

# CHAPTER 5. CUMBERLAND COUNTY

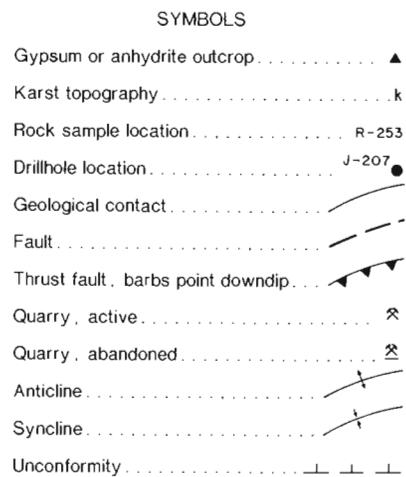
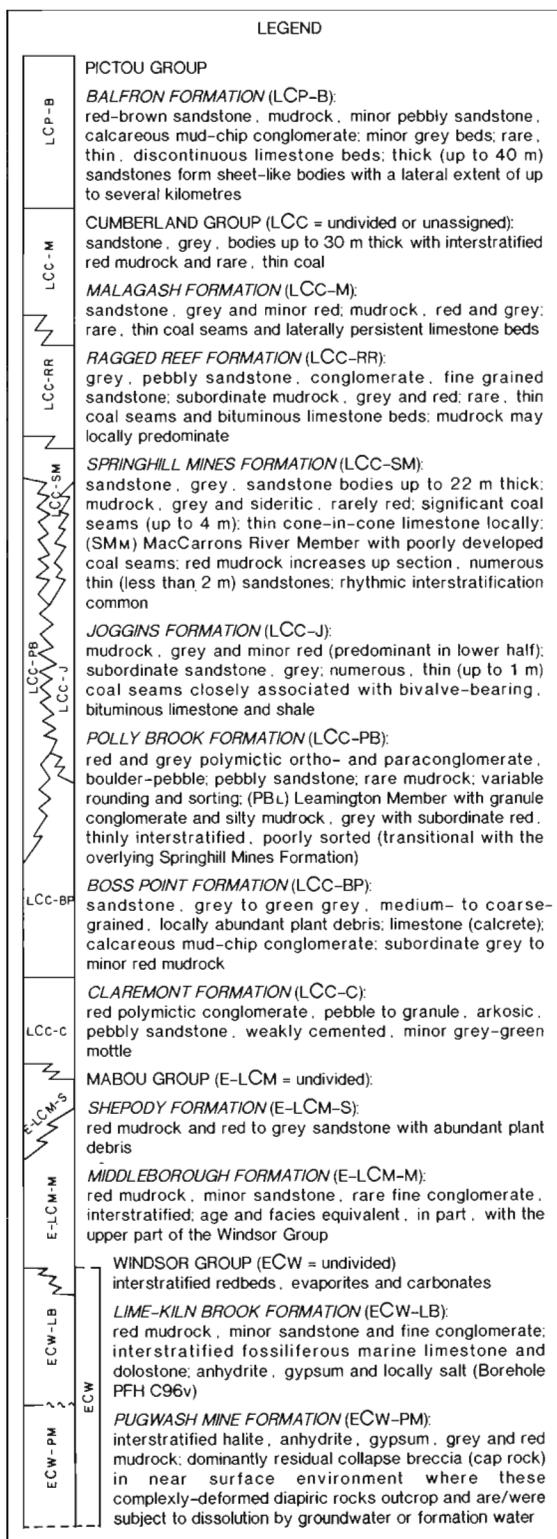


Figure 5-1. Continued.

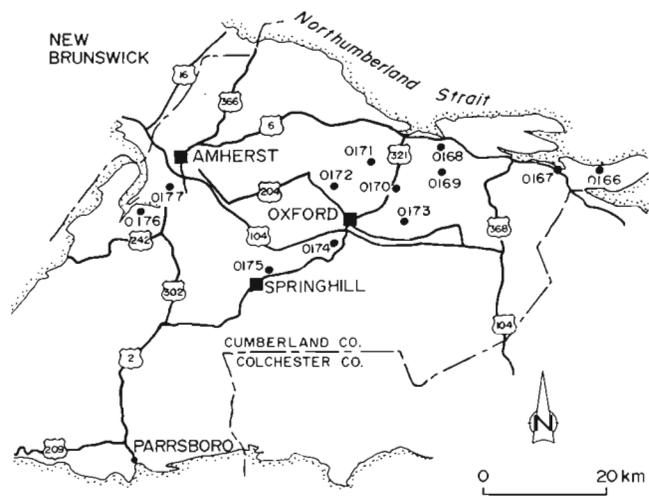


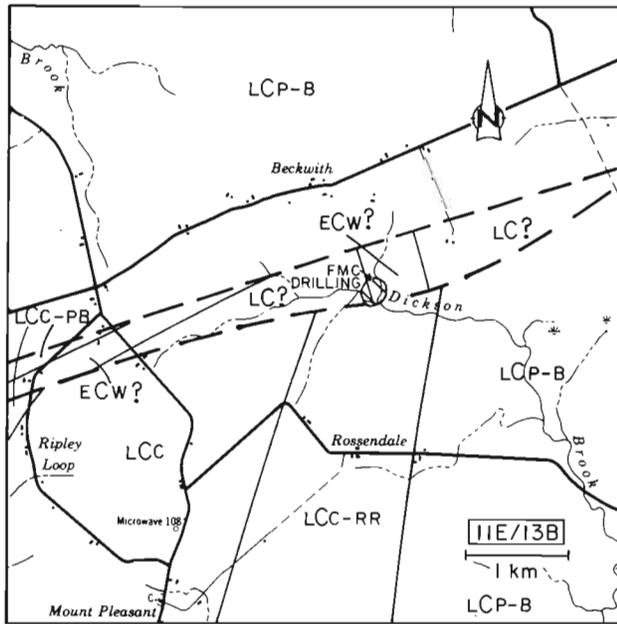
Figure 5-2. Location map for Cumberland County gypsum and anhydrite occurrences by reference number.

after Ryan et al., 1990a; 1990b; Ryan and Boehner, 1990

Figure 5-1. Geological legend for Cumberland County gypsum and anhydrite occurrence maps.

