CHAPTER 6
ANTIGONISH-MABOU AREA

INTRODUCTION

The Antigonish-Mabou area is located in parts of Antigonish and southwestern Inverness Counties in mainland Nova Scotia and Cape Breton Island (Figs. 1-4 and 1-10). Four salt deposits and two occurrences are located in the Antigonish-Mabou area (Fig. 1-4). The deposits are, for the most part, poorly documented as to their quality and lateral extent. They are generally known only from a few drillholes and geophysical data, especially Bouguer gravity anomaly interpretations.

Three deposits located in the Antigonish area are the Antigonish, James River and Southside Harbour deposits. The Antigonish deposit is defined by two drillholes KEH-1 and AP-2-74. The James River deposit is defined by three drillholes KEH-5, JR-3 and AP-1-74. The Antigonish and James River deposits were defined as the result of exploration by Kenneco Exploration (Canada) Limited, Amax Exploration Limited and Millmor-Rodgers Quebec Uranium et al. between 1966 and 1974. Small shows of potash minerals are reported in the James River deposit. The Southside Harbour deposit is the best defined of the three. It is known from five drillholes: NSDM 1708, NSDM 1835, NSDM 1836, NSDM 4862 (Novasel No. 1) and Bradox Oil Southside Harbour No. 1. Traces of potash are present in Novasel No. 1. The Southside Harbour deposit was outlined in a feasibility study for the potential development of a soda ash industry sponsored by the Nova Scotia Department of Trade and Industry in the early 1950's. In the Mabou area, the Mabou deposit is the only deposit recognized and it is defined by four deep petroleum exploration boreholes. The salt deposits and occurrences in the Antigonish-Mabou area are described in the following order: Antigonish, James River, Mabou, Ohio, Pomquet River and Southside Harbour.

GENERAL GEOLOGY

The Antigonish-Mabou area contains rocks with a rather complex history. The major geological divisions as summarized in the following paragraphs are intended to briefly outline the general geological configuration of the area (Fig. 6-1).

The oldest rocks in the Antigonish area are located in the Antigonish Highlands (Fig. 1-1) and comprise Middle-Lower Paleozoic and possibly Proterozoic sedimentary, volcanic and intrusive rocks. To the northeast and east, in the Mabou area, the oldest rocks occur in the Creignish Hills and comprise highly deformed Proterozoic sedimentary, volcanic and intrusive rocks (Fig. 1-1). To the north, the Mabou area is bounded by the Mabou Highlands which comprise Middle Paleozoic intrusive rocks and younger sedimentary and volcanic rocks.

Sedimentary rocks, including sandstone, conglomerate, and shale of the Lower Carboniferous Horton Group (Figs. 6-2 and 6-3) occur along the southeastern border of the area. These rocks were deposited on top of and marginal to the older rocks of highland areas, such as the Mabou Highlands, Creignish Hills, and Cape George area to the north of Antigonish. The lowland parts of the Antigonish-Mabou area are underlain by shale, evaporites, including halite, anhydrite and gypsum, and limestone strata of the Lower Carboniferous Windsor Group. The Windsor Group is overlain in the central part of the area by a thick succession of Upper Carboniferous strata comprising the Canso, Riversdale and locally Pictou Groups.

The stratigraphy of the Windsor Group in the Antigonish-Mabou area has been studied and described by various workers including Sage (1954), Stacey (1953), Norman (1935), Boehner (1980b), and Boehner and Giles (1982). These studies outlined the general geology in the area, but were hindered to varying degrees by structural complications, limited exposure, and only a few boreholes. Locally Windsor Group evaporites have migrated to form diapirs contributing to the already rather complex structure that reflects adjustment of basement blocks. Structural trends in the Carboniferous rocks appear in general to be oriented to the northeast and north, with less well-defined trends at varying angles to the major trend. Boehner (1980a) and Boehner and Giles (1982) reported the presence of a major thrust fault at the top of the main salt section in the Antigonish Basin.

The Antigonish Thrust Fault predates the latest movement of the series of northeasterly trending longitudinal faults. The majority of the rocks outcropping in the Antigonish Basin (above the main salt section) are inferred to be allochthonous. Thrust faulting and evaporite diapirism are also inferred (but not confirmed) to be present in the Mabou area.

The Windsor Group (Fig. 6-4) in the Antigonish area comprises a succession of fossiliferous limestone, gypsum, anhydrite, halite, and thick siltstone. Generally these rocks rest conformably on strata of the Horton Group although they locally overlap onto pre-Carboniferous rocks. Several northeasterly trending faults to the north of Antigonish bring Windsor Group strata in contact with Horton Group or pre-Carboniferous Browns Mountain Group rocks or both.

Sage (1954) stated that the stratigraphy in the Antigonish area was compiled by piecing together many small and badly broken sections and by comparisons to the relatively intact, but incomplete Port Hood Island section, and the Windsor Group type section at Windsor. Although he stated that the Pomquet River and the Monks Head sections were the most complete Windsor Group sections in relation to the number of limestone units present, he also indicated that over one half of the Pomquet River section was overturned and the Monks Head section was "shuffled like a pack of cards." He concluded the Windsor Group had an approximate average thickness of between 600 and 900 m.

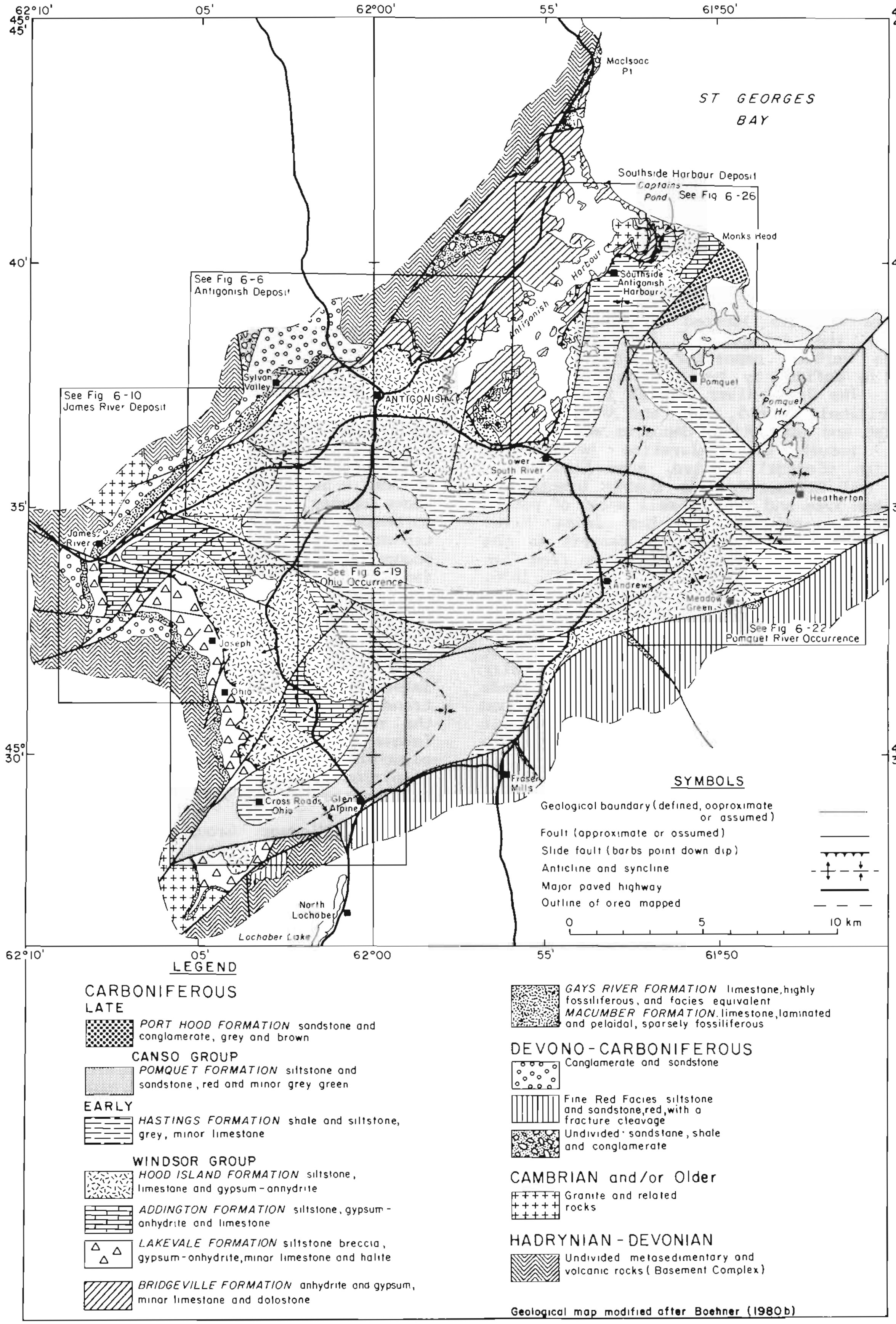

Figure 6-1. Geological map of the Antigonish Basin showing salt deposits geological map areas.

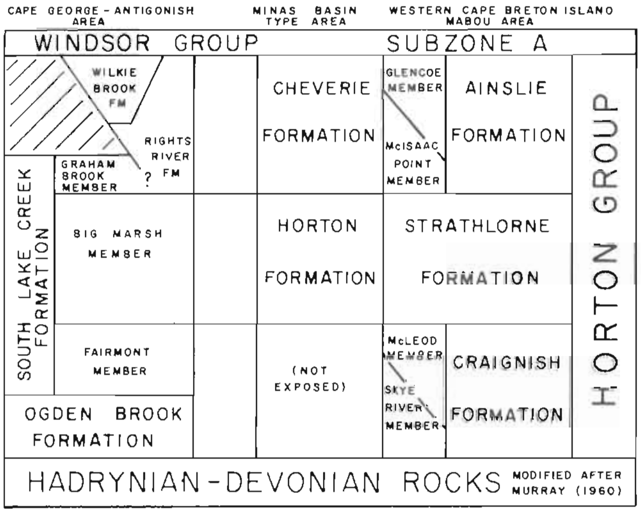

Figure 6-2. Horton Group stratigraphy and general correlation, Antigonish-Mabou area, Nova Scotia.

The stratigraphic section of the fossiliferous limestone units is the basis of Sage's (1954) subdivision of the Windsor Group in the Antigonish area. These units based in part upon work by Stacey (1953) in Cape Breton were assigned to the faunal subzones defined by Bell (1929) and were given numerical subscripts in ascending order. These units, together with the corresponding lithologic names for the Antigonish area (after Sage, 1954), are as follows:

Subzone	Unit Number	Informal Name
E	E_1	Schizodus
D	D_3	No Name
	D_2	No Name
	D_1	Giant Ripple
C	C_3	Columnar Algal
	C_2	No Name
	C_1	Small Algal
B	B_3	1st oolitic
	B_2	2nd oolitic
	B_1	Quarry
A	A_2	Canary
	A_1	Basal, Ribbon, "sandy limy"

According to Sage (1954) the Upper Windsor and B Subzone sections comprise approximately 244 m (800 ft.). His stratigraphic placement of the salt and the Quarry or B_1 limestone, in the Windsor Group in the Southside Harbour area, has been revised based upon more recent work by Boehner and Giles (1982), Boehner (1980b), Giles et al. (1979) and deep drilling by Brador Oil Company Limited in 1975 (Farries Engineering Ltd., 1976). These studies have recognized the occurrence of locally developed, highly fossiliferous A Subzone limestone banks where the Windsor Group onlaps pre-Carboniferous rocks and oversteps the Horton Group. This limestone is thicker than the more areally extensive laminated limestone that occurs throughout the area, generally overlying the Horton Group. This laminated limestone unit is variously referred to as the A_1 (basal sandy) limestone (Sage, 1954), Ribbon limestone (Stacey, 1953), Macumber limestone (Schenk, 1967a,b, 1969) and Macumber Formation (Boehner and Giles, 1982). The fossiliferous banks of the Gays River Formation bear a fauna similar to the B Subzone. They are developed on favourable topographic highs, thin rapidly into a more widespread sporadically fossiliferous laminated facies and are overlain by a thick, massive anhydrite unit (Bridgeville Formation) typical of the A Subzone in the Shubenacadie area.

In Sage's (1954, p. 44) Southside Harbour cross-section the B_1 or Quarry limestone (Gays River Formation) rests with distinct angular unconformity on a pre-Carboniferous granite knob and is overlain by a thick anhydrite-gypsum (Bridgeville Formation) which in turn is overlain with faulted contact by a thick red and grey siltstone section (Hastings Formation). Salt of the Hartshorn Formation is encountered eastward from the basement high and is separated from the thick red siltstone section by the Antigonish Thrust Fault. Deep drilling for petroleum by Brador Oil Company Limited in 1975 (Farries Engineering Ltd., 1976) in Southside Harbour No. 1, indicated that the Hartshorn Formation salt is thick (greater than 120 m) and overlies the thick Bridgeville Formation anhydrite (110 m) which in turn, overlies the Gays River Formation-Macumber Formation limestone (basal Windsor Group). The Windsor Group rests upon a thick (greater than 425 m) section of Horton Group which unconformably overlies granitoid rocks.

Sage (1954) indicated the salt is part of the B Subzone, however, it is probable that a better case may be made for A Subzone assignment for the salt-gypsum section and the quarry limestone (Fig. 6-28). The salt may occur as a lateral stratigraphic and possible facies equivalent in part (though not entirely time equivalent) of the thick anhydrite unit. This is a very similar interpretation to that of the Shubenacadie-Stewiacke deposit (Fig. 2-25). These stratigraphic relations may explain the salt deposits in the western part of the Antigonish area and in particular the James River-Ohio area. At this location fossiliferous basal Windsor limestone (Gays River Formation) rests with angular unconformity on pre-Carboniferous rocks (Stewart, 1976) and is overlain by a thick anhydrite unit (Bridgeville Formation) which in turn is overlain by a variably thick section of salt (Hartshorn Formation).

The A Subzone section in the Antigonish Basin is overlain with uncertain relationship by the B Subzone and the Upper Windsor (Addington and Hood Island Formations). Boehner (1980b) postulated the existence of a major thrust fault at this contact. This part of the section comprises approximately 244 m (800 ft.) of intercalated red siltstone or sandstone with thin gypsum, anhydrite and fossiliferous limestone (B_2, B_3, C_1, C_2, C_3, D_1, D_2, D_3, and E_1 units of Sage, 1954). The Milk Plant section near

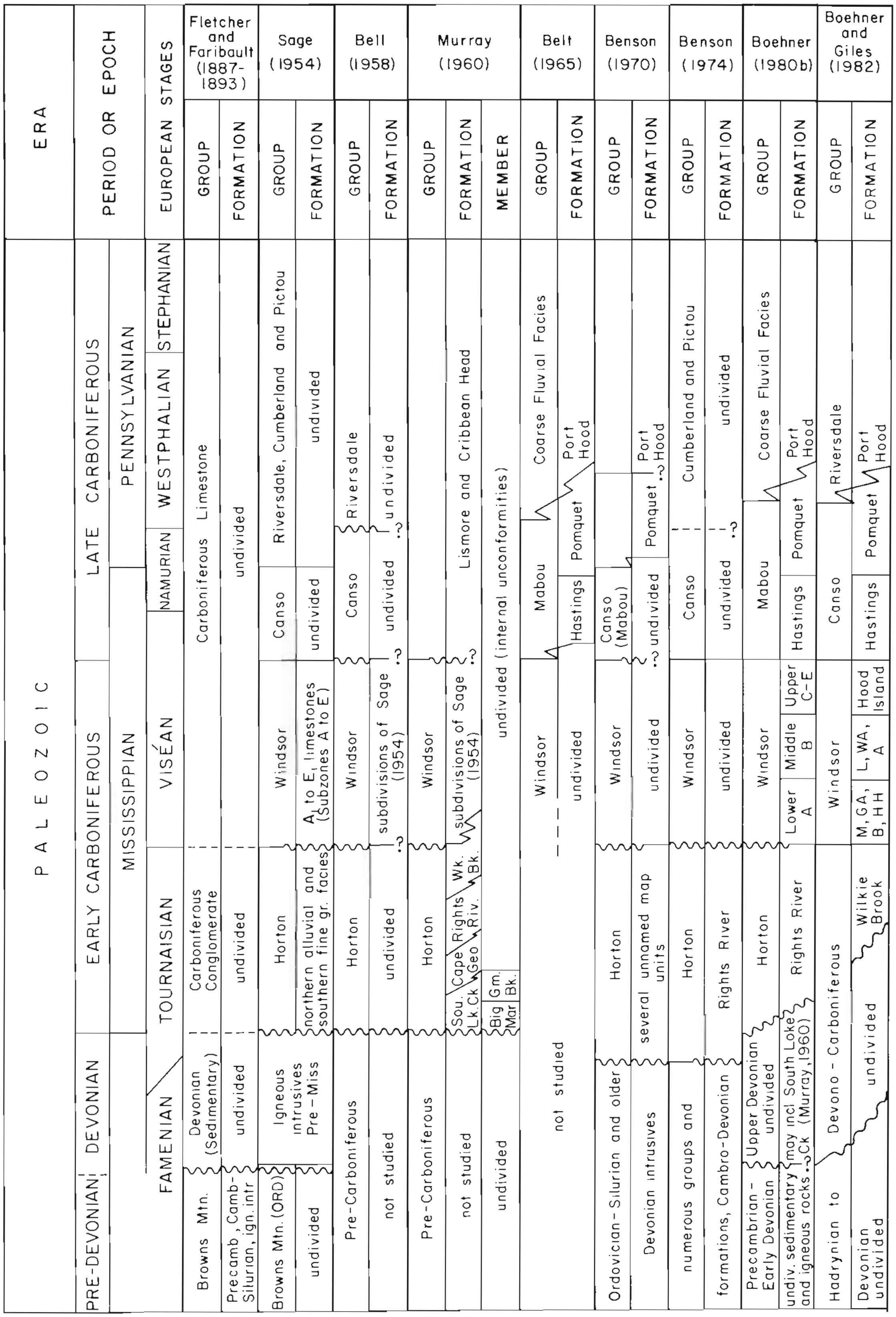

Figure 6-3. Summary of Antigonish Basin stratigraphic nomenclature with approximate age correlation. Conformable section (stated, inferred)——---; Unconformity ∿∿ ; Facies boundary /\/\ ; Contact relations unspecified and uncertain — ? — ; M = Macumber, GR = Gays River, B = Bridgeville, HH = Hartshorn, L = Lakevale, WA = Wallace, A = Addington.

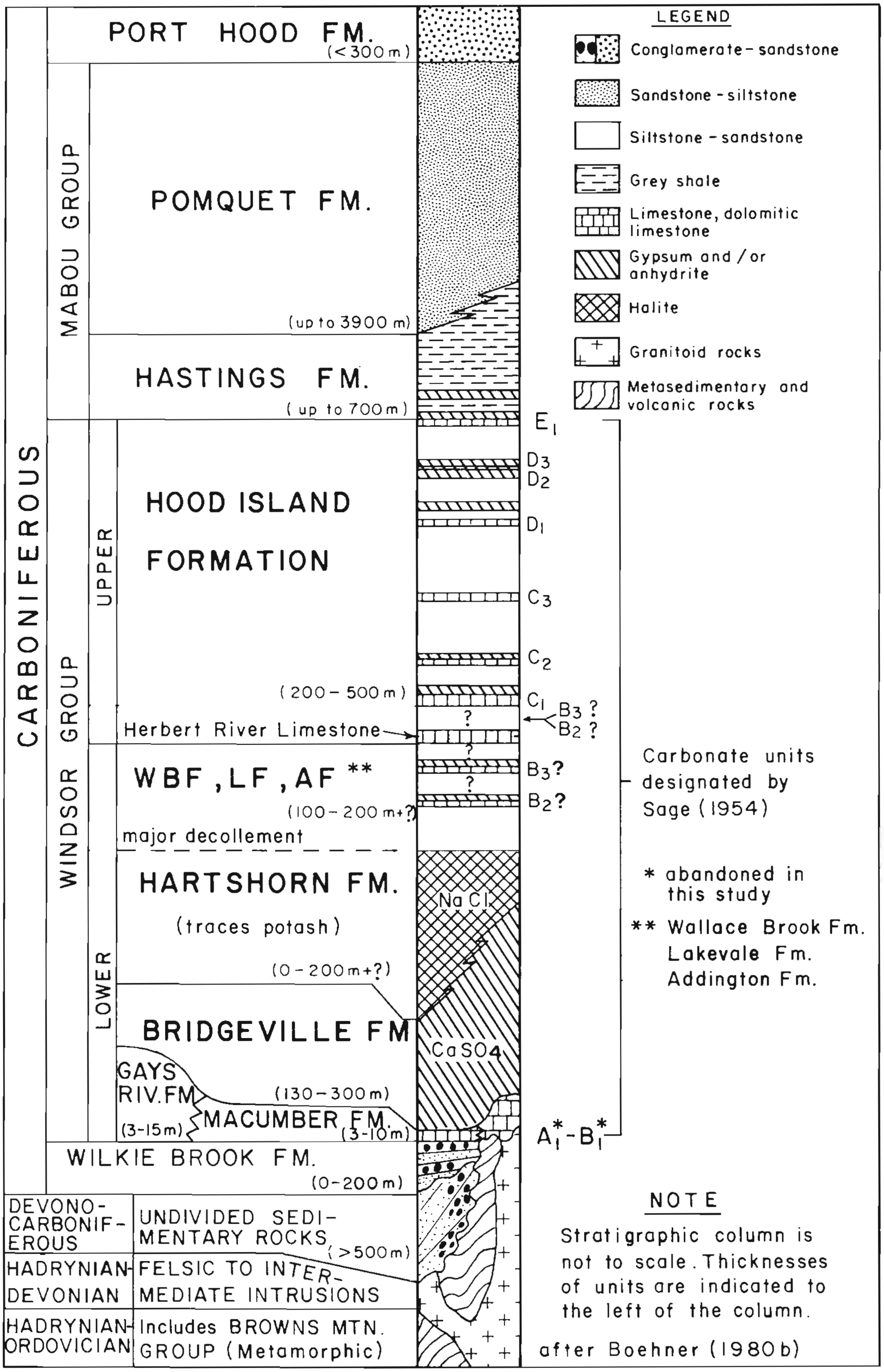

Figure 6-4. Stratigraphic column for Antigonish Basin.

Antigonish described by Sage (1954) has anomalously thick, clastic interbeds. Locally, thin gypsum beds may overlie the limestone units, for example the C_1, C_2 and D_1 of the Monks Head section.

Boehner and Giles (1982) subdivided this part of the section into four formations including the Addington, Lakevale, Wallace Brook and Hood Island (Fig. 6-4). The alphanumeric carbonate member designations of Sage (1954) were retained with the exception of the A_1 (Macumber Formation), A_2, and B_1 (Gays River Formation) which were abandoned.

The total thickness of the A Subzone evaporite section is not certain because of the lack of data and the thrust fault at contact with the poorly-defined younger B Subzone strata. Estimated thicknesses for this package are probably in the order of 300 to 460 m. Sage (1954) reported approximately 580 m (1900 ft.) of section for the entire Windsor Group as exposed in the Pomquet River section. Although the average total thickness for the entire Windsor Group is probably in the order of 550 to 760 m, thicker sections may be present in the St. Georges Bay area and northwest of the Captains Pond - Williams Point basement high trend.

The stratigraphy of the Windsor Group in the western part of Cape Breton was studied and described by Norman (1935) and Stacey (1953). Norman (1935) recognized a two part ("member") subdivision of the Windsor Group. The Lower Windsor is exposed in partial sections on Port Hood Island and on Mabou Harbour. On Port Hood Island Norman (1935) reported a thickness of 319 m (1047 ft.) for the upper part of the Lower Windsor Group composed of red shales, gypsum and limestone. At Mabou Mines the lower part of the Lower Windsor section is a 126 m (415 ft.) thick section composed of A_1 limestone (Macumber Formation) overlain by a thick anhydrite unit (Fig. 6-5). Both sections are incomplete due to faulting. Locally the Port Hood Island section is also highly disturbed and incomplete.

