Natural Resources Canada | Ressources naturelles Canada

GEOLOGICAL SURVEY OF CANADA | COMMISSION GÉOLOGIQUE DU CANADA

NOVA SCOTIA Natural Resources

Stratigraphy and structure of the Malagawatch salt deposit - Windsor Group, Central Cape Breton Island, Nova Scotia

Peter S. Giles[1]

[1] Natural Resources Canada; GSC Atlantic, Dartmouth, Nova Scotia; e-mail PGiles@nrcan.gc.ca

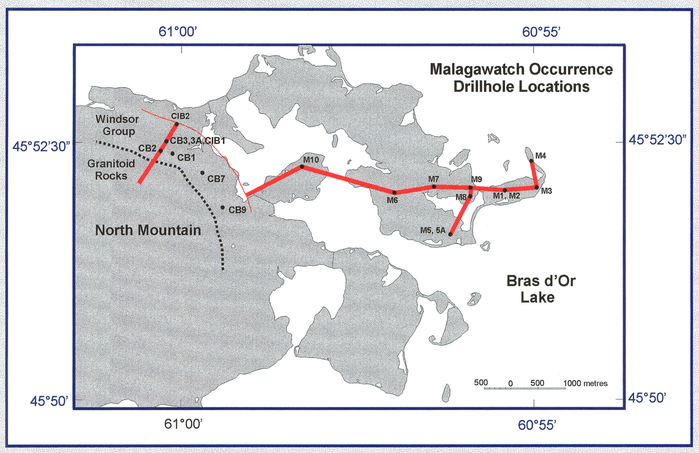
Ten deep wells define a major salt deposit in the Malagawatch area of central Cape Breton Island. This deposit is notable for its documentation of the stratigraphic extent of bedded rock salt throughout almost the entire Windsor Group in cyclically repeated sedimentary rhythms of variable thickness. In addition, extensive coring of the deposit in combination with downhole mechanical logging provides an excellent base-line study of variations in the geophysical response of Windsor Group strata both laterally and vertically. These deep wells also reveal the importance of ground-water dissolution in governing the depth (from surface) to salt, and more importantly, document that the first downwards appearance of bedded halite in any such deep well has little significance in terms of marking local stratigraphic position.

The highest Windsor Group strata cored in the Malagawatch drill holes are redbeds lying just above the C3 limestone of the upper Windsor Group. The lowest Windsor Group strata were cored in a separate series of more shallow holes, included in the accompanying cross-section, and represent basal Windsor beds of the thick "basal anhydrite" and laminated limestone of the Macumber Formation. Hole M10 drilled almost the entire thickness of the basal anhydrite, but stopped short of the Macumber Formation. Although tightly folded in both small and large scale structures, the Malagawatch wells collectively provide an excellent record of stratigraphic detail, unmatched in any other area of Cape Breton Island.

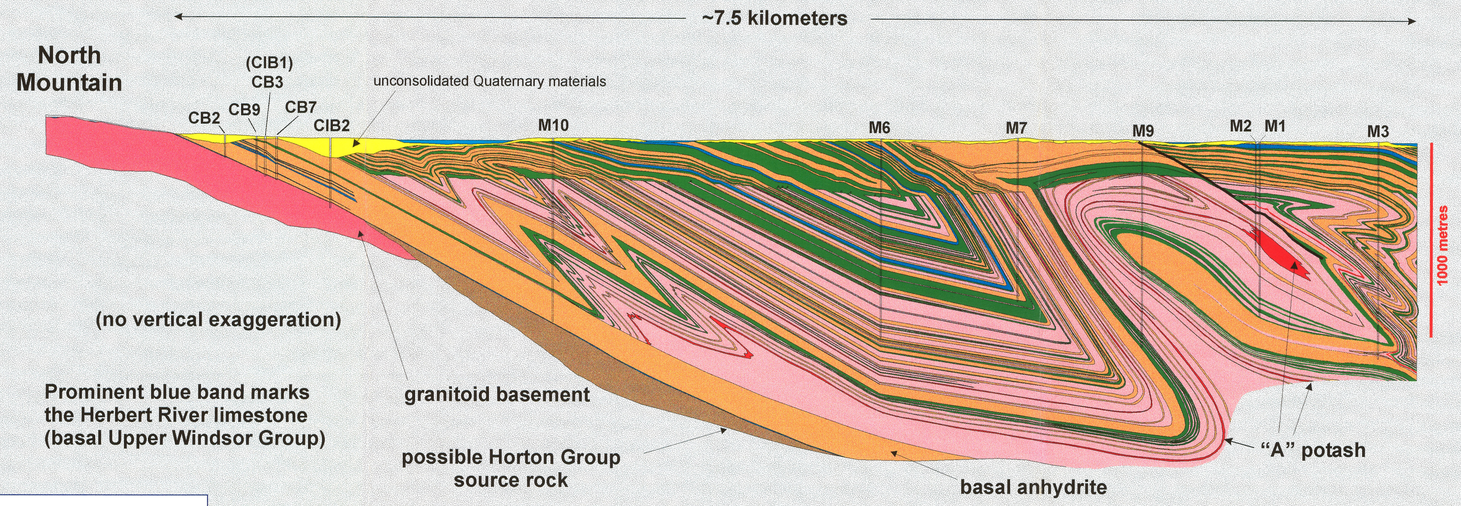
Potash salts are interbedded with halite at two principal stratigraphic levels, the higher within the middle part of the Windsor Group, and the lower within the thick salt succession which completes the first major cycle of sedimentation in the lower Windsor Group. These potash beds are regionally of economic interest but at Malagawatch, may have limited potential due to the deposit's structural complexity. Thick beds of relatively pure halite are also potential resources, and in addition may provide horizons suitable for the development of underground storage caverns. Other economic aspects of the deposit include the presence of light liquid hydrocarbons in holes drilled to the level of the Macumber Formation at relatively shallow depths on the flanks of North Mountain.