**BECKWITH (0171)**  
 NTS 11E/13B  
 UTM 436600 E 5074420 N

The Beckwith occurrence is located 10 km north of the Town of Oxford, Cumberland County (Fig. 5-3). A celestite occurrence at this site has been investigated by several companies over the years and diamond drilling by these companies has encountered some gypsum and anhydrite.



Geology after Ryan et al., 1990a

Figure 5-3. Location and geology of the Beckwith occurrence area. See Figures 5-1 and 5-2 for legend and location.

Recent geological mapping by Ryan et al. (1990a) indicated that the immediate vicinity of the occurrence is underlain by a fault-bound block of undivided Windsor Group rocks. These are surrounded by younger clastics of the Cumberland Group Ragged Reef Formation, the Pictou Group Balfour Formation and undefined Late Carboniferous sedimentary rocks. The area is transected by a series of east-west trending faults which result in a very complex local geology.

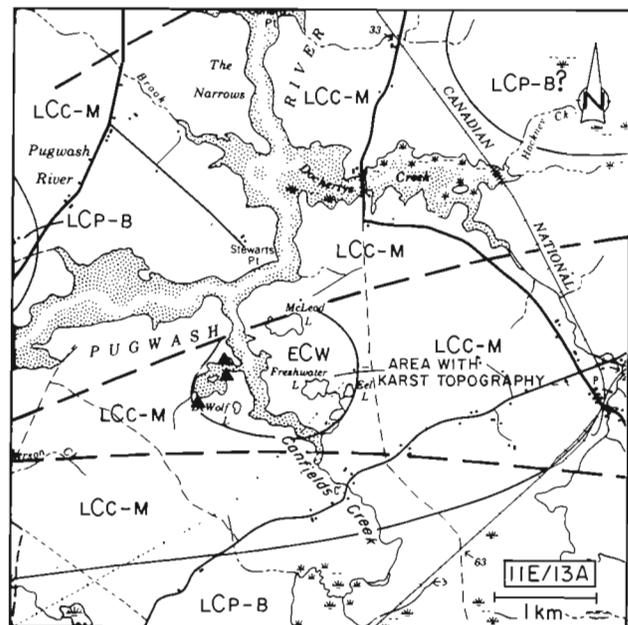
FMC Corp. drilled 36 wireline drillholes and 42 rotary drillholes on this property in 1970 while exploring for celestite (FMC Corp., 1969-71). A total of 36 of these encountered gypsum and anhydrite and many holes which failed to encounter gypsum or anhydrite were stopped at shallow depths. Descriptions of the calcium sulphate horizons are only cursory, however the gypsum appears to become anhydrite rapidly with depth. The gypsum encountered nearest to surface was in hole 111

in which only 11.3 m of overburden overlies 'gypsum-anhydrite'.

The Beckwith occurrence is of geological interest only. The complex geology and highly faulted nature of the area as well as the apparently thin hydration greatly lessen the possibilities of finding an economic deposit in this area.

**CANFIELDS CREEK (0169)**  
 NTS 11E/13A  
 UTM 447440 E 5071480 N

The Canfields Creek occurrence area is located 6 km south of the Town of Pugwash, Cumberland County (Fig. 5-4). Several exposures of gypsum have been noted in this area by Ryan et al. (1990a) along the banks of Canfields Creek. Although numerous exploration diamond-drill holes have been completed in a nearby copper prospect, none have penetrated the Windsor Group strata.



Geology after Ryan et al., 1990a

Figure 5-4. Location and geology of the Canfields Creek occurrence area. See Figures 5-1 and 5-2 for legend and location.

Recent geological mapping in the Cumberland Basin by Ryan et al. (1990a) indicated the presence of a roughly circular area which is underlain by the Windsor Group at Canfields Creek. These units are surrounded by much younger Cumberland Group Malagash Formation clastics which unconformably overlie the clastics, carbonates and evaporites of the Windsor Group (Ryan et al., 1990a).

Ryan (personal communication) noted the presence of several small (2 x 4 m), rounded, white to grey, dirty gypsum outcrops in the area. A number of large circular ponds and areas of karst topography can be found in the area as well. No subsurface information is available at present in the Canfields Creek area.

The gypsum occurrence at Canfields Creek is of geological interest only. The limited areal extent of the Windsor Group here, as well as the presence of the Creek which flows through the middle of the low marshy area would probably prevent development.

**HANSFORD (0173)**  
NTS 11E/12C  
UTM 440500 E 5062940 N

Located 7 km east of the Town of Oxford, Cumberland County, the Hansford occurrence consists of several small surface exposures of gypsum with accompanying moderate to light karst topography (Fig. 5-5). No drill-hole information is available in the immediate vicinity.

