Geophysical investigation of salt tectonics and deeper structure in the eastern Magdalen Basin

Nathan Hayward[1], Alan Grant[1], Sonya A. Dehler[1], and Paul Durling[2]

1. Geological Survey of Canada (Atlantic), Bedford Institute of Oceanography, P.O. Box 1006, Dartmouth, NS B2Y 4A2, Canada <hayward@agc.bio.ns.ca>

2. Corridor Resources Incorporated, 301 Cornwallis House, 5475 Spring Garden Road, Halifax, NS B3J 3T2, Canada

Investigation of salt structures in the eastern Magdalen Basin has revealed an area of intense salt tectonism, above a fault-bounded sub-salt high. The basin contains up to 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, as a result of faulting and tectonism of evaporites of the Viséan Windsor Group. Clusters of short wavelength magnetic lineations, associated with gravity anomaly lows, coincide with the salt structures and define NNE- and ENE-trending linear belts. These enclose rhomboidal zones of very low amplitude magnetic anomalies. Seismic profiles show the lineations to be related to zones of deformation and diapir collapse near the margins of salt structures. Euler deconvolution models indicate shallow (< 400 m) fault or contact-type magnetic sources, interpreted to result from mineralization associated with alteration in salt-impregnated, iron-rich sedimentary rocks, brecciated during salt activity. Measurements on mine samples confirm the presence of higher susceptibility carnallite-rich veins with salt units. Deeper sources (< 1 km) within and at margins of salt, are related to faulting and linked to the deeper structure. The base event, the deepest regionally mappable seismic reflection (2–5 s. TWTT, ~ 5–11 km), is associated with an unconformity at the base of the Windsor Group, sampled at the Cap Rouge well.

Atlantic Geology, 2002, Volume 38, Number 1

Salt structures and associated features are influenced by faults and related topography of the base event.

Structural trends in the eastern Magdalen Basin are consistent with a dextral transpressive regime associated with the Cobequid-Chedabucto fault zone and related faults. Motion on this fault produced WNW compression and ENE dextral motion in the eastern Magdalen Basin from the Late Viséan to Westphalian D. Thrusting of the base event to the ENE and WSW, and dextral motion on ENE trending faults bounding the southern edges of rhomboidal blocks were integral in forming the pattern of salt deformation observed in the present basin.