The upper subdivision of the Windsor Group, Norman (1935) indicated, is best developed on Port Hood Island and is approximately equivalent to the Upper Windsor zone of Bell (1929). In this section, stratigraphic intervals in the Upper Windsor are nearly twice as thick as some equivalent sections in the Antigonish area. The Upper Windsor of Norman (1935), on Port Hood Island comprises approximately 198 m (650 ft.) of interbedded red shale, limestone, gypsum and anhydrite. The total Windsor Group section was indicated by Norman (1935) to be approximately 610 m (2000 ft.) thick.

Stacey (1953) studied the Windsor Group stratigraphy in parts of Cape Breton Island and indicated a total thickness of 670-825 m (2200-2700 ft.) in the Mabou-Judique area in western Cape Breton. He indicated the exposure on Port Hood Island to be the most complete in the area. It contains approximately 457 m (1500 ft.) of Upper Windsor and B Subzone units to which he applied the following terminology, B_2, B_3, C_1, C_2, C_3, D_1, D_2, D_3, and E_1 (Fig. 6-5).

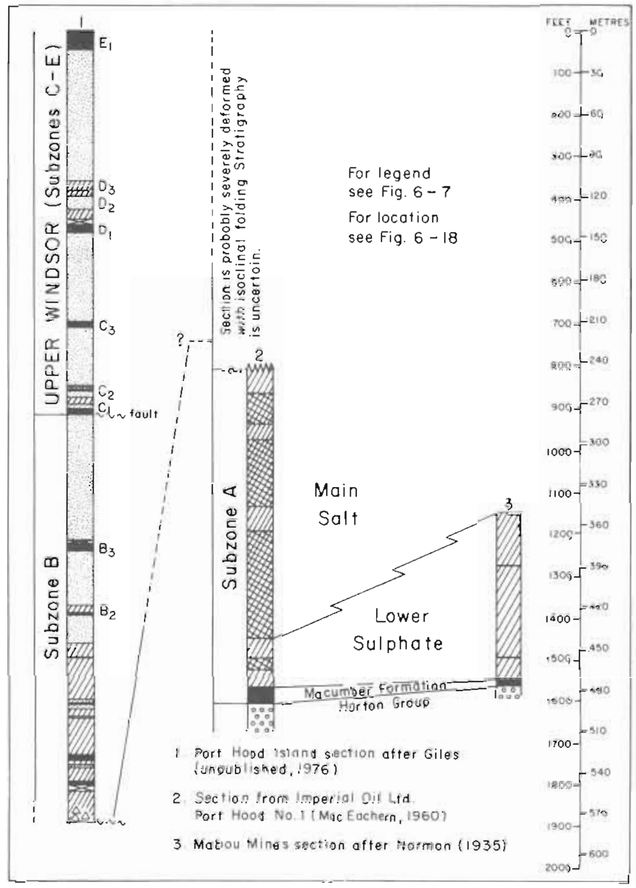

Figure 6-5. Preliminary Windsor Group stratigraphic columns, Antigonish-Mabou area.

In the Port Hood Island section the Upper Windsor C_1-E_1 units are approximately 305 m (1000 ft.) thick, the B_2-C_1 section is approximately 150 m (500 ft.) and the deformed gypsum beneath the B_2 is approximately 107 m (350 ft.) thick.

Stacey (1953) postulated the section between the lowermost gypsum on Port Hood Island and the A_1 basal limestone in ascending order as follows:

200'± Salt
? Maroon siltstone
40'± B_1 limestone.
Subzone A
? Maroon siltstone
20-60' A_2 limestone
10-100' Maroon siltstone
30-50' A_1 limestone
HORTON GROUP

In proposing this section Stacey (1953) used as a reference the Southside Harbour area that was being investigated at the time by Sage (1954). Sage (1954) considered the salt and Quarry (B_1) limestone to be part of the B Subzone. Reinterpretation of this cross-section and the recognition of a fossiliferous A Subzone basal limestone in other areas suggest that the lower parts of the section, including the salt and Quarry limestone, are probably part of the A Subzone.

ANTIGONISH DEPOSIT

The Antigonish deposit (NTS 11F/12 and 11E/09) is located approximately 3.5 km west of Antigonish, Antigonish County, Nova Scotia (Figs. 1-10 and 6-6).

The area is readily accessible through a series of paved and unpaved roads connected with the Trans-Canada Highway 104. The Canadian National Railway mainline between Stellarton and Port Hawkesbury is located approximately 2.5 km north of the deposit.

The terrain in the vicinity is typical of Carboniferous Antigonish Lowlands with gently undulating hills and elevations rarely exceeding 75 m. The lowland area is bordered on the north by the Antigonish Highlands, comprising older Paleozoic rocks which rise rapidly to elevations of up to 300 m.

HISTORICAL BACKGROUND

Salt springs and seeps were described in the vicinity of Antigonish area by Dawson (1868), who reported that a boring operation for salt brine was undertaken in the area of the "harbour landing place". Strong salt brine was reported to have been encountered. Fletcher (1887) indicated the presence of salt springs in the area and described the history of the salt venture located near Town Point approximately 9 km northeast of Antigonish.

> Salt springs and ponds are found everywhere in the neighborhood of the gypsum, as at Pomquet, and South Rivers, Brierly Brook, Addington Forks, and other places. Salt was made many years ago from the salt pond near the town of Antigonish. In May, 1866, a company called the Nova Scotia Salt Works and Exploration Company, was incorporated under the management of Mr. Josiah Deacon, to conduct boring operations to discover the source of the brine. The first boring was sunk on Town Point, near the mouth of the harbour, a six-inch borehole, lined with iron tubing, being driven through a considerable thickness of soil and clay, then through a thick band of gypsum into sandstones, without finding any indication of brine; so that further operations in this locality were abandoned.
>
> Encouraged by indications of salt water and salt on the surface, where the railway station now stands, a second borehole was put down here; and a nine-inch cast-iron pipe sunk through sixteen feet of gravel, full of weak surface brine. The auger then passed through red, blue and brown marl, with thin bands of fibrous gypsum; then through several layers of magnesian sandstone, striking a bed of gypsum 141 feet from the surface.
>
> After penetrating 18 feet into the gypsum, there was a flow of pure, strong, limpid brine from a cleft, which flowed nearly to the surface, could only be lowered a few feet by pumping, and discharged a large volume of sulpheretted hydrogen gas. A large steam engine was erected for pumping, and furnaces, tanks and evaporating pans of large dimensions, constructed for the production of salt. After the manufacture of a considerable quantity of salt, the strength of the brine became very much reduced. Another borehole was accordingly put through clays to a depth of 650 feet, but finding no indications of brine, that of the other boring being too weak for use, and the working capital exhausted, the work was abandoned.

Pohl (in Hayes, 1931) located four salt springs in the area of the Antigonish deposit (probably the same as indicated by Fletcher, 1887); one near Brierly Brook, another near Antigonish and two near Salt Springs. These were sampled and analyzed by Cole (1930a).

In 1953 the Malagash Salt Company drilled two holes (NSDM 1977, 1978) to maximum depth of 226 m in exploration for salt approximately 1.5 km east of Antigonish, but no salt was encountered. The geology of the Antigonish area (11F/12), in particular the Windsor Group, was described and mapped by Sage (1954).

In 1966 Kenneco Explorations (Canada) Limited (Grace, 1966) explored the Antigonish area for salt-sulphur-potash and base metal deposits. A diamond-drill hole, KEH-1 was drilled on a Bouguer gravity minimum located approximately midway between Salt Springs and Brierly Brook. Salt was intersected between 319 and 366 m (1047 and 1201 ft.) and the hole was ultimately stopped at 371 m (1217 ft.)

In 1974 Amax Exploration Incorporated contracted the Nova Scotia Research Foundation to recompute old and new gravity data in the area. Two Bouguer gravity minima were outlined, one near Addington Forks on the west (James River deposit) and one centred near Salt Springs, 3.5 km west of Antigonish. Amax drilled AP-2-74 near the centre of the latter anomaly approximately 1.6 km southeast of KEH-1. Salt mixed with shale was interaected between 387 and 486 m (1271 and 1594 ft.). This hole was completed at 556.6 m (1826 ft.).

GEOLOGY

The geology in the vicinity of the Antigonish deposit was mapped and described by Benson (1970, 1974) and Sage (1954), but it is only recently that the Windsor Group has been described and mapped in subdivided units (Boehner, 1980a; Boehner and Giles, 1982).

The oldest rocks in the area outcrop to the north and northwest in the Antigonish Highlands. These folded and faulted sedimentary, metamorphic, and intrusive rocks are assigned to the Hadrynian-Devonian. They are overlain with angular unconformity by Devono-Carboniferous strata comprising conglomerate, sandstone and shale. The Windsor Group comprises gypsum, anhydrite, halite, red shales and limestone and rests conformably upon the Devono-Carboniferous strata.

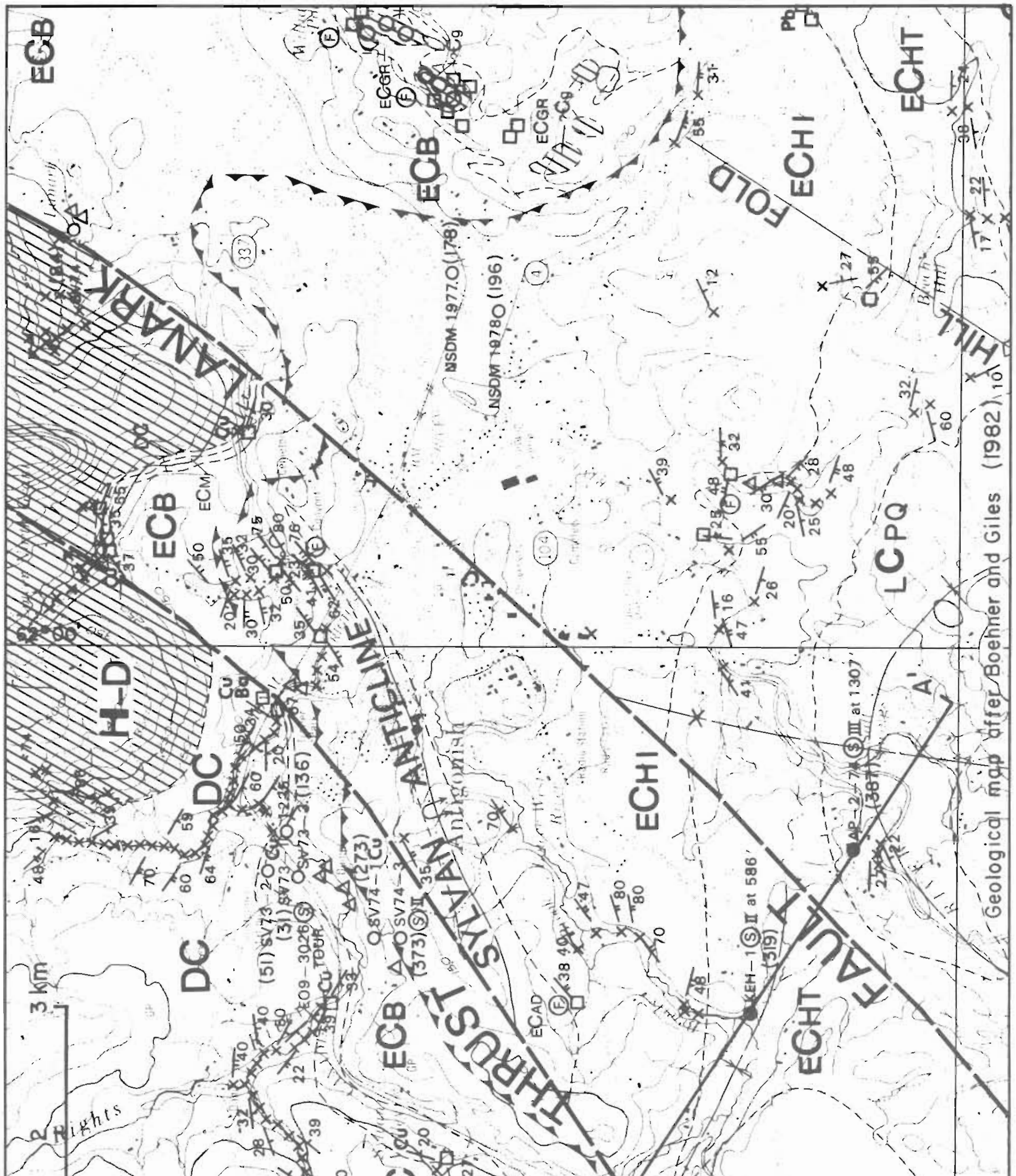

Figure 6-6. Geological map and legend, Antigonish deposit. Map after Boehner and Giles (1982).

LEGEND

SYSTEM / SUBSYSTEM / SERIES / STAGES

PALAEOZOIC — CARBONIFEROUS — SILESIAN (NAMURIAN, WESTPHALIAN); DINANTIAN (VISEAN: BRIGANTIAN, ASBIAN, HOLKERIAN, ARUNDIAN; WARNANTIAN, LIVIEN, MOLINACIEN; TOURNAISIAN: HASTARIEN, IVORIEN, CHADIAN); DEVONIAN; SIL.; ORD.; CAMB.; HADRYNIAN — BRITISH ISLES / BELGIUM

RIVERSDALE GROUP

LCPH — *PORT HOOD FORMATION:* grey and brown sandstone and conglomerate

CANSO GROUP

LCPO — *POMQUET FORMATION:* red and minor grey - green siltstone and sandstone

ECHT — *HASTINGS FORMATION:* grey shale and siltstone with red shale and minor limestone

WINDSOR GROUP

ECHI — *HOOD ISLAND FORMATION:* red siltstone and sandstone with intercalated marine limestone and dolostone and minor gypsum; rhythmic alternation of these rock units is characteristic

~~~~ disconformity ~~~~

ECWA / ECAD / ECL

ADDINGTON FORMATION (ECAD): red siltstone, with gypsum and anhydrite and thin carbonate beds; rhythmic alternation of these rock units is typical

WALLACE BROOK FORMATION (ECWA): limestone, with minor dolostone, intercalated with red siltstone and sandstone; includes gypsum and anhydrite in the subsurface

LAKEVALE FORMATION (ECL): grey and reddish-brown polymictic conglomerate and paraconglomerate with gypsum and anhydrite in the subsurface; minor carbonate rocks are intercalated in some sections

~~~~ disconformity and/or thrust fault ~~~~

ECHH / ECB / ECGR / ECM

HARTSHORN FORMATION (ECH): halite, grey and white with thin interbeds of anhydrite and grey-green siltstone, minor sylvite and carnallite; known only in the subsurface

BRIDGEVILLE FORMATION (ECB): anhydrite and gypsum, with limestone and dolomitic limestone in variable proportion as interbeds

GAYS RIVER FORMATION (ECGR): limestone, minor dolostone, thinly bedded, argillaceous, in part peloidal, locally thickly bedded and highly fossiliferous in mound-shaped deposits resting upon pre-Carboniferous rocks

MACUMBER FORMATION (ECM): limestone in part dolomitic, laminated and/or banded, peloidal, sparsely fossiliferous; includes limestone breccias of complex origin

HORTON GROUP

ECWB — *WILKIE BROOK FORMATION:* conglomerate, sandstone and shale with minor algal and oölitic limestone

~~~~ angular unconformity ~~~~

DC — Undivided *DEVONO-CARBONIFEROUS ROCKS:* grey and reddish-brown polymictic conglomerate, grey and pale red feldspathic sandstone, red shale, and grey shale, in part highly bituminous; thin beds of fresh-water limestone occur in association with grey shales, and volcanic rocks are known in the subsurface south of Stewart Lake

~~~~ angular unconformity ~~~~

H-D — Undivided *HADRYNIAN TO DEVONIAN ROCKS:* shale, slate, greywacke, basalt and rhyolite; variably deformed and metamorphosed; may include rocks previously assigned to the Knoydart Formation, Arisaig Group, Browns Mountain Group and Georgeville Group

?Cg / Cgt — *PLUTONIC ROCKS:* Antigonish Harbour and James River Plutons (?Cg) granite and microgranite; Ohio River Pluton (Cgt) granitoid rocks

SYMBOLS

Rock outcrop limestone, dolostone; commonly fossiliferous .... □
gypsum, anhydrite .... △
terrigenous sedimentary and volcanic rocks .... ×
granitoid rocks .... ○

areas with continuous outcrop ....

Bedding; horizontal, inclined, vertical, overturned, tops unknown ....

Geological boundary, approximate, dotted beneath major bodies of water ....

Fault, approximate, dotted beneath major bodies of water ....

relative fault movement wrench fault ....

symbol on downthrown side ....

Thrust fault, barbs point down-dip ....

Anticline and syncline ....

Anitform and synform ....

Anticline and syncline, overturned ....

Fossil locality .... Ⓕ

Spore locality (zonation after Utting - 1978, 1980) .... II Ⓢ

Diamond-drill hole .... ● JR – 2

Mine or quarry, **ls** - limestone .... **ls**

Mineral occurrence or prospect; **Pb** - lead, **Zn** - zinc, **Cu** - copper, **Ba** - barite, **Fl**- fluorite .... □ **Pb**

Rb - Sr whole rock isochron age (^{87}Rb) = 1.42×10^{11}/yr .... 533 ± 19

Drillhole intesecting salt, number (depth to salt in metres) .... ● AP-1-7 (408)

Drillhole, number (total depth in metres) .... ○ AF-1 (278)

In general, the geology in the deposit area appears to define a northeasterly trending syncline as a continuation of the syncline graben inferred to occur in the James River area to the southwest. Boehner (1980b) and Boehner and Giles (1982) indicated this configuration is complicated by the Antigonish Thrust Fault (Fig. 6-6).

Diamond-drilling on the Bouguer gravity low near Antigonish by Kenneco Explorations (Canada) Limited (Grace, 1966) in 1966 (KEH-1) and Amax Exploration Incorporated in 1974 (AP-2-74) indicates a moderate to steeply dipping thick section of red siltstone and fine sandstone with rare thin gypsum and very rare limestone beds overlying the salt (Fig. 6-7). KEH-1 intersected a section of Hastings Formation overlying the Hood Island Formation which is incomplete at its base because of the Antigonish Thrust Fault immediately above the Hartshorn Formation salt. Spore data obtained from a depth of 398 m (1307 ft.) in AP-2-74, indicate the strata are probably Canso Group.

Drilling in the Sylvan Valley area by Imperial Oil in 1973 and 1974 (Ward, 1974) confirmed the presence of a thick section of the Bridgville Formation anhydrite overlying the Macumber Formation limestone which overlies Devono-Carboniferous conglomerate and sandstone (Figs. 6-7 and 6-8). In one hole SV74-3, a section of red shale with minor limestone was described above the Bridgeville Formation, but salt was not reported (Ward, 1975a).

In 1953 the Malagash Salt Company drilled two exploration holes NSDM 1977 and 1978 near Williams Point (Fig. 6-6 and 6-7). Salt was not reported in these holes and the section of limestone, shale and gypsum intersected is probably part of the Hood Island Formation. The presence of the basal Windsor Group section at Williams Point indicates the possibility of a fault along the southern side or in Antigonish Harbour. A single hole SV74-2 was drilled by Imperial Oil near Lanark in 1974. The hole, drilled with a dip of 45° on an azimuth of 315°, intersected a section of gypsum and was abandoned in a thick unconsolidated solution trench at 125 m (410 ft.). This zone of poor recovery coincides with the Lanark Fault (Fig. 6-6).

In 1976 U.S. Borax (Pacific Coast Exploration) drilled four holes near Lower South River (LSR-1 to -4, Figs. 6-7 and 6-26). A thick section of Bridgeville Formation anhydrite overlying Gays River Formation limestone was intersected in these holes. The limestone at Lower South River is fossiliferous and rests with nonconformity on granitoid and volcanic rocks.

GEOPHYSICS

A Bouguer gravity anomaly map (11E/09) by the Nova Scotia Research Foundation (1974; Fig. 6-9) indicates a small (6 mGal) minimum coincident with the Antigonish deposit. Small gravity maxima situated north and east of Antigonish and northwest of the deposit appear to coincide with the Bridgeville Formation (anhydrite) outcrop areas. Further exploration drilling will be required to establish the thickness and extent of the salt indicated by the gravity data.

GEOCHEMISTRY

Salt springs and seeps in the area were sampled and analyzed by Cole (1930a). Cole described and reported analyses (Table 6-1) on the following four springs:

Etheridge Springs (Nos. 21 and 22). Two saline springs occur on the farm of Howard Etheridge, Salt Springs P.O., Antigonish County. The stronger one (No. 21) occurs on the east bank of West River. The flow is small but the water bubbles up quite freely on occasions. In the meadow back of the house there are several shallow saline ponds (No. 22) and, although no spring nor inlet is visible, they remain distinctly saline even after heavy rains.

Brierly Brook Spring (No. 26). The most strongly saline spring of the district is found on the north side of Brierly Brook, 2 1/2 miles west-southwest of Antigonish station, on the land of Martin Somers. The spring occurs at the west end of a small shallow pond at the base of a low escarpment and there is a flow out of this pond of about 5 gallons per minute. Another saline pond occurs 75 feet to the southwest of the main one, but there are no visible springs in it.

Antigonish Spring (No. 27). In the meadow land around the creek which runs along the southeastern outskirts of the town there is a brine pond in which several weakly flowing springs bubble up. The flow out of this pond is approximately 2 gallons per minute.

The chemistry of the salt springs is typical of moderately $CaSO_4$ enriched NaCl springs in Nova Scotia. No. 22 is anomalous in its Mg content, but none appear to be anomalous in K content.

ECONOMIC CONSIDERATIONS

The Antigonish deposit consists of halite. No potash has been reported. Salt of unknown purity was intersected in two drillholes, AP-2-74 and KEH-1, drilled on a Bouguer gravity minimum centred between Brierly Brook and Salt Springs. In KEH-1 salt was intersected between 319 and 366 m, and in AP-2-74 between 387 and 486 m. Salt springs and seeps are common in the area.

The deposit is located adjacent to the Trans-Canada Highway 104 and the Canadian National Railway mainline between Stellarton and Port Hawkesbury. The deposit area has potential for further salt exploration and possibly may contain potash salts.

JAMES RIVER DEPOSIT

The James River deposit is located approximately 2 km south of James River (NTS 11E/09) and 12 km

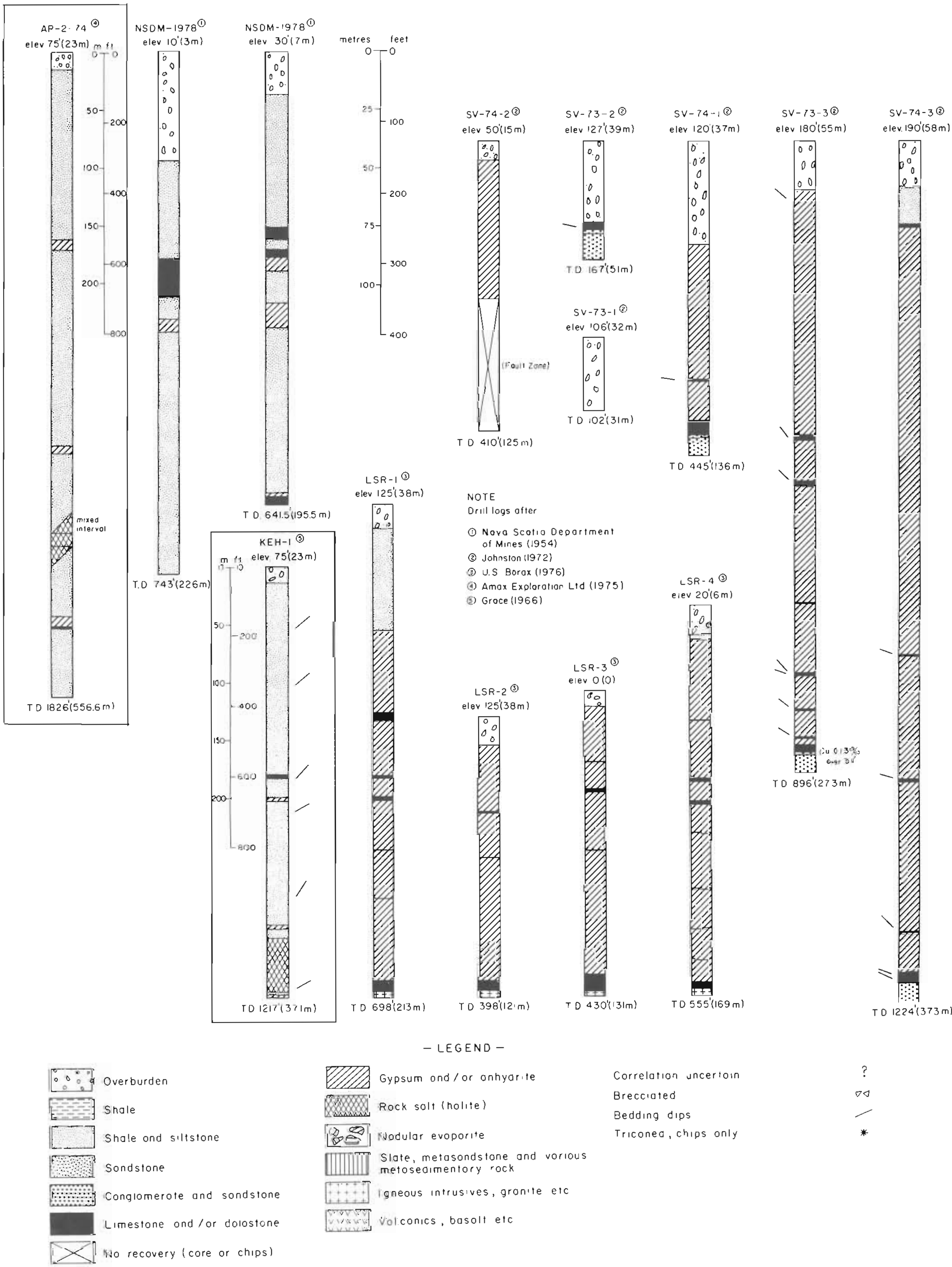

Figure 6-7. Drillhole profiles, Antigonish deposit.