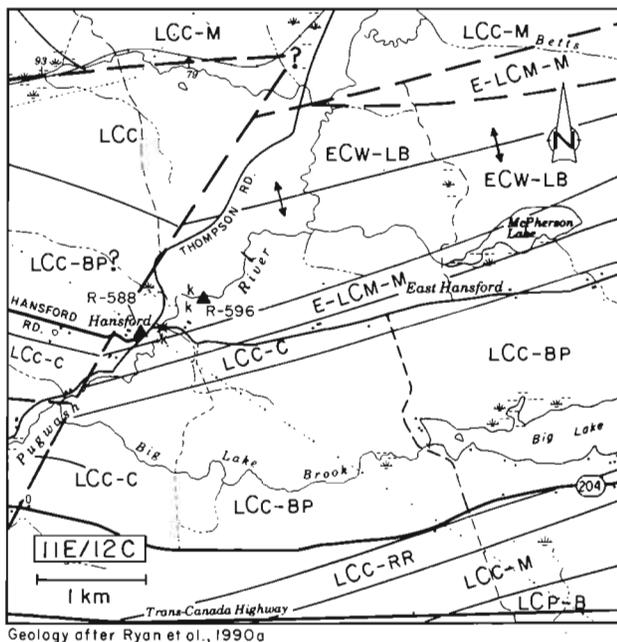


Figure 5-5. Location and geology of the Hansford occurrence area. See Figures 5-1 and 5-2 for legend and location.

Geological mapping of the area by Ryan et al. (1990a) indicated that much of it is underlain by carbonates, clastics and calcium sulphate strata of the Lime-kiln Brook Formation of the Windsor Group. These units strike east-west, are cut to the west by a fault and are flanked to the north and south by younger clastics of the Mabou Group Middleborough Formation.

Gypsum outcrops immediately north of the Hansford Road just west of where it crosses the Thompson Road. The exposure consists of several small, round, light grey gypsum outcrops having common intermixed carbonate material. Gypsum also outcrops 600 m downstream along the Pugwash River below the bridge on the Hansford Road. This exposure consists of a number of blocks of fine grained, white gypsum containing only minor carbonate and selenite. Ryan et al. (1990a) noted the presence of clastic and carbonate outcrop in the area of the second exposure.

Limited exposure and the presence of extensive clastic and carbonate outcrops close by have been interpreted by Ryan et al. (1990a) as belonging to the clastic dominated Lime-kiln Brook Formation. These gypsum exposures are of geological interest; it is unlikely that they will be of economic interest because they are thin and apparently limited in extent.

**LAZY BAY (0167)**  
NTS 11E/14B  
UTM 467100 E 5071700 N

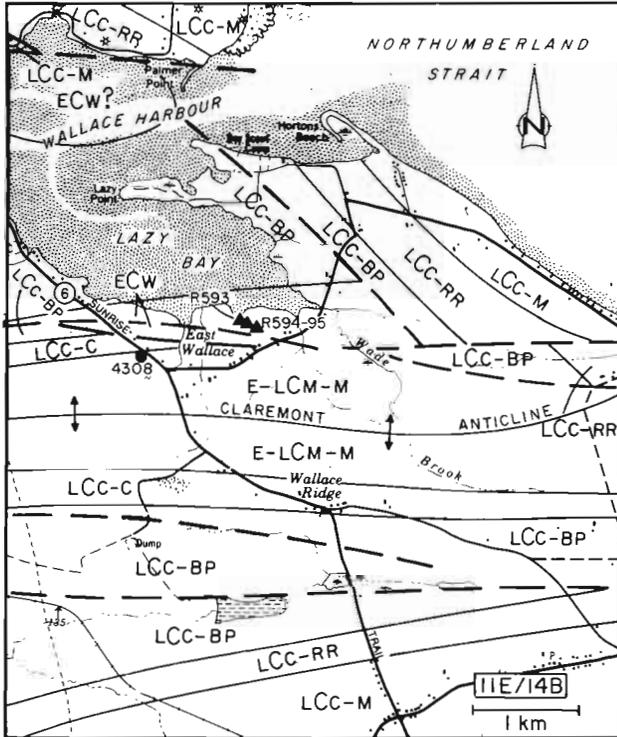
The Lazy Bay occurrence area is located along the southeastern portion of Lazy Bay, 4 km southeast of the Village of Wallace, Cumberland County (Fig. 5-6). An area of gypsum exposures up to 10 m high and 250 m long can be seen from the shore here. Several drillholes have been completed within a few kilometres of the occurrence area, however only one is close to the surface exposures (NSDM hole 4308 in 1966) (Nova Scotia Department of Mines, 1967a).

Geological mapping by Ryan and Boehner (1990) referred to this area of Windsor Group exposures as the Lazy Bay Diapir, a highly contorted sequence of clastics, evaporites and carbonates. These units are in fault contact with younger clastic units of the Mabou and Cumberland Groups which surround them. Ryan and Boehner (1990) also suggested the presence of a second diapir just north-northwest of the one at Lazy Bay. This structure, the Wallace Harbour Diapir, is inferred by a gravity low over that area.

The gypsum exposed at the surface in this area is white to light grey in colour, fine- to medium-grained and contains variable amounts of intermixed silt and limestone material (10-30%). Limestone interbeds found in the outcrop trend east-west and are dipping nearly vertically.

Local residents report that some gypsum was taken from this site to be used in the area for plastering houses. However, there appears to be no indications of

large scale extraction or any historical production figures. This occurrence is of geological interest only. There appears to be insufficient volumes of material to be of economic interest except for perhaps local use as a soil amendment or fertilizer.