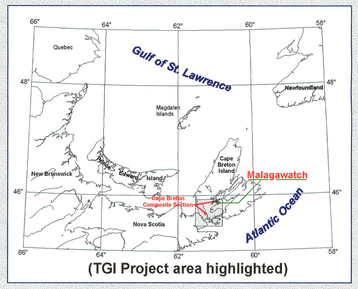
Material illustrated in this Open File was presented at Mining Matters 2001, Nova Scotia Department of Natural Resources, as one of a series of posters addressing Nova Scotia's salt deposits. The same material can be seen in modified format on that department's web site where products of the Targeted Geoscience Initiative in southwestern Cape Breton Island are highlighted. This report was released with the permission of the Director, Geological Survey of Canada - Atlantic.

Open files are products that have not gone through the GSC formal publication process.



MALAGAWATCH SALT DEPOSIT

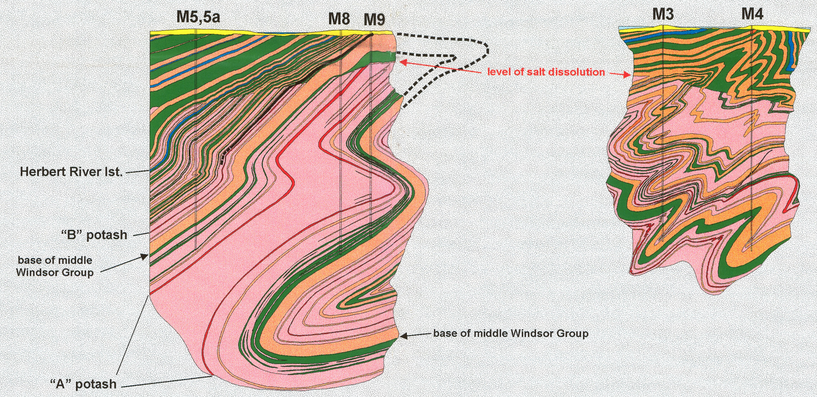




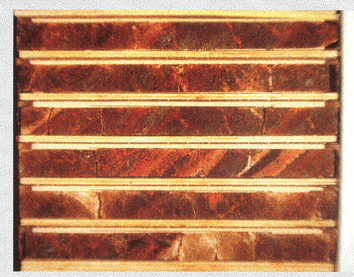
(TGI Project area highlighted)

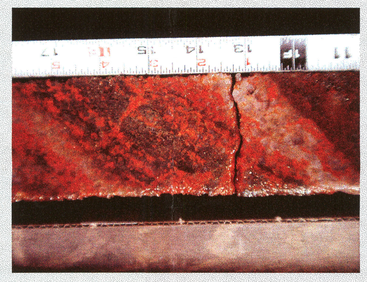
Legend

- unconsolidated Quaternary deposits
- gray siltstone
- red and green siltstone
- carbonate rocks (marker bed)
- anhydrite and gypsum with associated carbonate rocks
- halite
- potash
- fault



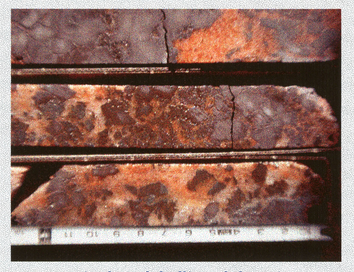
Rock salt is a significant contributor to the mineral economy of Nova Scotia. In the deep subsurface of southern and central Cape Breton Island, halite is present throughout the Windsor Group. Although variable in quality due to admixed anhydrite in thin interbeds, as well as red and green-gray siltstone as interstitial and interbedded material, many of the stratified salts are of very high purity. These salts are attractive not only as a potential source of road and table salt, but as beds amenable to the development of salt caverns suitable for the storage of hydrocarbons. Halite is also a potential feedstock for petrochemical applications, suggesting possible new development opportunities linked with the availability of offshore energy. On the left is an example of very high purity salt drilled at the Malagawatch deposit.




detail of "A potash"