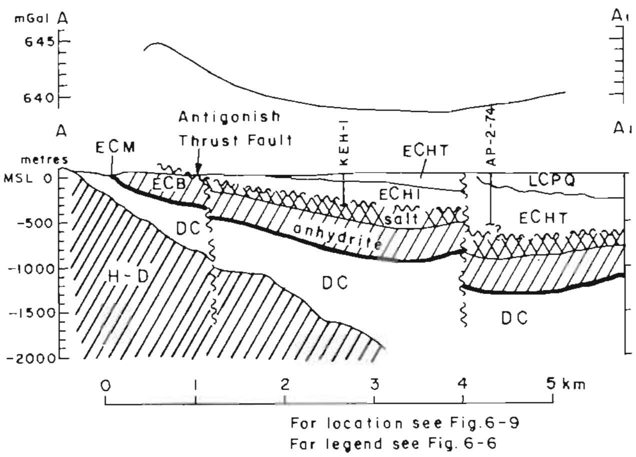

Figure 6-8. Bouguer gravity and geological cross-section, Antigonish deposit.

west of Antigonish, Antigonish County, Nova Scotia (Figs. 1-10 and 6-10).

The area is readily accessible from a series of paved and unpaved roads connected to the Trans-Canada Highway 104 which passes approximately 1 km north of the deposit area. The mainline of Canadian National Railway between Port Hawkesbury and Stellarton is located approximately 1.5 km north of the area.

The deposit is located in gently rolling terrain with elevations rarely exceeding 75 m in the Antigonish Lowlands which are underlain by Carboniferous strata. The Lowlands are bordered on the west and north by the older Paleozoic rocks of Antigonish Highlands where elevations rise rapidly to 225 m and locally exceed 300 m.

HISTORICAL BACKGROUND

The possible presence of salt rocks in the James River area was first indicated by the occurrence

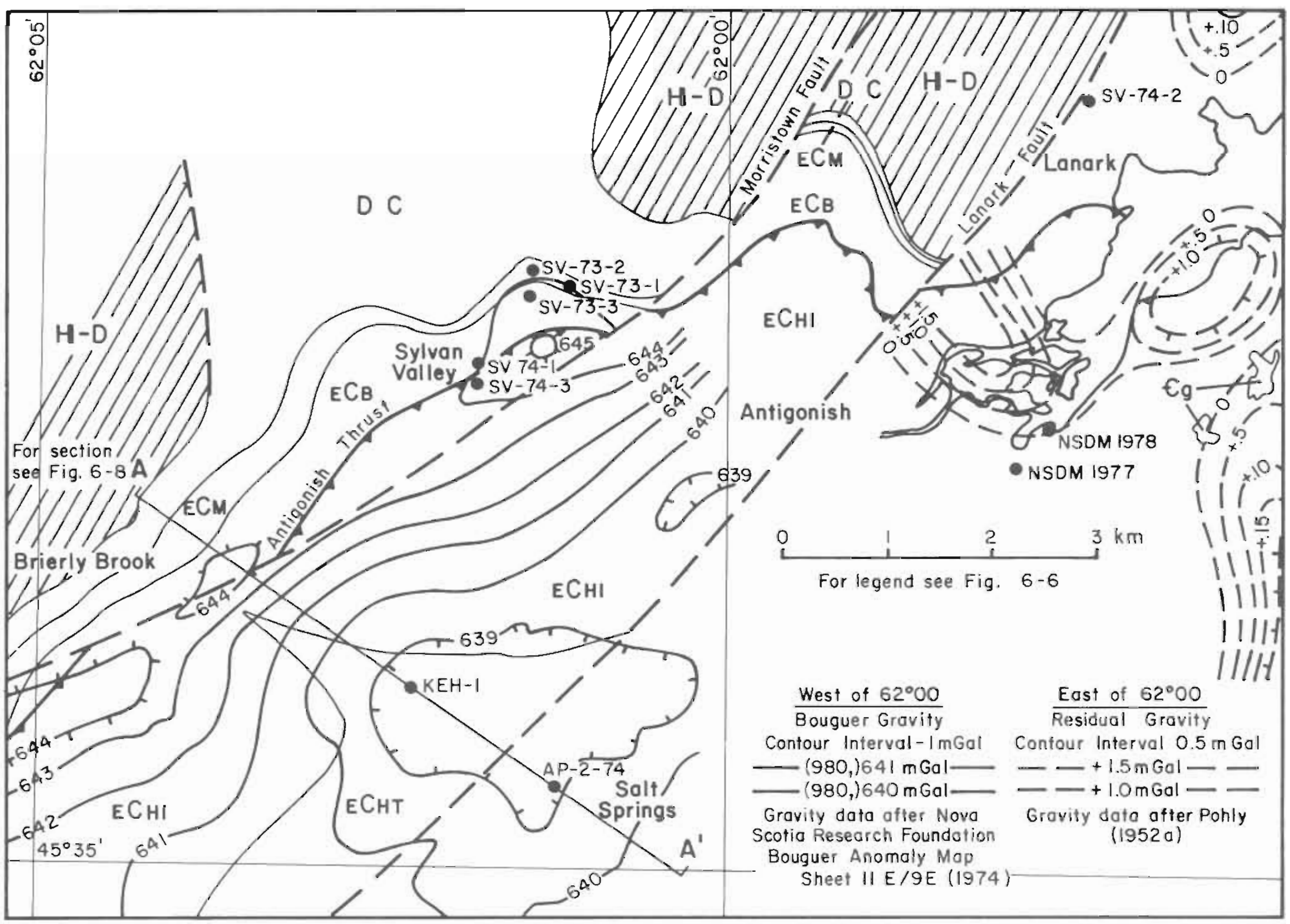

Figure 6-9. Gravity anomaly and general geological map, Antigonish deposit.

Table 6-1. Analyses of salt springs, Antigonish deposit*

SPRING NO.	**21**	**22**	**26**	**27**
FIELD NOTES AT TIME OF SAMPLING				
Temperature of atmosphere, °F	72	72	65	73
Temperature of brine, °F	50	72	48	55
Baume degrees	6.5	1.5	6.75	3.5
Equivalent specific gravity ..	1.045	1.010	1.046	1.024
LABORATORY NOTES				
Specific gravity at 60° F	1.0335	1.0168	1.0175	1.0277
Total solids at 110°C	4.41	2.13	6.55	3.77
Reaction	N	N	N	N
ANALYSES OF SOLIDS				
Na .... Per cent	33.22	32.18	34.53	34.07
K .... Per cent	0.13	0.09	0.11	0.14
Ca .... Per cent	3.26	3.87	2.50	3.00
Mg .... Per cent	0.14	0.43	0.09	0.23
SO_4 .... Per cent	.50	9.68	6.15	6.35
Cl .... Per cent	51.65	50.60	53.61	53.94
Br .... Per cent	none	none	none	none
I .... Per cent	none	none	none	none
Total	96.90	96.85	96.99	97.73
HYPOTHETICAL COMBINATION				
$CaSO_4$ .... Per cent	11.06	13.16	8.64	9.00
$CaCl_2$ .... Per cent	0.83	-	-	0.97
$MgSO_4$ .... Per cent	-	0.49	-	-
$MgCl_2$ .... Per cent	-	1.24	0.35	0.90
K_2SO_4 .... Per cent	-	-	-	-
KCl .... Per cent	0.12	0.17	0.21	0.26
Na_2CO_4 .... Per cent	-	-	-	-
NaCl .... Per cent	84.85	81.79	87.78	86.60
Total	96.86	96.85	96.98	97.73

*Cole (p. 9, 1930a)

of salt springs and seeps. Fletcher (1887) stated that salt springs and ponds are found in the neighbourhood of gypsum at places such as Brierly Brook and Addington Forks. Pohl (in Hayes, 1931) recorded the occurrence of many salt springs and seeps in the "Antigonish Basin", twelve of which were located and sampled. Several were located immediately to the east of the James River-Addington Forks area. These samples were analyzed and described by Cole (1930a). The area was determined by Pohl (in Hayes, 1931) to require much more detailed examination before it could be adequately assessed for its salt and potash potential.

Pohly (1952a and b) indicated the occurrence of a gravity minimum in the James River-Addington Forks area, but felt that the structure and gravity could not be reliably interpreted from the data available.

More recently mineral exploration by Kenneco Explorations (Canada) (1966) (Grace, 1966), Millmor- Rogers Syndicate (1974), Amax (1975) and Ward (1974, 1975b) has established the presence of salt and potash in the area.

GEOLOGY

The geology in the vicinity of the James River deposit (Fig. 6-10) has been described by Benson

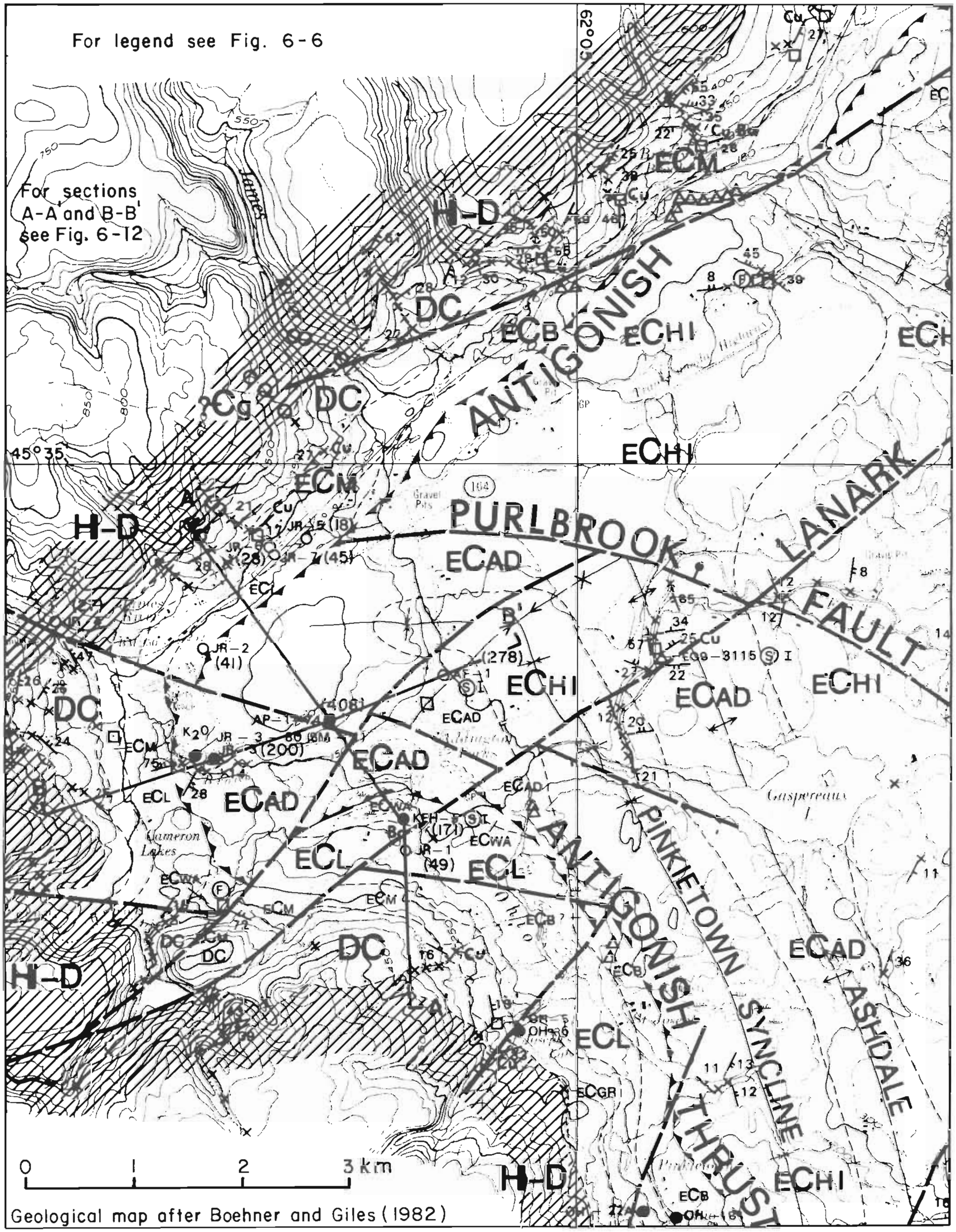

Figure 6-10. Geological map, James River deposit, Antigonish County.

(1974), Boehner (1980b) and Boehner and Giles (1982). In general, the Lower Carboniferous Windsor Group which contains major salt deposits is located in the Antigonish Lowlands and overlies with apparent conformity rocks assigned to the Devono-Carboniferous. These rocks, comprising sandstone, conglomerate and shale, rest with angular unconformity on the faulted and folded sedimentary, metamorphic, and intrusive rocks that outcrop west and north in the Antigonish Highlands.

The Windsor Group comprises interstratified gypsum, anhydrite, halite, red siltstone and shale, and limestone. To the north and northwest the Windsor Group overlies a thin outcrop band of Devono-Carboniferous, but to the west it appears to rest unconformably on the older rocks of the Antigonish Highlands. The rocks in the deposit area have been disrupted by faulting and folding to produce a complicated structural configuration (Fig. 6-10). Faults in the area are of three major types; high angle longitudinal (northeast trending), high angle transverse (northwest trending), and low angle thrust. Latest movement has occurred on the northeasterly trending faults, but the most important fault related to the salt in the area is the Antigonish Thrust. All strata above the Hartshorn Formation salt are allochthonous. The upper part of the salt is highly deformed and the presence of minor potash near the top may be all that remains of significant deposits that have been removed by faulting and/or subsequent dissolution.

The JR-3 drillhole (Figs. 6-10 and 6-11) drilled by 1973 Millmor-Rogers Syndicate (1974) intersected red shales to approximately 140 m, gypsum, limestone, and shale to 207 m and was abandoned in Hartshorn Formation salt at 250 m. This hole was redrilled nearby in 1980 by Cuvier Mines Ltd. (Black, 1981) (BM-1, JR-3-80) to a total depth of 343 m (1124 ft.). Approximately 30.5 m (100 ft.) of salt with minor potash were intersected in faulted contact with Bridgeville Formation anhydrite below and Addington Formation above.

KEH-5 is situated approximately 2 km southwest of JR-3 (Figs. 6-10 and 6-11) and was drilled by Kenneco Explorations (Canada) Limited (1966) (Grace, 1966). This hole intersected red shale, limestone and gypsum with a few veins of halite to a depth of approximately 300 m, red shales to 430 m, fractured anhydrite and then fractured laminated limestone to 450 m. It was believed to have been stopped in Horton Group at 471.5 m. Diamond-drilling further south along the contact with the Antigonish Highlands basement complex, by Kenneco Explorations (Canada) Limited and Imperial Oil Limited, has intersected fossiliferous Windsor Group limestone (Gays River Formation).

AP-1-74 (Figs. 6-10 and 6-11) was drilled approximately 1.1 km northeast of JR-3 by Amax Exploration Ltd. (1975). This hole intersected red shales to 130 m, anhydrite and gypsum to 180 m, red shales to 400 m, salt to 620 m and was abandoned in anhydrite at 675.4 m. The AF-1 drillhole (Burton in Ward, 1975b), located approximately 1.1 km northeast of AP-1-74, was drilled by Imperial Oil and intersected red shale, gypsum, anhydrite and two limestone beds. It was stopped at 278 m without reaching salt. The JR-3, AP-1-74 and AF-1 drillholes are inferred to lie in or very near the axis of a synclinal trough (Figs. 6-10 and 6-12).

GEOPHYSICS

The Bouguer gravity anomaly map for the James River area (Fig. 6-13) has a Bouguer minimum centred near Addington Forks which is pear shaped, trends northeasterly and connects with another minimum centred near Salt Springs (Fig. 6-6).

To the northwest of the Addington Forks minimum there are three contiguous gravity maxima paralleling the northwestern contact. These probably represent the outcrop belt of anhydrite and the pre-Carboniferous basement (Fig. 6-12). South and east of the Addington Forks minimum a broad triangular shaped maximum occurs with its centre located near St. Joseph. This high coincides with outcrop and subcrop area of Bridgeville Formation anhydrite overlying basement with thin intervening Devono-Carboniferous sediments.

GEOCHEMISTRY

The only available analyses (Table 6-2) of salt in the James River deposit are those in an unpublished B.Sc. honours thesis by Stewart (1976).

The average analysis of the salt sampled over the 478.5-605.3 m (1570-1986 ft.) interval is 69% NaCl (calculated from Na). The calculation of NaCl from Na gives a low value because of the difficulty in measuring Na at high concentrations. Possibly a better assessment of the salt quality may be obtained by assuming the NaCl approximately equals 100% minus per cent water insoluble.

ECONOMIC CONSIDERATIONS

The James River deposit consists of halite with thin (less than 1 m) intervals of low grade (1-6.25%, K_2O) potash reported in two drillholes, AP-1-74 and JR-3. In the thickest known section, from AP-1-74, the salt was intersected in the interval 408.4-621.2 m (1340-2038 ft.). Analyses of the salt from AP-1-74 by Stewart (1976) indicate an average NaCl content of 69% in samples taken from the interval 478.5-605.3 m (1570-1986 ft.).

The size of the deposit has not been established by drilling, but based on the associated Bouguer gravity anomaly, it probably is approximately 3000 m long, 1500 m wide, and 100 m thick.

Salt springs are reported in the deposit area, but are much more common in the Salt Springs area immediately to the east.

The deposit is located adjacent to the Trans-Canada Highway 104 and Canadian National Railway mainline that runs between Stellarton and Sydney.

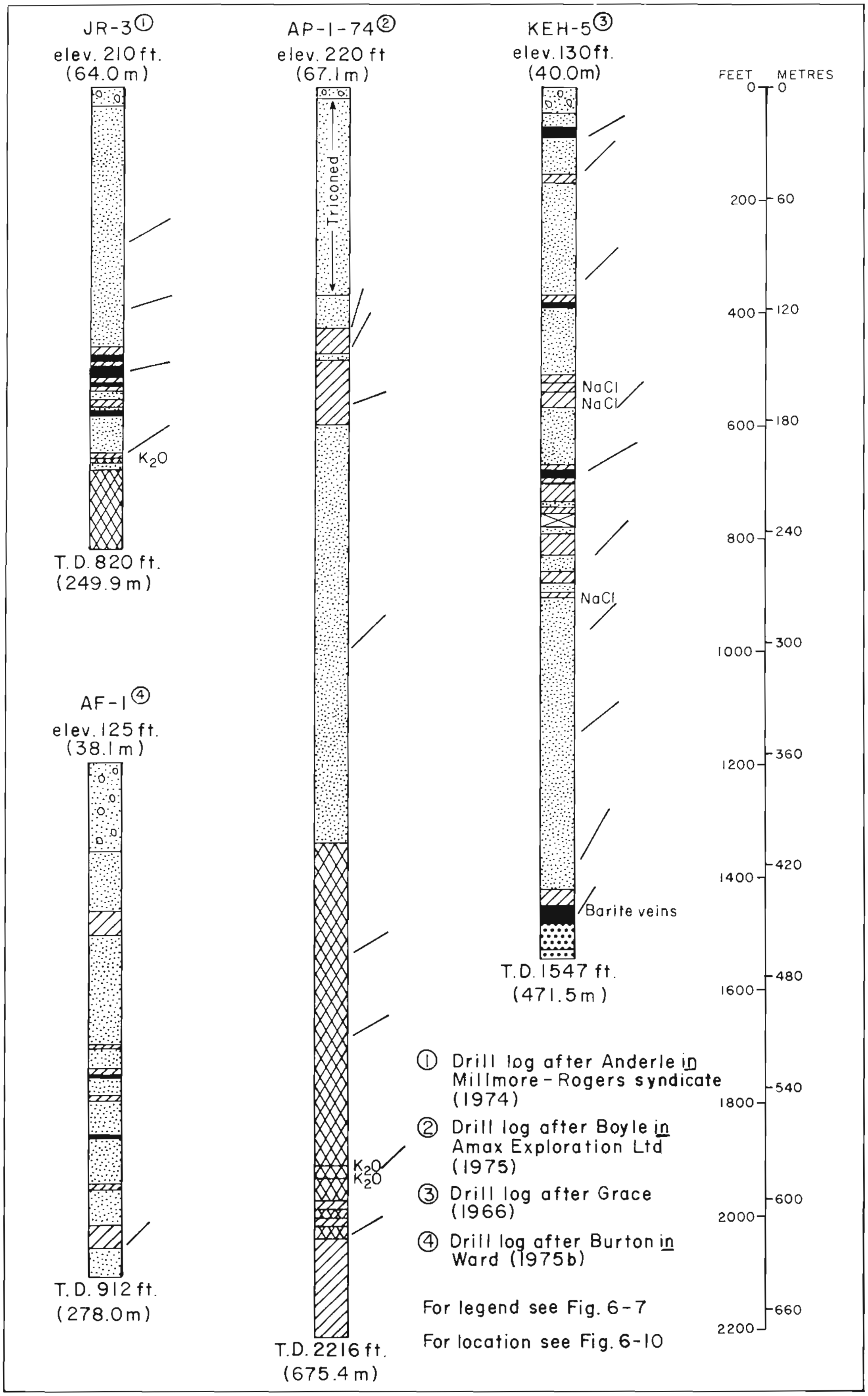

Figure 6-11. Drillhole profiles, James River deposit.

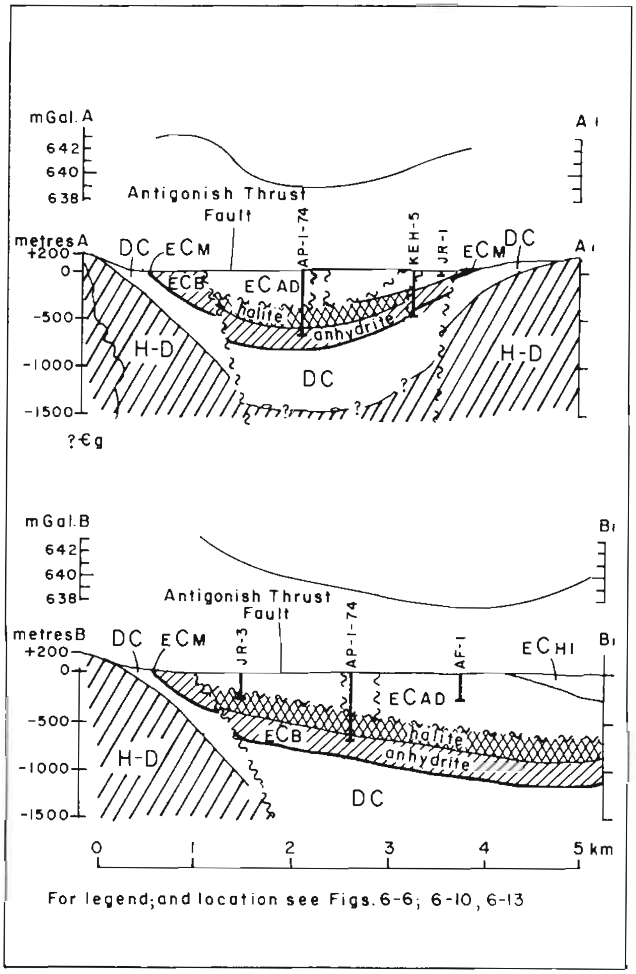

Figure 6-12. Bouguer gravity and geological profiles, James River deposit.