Geology after Ryan and Bohner, 1990

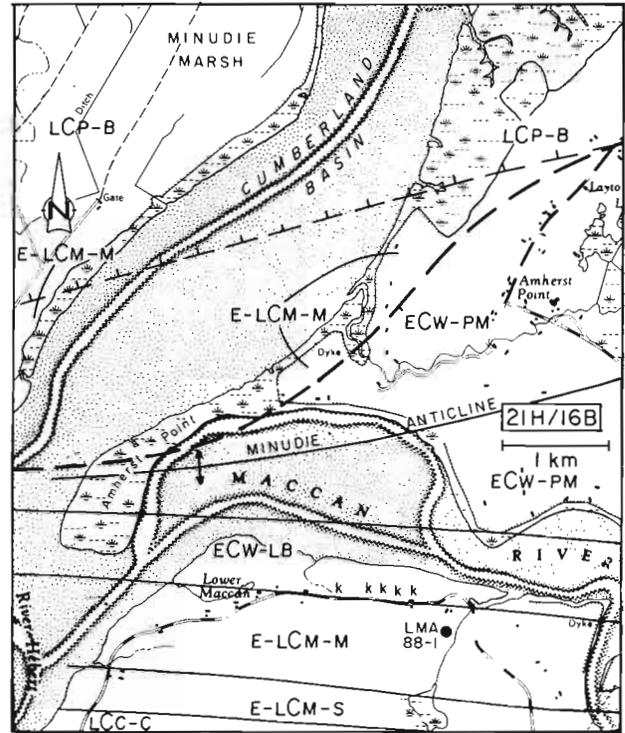
Figure 5-6. Location and geology of the Lazy Bay occurrence area. See Figures 5-1 and 5-2 for legend and location.

**LOWER MACCAN (0176)**  
 NTS 21H/16B  
 UTM 400000 E 5068200 N

The Lower Maccan occurrence area is located 9 km southwest of the Town of Amherst, Cumberland County (Fig. 5-7). A series of sinkholes have been noted in this area and anhydrite interbeds have been intersected in the subsurface by Nova Scotia Department of Mines and Energy drillhole LMA 88-1 (Bohner, 1990).

Regional geological mapping by Ryan et al. (1990b) indicated that this area lies along the southern side of the easterly trending Minudie Anticline which extends west to the shores of the Cumberland Basin. Locally, the area is underlain by the interbedded clastics, carbonates and anhydrite of the Lime-kiln Brook Formation which overlies the structurally complex diapiric Windsor Group to the north. Younger clastics of the Middleborough Formation of the Mabou Group overlie Windsor strata to the north and south of the area. The

anhydrite interbeds in LMA 88-1 are thin, generally <5 m with maximum thickness of 13 m and thus are not economically attractive.



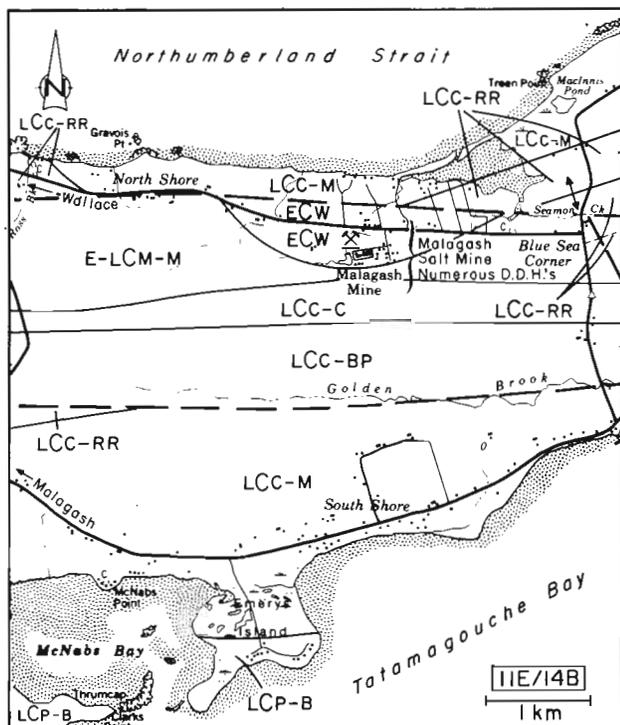
Geology after Ryan et al., 1990b

Figure 5-7. Location and geology of the Lower Maccan occurrence area. See Figures 5-1 and 5-2 for legend and location.

Although of no economic interest, the calcium sulphate horizons encountered in LMA 88-1 may facilitate geological interpretations and appraisals of other outcrop areas of Lime-kiln Brook Formation. Gypsum/anhydrite intervals are not seen in surface exposures of the Lime-kiln Brook Formation seen elsewhere in the area, however should drilling be carried out at other locales their presence may assist in correlating between sections.

**MALAGASH (0166)**  
 NTS 11E/14B  
 UTM 474500 E 5070500 N

The Malagash occurrence area is located in the vicinity of the abandoned Malagash salt mine, 11 km east of the Village of Wallace, Cumberland County (Fig. 5-8). No surficial indications of the underlying gypsum or anhydrite occur in this area, however much information is available from the salt mine workings as well as exploration and development drilling which encountered calcium sulphates in the subsurface.



Geology after Ryan and Boehner, 1990

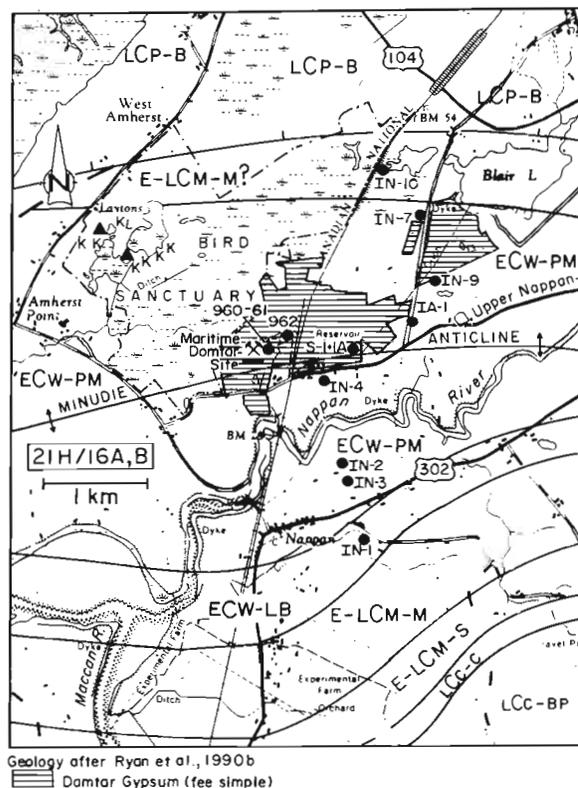
Figure 5-8. Location and geology of the Malagash occurrence area. See Figures 5-1 and 5-2 for legend and location.