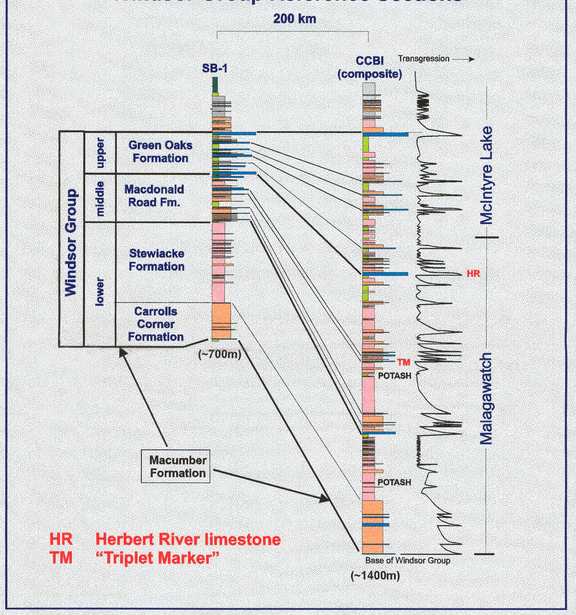
Potash salts, represented at Malagawatch mainly by KCl (sylvite), are currently mined from the lower Windsor Group in southern New Brunswick. Their presence in central Cape Breton Island is well documented, although structural complexity of many of the deposits drilled to date limits utilization of this resource. Grade and thickness of the "A Potash" at Malagawatch are comparable to deposits mined elsewhere, and in an appropriate structural configuration, suggest potential for development. Examples of the "A Potash" as intersected at Malagawatch are shown in adjacent photographs.


anhydrite interbed in halite


stockwork halite veining at anhydrite- siltstone contact

Siltstone and anhydrite comprise the main impurities in Nova Scotia's salt deposits. Photographs illustrate these beds, their intimate association with halite, and their nature in highly deformed successions typical of fold closures and zones of shear deformation. Siltstone-dominated intervals in particular seem to be prone to intense fracturing with the development of stockwork veins of highly coloured halite.

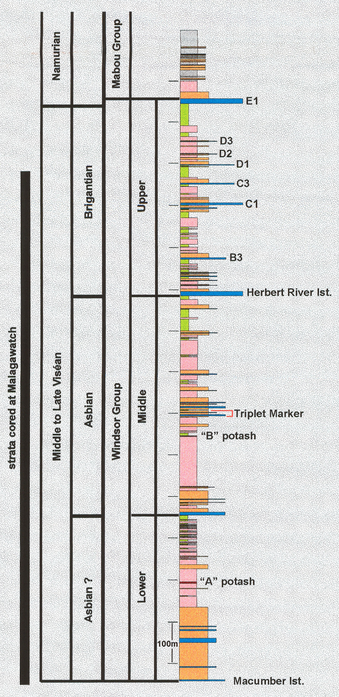
Windsor Group Reference Sections



HR Herbert River limestone
TM "Triplet Marker"

The Cape Breton composite section, constructed largely from the deep drilling at Malagawatch, can be correlated with the principal reference section for the Windsor Group (SB-1 - Shubenacadie Basin). This diagram illustrates the pronounced increase in halite content in the Cape Breton succession, and the appearance of potash salts in this very saline depositional setting.

Composite Stratigraphy
Windsor Group of central Cape Breton Island



Malagawatch Stratigraphy

A composite Windsor Group succession can be constructed using data from Malagawatch, supplemented with data from the McIntyre Lake deposit, located to the west in the Strait of Canso area. The section shown has been corrected for tectonic tilt so that all thicknesses are restored as closely as possible to original thickness. In this procedure, no correction for possible salt thinning or thickening during salt flow can be made. Therefore, the stratigraphic reconstruction is only approximate. Nevertheless, the carbonate rock units which, in the Windsor Group, provide the best tool for regional correlation, are shown in their appropriate stratigraphic position.

The group can be considered lithostratigraphically in three parts. The upper part is regionally the best documented, and extends from the base of the Herbert River limestone to the top of the E1 or Kennetcook limestone. The middle part corresponds to the historically defined B subzone (macrofaunal), based on the faunal characteristics of the marine faunas. Like the upper Windsor Group, the middle Windsor is characterized by numerous marine intercalations (limestones and dolostones) with associated evaporites deposited in small-scale sedimentary rhythms. The lower Windsor Group is represented in ascending order by the Macumber Formation, a capping major anhydrite informally termed the basal anhydrite, and a thick salt succession. These three rock units define a single major cycle of sedimentation. The base of the Macumber Formation is defined regionally as the base of the Windsor Group in Nova Scotia.

Contribution to Geological Survey of Canada, Targeted Geoscience Initiative
Geological Mapping for Mineral Development in South Central Cape Breton Island

A joint project with the Nova Scotia Department of Natural Resources

Available from
Geological Survey of Canada
Bedford Institute of Oceanography
1 Challenger Drive
Dartmouth, Nova Scotia, Canada

OPEN FILE
DOSSIER PUBLIC
1531
GEOLOGICAL SURVEY OF CANADA
COMMISSION GÉOLOGIQUE DU CANADA
OTTAWA
2003

Recommended citation:

Giles, P.S., 2003. Stratigraphy and structure of the Malagawatch salt deposit - Windsor Group, central Cape Breton Island, Nova Scotia. Geological Survey of Canada, Open File 1531