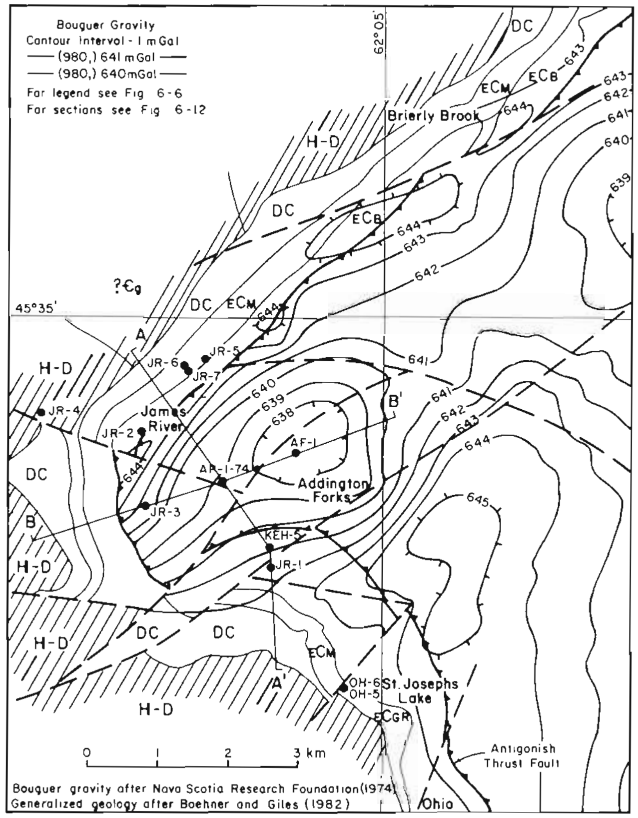

Figure 6-13. Bouguer gravity and general geological map, James River deposit.

The deposit requires further exploration drilling and chemical analyses to determine its economic significance.

MABOU DEPOSIT

The Mabou deposit (NTS 11K/03) is located approximately 7 km southwest of Mabou and 6 km northeast of Port Hood near the community of Southwest Mabou, Inverness County, Cape Breton Island (Figs. 1-10 and 6-14).

The area is easily accessible through a series of paved and unpaved roads connected with Route 19 that runs from Port Hastings on the Strait of Canso through Port Hood to Inverness and the Cabot Trail on the western shore of Cape Breton Island. The Canadian National Railway line between Port Hastings and Inverness passes through Southwest Mabou.

The terrain in the area, underlain by Windsor Group and younger rocks, is characterized by rolling hills with elevations rising up to 125 m. The area to the east is underlain by Horton Group and older rocks and the terrain has more relief with elevations of 200 m and locally exceeding 250 m. Local relief is high near the valleys of the Mabou, East Mabou, Southeast Mabou and Mull Rivers and locally along the Northumberland Strait shoreline. To the north of Mabou Harbour, the Mabou Highlands, underlain by granitic and volcanic rocks, rise abruptly to a flat topped area where elevations exceed 300 m.

HISTORICAL BACKGROUND

The western part of Cape Breton Island has been the object of petroleum exploration since the mid 1850's. One of the first attempts in Nova Scotia to obtain petroleum in commercial quantities was reportedly undertaken by Pioneer Oil and Salt Company near Lake Ainslie in 1864 (Norman, 1932a).

How (1869) reported that salt derived from springs was made by the early Scottish settlers in the Judique area. The Mabou area was investigated by Hayes (1931) for its potash potential as part of a regional potash assessment. Hayes (1931) reported the occurrence of several brine seeps in the bed of Glendyer Brook approximately 1.2 km upstream from Glendyer Railway Station. These seeps occur in a limestone unit assigned to the Upper Windsor. This salt spring was sampled by Norman and analyses were made and reported by Cole (in Hayes, 1931).

The geology of the area was described and mapped by Norman (1935). He reported that early attention to the possibility of commercial

Table 6-2. Chemical analyses of salt samples from AP-1-74, James River deposit*

Sample Depth (feet)	% CaO	% Na_2O	% K_2O	% MgO	% Water Insoluble	% NaCl (Calculated from Na)
1382	0.76	38.0	1.0	0.02	Nil	72
1393	0.80	30.0	0.8	0.90	20.3	56
1494	0.90	35.0	0.3	0.25	6.7	66
1510	1.04	32.0	1.0	2.51	12.6	61
1530	1.05	37.0	0.4	1.10	2.4	70
1541	0.20	36.0	0.27	0.25	4.8	68
1599	1.2	36.0	0.5	0.06	3.4	68
1634	0.44	37.0	0.3	0.05	3.6	70
1681	1.20	36.0	0.4	0.35	3.9	68
1721	1.28	38.0	0.5	1.0	Nil	72
1816	0.56	36.0	1.0	0.30	4.7	68
1916	0.44	36.0	0.5	0.06	4.6	68
1936	0.69	36.0	6.25	0.60	Nil	68
1956	0.80	38.0	0.25	0.01	Nil	72
1986	0.92	38.0	0.25	0.06	Nil	72

*Stewart (1976)

petroleum deposits was attracted by the occurrence of oil seepages on the western side of Lake Ainslie, at McIsaac Point and at Ainslie Point. In 1926 and 1927 Gulf Oil Company drilled a series of shallow core holes totalling 1017 m (3335 ft.) (Mather and Trask, 1929) to determine the nature of the structure at Southwest Mabou. Windsor Group evaporites were intersected, but salt was not reported. The results were apparently not sufficiently encouraging to warrant further, deeper testing for petroleum.

In the early 1940's geological surveys were undertaken in the area by the Cape Breton Petroleum Company (Whitehead, 1941). A seismic survey by Heiland Exploration Company was undertaken near Southwest Mabou in 1942. Encouraged by the areas potential for petroleum, Lion Oil Refining Company of Eldorado, Arkansas acquired an interest in the tracts leased to Cape Breton Petroleum Company and in 1944 began boring Mac No. 1 near Southwest Mabou (MacNeil, 1944b). This hole reached a total depth of 1700.5 m (5579 ft.). A salt zone was intersected at approximately 425 m (1395 ft.) and was not completely penetrated. Further geological and geophysical surveys supervised by MacNeil were undertaken at the same time as the drilling was in progress. A second hole, Mary No. 1, was drilled approximately 975 m (3200 ft.) northwest of Mac No. 1. Salt was first intersected at 1366 and the hole was abandoned in a gypsum bed at 2093.7 m (6869 ft.).

In the late 1950's Imperial Oil Limited obtained a petroleum exploration licence in the Mabou area. Several geological and geophysical surveys including seismic, gravity and preliminary stratigraphic test drilling, were undertaken. In 1959 Imperial Oil Limited drilled Mabou No. 1 (MacEachren, 1959). This well, abandoned in Horton Group strata at 1568.2 m (5145 ft.), encountered small amounts of salt near the base of the Windsor Group at approximately 732 m (2400 ft.).

In early 1960 Imperial Oil Limited drilled a second hole, Port Hood No. 1, (MacEachren, 1960). Salt was first intersected at 1859.3-2255.5 m (6100-7400 ft.). Massive salt with some shale and locally thick beds of anhydrite were encountered to a depth of 2950 m (9680 ft.) and the well was abandoned at 2999.2 m (9840 ft.).

GEOLOGY

The stratigraphy and structure in the Mabou area has been described in published and unpublished reports by Bell (1926), Mather and Trask (1929), Norman (1932a and b, 1935), Whitehead (1941, 1943), MacNeil (1944a, b and c, 1945a and b), Stacey (1953), Murray (1960), Belt (1962), and Kelley (1967b). The stratigraphic nomenclature and subdivision is rather complex and varies from worker to worker. An outline of the general Carboniferous stratigraphic section was presented at the beginning of the Antigonish-Mabou area section. Discussion of the stratigraphy and structure in the area of the Mabou deposit will focus mainly on the Windsor Group while other strata will be described in general terms.

The most comprehensive published report on the geology in the immediate vicinity of the

Mabou deposit (Fig. 6-14) was by Norman (1935). He recognized rocks that range in age from Precambrian to Upper Carboniferous. The Precambrian, George River Group composed of metamorphosed quartzite and intruaions of granodiorite, diorite, sheared diorite and granite, occur as a massif block forming the Msbou Highlands to the north of Mabou Harbour. A Paleozoic-Precambrain unit was also mapped on the western side of the Mabou Highlands. These rocks compoaed of rhyolite, andesite, tuff, volcanic breccia, red shale, sandstone, conglomerate and diabase were considered by Kelley (1967b) and Kelley and MacKasey (1965) to be basal Mississippian, Fisset Brook Formation.

The Fisset Brook Formation is in turn overlain conformably by the Lower Carboniferous Horton Group. Norman (1935) indicated a total thickness of approximately 1800 m (6000 ft.) of sandstone, ahale and conglomerate. Detailed examinations of the Horton Group stratigraphy have been made by Murray (1960) and by Kelley (1967b). Kelley (1967b) revised and extended the stratigraphic nomenclature of Murray (1960). The continental clastic Horton Group is succeeded conformably to unconformably by the mixed marine and continental Windsor Group, which comprises red shale, gypsum, anhydrite, halite and fossiliferous limestone. The stratigraphy of the Windsor Group has been studied in the area by Norman (1935) and Stacey (1953). Due to structural complications, the details of the stratigraphy of the whole section were not determinable, although sections on Port Hood Island gave relatively complete exposure of the Upper Windsor and part of the B Subzone (Fig. 6-4) and exposures in the Mabou Mines section repreaent the lower part of the A Subzone and the Horton-Windsor contact.

Norman (1935) considered the thick gypsum-anhydrite bed at Mabou Mines to be equivalent, in part, to the gypsum unit in the lowest part of the Port Hood Island section. Boehner and Giles (1982) indicated that the majority, if not sll, of the severely deformed gypsum section is part of the Addington Formation (B Subzone) based on the presence of thin fossiliferous limestone units (Fig. 6-4). In the area of Mabou Harbour North, Norman (1935) reported a section similar to the Mabou Mines Section (Bridgeville Formation).

The section encountered near the bottom of Port Hood No. 1 (Fig. 6-15) appears to be the basal Windsor Group, lower sulphate and basal limestone overlying the Horton Group (Mabou Mines section).

The stratigraphic position of the major salt in the Mabou area is inferred to be located above the thick lower massive gypsum-anhydrite and basal laminated limestone units of the A Subzone. The salt in the Mabou drilling appears (although the data available are inconclusive) to be overlain by an intercalated gypsum, limestone, siltstone ssction interpreted to be equivalent to the B Subzone (Addington Formation). This section which is dominated by evaporites is in turn overlain by the intercalated red shale and limestone units of the Upper Windsor (Hood Island Formation). In the Port Hood No. 1 borehole salt was reported to occur as veins impregnating brecciated shale and limestone sections (Fig. 6-15). The extent and details of this breccia zone are not discernible in the uncored intervals, but the mixing of shale, limestone and salt in cuttings sampled indicates it probably occupies an extensive halo surrounding a deformed salt mass. It is probable that isoclinal folding of the section has accompanied salt impregnation, fragmentation and dislocation of relatively competent blocks. In the Mabou No. 1 borehole (Fig. 6-16), the salt is not abundant, and the section is thinner and incomplete because of faulting.

Lion Oil, Mac No. 1 (MacNeil, 1944a, b, and c) was drilled closest to the Windsor Group outcrop area near the core of the Southwest Mabou structure (Figs. 6-14, 6-15, and 6-16). The first indications of the salt zone were encountered at 425 m (1395 ft.). Ths hole was stopped in aalt at 1700.5 m (5579 ft.). Lion Oil, Mary No. 1 (1944) was drilled approximately 975 m north-northwest of Mac No. 1. The salt zone was first encountered at 1366 m (4480 ft.). A massive gypsum bed was intersected at 2065.5 m (6780 ft.) and the hole was stopped in gypsum at 2093.7 m (6869 ft.). In 1960 Imperial Oil, Port Hood No. 1, was drilled near Rocky Ridge, approximately 1.8 km west-northwest of Mac No. 1. Salt was encountered at a still greater depth in this hole and was first reported as a vein halo in fractured rocks at a depth of approximately 1859.3 to 2255.5 m (6100 to 7400 ft.). Salt was intersected to 2944.4 m (9660 ft.). Sections of anhydrite and then laminated limestone were intersected to 2982 m (9783 ft.) where the Horton Group was intersected. The hole was abandoned in Horton at 2999.2 m (9840 ft.). Imperial Oil Mabou No. 1 was drilled near Southwest Ridge in 1959 (Cote and Hill, 1960), approximately 5 km east of Lion Oil, Mac No. 1. This hole is believed to have penetrated Mabou Formation to approximately 195 m (640 ft.) where Windsor Group rock types were first reported. The first indications of salt were reported at 688.8 m (2260 ft.). The salt was described in the cored intervals as orange halite in brecciated grey shale. The base of the Windsor Group with a thin anhydrite overlying a laminated limestone was indicated at 745.2 m (2445 ft.) where the Horton Group was intersected. The hole was abandoned in Horton Group strata at 1568.2 m (5145 ft.). Since the salt in this hole occurs only as veins in brecciated shales it is inferred to have been tectonically squeezed out.

The Windsor Group in the area is overlain with apparent conformity by a section of strata called the Mabou Formation by Norman (1935). The Mabou Formation (part of the Canso Group) comprises approximately 915 m (3000 ft.) of red sandstone and shale interbedded with grey sandstone and shale, and minor thin limestone beds. The lower contact with the uppermost Upper Windsor limestone unit, (the E_1 or Schizodus) is not exposed on Port Hood Island, although Norman (1935) reported that the uppermost Windsor

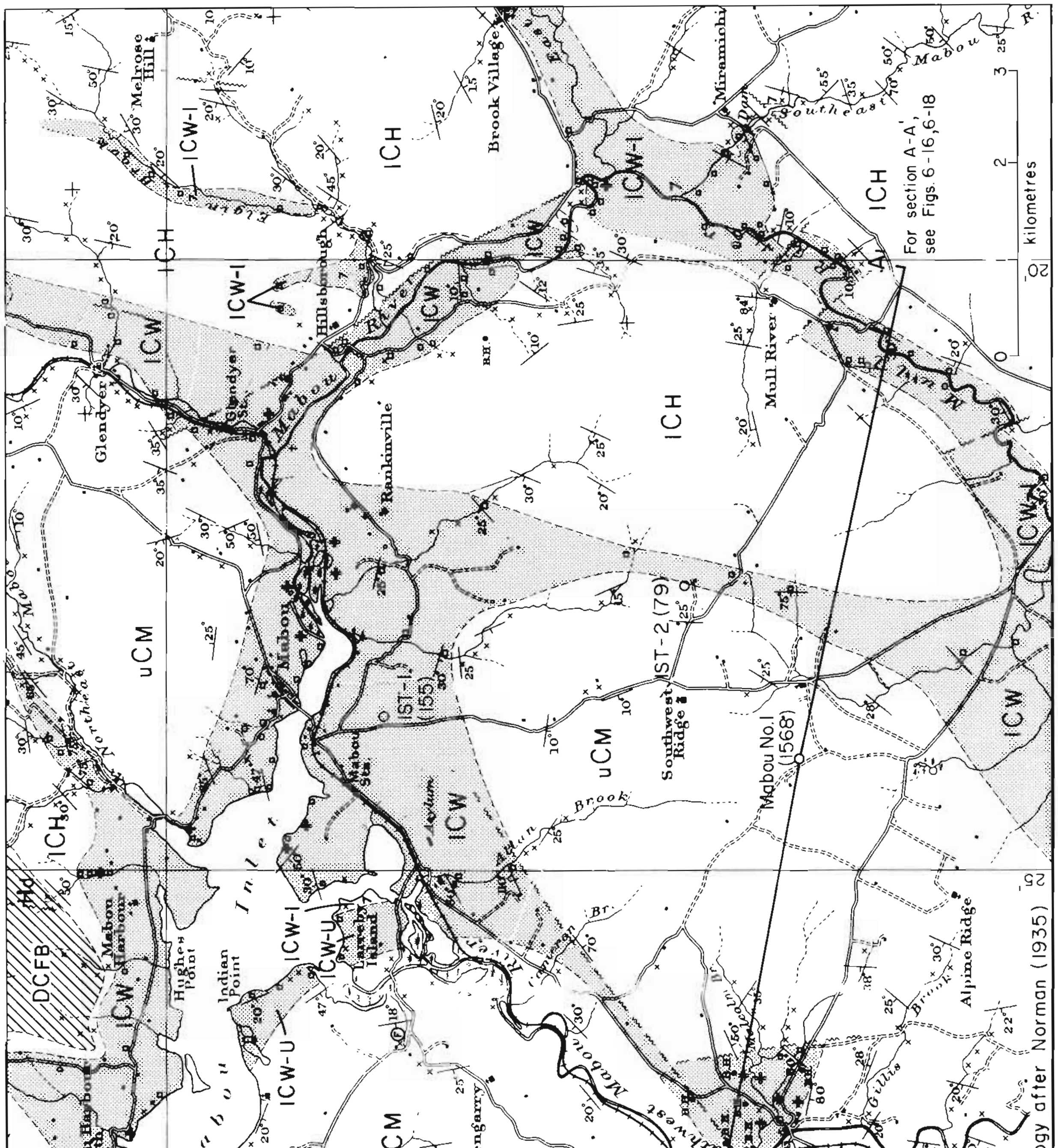

Figure 6-14. Geology in the vicinity of the Mabou deposit, Inverness County.

LEGEND

UPPER CARBONIFEROUS

RIVERSDALE GROUP

UCR-PH — *PORT HOOD FORMATION:* sandstone, shale, and minor coal

CANSO and/or RIVERSDALE GROUP(S)

UCM — *MABOU FORMATION:* sandstone, siltstone and shale

LOWER CARBONIFEROUS

WINDSOR GROUP

ICW-U — Upper: sandstone, shale, gypsum, limestone

ICW-l — Lower: gypsum, sandstone, shale, limestone

ICW — Undivided: sandstone, shale, gypsum, limestone

HORTON GROUP

ICH — Undivided sandstone, conglomerate and shale

DEVONO-CARBONIFEROUS

DCFB — *FISSET BROOK FORMATION:* basalt, rhyolite, tuff, conglomerate and sandstone

HADRYNIAN?

Hd — Sheared diorite?

SYMBOLS

Heavily drift-covered area	
Rock outcrop, area of outcrop	x
Limestone or dolomite outcrop (Faribault-Fletcher maps)	
Gypsum outcrop	#
Geological boundary (defined, approximate, assumed)	
Bedding, tops known (inclined, vertical, overturned, horizontal)	+
Bedding, tops unknown (inclined)	
Schistosity (inclined, vertical, dip unknown)	
Gneissosity (inclined, vertical)	
Plunge of minor fold	
Drag fold (arrow indicates plunge)	
Fault (defined, approximate, assumed)	
Fault (solid circle indicates downthrow side)	
Joint (inclined, vertical)	
Anticline (defined, approximate, arrow indicates direction of plunge)	
Syncline (defined, approximate, arrow indicates direction of plunge)	
Fossil locality	Ⓕ
Spore sample	Ⓢ
Glacial striae (ice flow direction known)	
Gravel deposit	
Quarry	
Diamond-drill hole	DDH •
Borehole	BH •
Sinkhole	SH ○
Salt spring	⊕
Observed karst topography	
Drillhole intersecting salt; number (depth to salt, metres)	● IP-1(520)
Drillhole without salt; number (Total depth, metres)	○ SR6-1(277)
Drillhole location precise to 150 m	*

MINERALS

Anhydrite	ah	Limestone	lst
Gypsum	gyp	Pyrite	py
Lead	Pb	Zinc	Zn
Celestite	Sr		

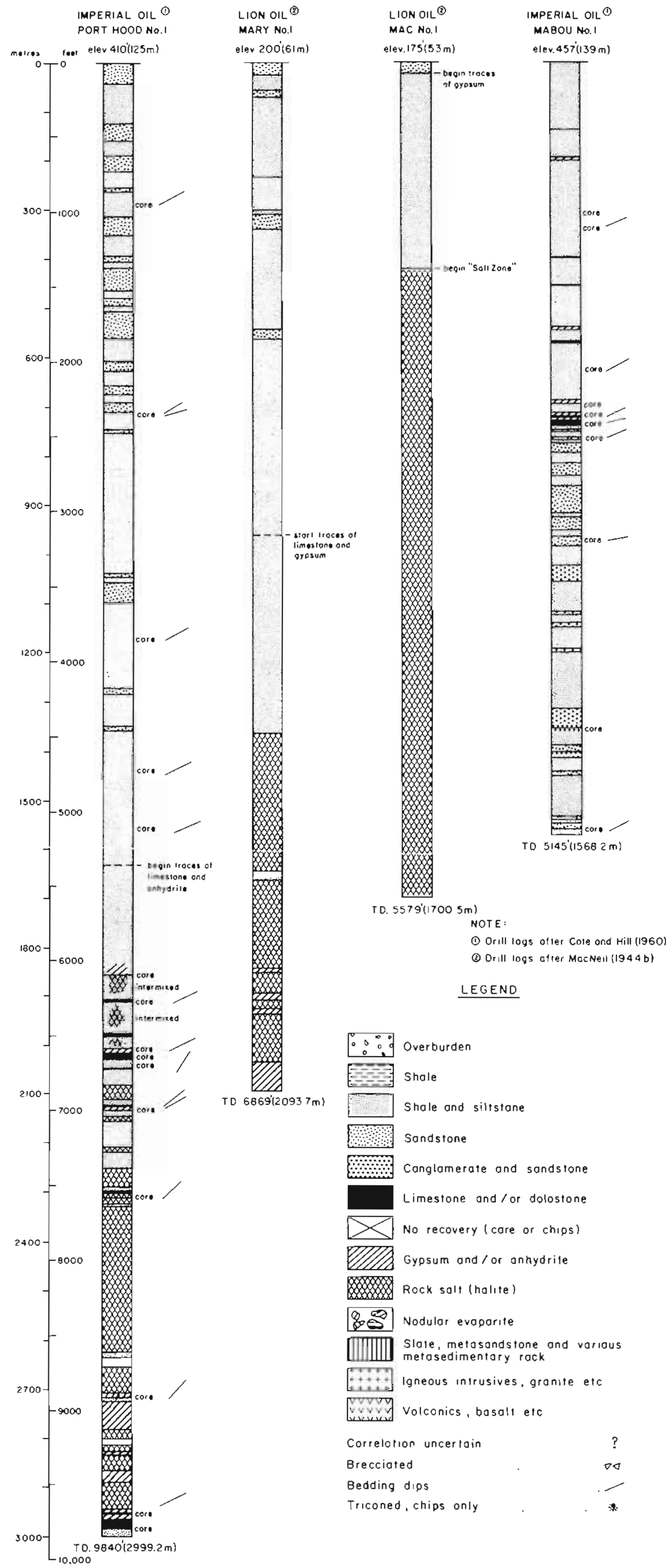

Figure 6-15. Drillhole profiles, Mabou deposit.