Recent geological mapping by Ryan and Boehner (1990) indicated that much of this area is underlain by undivided diapiric Windsor Group redbeds, evaporites and carbonates. The outcrop areas of these Windsor Group evaporite diapirs are typical residual accumulation/solution collapse material resulting from the dissolution of salt units to depths of up to 300 m in the subsurface. The geology of this material is complex and not well defined and ranges from well stratified to highly chaotic and disrupted. These units are surrounded by younger clastic units with the Middleborough Formation and Claremont Formation to the east, west and south and Cumberland Group, Malagash and Ragged Reef Formations to the north. Boehner (1986) summarized the stratigraphic and structural work in the area to that time and is the best source for additional geological information. The calcium sulphate horizons are interbedded with salt and clastic units which are highly contorted in the diapiric structure. Hydration is common near surface, but no investigation of the depth of hydration has ever been undertaken.

Due to the complex structure of the Windsor Group at Malagash as well as the presence of salt interbeds, it is highly unlikely that the gypsum or anhydrite here would be considered for development. This occurrence is of geological interest only.

**NAPPAN (0177)**  
NTS 21H/16A, 21H/16B  
UTM 403500 E 5070500 N

The Nappan occurrence area is located 5 km southwest of the Town of Amherst, Cumberland County (Fig. 5-9). This area encompasses the Minudie Anticline from Amherst Point in the west to Upper Nappan in the east. Surface exposures, karst topography and drillhole intersections of gypsum and anhydrite have all been noted in this area.



Geology after Ryan et al., 1990b  
Damtar Gypsum (see simple)

Figure 5-9. Location and geology of the Nappan occurrence area. See Figures 5-1 and 5-2 for legend and location.

Historical records indicate that at least four companies have produced gypsum from quarries in this area. Prior to 1913, the name Cumberland Plaster Co. appears on leases and Maritime Gypsum reported production from a quarry just northwest of Pugsleys Siding (historical name) between 1909 and 1913 (King, 1985). Maritime Gypsum moved gypsum along an electric cableway to a shipping pier 4 km to the west at Amherst Point and then by boat to markets in New York (Province of Nova Scotia, 1913a). At some later date this property was acquired by the Gypsum, Lime and Alabastine Co. who were bought out by Domtar in 1959. Domtar operated a quarry at the same site for four years between 1959 and 1962, making rail shipments of

gypsum to its wallboard plant in Montreal. Due to incomplete records of gypsum production compiled by the Nova Scotia Department of Mines in the late 1800s and early 1900s it is not possible to accurately determine how much gypsum was produced from these sites. However, it is unlikely that total production would exceed 300 000 t.

Recent regional mapping by Ryan et al. (1990b) indicated that much of this area is underlain by the structurally disturbed, interbedded evaporites, carbonates and clastics of the diapiric Windsor Group. These are overlain to the south by interbedded clastics, evaporites and carbonates of the Lime-kiln Brook Formation of the Windsor Group which are in turn overlain by clastics of the Middleborough Formation of the Mabou Group. Boehner (1986) gave a much more detailed description of the geology of the area in the section on the Nappan Salt Deposit.

Drilling has been carried out in the Nappan area over the years for oil, salt and gypsum by a number of companies. Maritime Gypsum Co. had 18 holes drilled by the Nova Scotia Department of Mines in 1911-1912 in the vicinity of its quarry. The depth of these holes was 34.4 m and almost all encountered gypsum containing various amounts of clay, sand infilled material as well as anhydrite horizons (Province of Nova Scotia, 1913b). Later, gypsum was again the reason for drill-holes put down by Gypsum, Lime and Alabastine and Domtar between 1957 and 1962 in the same area. During these years at least 43 drillholes were completed in an attempt to prove up additional reserves in and around the quarry.

In addition to drilling for gypsum, a number of deeper holes were drilled in the area to search for oil and salt. Imperial Oil drilled 10 holes in 1929 (Boehner, personal communication) which helped to determine the nature of the local stratigraphy prior to drilling Amherst No. 1 (IA-1) to a depth of 1260 m in 1931 in search of oil. The Nova Scotia Department of Mines drilled three holes in the area to investigate salt horizons encountered by Imperial's Amherst No. 1 well in 1943-44 (Record Nos. 960, 961 and 962) (Province of Nova Scotia, 1944). Finally from 1945 to 1947, Sun Oil Co. Ltd. drilled for oil in the area, going to a total depth of 1981 m in hole 1 and further to 3506 m in a second hole, 14 (S-1, -1A) (Sun Oil Company Ltd., 1947).

Virtually all of the drillholes put down in the central portion of the Minudie Anticline encountered gypsum in their upper portions. Drillhole descriptions vary, however the gypsum is generally quite deeply cut with infilled material and cavities to +30 m. Hydration

extends to +100 m in some holes, but anhydrite was encountered in some holes at depths of <30 m. An evaluation program carried out by Domtar in 1961 on the Nappan gypsum quarry site indicated that the immediate area was structurally complex, with abundant seams of clay, sand and anhydrite (Domtar Gypsum, confidential company report). No reserve estimates were given, but they are believed to have been low.

