed an area of intense salt tectonism, above a fault-bounded sub-salt high. The basin contains ¶18 km of Paleozoic sedimentary rocks resting on the crystalline basement of the Acadian Orogeny. Carboniferous rocks, although regionally exhibiting minor deformation, are intensely deformed to the southeast of the Magdalen Islands, due to faulting and evaporite tectonism of the Viséan Windsor Group. Clusters of NNE and ENE trending short-wavelength magnetic lineations, which coincide with the salt structures, enclose rhomboidal zones of low-amplitude magnetic anomalies. Seismic profiles show the lineations to be related to deformation and diapir collapse near salt structure margins. Euler deconvolution models indicate shallow (< 400 m) fault type magnetic sources, interpreted to result from alteration mineralisation in salt-impregnated, brecciated iron-rich sedimentary rocks. Mine samples confirm the presence of higher susceptibility carnallite-rich veins at these depths. Deeper sources (<1 km) are related to faulting, linked to deeper structure. The base event, a regionally mapable seismic reflection at ~5-11 km, is associated with an unconformity at the base of the Windsor Group, sampled at the Cap Rouge well. Salt structures and associated features are influenced by faults and related topography of the base event.

Structures in the basin are consistent with a dextral transpressive regime associated with the Cobequid-Chedabucto fault zone. This produced WNW compression and ENE dextral motion along faults in the basin during the Early Carboniferous. NNE striking base event thrusting, and ENE dextral faulting were integral in forming the observed pattern of salt deformation.