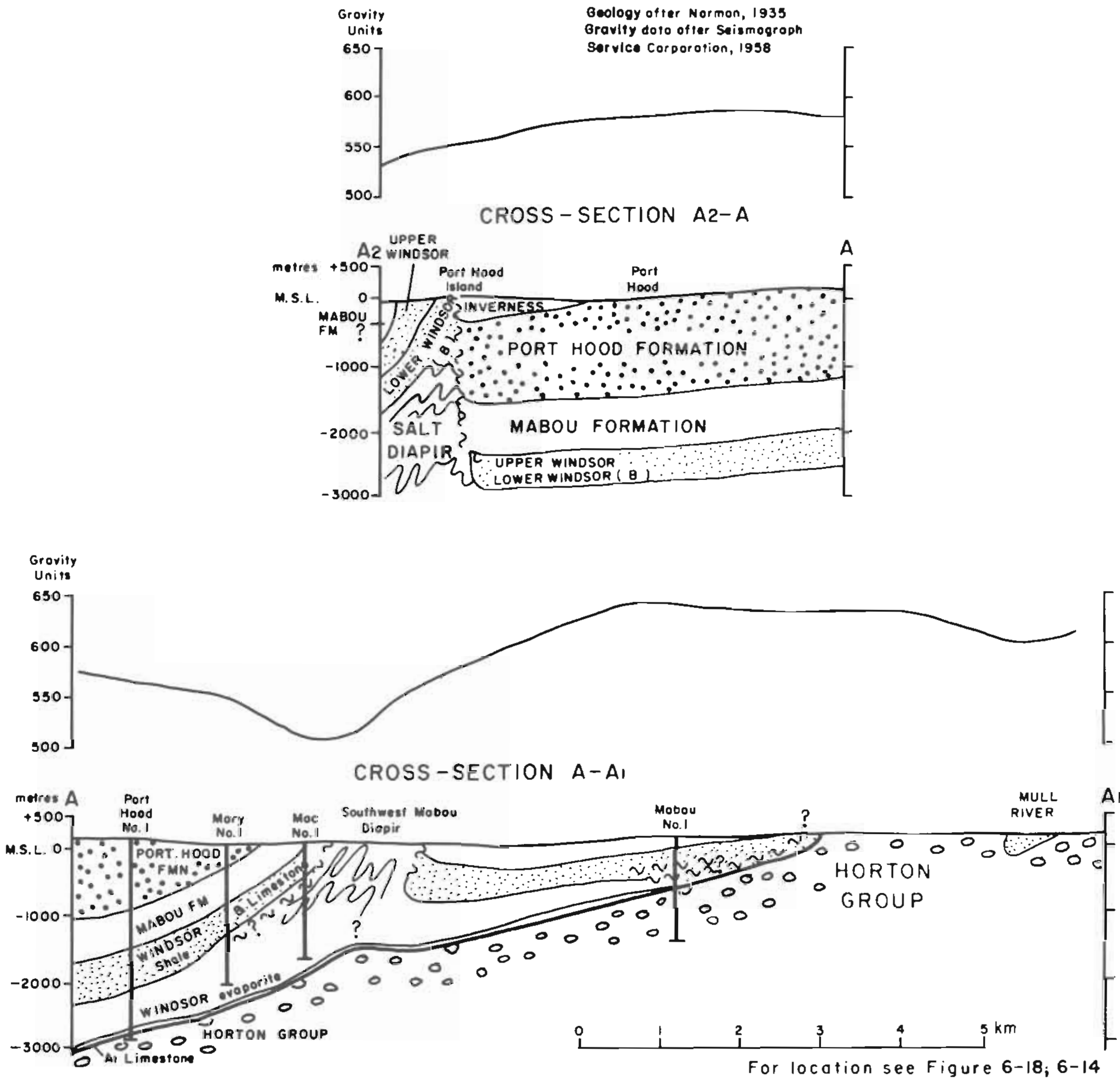

Figure 6-16. Gravity and geological cross-sections, Mabou deposit, Inverness County.

Group beds lacking on Port Hood Island are exposed at Ragged Point south of Port Hood. Here Norman (1935) reported 107 m (350 ft.) of "Windsor Group" red shale with three thin gypsum beds at the contact zone between the E_1 limestone and the base of the Mabou Formation. He further indicated that the contact between the Windsor Group and younger strata ranges from conformable to unconformable. The disconformable relationship, according to Norman (1935), indicates gentle folding and erosion of the Windsor Group prior to the deposition of the Mabou Formation. The Mabou Formation has been preserved in the following three synclinal outcrop areas: in the western part of the map area between Southwest Mabou and West Mabou Harbour; in the eastern part between Alpine Ridge and Southwest Ridge; and north of Mabou Harbour near Glendyer. The Mabou-Port Hood Formation contact is transitional. The Port Hood Formation comprises approximately 1220 m (4000 ft.) of grey arkosic sandstone alternating with red shale, interbedded sandstone, and shale with some coal seams. The Port Hood Formation occurs in a major synclinal structure west of Port Hood No. 1 (Fig. 6-14) and is overlain by the Inverness Formation (Riversdale Group) which consists of approximately 700 m (2300 ft.) of grey sandstone, arkose, conglomerate, and grey shale with intercalated coal seams. The Inverness and Broad Cove Formations apparently overlap older strata and occur, for the most part, in a series of fault blocks along the western coast of Cape Breton.

The Carboniferous rocks in the Mabou area occur in a series of synclines and anticlines defined by Upper Carboniferous strata, including the Mabou, Inverness and Port Hood Formations. The Lower Carboniferous Horton Group occurs peripheral to the pre-Carboniferous basement rocks in the Mabou Highlands to the north and the Creignish Hills to the southeast. The Horton Group is present in a major anticline to the west and is inferred to underlie the remainder of the Carboniferous depositional area. The major fold structures trend generally northeast-southwest and plunge gently to the southwest. The entire sequence is crossed by a series of faults with major and minor displacement. Although Norman (1935) indicated that in most instances the faults were not well defined, he mapped an easterly dipping reverse fault on the eastern side of the Inverness coalfield. He estimated the displacement of this fault to exceed 914 m (3000 ft.).

A major northeasterly trending fault zone through Southwest Mabou coincides with the outcrop belt of Windsor Group. The Windsor Group is indicated to be overturned and dipping 70° south on Allsn Brook approximataly 4 km northeaat of Southwest Mabou. Abundant gypsum outcrops were mapped in the Southwest Mabou area by Norman (1935) indicating Windsor Group is probably present in the area. This structure was described as an anticline by Norman (1935), but drilling and interpretations by Lion Oil Refining Company and Imperial Oil Limited indicate a more complex diapiric structure (Fig. 6-17). This situation is probably similar to those described in the Cumberland area where the atructures were initially believed to have been simple anticlines, with little thickening expected in the evaporites of the Windsor Group. Subsequent drilling, however, has demonstrated extreme thickening, plastic deformation and diapiric intruaion probably ss a result of tectonism.

The structural configuration of the rocks in the Southwest Mabou area has been described and interpreted (Fig. 6-17) by several previous workers including MacNeil and Whitehead (in Stacey, 1953), MacNeil (1945a and b), Bell (1958) and Roliff (1961). MacNeil (1945a and b) and MacNeil and Whitehead (in Stacey, 1953) portrayed the structure as an anticlinal diapir with a moderate angle reverse or thrust fault to the southeast. They believed the soft, plastic, incompetent Windsor Group rocks were aqueezed between two relatively competent sandstone sections, the Horton Group below and the Canso-Riversdale above. The Horton was believed to have been folded into a relatively simple anticline. In contrast, the mobile Windsor Group behaved as an incompetent, partially intrusive mass. The siltstone, shale, limestone, and gypsum of the Upper Windsor, overlying the massive salt, were highly fractured brecciated and impregnated by veins of halite. This feature is apparent from the borehole lithologic chip logs and core logs and is similar to that encountered in the Cumberland area structures. This brecciation is probably most severe adjacent to the active core of the diapir such as in Mary No. 1, Mac No. 1, and to a lesser degree, Port Hood No. 1. Flowage to the evaporite core probably occurred away from the adjacent synclines and generally towards the axial area. It is suspected that the Windsor Group section in Mabou No. 1 represents a severely brecciated and attenuated section from which the salt has moved by shearing and flowage into the Southwest Mabou area to the west. This feature may also have been developed east of the structure, but has been subsequently removed by erosion. The Port Hood Island structure (Fig. 6-16) is interpreted to be a salt-cored, faulted anticline although drill data are not available to support the inferred presence of the salt core.

GEOPHYSICS

One of the earliest seismograph surveys in Atlantic Canada was undertaken in the Southwest Mabou area by Heiland Exploration Company of Shrevsport, Louisiana (1942) for Cape Breton Petroleum Company. Thia survey covered several lines between Southwest Mabou and Mabou Harbour. In 1944 a gravity survey was undertaken by Robert H. Ray, Inc. (1944) for Lion Oil Refining Company. This survey, with stations at approximately 0.5 mile intervals, covered a large portion of western Cape Breton Island between Judique and Margaree.

The Inverness and Mabou areas were covered by a gravity meter survey using one quarter mile spacing by Seismograph Service Corporation (1958) for Imperial Oil Limited. This survey is presented as a simplified Bouguer gravity contour map in Figure 6-18.

In 1959 The Nova Scotia Research Foundation (1959b) surveyed several reflection seismic profiles in the Mabou area near Mabou Station and Southwest Ridge.

GEOCHEMISTRY

The occurrence of brine springs on Glendyer Brook is reported by Norman (1935). Cole (1930a) analyzed a brine sample (Table 6-3) collected by Norman who described its locstion as follows:

> The spring sampled flows out of a brown limestone 30 feet thick, where it crosses Glendyer Brook 3000 feet upstream from Glendyer Station, Inverness County, a station on The Inverness Railroad, and about 1000 feet downstream from old Glendyer Mills. The limestone belongs to the Upper Windsor series. The beds are massive though cut by joint-planes, while certain irregular layers are porous.

The chemistry of the Glendyer spring is typical of many NaCl springs with low $CaSO_4$ content which is associated with the dissolution of Windsor Group evaporites.

Salt in the Mabou deposit has only been analyzed in one section from Imperial Port Hood No. 1. A total of 26 samples from the interval 2100 m to 3249 m (6890-10660 ft.) were analyzed by Smith (1960) and the results are presented in Table 6-4. The bromine and potassium contents of this salt are low indicating brine concentrations were probably too low to reach saturation in potash.

In 1966 the bromine geochemistry of salt deposits in Nova Scotia was studied by Baar

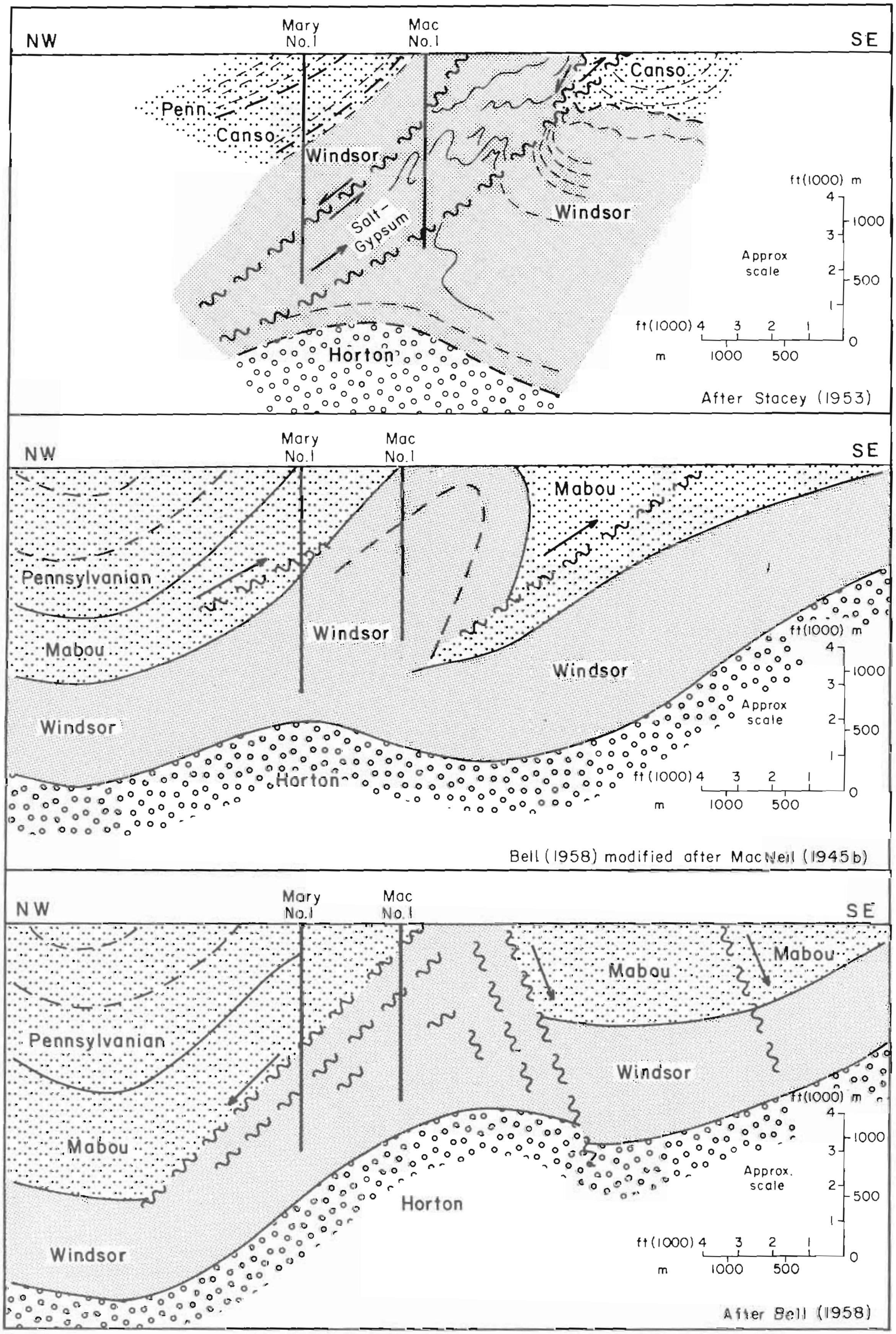

Figure 6-17. Schematic cross-sections of the Mabou deposit.

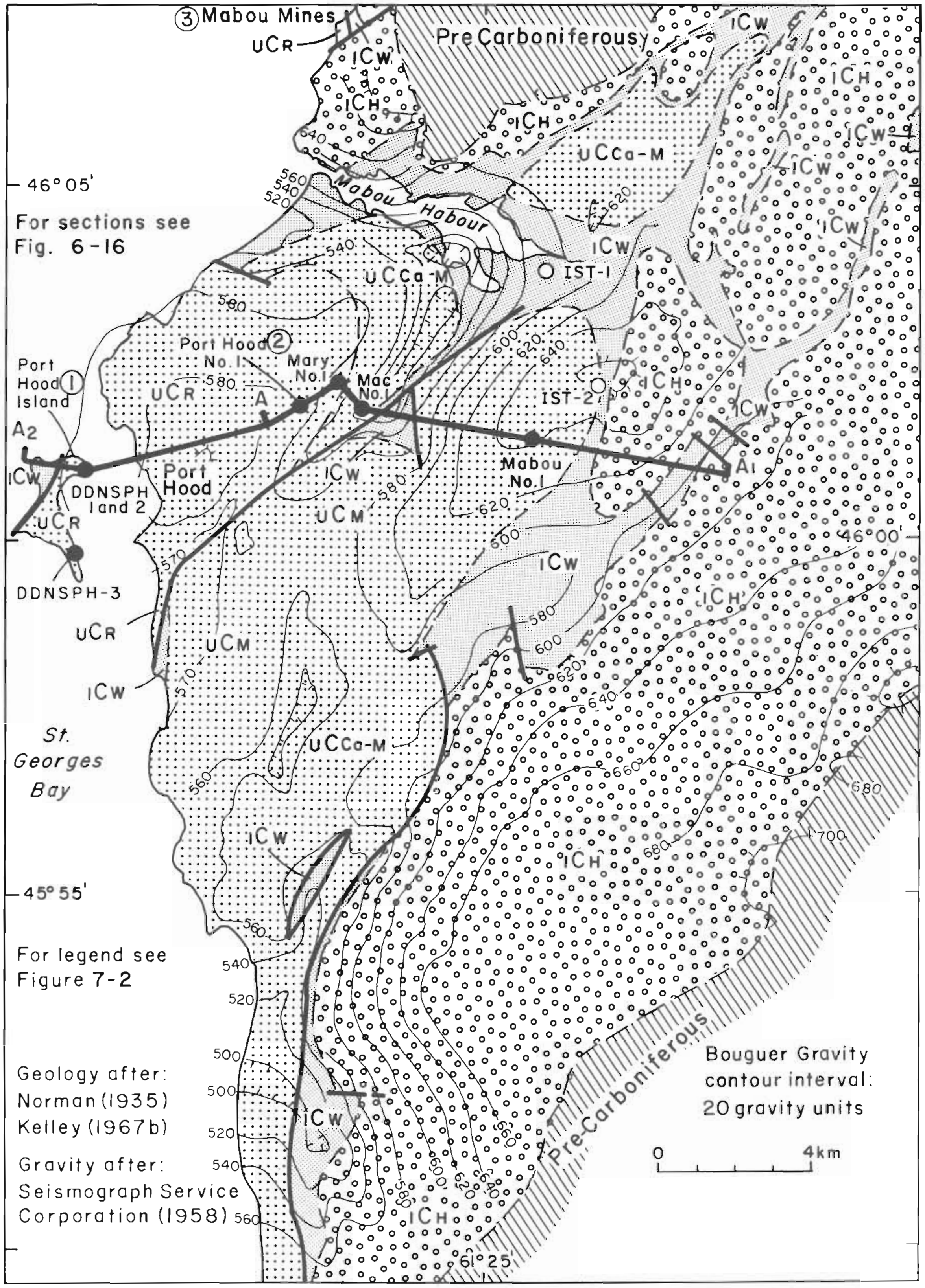

Figure 6-18. Bouguer gravity and general geology, Mabou area, Inverness County.

(1966) as part of the 1966 Potash Project. Baar analyzed core samples from Imperial Oil Port Hood No. 1 and cutting samples from Port Hood No. 1 and Lion Oil Mary No. 1. These results are presented in Table 6-5. The bromine and potassium analyses indicate low brine concentrations.

Table 6-3. Analyses of Glendyer spring, Mabou deposit, Inverness County*

Sample No.	**38**
FIELD NOTES AT TIME OF SAMPLING	
Temperature of atmosphere, °F	n.d.
Temperature of brine, °F	n.d.
Baume degrees	n.d.
Equivalent specific gravity	-
LABORATORY NOTES	
Specific gravity at 60°F	1.023
Total solids at 110°C	3.25
Reaction	N
ANALYSES OF SOLIDS	
Na ....Per cent	34.77
K ....Per cent	0.06
Ca ....Per cent	2.04
Mg ....Per cent	0.19
SO_4 ....Per cent	4.23
Cl ....Per cent	54.62
Br ....Per cent	none
I ....Per cent	none
Totals	95.91
HYPOTHETICAL COMBINATION	
$CaSO_4$ ....Per cent	5.99
$CaCl_2$ ....Per cent	0.78
$MgSO_4$ ....Per cent	-
$MgCl_2$ ....Per cent	0.65
K_2SO_4 ....Per cent	-
KCl ....Per cent	0.11
Na_2SO_4 ....Per cent	-
NaCl ....Per cent	88.38
Totals	95.01

*Cole (1930a)

ECONOMIC CONSIDERATIONS

Potash has not been reported in the Mabou salt deposit. The salt occurs at depths ranging from 425 to 2900 m with maximum thickness exceeding 1500 m. Details about the quality of the various salt horizons are unknown. The salt may occur in a structurally complex situation analogous to some of the salt intrusions in the Cumberland area. A substantial Bouguer gravity anomaly is coincident with the deposit area. Salt springs indicative of subsurface dissolution of salt are not common in the area. The deposit is situated close to railway and highway transportation, but is located approximately 10 km inland from potential tide water shipping sites. The deposit requires further exploration drilling to determine its quality, distribution and economic importance.

OHIO OCCURRENCE

The Ohio occurrence (NTS 11E/09 and 11E/08) is situated in the western part of the Antigonish Basin near Ohio and is approximately 7 km south of the James River deposit (Figs. 1-10 and 6-19). St. Joseph is located approximately 11 km north and Cross Roads Ohio 3 km south of the Ohio occurrence.

The area is readily accessible through a series of paved and unpaved roads connected with the Trans-Canada Highway 104 and Route 7.

The terrain in the area is typical of the Carboniferous Antigonish Lowlands with gently rolling hills and elevations rarely exceeding 125 m. Immediately west of the area however elevations rise abruptly to 240 m in the Antigonish Highlands.

HISTORICAL BACKGROUND

The Antigonish Basin was investigated for its potash potential by Pohl as part of a regional survey by Hayes (1931). Many salt springs and seeps were located, but none were found in the area of the Ohio occurrence. Springs were described however, in the Salt Springs area 9 km to the northeast and near Dunmore 8 km east. No further exploration for salt and potash was carried out until 1966 when Kenneco Exploration (Canada) Ltd. drilled several gravity anomalies (Grace, 1966). A gravity low indicative of salt was not defined in the Ohio area. Since the exploration activity in the Ohio area has been focused mainly on base metal mineralization including copper, lead and zinc. These deposits are associated with the basal part of the Windsor Group where it onlaps the pre-Carboniferous basement rocks of the Antigonish Highlands.

Exploration drilling for base metals was undertaken in the Ohio area by Kenneco Exploration (Canada) Ltd. (Grace, 1966) and more recently by Imperial Oil Ltd. (Burton, 1974) and Cuvier Mines Ltd. (Black, 1979). Salt was intersected in drillhole AN-AH-1 drilled in a base metal exploration survey by Cuvier Mines Ltd. near Ohio (Black, 1979).

GEOLOGY

The geology in the vicinity of the Ohio occurrence was described and mapped by Benson (1974), Boehner (1980b) and most recently by Boehner and Giles (1982). The Windsor Group in this area (Fig. 6-19) is indicated to occur in an onlap relationship with pre-Carboniferous basement. This relationship has been established in exploration drillholes by Kenneco Exploration (KEH-2) and Imperial Oil (OH-1 and OH-4) in which fossiliferous basal Windsor Group limestone (Gays River Formation of Giles et al. (1979)) directly overlies pre-Carboniferous felsic volcanic rocks. The stratigraphy of the Windsor Group rocks above this basal limestone is unclear due to the scarcity of outcrop and drillhole information in the area. Remnants of Bridgeville Formation gypsum and anhydrite occur locally. Outcrop patterns are disrupted by the reworked paraconglomerate of the Lakevale Formation and by the Antigonish Thrust Fault.

Table 6-4. Chemical analyses, drill cuttings Port Hood No. 1*.