The Nappan occurrence area appears to contain abundant near surface gypsum which is deeply incised by dissolution features, clastic material, as well as abundant remnant anhydrite lenses and beds. Even if large volumes of gypsum could be delineated here, the problem of removing large amounts of waste would have to be solved in order to make development feasible. A second, greater problem would be transportation of gypsum to markets, the nearest point for shipping being Pugwash located about 55 km east of the area. Should a local consumer ever develop in the area, then it might be possible to develop a small sized gypsum operation at Nappan.

#### OXFORD (0174)

NTS 11E/12C

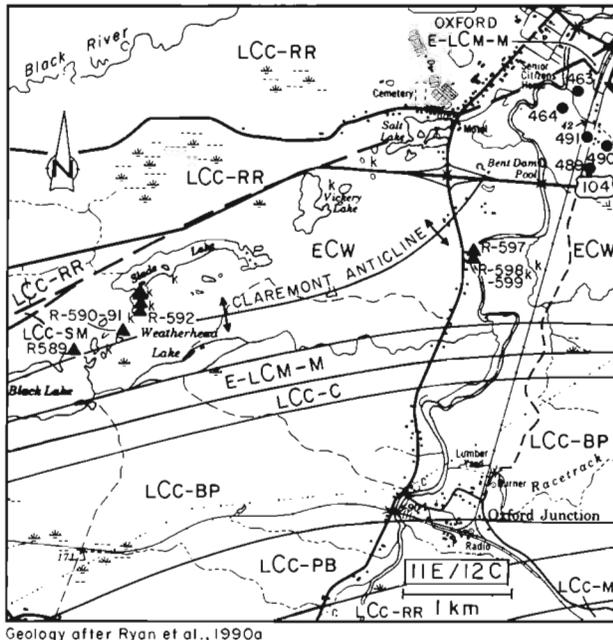
UTM 428600 E 5062200 N

The Oxford occurrence area is located immediately south and southwest of the Town of Oxford, Cumberland County (Fig. 5-10). Karst topography and gypsum exposures can be seen over an area extending 5000 m south and west of the Town and a number of drillholes have intersected calcium sulphate horizons to the south and southeast of Oxford.

Recent regional mapping by Ryan et al. (1990a) indicated that much of this area is underlain by a triangular shaped block of undivided, diapiric Windsor Group rocks. These are unconformably overlain by younger clastics of the Mabou Group Middleborough Formation to the south and east and are in fault contact to the north-northeast with much younger clastics of the Cumberland Group Ragged Reef Formation. Boehner (1986) gave a more detailed description of the area's geology.

Drilling has been undertaken in the Oxford area by three different groups, all for salt or potash. Nova Scotia Department of Mines drills completed a series of five holes for H. A. Patton immediately south of Oxford, two in 1924, the rest in 1926 (Province of Nova Scotia, 1925; 1927a). The Malagash Salt Company Ltd. drilled two holes in 1953 (Malagash Salt Company Ltd., 1953) located 3500 m southeast of Oxford. Nova Scotia Department of Mines drills completed two holes for

Amax Potash Ltd. nearby in 1979 (Nova Scotia Department of Mines and Energy, 1980). Although all holes encountered the Windsor Group, only hole 463 (Province of Nova Scotia, 1925) intersected interesting gypsum thicknesses close to surface (34.2 m gypsum and clay overlain by 15.2 m of overburden).



Geology after Ryan et al., 1990a

Figure 5-10. Location and geology of the Oxford occurrence area. See Figures 5-1 and 5-2 for legend and location.

Surface exposures can be seen in a heavily karsted zone which extends from Black Lake in the southwest to Salt Lake in the northeast. Gypsum found here varies from white to medium grey and orange, from fine grained and massive to coarse grained and sugary and contains variable amounts of intermixed clays and carbonates. This continuous zone, apparently underlain by gypsum is distinctly different from the highly contorted Windsor Group strata found in the eastern part of the occurrence area, however the apparent deep hydration suggests some degree of faulting through this zone.

The western zone of karst found in the Oxford area warrants additional drilling. The abundance of surface water and reports of salt springs at Salt Lake detract from the development potential of this area, however the abundance of karst and gypsum exposures over a large area suggests that large volumes of gypsum and anhydrite may be present here. The deep water port of Pugwash, where the Canadian Salt Company ships out its products, is located about 32 km to the northeast. The Trans-Canada Highway 104 cuts through the north-

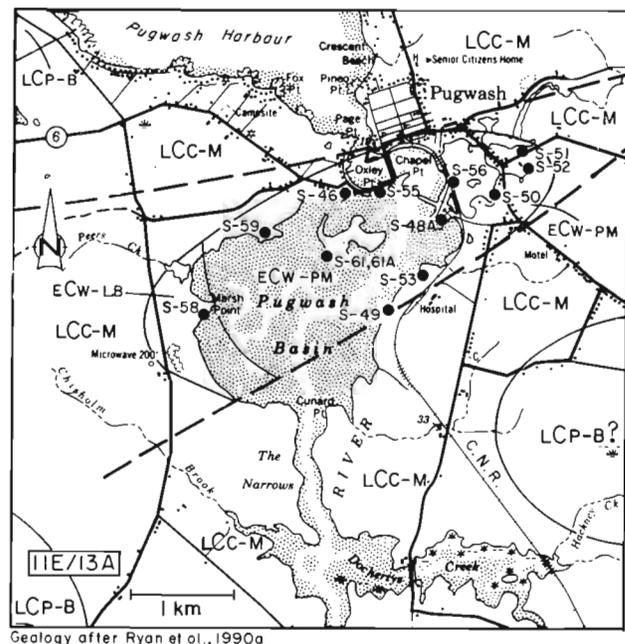
ern portion of the zone between Vickery Lake and Salt Lake providing easy access. Recent investigations into plaster-wood fibre wallboard products could have potential in this area of Cumberland County.

### PUGWASH (0168)

NTS 11E/13A

UTM 449040 E 5076640 N

The Pugwash occurrence area is located immediately south and southwest of the Town of Pugwash, Cumberland County (Fig. 5-11). Information on the area is available from exploration and development drilling carried out by the Canadian Rock Salt Co. (Canadian Salt Co. Ltd.) in the early 1950s and 1960s as well as from studies of the underground workings in the Pugwash Mine (Carter, in preparation).



Geology after Ryan et al., 1990a

Figure 5-11. Location and geology of the Pugwash occurrence area. See Figures 5-1 and 5-2 for legend and location.

Regional geological mapping carried out by Ryan et al. (1990a) indicated that much of the area around the Pugwash Basin is underlain by an oval shaped unit of Windsor Group rocks. Much of the area is underlain by highly contorted, interbedded salt and anhydrite of the Pugwash Mine Formation (Carter, in preparation). These strata intruded and are surrounded by much younger clastics of the Cumberland Group Malagash Formation which locally, unconformably overlie the Windsor Group strata. Carter (in preparation) has determined that the highly contorted Windsor units at Pugwash represent a piercement diapir.

Drillhole information, as well as underground studies by Evans (1972) and Carter (in preparation) indicated the highly complex structural nature of the Windsor Group strata at Pugwash. Several holes encountered interesting sections of impure gypsum up to 44.2 m thick under as little as 19.8 m of overburden (S-53) (Nova Scotia Department of Mines, 1953-1962). However, the geology and topography (i.e. presence of the Pugwash Basin) of this area would prevent any development of the gypsum found near surface. Significant volumes of anhydrite are present at Pugwash; thick interbeds are well defined in the salt mine workings. Unfortunately salt is noted as interbeds or intermixed in most anhydrite horizons, a fact which would render the anhydrite useless to most end users. At present, the Pugwash occurrence is of geological interest only. Anhydrite interbeds have been instrumental in geological investigations at the Pugwash Mine enabling workers in their attempts to sort out the complex structure.

**PURDY BROOK (0172)**  
NTS 11E/13B  
UTM 429580 E 5070400 N

The Purdy Brook occurrence area is located 6.5 km north-northwest of the Town of Oxford, Cumberland County (Fig. 5-12). One of five diamond-drill holes put down in this area in 1967 by Scurry Rainbow encountered significant thicknesses of gypsum. An area of moderate to heavy karst topography can also be found on the eastern side of Purdy Brook approximately 2000 m north of Route 204.

Regional mapping of the bedrock geology by Ryan et al. (1990a) indicated that much of this area is underlain by the units of the diapiric phase of the Windsor Group. These are overlain to the south and west by clastics of the Middleborough Formation of the Mabou Group and in fault contact to the east and north with much younger clastics of the Polley Brook Formation of the Cumberland Group.

Referring to this area as the Beckwith salt occurrence, Boehner (1986) used Scurry Rainbow drillhole information and Bouger gravity anomaly information to determine the probable presence of an underlying salt mass.

Scurry Rainbow's hole 27-2 encountered 58.5 m of light to medium grey, fine- to medium-grained gypsum with minor intermixed carbonate and clastic materials, overlain by 6.1 m of overburden (Kawase, 1967). However, hole 27-1 drilled nearby (precise location uncertain) drilled through 47.5 m of overburden before encountering 88.7 m of red shales with only minor

gypsum. Holes 27-3 and 27-4 both encountered similar situations, having deep overburden and thick clastic sections. In 27-4 drilling was stopped in anhydrite having a salty taste at 245.7 m. Boehner (1986) suggested that these holes penetrated the steeply dipping, contorted units which overlie a diapiric salt body.

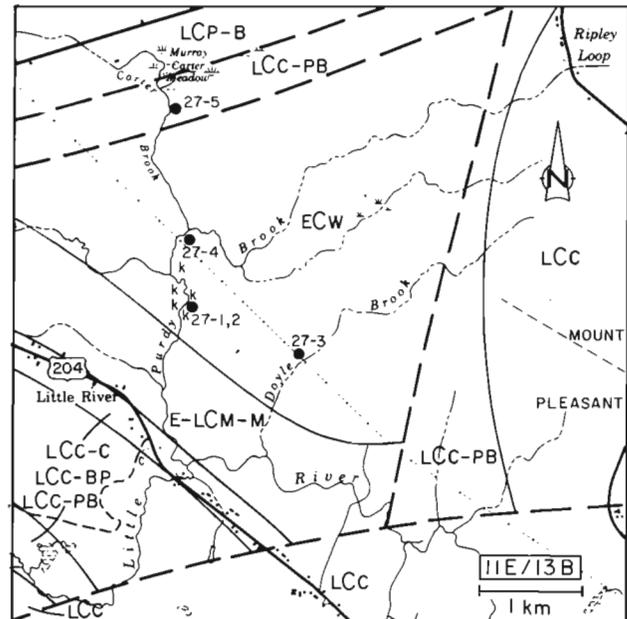


Figure 5-12. Location and geology of the Purdy Brook occurrence area. See Figures 5-1 and 5-2 for legend and location.