Depth in feet	Wt. % Soluble	Cl as Wt. % NaCl	Br as Wt. % NaBr	I as Wt. % NaI	K as Wt. % KCl
6890 - 6920	68.2	67.2	Nil	Nil	0.057
7050 - 7060	47.9	46.2	Nil	Nil	0.014
7240 - 7280	59.6	57.1	Nil	Nil	0.011
7420 - 7440	85.7	82.4	Nil	Nil	trace
7450 - 7470	82.1	76.2	Nil	Nil	Nil
7730	68.7	67.4	trace	Nil	0.009
7800 - 7850	66.3	66.4	Nil	Nil	0.014
7850 - 7900	89.1	88.9	Nil	Nil	0.035
6900 - 7950	77.8	75.6	trace	Nil	Nil
7950 - 8000	75.2	73.9	Nil	Nil	0.047
8000 - 8050	84.0	81.5	Nil	Nil	0.047
8050 - 8100	84.4	82.0	Nil	Nil	0.034
8100 - 8150	81.3	77.9	0.028	Nil	0.039
8150 - 8190	71.2	68.1	Nil	Nil	0.019
8210 - 8220	90.1	89.0	Nil	Nil	0.049
8390 - 8400	39.9	38.2	Nil	Nil	0.006
8500 - 8510	61.3	57.7	Nil	Nil	0.030
8550 - 8580	64.7	61.1	Nil	Nil	0.037
8580 - 8610	73.4	72.1	trace	Nil	0.014
8710 - 8760	62.8	57.4	Nil	Nil	0.045
8760 - 8800	73.1	70.2	Nil	Nil	0.052
8800 - 8850	49.4	44.3	Nil	Nil	0.036
9040 - 9050	82.9	79.6	Nil	Nil	0.033
9120 - 9167	56.1	53.2	Nil	Nil	0.011
6280 - 6290	99.9	99.2	Nil	Nil	0.015
6650 - 6660	99.1	99.5	trace	Nil	0.037

*Smith (1960)

Table 6-5. Analyses of drill core samples, Port Hood No. 1 and cutting samples from Port Hood No. 1 and Lion Oil Mary No. 1.*

Depth in feet	% K	% Br	% NaCl	%Br/100%NaCl
6105	0.052	0.0031	99.1	0.0032
6111	0.080	0.0020	96.0	0.0021
6283	0.05	0.0027	100.0	0.0027
6284	0.025	0.0030	100.0	0.0030
6284A	0.025	0.0032	96.6	0.0032
6286	0.025	0.0037	99.6	0.0037
6288	0.035	0.0030	100.0	0.0030
6289	0.033	0.0034	100.0	0.0034
6291	0.047	0.0034	100.0	0.0034
6292	0.028	0.0035	99.6	0.0035
6640	0.031	0.0052	99.6	0.0052
6655	0.043	0.0085	96.5	0.0088
7002	0.043	0.0025	93.0	0.0027

Bromine Contents (wt. % Br/100% NaCl) of cutting samples

Wt. % Br/100% NaCl	Number of Samples Port Hood No. 1(a)	Number of Samples Mary No. 1(b)
0.003 - 0.0039	-	11
0.004 - 0.0049	5	21
0.005 - 0.0059	3	4
0.006 - 0.0069	1	-

(a) Port Hood No. 1 between 7800 and 9420 feet
(b) Mary No. 1 between 5300 and 6800 feet

*Baar (1966)

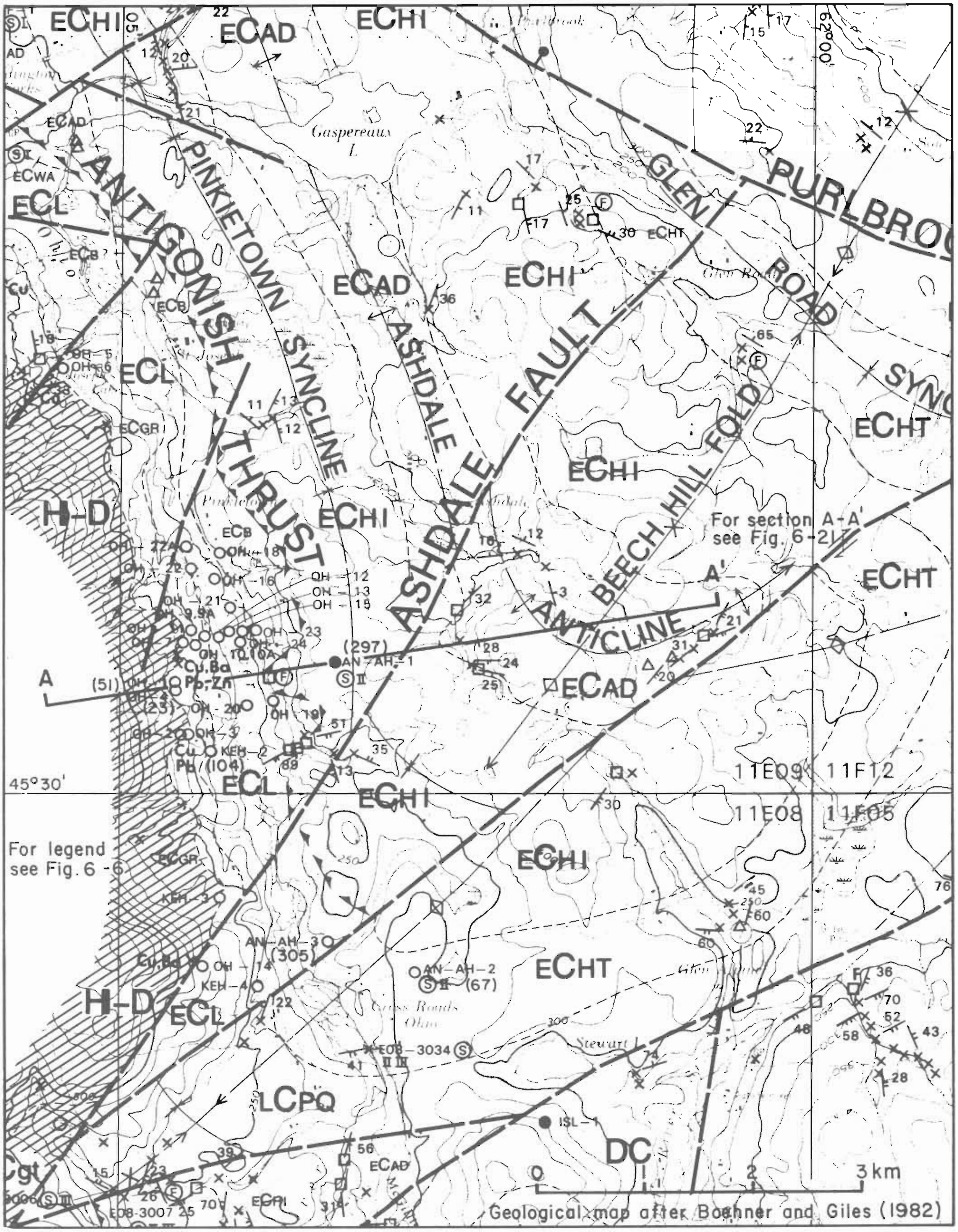

Figure 6-19. Geological map, Ohio occurrence, Antigonish County.

AN-AH-1, was drilled on the eastern side of the Ohio River approximately 1.5 km east of the erosional limit of the Windsor Group (Figs. 6-19, 6-20 and 6-21). Salt was intersected at a depth of 296.9-297.5 m (974-976 ft.). This thin bed is situated beneath 34.7 m (114 ft.) of massive anhydrite. It is not clear whether this bed is isolated in the anhydrite section or whether it is the start of an interbedded zone that might have been intersected if the hole had continued. Halite veins appear at a depth of 289 m (948 ft.), 7.9 m (26 ft.) above the top of the salt bed. The salt bed comprises pale orangeish medium grained halite with scattered grey-green siltstone inclusions. Bedding dips of the rocks in AN-AH-1 are generally moderate to gentle with an average of approximately 30°.

The stratigraphic assignment of the succession is not well defined at present. The following correlations are made on the basis of the work of Boehner (1980b) and Boehner and Giles (1982). The thick limestone near the top of the hole is correlated with the basal Upper Windsor limestone (Herbert River Limestone). The section beneath this major limestone is correlative with the middle part of the Windsor Group (Addington Formation) which is characterized by interbedded gypsum-anhydrite, carbonate and redbeds. The boundary between this succession and the major salt-sulphate section which generally underlies it is not readily apparent. The thin salt bed lies very near the Antigonish Thrust Fault located at this boundary, but the present data are insufficient to indicate exactly which side it lies on. The salt at Ohio is assigned occurrence status until further data on the lateral extent and thickness are available.

GEOPHYSICS

The area in the vicinity of the Ohio occurrence is included on a 2 inch to 1 mile total gravity map prepared for the Nova Scotia Department of Trade and Industry by the Nova Scotia Research Foundation (1955). Drillhole AN-AH-1 (Black, 1979) was drilled on the southern end of an elongate gravity maximum that is centred approximately 1 km northeast of St. Joseph. The major Antigonish Basin gravity low centred in the vicinity of the Pomquet River occurrence extends westward as far as the Glen Road area situated 5 km east of AN-AH-1. The exact relationship between the total gravity anomalies and the distribution of salt is not clear.

The major portion of the Antigonish Basin is probably underlain by thick Windsor Group salt, however in most instances the depth to the Hartshorn Formation salt may exceed 1000 m because of the thick overlying section of Canso Group strata. These rocks underlie most of the central part of the Basin. The thick sedimentary succession in the central part of the basin is probably a major contributor to the gravity low. The presence of stratified salt in the Ohio area, which is intermediate to the central basin total gravity low and the basement rocks of the Antigonish Highlands (gravity high), is probably masked by regional gravity increases produced by the proximity of relatively dense pre-Carboniferous basement in the subsurface at Ohio. The proximity and influence of basement rocks is further indicated by magnetometer surveys in the area.

GEOCHEMISTRY

No analyses are available on the salt in AN-AH-1. The salt is probably quite pure, but this is of little importance in such a thin intersection. Salt springs have not been reported in the immediate area indicating that if salt is present in significant quantities then it is probably well sealed against circulating groundwater.

ECONOMIC CONSIDERATIONS

The Ohio occurrence is a thin (60 cm) bed of halite in anhydrite that is of no economic significance if it is an isolated occurrence. The presence of salt may suggest the presence of a major stratified salt deposit possibly at greater depth. Further drilling would be necessary to determine if additional salt of economic importance is present.

POMQUET RIVER OCCURRENCE

The Pomquet River occurrence (NTS 11F/12) is situated approximately 3 km southwest of Pomquet Forks and 4 km northeast of St. Andrews near the Pomquet River, Antigonish County, Nova Scotia (Figs. 1-10 and 6-22).

The area is easily reached by a series of paved and unpaved roads connected with the Trans-Canada Highway 104 that runs east from Antigonish through Pomquet Forks to Port Hastings on the Strait of Canso. The mainline of the Canadian National Railway crosses the Pomquet River approximately 1.5 km north of Pomquet Forks.

The occurrence is located in the Carboniferous Antigonish Lowlands which typically has gently rolling terrain with elevations generally less than 75 m, but which locally reach up to 125 m in the west and 175 m in the south and east.

HISTORICAL BACKGROUND

Fletcher (1887) indicated salt springs and ponds were found associated with gypsum in several areas. The Pomquet area was investigated by Pohl as part of the "Antigonish Basin" area in a regional potash assessment compiled by Hayes (1931). Two salt springs were located by Pohl in the immediate vicinity of the Pomquet River occurrence. Several other salt springs were also located in the St. Andrews-Dunmore-Pinedale area approximately 6 km southwest of the Pomquet springs (Fig. 6-22). The major salt springs were sampled and analyzed by Cole (1930a).

Windsor Group rocks in the vicinity of the Pomquet River occurrence are as described and mapped by Sage (1954). The Pomquet River area was drilled for petroleum by Lura Corporation Limited in 1958. Two diamond-drill holes, NSDM 2554 (K-1) and NSDM 2555 (K-2), were spudded near

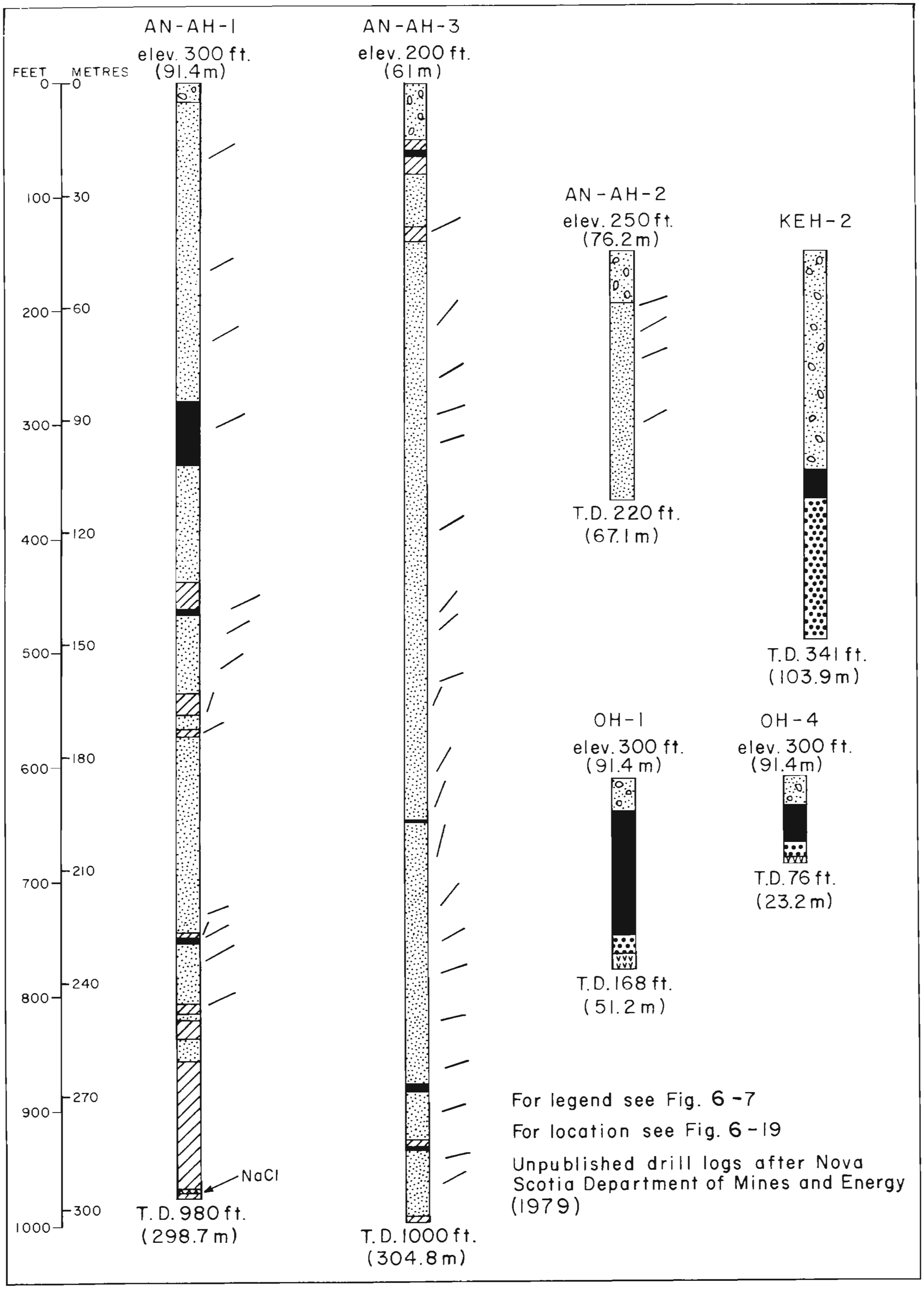

Figure 6-20. Drillhole profiles, Ohio occurrence, Antigonish County.

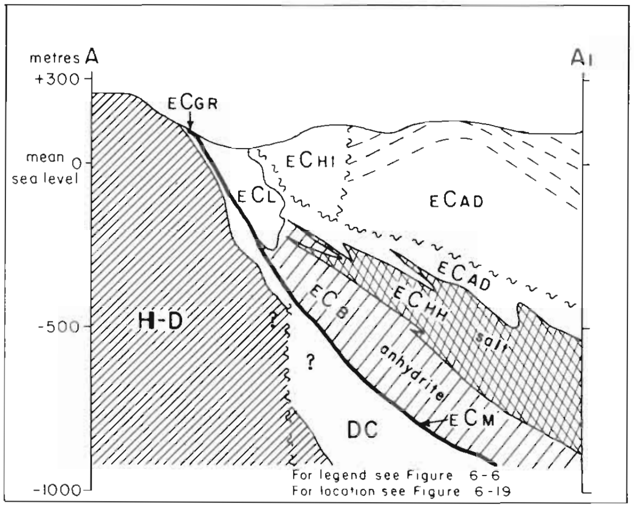

Figure 6-21. Geological cross-section, Ohio occurrence.

a Bouguer gravity low approximately 3 km southwest of Pomquet Forks (MacNeil, 1959). A strong flow of brine was reported to have been encountered near the top of NSDM 2554 and a bed of salt near the bottom. NSDM 2555 was drilled approximately 500 m southeast of NSDM 2554, but was abandoned without encountering salt.

In 1966 Kenneco Explorations (Canada) Ltd. explored the Antigonish area for possible salt-sulphur-potash and base metal deposits (Grace, 1966). KEH-6 was drilled on the southern edge of the Pomquet River Bouguer gravity minimum approximately 2.5 km southeast of NSDM 2554. Small quantities of salt in veins were reported at a depth of 204 m (668 ft.) and the hole was abandoned at 372.5 m (1222 ft.).

GEOLOGY

The geology in the vicinity of the Pomquet River occurrence was mapped and described by Sage (1954) and Benson (1970). MacNeil (1959) compiled a geological map included in an unpublished report on petroleum exploration for Lura Corporation Limited in 1958. The most recent work is included in a report on the Carboniferous geology in the Antigonish Basin by Boehner (1980b) and Boehner and Giles (1982) (Figs. 6-1, 6-5 and 6-22).

Rocks assigned to an undivided Devono-Carboniferous unit, Windsor and Canso Groups are mapped in the immediate vicinity of the occurrence. The Devono-Carboniferous rocks occur in a broad area to the southeast and have a northeastly outcrop trend. In this area the Devono-Carboniferous comprises moderate to steeply dipping beds of greyish red sandstone, siltstone, mudstone and shale.

This package is overlain with apparent conformity or is in fault contact with folded (locally overturned) red siltstone and shale, limestone, gypsum, anhydrite and halite of the Windsor Group. Sage (1954) reported that although one half of the section exposed on the Pomquet River is overturned, it represents one of the most complete with respect to the number of limestone members present (Giles, 1980). The Windsor Group rocks outcropping in the occurrence area have been assigned to the Addington and Hood Island Formations. The major basal evaporite section is not exposed. Isolated fault blocks of Macumber Formation are present on the southern side of the Glenroy Fault. The Windsor Group is conformably overlain by Canso Group strata comprising medium grey and greyish red siltstone, and fine grained sandstone.

The Glenroy and Pomquet Harbour Faults are the major longitudinal high angle faults in the Pomquet River occurrence area (Fig. 6-22). Both have significant dip and strike slip displacement and the Glenroy defines the southern border of the Antigonish Basin. The McLellan Road and Pomquet Station Faults are transverse faults with possible listric geometry. They are inferred to be closely related to the Antigonish Thrust Fault at depth. Although poorly defined in outcrop, the major folds in the Windsor Group have steeply dipping overturned limbs and fold axes that are nearly perpendicular to the major northeasterly trending faults. The Meadow Green Syncline is the exception with its arcuate fold axis and gently dipping limbs. The faults in the area together with the overturned beds suggest rather complex structure. Several salt springs indicate that salt is present in the vicinity.

Petroleum exploration in this area was undertaken by Lura Corporation Limited in 1958 (MacNeil, 1959). Two holes, NSDM 2554 (K-1) and NSDM 2555 (K-2), were drilled near the centre of gravity low (Figs. 6-23 and 6-24). Neither hole encountered petroleum and only one, K-1 intersected salt from 363 to 379 m (1191-1242 ft.). K-1 was abandoned at 401 m. Both holes encountered drilling difficulties and unfortunately were prematurely abandoned.

In 1966 Kenneco Explorations (Canada) Limited drilled KEH-6 (Grace, 1966) near Meadow Green on the southeastern flank of the Pomquet River gravity low (Fig. 6-23). Minor salt as veins was encountered at 204 m and the hole was abandoned at 372.5 m. Boehner (1980b) indicated this drillhole intersected a vertical to overturned section of the E_1 Limestone (Fig. 6-4) and the basal Hastings Formation.

GEOPHYSICS

The Nova Scotia Research Foundation (1959c) prepared a geophysical compilation and interpretation for Lura Corporation from surveys undertaken between 1952 and 1958. This compilation delineated a gravity anomaly (total gravity low) centred between St. Andrews and Pomquet Forks (Fig. 6-24). In an interpretation of a profile across the anomaly a high angle reverse fault was postulated at the Horton-Windsor contact. The two Lura drillholes, K-1 and K-2, were drilled near the centre of the low and indicated that the cause of the anomaly (believed to be low density salt) must be at a depth in excess of 300 m. A thin bed of salt was encountered in drillhole K-1 at a depth of 363 m,

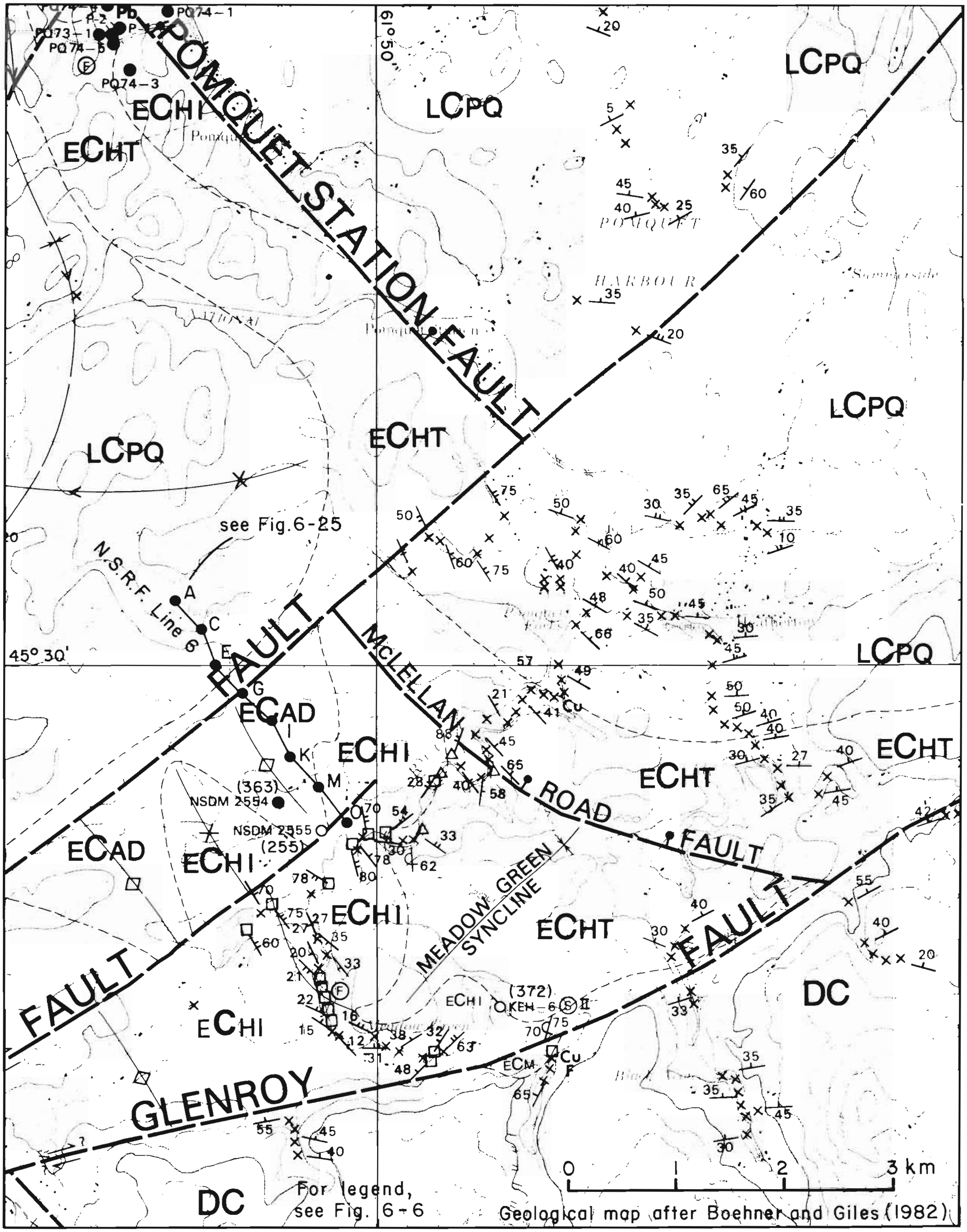

Figure 6-22. Geological map, Pomquet River occurrence, Antigonish County.

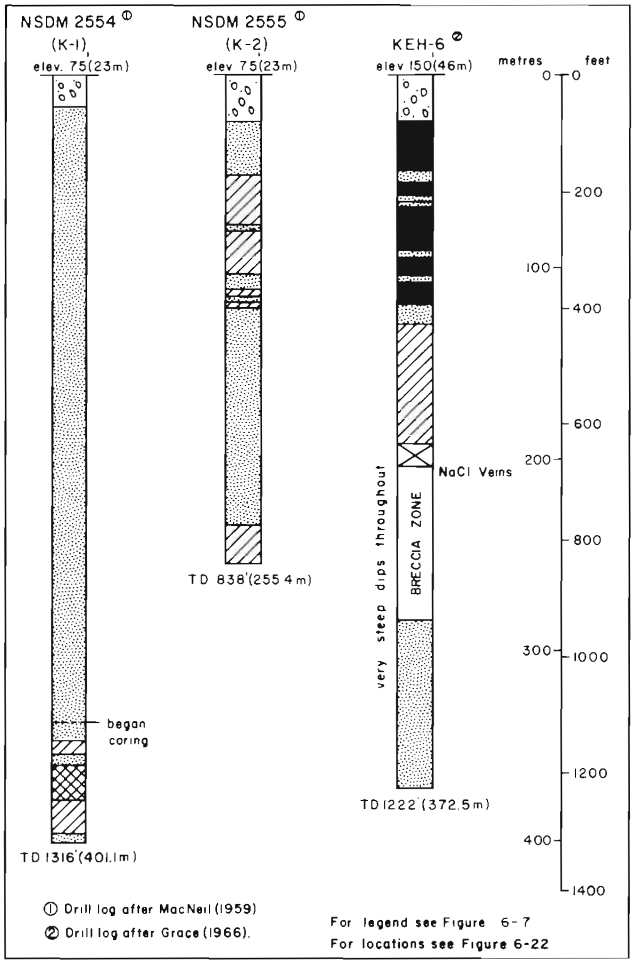

Figure 6-23. Drillhole profiles, Pomquet River occurrence, Antigonish County.

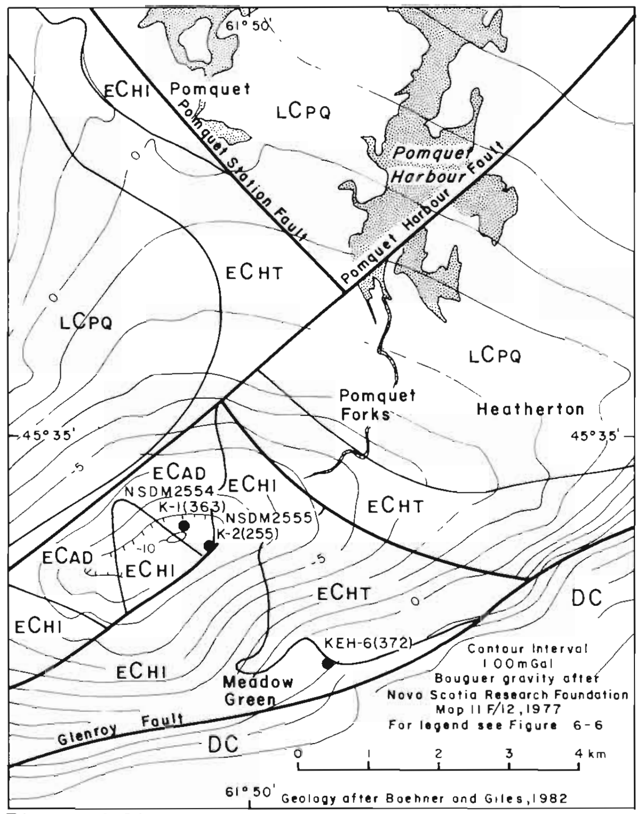

Figure 6-24. Bouguer gravity anomaly and general geological map, Pomquet River occurrence, Antigonish County.

but the major salt mass inferred to have produced the anomaly was not reached.

A reflection seismic survey line profile was made by the Nova Scotia Research Foundation (1959c) for Lura Corporation Limited. The line (line 6) is located approximately 400 m east of NSDM 2554 (K-1), and has a trend of north-northwest (Figs. 6-22 and 6-25). Bedding (reflector) dips are fairly regular in the area northwest of shot point G which is an area inferred to be underlain by relatively undisturbed Canso Group. The area between shot points G and O is more complicated with an antiform structure indicated.

GEOCHEMISTRY

Pohl (in Hayes, 1931) reported the occurrence of two salt springs in the Pomquet River area and two in the Dunmore area. These springs were described, sampled, and analyzed by Cole (1930a), who reported the following:

> Pomquet River Spring (No. 23). This spring is located on the south side of the first crossroad joining the Antigonish-Mulgrave highway west of where this highway crosses the Pomquet River, and 1.2 miles south on the crossroad from the highway. The flow is not appreciable but the seepage keeps the pond full even in the driest weather. The pond is nowhere more than one foot deep, with a length of 50 feet and a breadth of 20 feet. The bottom is soft black muck and if disturbed has a strong hydrogen sulphide smell.
>
> Pomquet River Intervals Spring (No. 24). Another saline spring occurs in the meadow intervals through which Pomquet River flows, about 2 1/2 miles upstream from where the Antigonish-Mulgrave highway crosses the river. The actual spring area covers about 30 feet square and the brine is coming up through gravel together with occasional gas bubbles. The gravel is all iron stained and on a dry day there are salt encrustations on the pebbles. The flow is hard to estimate but is probably not more than 1/4 gallon per minute. A number of depressions in the meadow land resemble gypsum sink-holes and many of the larger ones are filled with water.
>
> Dunmore Spring (No. 25). One mile west of Dunmore, Antigonish County, a post office on the west bank of the South Antigonish River, at a point 5 miles south of its mouth, a number of saline pools occur in the flats on the south side of a small creek.

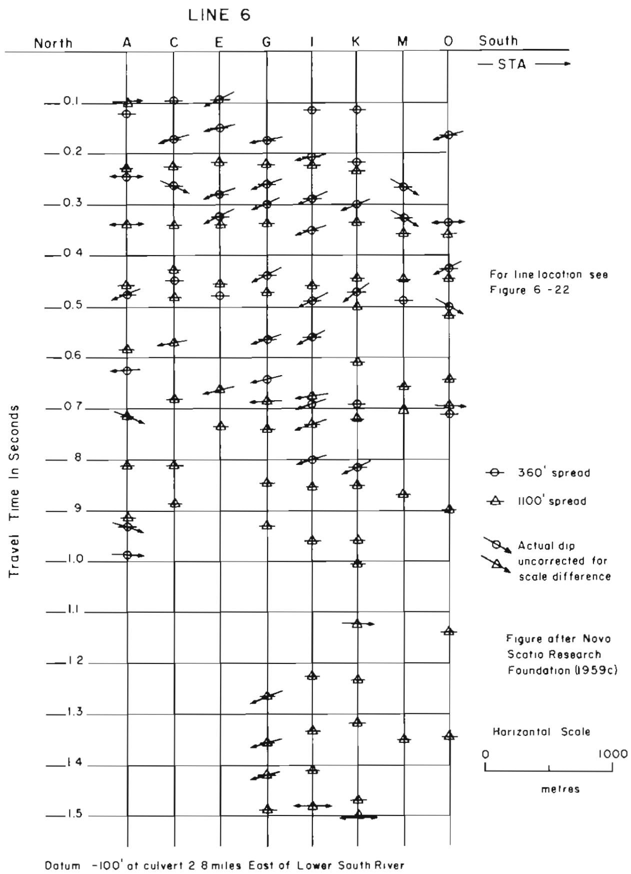

Figure 6-25. Reflection seismic survey, Line 6, Pomquet River occurrence, Antigonish County.

These springs have no appreciable flow and the salinity is low.

In addition Cole (1930a) reported analyses of the brines from the salt springs (Table 6-6). The springs have compositons typical of the many moderate $CaSO_4$ salt springs in Nova Scotia. Spring No. 23 is anomalous in its hypothetical content of $MgSO_4$ and Na_2SO_4. The salt springs in the Pomquet River occurrence area are probably related to faults and fractures connecting Windsor Group salt beds with circulating ground water.

ECONOMIC CONSIDERATIONS

The Windsor Group evaporite sequence in the area of the Pomquet River occurrence contains halite of unknown quality, thickness and distribution. Potash salts have not been reported. Salt was intersected at depths of 363-379 m in a drillhole located near the centre of a major Bouguer gravity low. Salt springs are common in the structurally complex area. This occurrence will require further exploration to determine its economic potential.

SOUTHSIDE HARBOUR DEPOSIT

The Southside Harbour deposit (NTS 11F/12) is located between Southside Antigonish Harbour and Pomquet approximately 10 km northeast of Antigonish, Antigonish County, Nova Scotia (Figs. 1-10 and 6-26).

The area is readily accessible from a series of paved and unpaved roads connected with the Trans-Canada Highway 104 that runs from Antigonish through Lower South River to Port Hawkesbury. Southside Antigonish Harbour is located approximately 7 km north of Lower South River. The mainline of the Canadian National Railway between Stellarton and Port Hawkesbury crosses Antigonish Harbour near South River Station approximately 5.8 km south of the deposit.

The deposit is located in the Antigonish Carboniferous Lowlands which are characterized by gently rolling terrain where elevations are generally less than 75 m though locally reach up to 125 m. In the higher land to the southeast, elevations of 175 m are encountered. In the immediate area of the deposit elevations are generally less than 50 m though locally, for example in areas to the west underlain by granite, elevations of 75 m are present.

HISTORICAL BACKGROUND

Fletcher (1887) described the history of a salt venture which was begun by Deacon of the Nova Scotia Salt Works and Exploration Company in 1866. Exploratory drilling began at Town Point approximately 1.5 km northwest of Southside Harbour on the northern shore of Antigonish Harbour, but salt was not encountered. The venture was more successful at Antigonish, but it too failed when the brine quantity and quality deteriorated and more could not be located.

The Antigonish Basin was assessed for its potash potential by Pohl as part of a regional project under Hayes (1931). Many salt springs were located in the area although none were described in the immediate vicinity of the Southside Harbour deposit.

In early 1951 the Nova Scotia Department of Trade and Industry engaged the firm Donald, Ross and Company of Montreal, to investigate the potential for establishing a soda ash industry in the Province. The project at Southside Harbour involved the Nova Scotia Research Foundation, the Nova Scotia Department of Mines (1952a) and MacNeil as consultant geologist. The Southside Harbour area was the primary target because a high grade limestone deposit was known to be present. Geological and geophysical surveys accompanied by a diamond-drilling exploration program in 1951 and 1952 outlined a salt deposit of indeterminate size near Southside Harbour.

In 1951 the Nova Scotia Department of Mines (1952a) drilled NSDM 1708, approximately 520 m east of the Southside Harbour road. Salt was first encountered at 237 m (779 ft.) and the hole was abandoned at 318.5 m (1045 ft.) (Fig. 6-27).

The Seismograph Service Corporation was employed to do a gravity and magnetic survey of the area in 1952 (Pohly, 1952a). In 1952 two other holes were drilled into a gravity minimum

Table 6-6. Analyses of salt springs, Pomquet River area, Antigonish County*.

Sample No.	23	24	25
FIELD NOTES AT TIME OF SAMPLING			
Temperature of atmosphere, °F	65	65	65
Temperature of brine, °F	64	51	62
Baume degrees	1.5	4.0	1.75
Equivalent specific gravity ..	1.010	1.027	1.012
LABORATORY NOTES			
Specific gravity at 60°F	1.0155	1.0300	1.0055
Total solids at 110°C	1.88	4.07	0.80
Reaction	N	N	N
ANALYSES OF SOLIDS			
Na ....Per cent	31.35	33.35	33.21
K ....Per cent	0.15	0.11	0.17
Ca ....Per cent	3.08	3.44	2.22
Mg ....Per cent	0.57	0.13	0.16
SO_4 ....Per cent	13.64	8.39	4.60
Cl ....Per cent	45.51	51.69	52.35
Br ....Per cent	n.d.	None	n.d.
I ....Per cent	n.d.	None	n.d.
Totals	94.30	97.11	92.71
HYPOTHETICAL COMBINATION			
$CaSO_4$ ....Per cent	10.47	11.70	6.52
$CaCl_2$ ....Per cent	-	-	0.83
$MgSO_4$ ....Per cent	2.82	0.16	-
$MgCl_2$ ....Per cent	-	0.27	0.62
K_2SO_4 ....Per cent	0.34	-	-
KCl ....Per cent	-	0.21	0.32
Na_2SO_4 ....Per cent	5.61	-	-
NaCl ....Per cent	75.03	84.77	84.40
Totals	94.30	97.11	92.69

*Cole (1930a)

located east of NSDM 1708. NSDM 1835 intersected salt at 231.6 m (760 ft.) and was abandoned at 356.6 m (1170 ft.). NSDM 1836 intersected salt at 232.8 m (764 ft.) and was stopped at 436.5 m (1432 ft.) (Fig. 6-27).

Lura Corporation Limited explored the Southside Harbour-Monks Head area for petroleum in 1958 after a small gas flow was encountered in NSDM 1836. A single drillhole, Lura No. 1 (NSDM 2671) (Shaw, 1969), was drilled near Monks Head near the axis of the Monks Head Anticline approximately 3 km northeast of NSDM 1708. Salt was not intersected and there were no petroleum showings.

In 1969 Novasel Limited drilled Novasel 1 (NSDM 4862) (Nova Scotia Department of Mines, 1970) approximately 1.3 km east-southeast of NSDM 1708. Salt was first intersected at 235 m (770 ft.) and the hole was abandoned at 356.6 m (1200 ft.). A small gas flow encountered in NSDM 1836, together with other factors, prompted the Brador Oil Company Limited to drill for petroleum in the Southside Harbour area. In 1976 Brador Anschutz Hole No. 1 was drilled immediately north of NSDM 1708 and 1836 (Farries Engineering Ltd; 1976). Salt was intersected between 250 and 460 m (820 and 1510 ft.).

GEOLOGY

The geology in the vicinity of the Southside Harbour deposit was described and mapped by Sage (1954), Benson (1970), Boehner (1980b) and Boehner and Giles (1982) (Fig. 6-1).

The oldest (Lower Paleozoic) rocks are found in an isolated block to the northwest of Antigonish Harbour. These rocks consist of faulted and folded grey green siltstone and argillite, greywacke, minor tuff, conglomerate and dark green andesite assigned to the Browns Mountain Group (Benson, 1970). A small granite body is indicated to have intruded the Browns Mountain Group.

These rocks are overlain with angular unconformity by rocks assigned to the Lower Carboniferous Horton Group which comprises interstratified conglomerate and sandstone.

The Horton Group is overlain conformably(?) by Windsor Group strata which comprise siltstone, shale, gypsum, anhydrite, halite, and limestone. The stratigraphy of the Windsor Group in the area was studied and described by Sage (1954) who concentrated mainly on the limestone units. The stratigraphic section was described by Sage

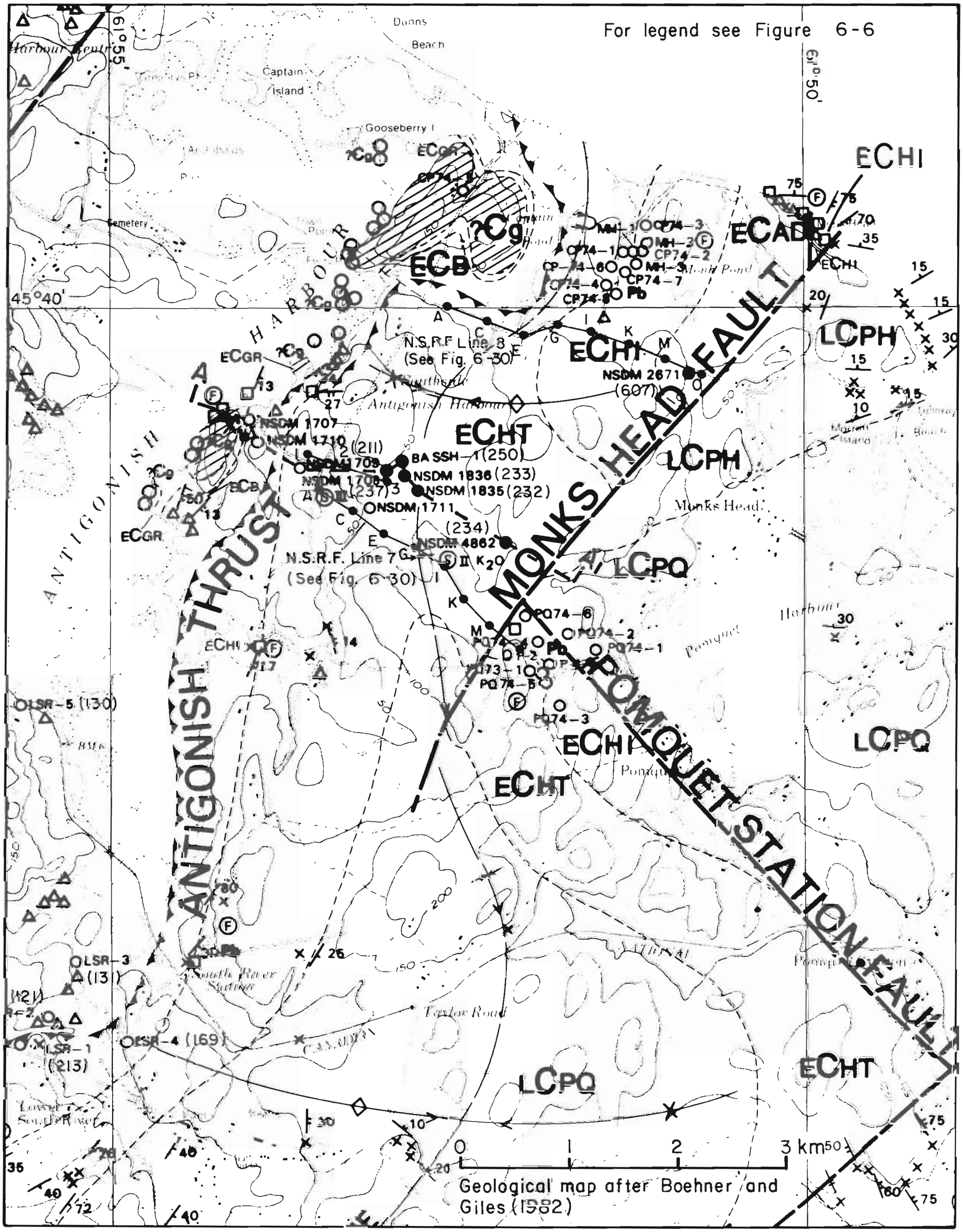

Figure 6-26. Geology in the vicinity of the Southside Harbour deposit, Antigonish County.

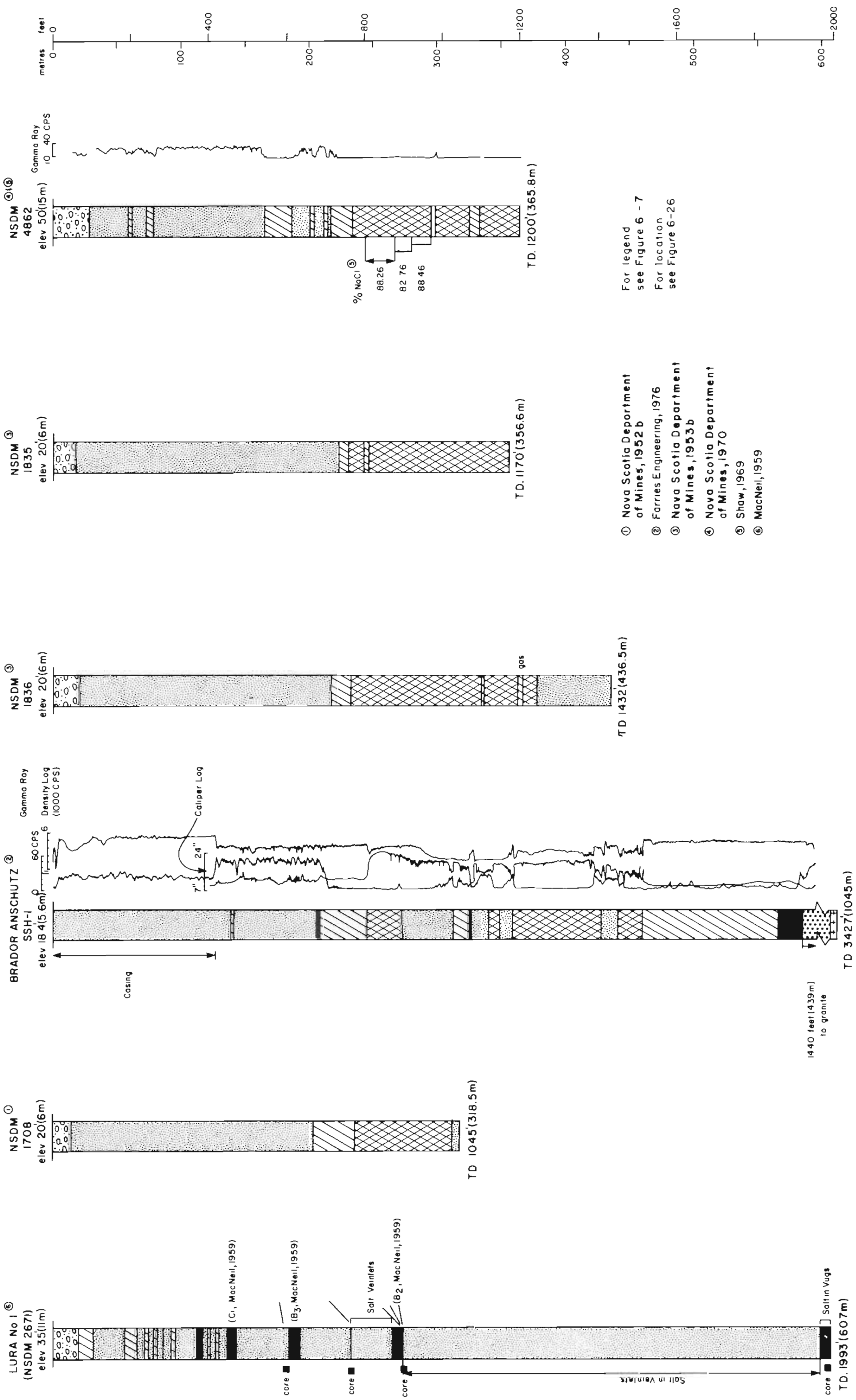

Figure 6-27. Drillhole profiles, Southside Harbour deposit, Antigonish County.

(1954) and has since been revised by Boehner (1980b) and summarized in Figure 6-5.

On the southern and southeastern sides of Antigonish Harbour several prominent hills between Williams Point and Captains Pond are evident. At Williams Point the Windsor Group onlaps onto these rocks and apparently oversteps the Devono-Carboniferous which is known only from deep subsurface data. Murray (1971) described a fossiliferous mound-like limestone encircling the granodiorite knobs and ridges in this area and indicated a basal granite (granodiorite) pebble limestone conglomerate at the top of the granite. This limestone was described as the B_1 limestone by Sage (1954) based on its megafaunal assemblage, however Boehner and Giles (1982) correlated it with the Gays River Formation. A similar development of a mound-like limestone on granite occurs in the Calpo Limestone Company quarry near Southside Antigonish Harbour. Both are surrounded and overlain by gypsum and anhydrite of the Bridgeville Formation. Drilling indicates the Gays River Formation limestone continues down the erosional contact slope with the granite (Fig. 6-7).

The Brador Anschutz South Side Harbour No. 1 well (Farries Engineering, 1976) (Fig. 6-27) located 1.5 km east of the Calpo Limestone quarry, intersected Devono-Carboniferous clastic rocks with a thickness of approximately 440 m. In this well the basal Windsor Group limestone (Macumber Formation) is overlain by approximately 100 m of massive anhydrite (Bridgeville Formation) and then 200 m of halite with interbedded anhydrite and shale (Hartshorn Formation). This section is separated from 250 m of red shale with minor grey shale of the Hastings Formation by the Antigonish Thrust Fault. A cross-section through this hole and the other drilling in the area (Fig. 6-28) is interpreted differently than Sage (1954) and Shaw (1969). This revised interpretation is based on the new deep drillhole data and partly on experience in the Shubenacadie area in central Nova Scotia where fossiliferous A Subzone mound-like or bank carbonate deposits (Gays River Formation) occur in areas where the Windsor Group oversteps the Horton Group (Giles et al., 1979).

In addition to the Antigonish Thrust Fault there are several major faults in the Southside Harbour deposit area. The Monks Head Fault (Fig. 6-26) is a northeasterly trending high angle fault that parallels the Lanark and Morristown Faults (Fig. 6-6). The Antigonish Thrust Fault is the most important with respect to salt and potash exploration. Deformation in the area ranges from broad open folds near Southside Antigonish Harbour to steeply dipping overturned folds near Monks Head.