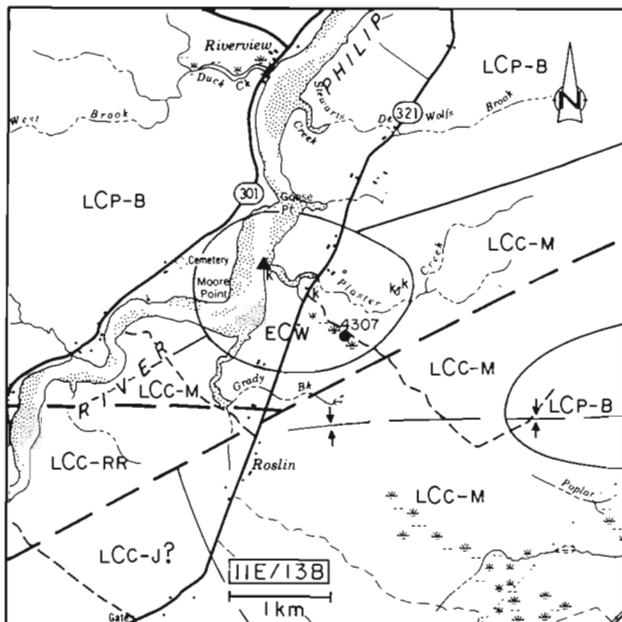
Although hole 27-2 did pass through, what was described as a good gypsum horizon and karst topography suggests the presence of an extensive horizon of gypsum in the area, there is insufficient evidence to properly assess this occurrence. If the underlying geology is steeply dipping and highly contorted, as is suggested, then there would be little chance of developing a large gypsum deposit in this area. Additional drilling should be undertaken in the vicinity of 27-2 and the karst area to further assess this occurrence because it is one of the few in this part of the Province having any development potential.

**ROSLIN (0170)**  
NTS 11E/13B  
UTM 440500 E 5069500 N

The Roslin occurrence area is located 9 km northeast of the Town of Oxford, Cumberland County (Fig. 5-13). Small blocks of gypsum are seen along the eastern bank of River Philip in this area as well as several areas of light to moderate karst topography. One diamond-drill hole (NSDM 4307) completed by the Department in

1966 for the Nova Scotia Research Foundation encountered Windsor Group strata (Province of Nova Scotia, 1967).

Geological mapping by Ryan et al. (1990a) indicated that the Windsor Group rocks found at Roslin represent a diapir, of structurally deformed clastics, carbonates and evaporites, which is surrounded by younger clastics of the Cumberland Group Malagash Formation and Pictou Group Balfour Formation. Insufficient information is available to determine the nature of these contacts which Bell (1944) suggested were faulted.



Geology after Ryan et al., 1990a

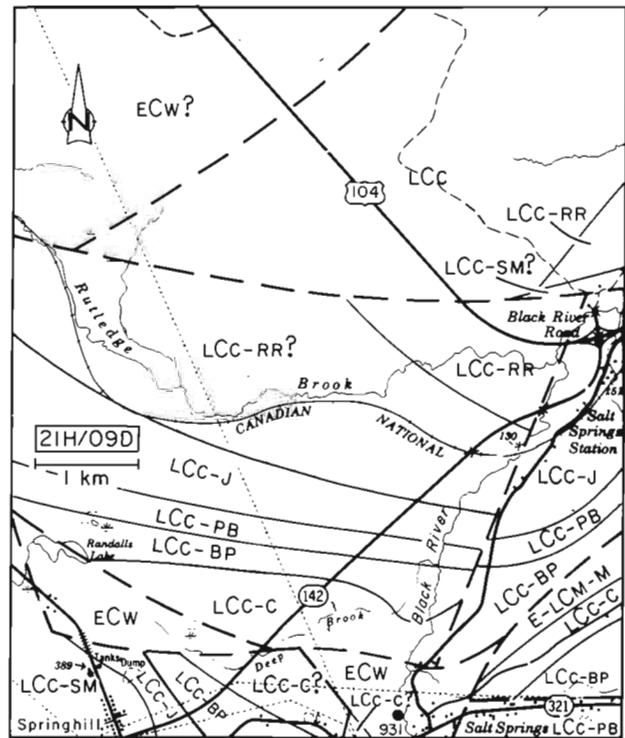
Figure 5-13. Location and geology of the Roslin occurrence area. See Figures 5-1 and 5-2 for legend and location.

Drillhole 4307 was put down on a negative Bouger gravity anomaly as part of a regional potash exploration program. No gypsum or anhydrite were encountered before the hole was stopped at 306 m, however the presence of salt in the holes supports the karst topography that the Roslin area like most of the Windsor Group outcrop areas is in part underlain by gypsum and anhydrite.

This area is of little interest other than geological with regard to its gypsum and anhydrite resources.

**SPRINGHILL (0175)**  
NTS 21H/09D  
UTM 420060 E 5056820 N

The Springhill occurrence area encompasses several separate areas north and east of the Town of Springhill, Cumberland County, which are believed to be underlain by Windsor Group strata (Fig. 5-14). Previously reported, but unconfirmed karst topography and reported salt springs are the only evidence for two of the areas. Although gypsum and anhydrite have been reported in drillholes in two other areas, exposures have not been noted in any of these areas.



Geology after Ryan et al., 1990b

Figure 5-14. Location and geology of the Springhill occurrence area. See Figures 5-1 and 5-2 for legend and location.

Recent geological mapping of the area (Ryan et al., 1990b) indicated it to be highly faulted, containing several isolated areas underlain by clastics, carbonates and evaporites of the Windsor Group. Most of the area is underlain by clastics of the Cumberland Group. The best documented of these Windsor Group blocks is the Black River Diapir (Boehner, 1986; Calder, 1980) with

numerous salt springs. Drillhole 931 (Province of Nova Scotia, 1943) clearly indicated the presence of Windsor Group strata including evaporites under a small fault-bound area along the Black River just north of Salt Springs.

Drillhole 931 was drilled by the Nova Scotia Department of Mines in 1941-42 to investigate the

geology in the Black River area. It encountered a sequence of interbedded gypsum, anhydrite and shales presumably of Lower Windsor Group. Although apparently thick gypsum horizons were intersected at depth, they were overlain by shales up to 36.6 m thick. This fact, as well as the highly faulted nature of the Windsor Group blocks found in the Springhill area, render them of geological interest only.