The Southside Harbour salt deposit was initially outlined by 3 diamond-drill holes, NSDM 1708, 1835 and 1836, drilled by the Nova Scotia Department of Mines (1952b, 1953b) in the early 1950's. In these holes the gently dipping halite is interbedded with red shale and anhydrite (Fig. 6-27). In 1969 Novasel Ltd. drilled Novasel No. 1 in an attempt to extend the salt mass further to the east (Shaw, 1969). Although the halite section was not completely penetrated, a substantial section of halite with some anhydrite and shale interbeds was intersected.

In 1976 Brador Oil Company Limited drilled Brador Anschutz Southside Harbour No. 1 near NSDM 1708 and NSDM 1836 (Farries Engineering, 1976). This hole was the first to be drilled through the Devono-Carboniferous to pre-Carboniferous basement (Fig. 6-28). The entire Windsor Group section present was intersected and the total thickness and stratigraphic position of the halite above the Bridgeville Formation sulphate and basal Windsor carbonate was established. Limestone beds were reported as thin interbeds with the halite, red shale and anhydrite which may indicate that the section above the upper part of the salt may be part of the Addington Formation. Drill core from this part of the section is not available, consequently the details of the stratigraphic assignment of the units are not clear.

Exploration in the area has not been restricted to the Southside Harbour area. In 1958 Lura Corporation Limited drilled Lura No. 1 approximately 2.5 km northeast of the soda ash project drilling (MacNeil, 1959). The hole was not entirely cored, but salt was reported to occur sporadically as thin beds, veins and cement (Fig. 6-27). The hole was prematurely abandoned at 607 m (1993 ft.) due to drilling difficulties without penetrating the main salt section. MacNeil (1959) correlated the carbonate units with the B_2, B_3, and C_1 limestones of Sage (1954). If the structural complexity evident in the Monks Head section, located 1.5 km north and described by Schenk (1969), extends into the area of Lura No. 1, then any assignment in the absence of a complete cored section becomes tenuous.

In 1973 and 1974 Imperial Oil Limited undertook a base metal exploration diamond-drill program in the area of Pomquet southeast of the Southside Harbour deposit and near Captains Pond to the northeast. Seven holes (PQ series) were drilled in the vicinity of Sage's (1954) Saw Mill section (Upper Windsor) near Pomquet (Fig. 6-26). Salt residue was reported in some of the core. This drilling confirms and locates more precisely the Monks Head Fault originally mapped by Sage (1954) and the previously unrecognized Pomquet Station Fault.

Eight holes (CP series) were drilled by Imperial Oil near Captains Pond. Seven were drilled near an E_1 limestone outcrop located approximately midway between Captains Pond and Monk Pond. These drillholes are located near the Monks Head limestone deposit described by Murray (1975). The drilling by Imperial Oil encountered a disturbed and locally overturned section of Upper Windsor rocks. A single hole CP74-5 was drilled farther to the west of Captains Pond on the eastern side of a granite knob. This hole penetrated granite at a depth of 52 m (170 ft.) beneath overburden.

GEOPHYSICS

A gravity survey by the Seismograph Service Corporation (Pohly, 1952a) outlined three residual gravity maxima on the same trend as the Monks Head Fault (Fig. 6-29). Another elongate

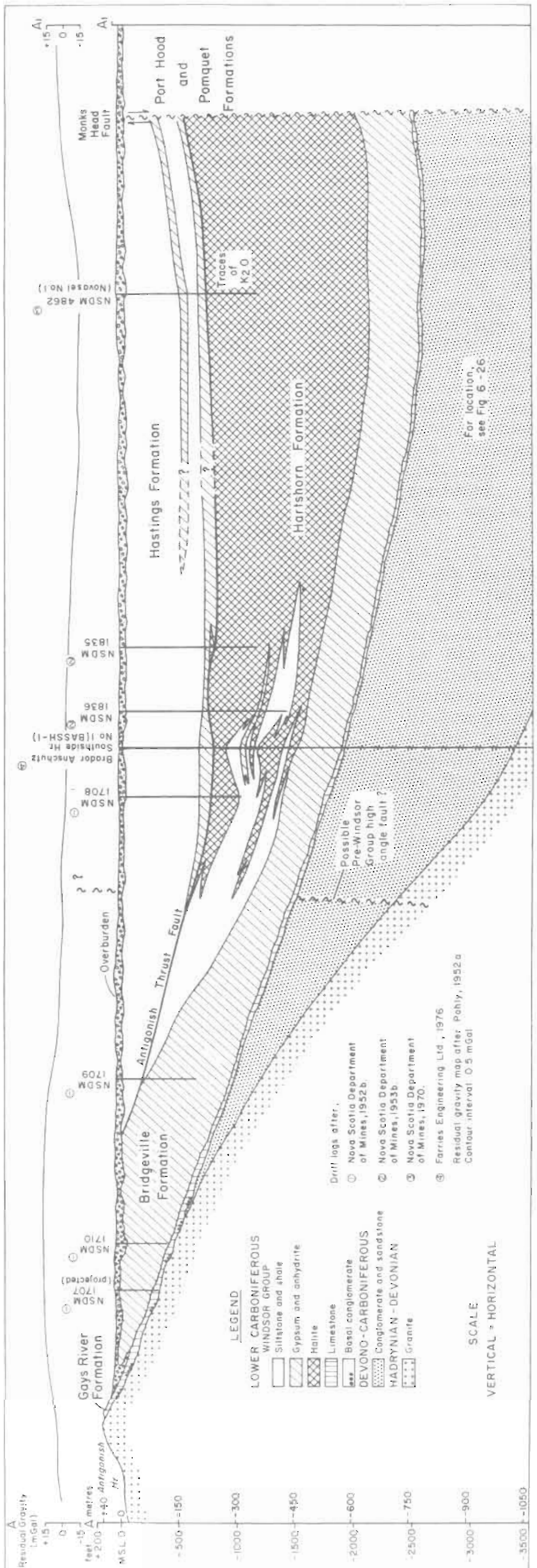

Figure 6-28. Geological and gravity cross-section, Southside Harbour deposit, Antigonish County.

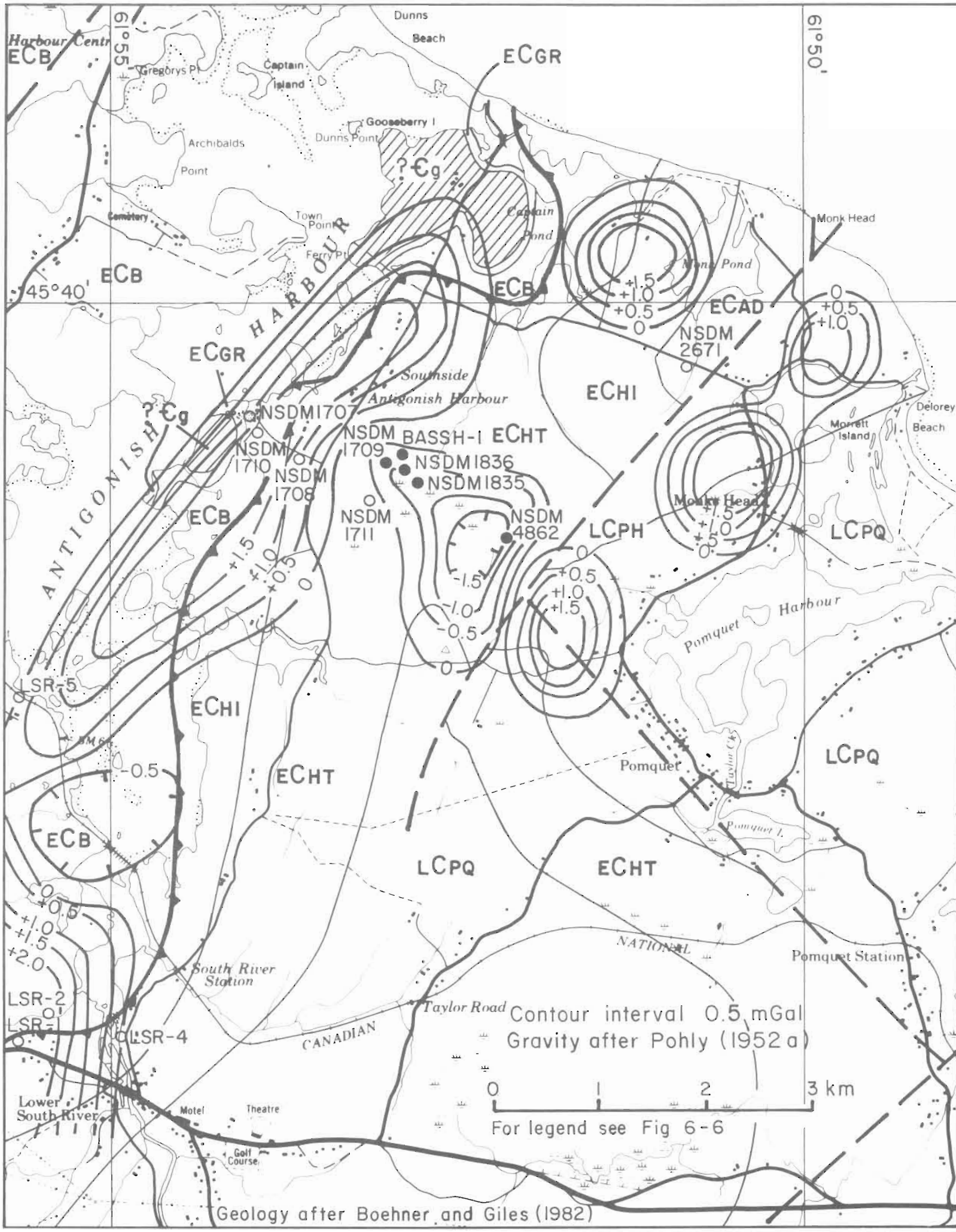

Figure 6-29. Residual gravity anomaly map, Southside Harbour deposit, Antigonish County.

positive anomaly coincides with the relatively dense granite and anhydrite in the Williams Point-Captains Pond trend. Exploration drilling has confirmed that a negative residual gravity anomaly coincides with the salt deposit and occurs between the previously described positive anomalies. In order to more fully evaluate the extension of the salt mass to the northeast and southwest, detailed gravity survey and exploratory drilling are required.

In 1958 the Nova Scotia Research Foundation (1959c) was employed by Lura Corporation for gravity magnetic and reflection seismic surveys and interpretations in the Southside Harbour-Monks Head area. Two gravity profiles were constructed with trends of west-northwest to east-southeast. In one of the gravity-geology sections drawn with some drillhole control, the Monks Head Anticline is indicated to be fault bound on the east and west which agrees with the inferred fault in Figure 6-28.

Two reflection seismic profiles were surveyed by the Nova Scotia Research Foundation (1959c). One line (Line 7) (Fig. 6-26) is oriented approximately northwest-southeast and is situated immediately southwest of the line of the Southside Harbour cross-section (Fig. 6-30). This profile suggests that the strata are nearly horizontal above the salt. The second line (Line 8), trending approximately east-west, is located along the northern road between Southside Antigonish Harbour and Monks Head approximately 1.5 km north of the Southside Harbour cross-section (Fig. 6-30). This profile is more difficult to interpret, but the section is probably folded and somewhat broken in the area.

GEOCHEMISTRY

Two drillhole salt sections from the Southside Harbour deposit have been analyzed for major constituents. Analyses from NSDM 1708 are reported by the Nova Scotia Department of Trade and Industry (Nova Scotia Department of Mines, 1952a) (Table 6-7). The interval 244-282 m (800-925 ft.) has an average analyses of 85.77% NaCl and the interval 297-308 m (975-1009.5 ft.) has an average grade of 81.9% NaCl. Analyses of salt samples from Novasel No. 1 (NSDM 4862) are presented in Table 6-8. In Novasel No. 1 the intervals 242-267 m (795-875 ft.) have an average grade of 88.19%; 267-280 m (875-920 ft.), 82.67%; and 280-296 m (920-970 ft.), 88.5%. Baar (1966) studied the bromine geochemistry of salt in Nova Scotia with particular reference to its potential use as a potash prospecting method. In the Antigonish area the NSDM 1708 drillhole was selected for Br and NaCl analyses. The results of these analyses are presented in Figure 6-31. He concluded that the normal bromine contents

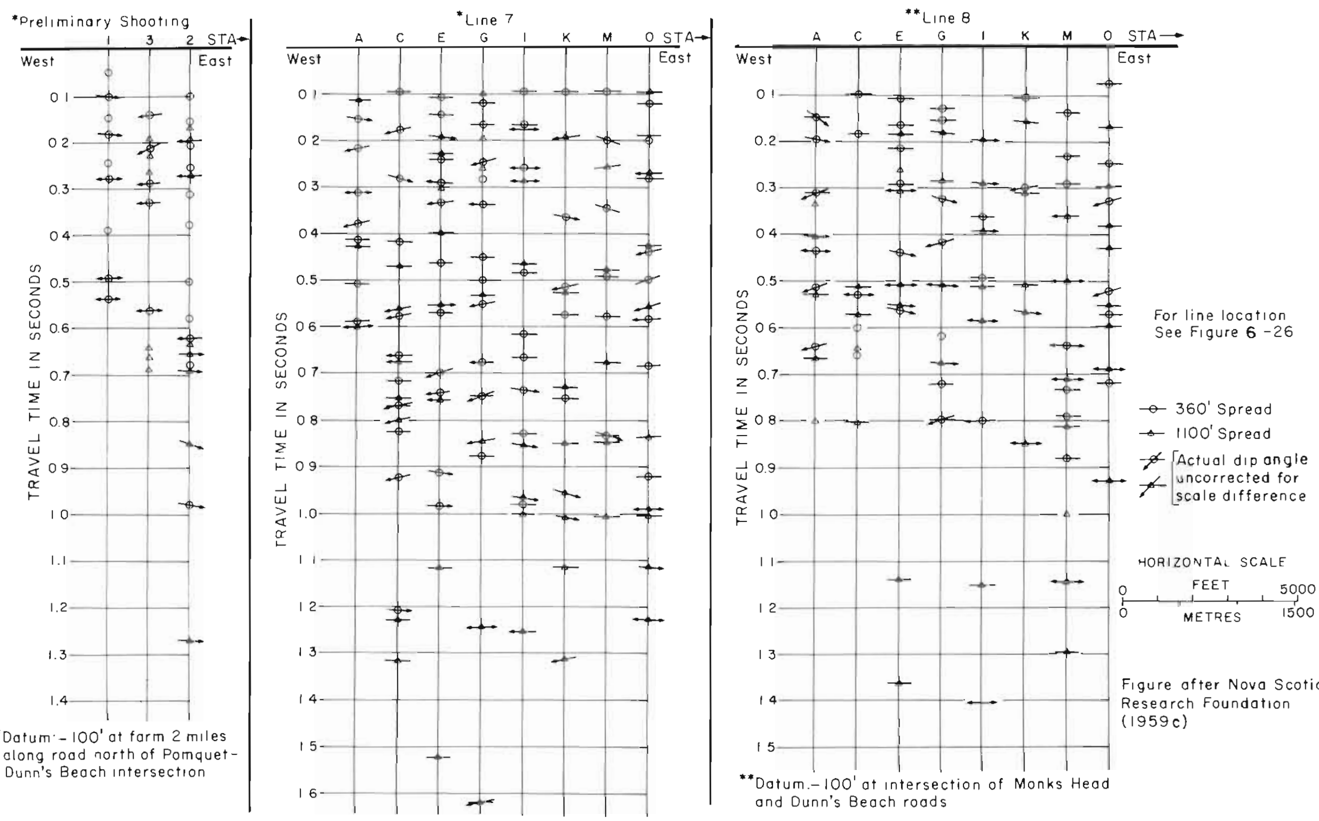

Figure 6-30. Reflection seismic survey, Lines 7 and 8, Southside Harbour deposit, Antigonish County.

indicating low degrees of concentration persisted through the section. Some irregular bromine contents in secondary halite indicated the migration of higher concentrated solutions through parts of the section. He attributed the higher, 0.27% K (as opposed to the normal, less than 0.07%), to this phenomenon. Traces of potash salts were noted in Novasel No. 1 at approximately the same depth as the 0.27% K analysis (Boehner, unpublished drill log, 1979).

ECONOMIC CONSIDERATIONS

The Southside Harbour deposit contains halite and some minor traces of potash. Two of the salt sections have been analyzed and the following intervals and NaCl grades are reported. In NSDM 1708, the interval 291-313 m (800-925 ft.) has an average analyses of 85.77% NaCl and the interval 291-313 m (955.5-1026.5 ft.) has an average analyses of 80.7%. In Novasel No. 1 the complete interval, 242-296 m (795-970 ft.) has an average grade of 86.5%. The top of the salt in the Southside Harbour deposit occurs at depths of between 242 and 296 m (760 and 800 ft.). The salt section thickness is in the order of 213 m (700 ft.). The salt occurs over a width of greater than 1000 m, but its continuation has not been confirmed by exploration drilling. Further exploration drilling and gravity surveys will be required to determine the quantity, quality and economic viability of the deposit.

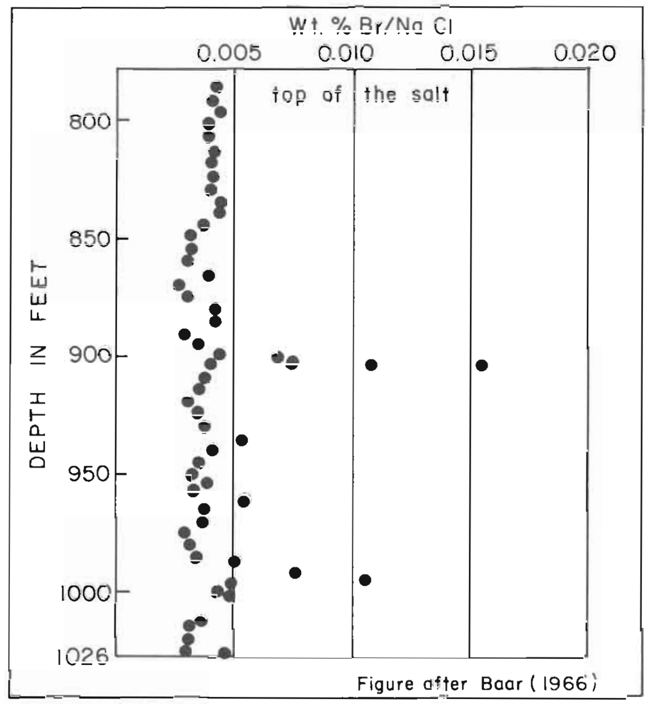

Figure 6-31. Bromine profile, NSDM 1708, Southside Harbour deposit.

Table 6-7. Chemical analyses, NSDM 1708, Southside Harbour, Antigonish County; analyses reported in per cent.*

Interval (feet)	NaCl (from Cl)	$CaSO_4$ (S)	Water Insol.	Moist.	Loss at 275°C	Tot.	R_2O_3	SO_3	CaO	MgO	Cl
785 - 800	78.80	4.17	16.86	0.11	nil	99.94	nil	2.45	1.79	nil	47.80
800 - 825	85.62	3.96	11.84	0.08	nil	101.5	nil	2.30	1.73	nil	51.94
825 - 838	85.14	4.17	10.09	0.17	nil	99.57	trace	2.45	1.57	nil	51.64
838 - 850	87.44	3.58	6.43	0.05	nil	97.50	nil	2.11	1.65	nil	53.04
850 - 871.5	88.05	3.99	6.85	0.04	nil	98.93	nil	2.35	1.76	nil	53.41
871.5- 900	85.54	5.15	8.41	0.09	nil	99.19	nil	2.83	2.21	nil	51.89
900 - 903	88.43	5.43	6.04	0.15	nil	100.05	trace	3.19	2.32	nil	53.64
903 - 909	83.93	3.43	12.73	0.09	nil	100.01	nil	2.02	1.50	nil	50.91
909 - 925	82.81	3.33	13.75	0.12	nil	100.01	trace	1.95	1.46	nil	50.23
925 - 928.5	17.75	3.33	79.36	0.11	nil	100.55	nil	1.96	1.64	nil	10.77
928.5- 949	75.89	3.40	20.93	0.06	nil	100.3	nil	1.99	1.51	nil	46.04
949 - 952.5	70.59	4.85	23.61	0.07	nil	99.1	nil	2.85	2.10	nil	42.83
952.5- 955.5	14.65	3.21	81.99	0.09	nil	99.9	nil	1.88	1.42	nil	8.89
955.5- 975	72.24	5.95	20.95	0.04	0.01	99.2	nil	3.50	2.50	nil	43.82
975 - 987.5	80.35	5.10	14.14	0.09	0.01	99.7	nil	3.00	2.20	nil	48.74
987.5-1005	79.02	2.08	19.27	1.13	0.06	100.6	nil	1.23	1.12	nil	47.93
1005 -1009.5	97.55	2.86	0.20	0.09	0.01	99.6	nil	1.03	0.80	nil	57.83
1009.5-1021	60.95	2.15	33.90	2.40	0.16	99.6	nil	1.56	1.40	nil	36.97
1021 -1026.5	94.78	2.86	1.98	0.12	0.02	99.8	nil	1.68	1.26	nil	57.49
1026.5-1035	30.87	3.70	62.10	3.87	0.62	100.6	nil	1.82	2.10	trace	18.73
1035 -1049	49.25	2.36	43.23	2.44	0.40	98.0	nil	1.38	1.65	trace	29.87

*Analyst Dr. W. T. Foley, St. Francis Xavier University, Antigonish, Nova Scotia (Nova Scotia Department of Mines, 1952a)

Table 6-8. Chemical analyses, Novasel-1 (NSDM 4862), Southside Harbour, Antigonish County; analyses reported in per cent.**

Interval (feet)	NaCl Na(2.54)	NaCl Cl(1.65)	Ca	SO_4	Insoluble Residue	Loss on Ignition	K	Mg	Sr
787 - 790	88.27	89.43			3.28				
790 - 795	84.33	85.17			6.32				
795 - 800	89.41	88.19			3.00				
800 - 805	88.39	89.02	1.08	1.58	3.66	-0.05*	0.01	-0.0004*	-0.05*
805 - 810	88.90	87.91			4.25				
810 - 815	86.87	88.19			4.28				
815 - 820	86.79	89.84			3.41				
320 - 825	86.87	88.74			3.80				
325 - 830	88.39	88.46			3.32				
830 - 835	89.66	90.23			2.28				
835 - 840	87.63	87.63			4.62				
840 - 845	87.63	88.46			3.75				
845 - 850	88.39	89.00			3.73				
850 - 855	87.89	87.85			6.30				
855 - 860	89.50	88.26			6.13				
860 - 865	91.06	92.02	0.88	1.70	3.34	0.10	0.02	-0.0007	-0.0004
865 - 870	89.17	91.46			3.14				
870 - 875	85.59	87.25			5.76				
875 - 880	83.44	84.78			8.18				
880 - 885	83.19	86.03			6.56				
885 - 890	84.71	86.31			6.28				
890 - 895	83.69	84.78			7.65				
895 - 900	79.12	80.31	1.43	2.76	10.89	0.06	0.06	-0.0007	-0.0004
900 - 905	81.15	83.52			9.40				
905 - 910	84.96	84.50			8.24				
910 - 915	81.40	85.06			8.21				
915 - 920	83.19	85.34			7.45				
920 - 925	86.46	89.23			4.89				
925 - 930	90.50	89.51			6.18				
930 - 935	92.33	90.07			4.64				
935 - 940	86.36	89.79	1.01	1.85	4.42	0.10	0.27	-0.0007	-0.0004
940 - 945	87.63	89.23			5.16				
945 - 950	88.90	89.51			4.32				
950 - 955	88.27	89.79			4.85				
955 - 960	88.39	86.44			7.06				
960 - 965	87.38	87.00			11.09				
965 - 970	88.39	89.23			4.18				
970 - 975	75.06	78.08	1.00	1.99	15.96	0.91	0.09	0.007	-0.0004*
975 - 985	72.52	70.83			18.46				
985 - 995	80.77	79.18			13.90				
995 -1005	79.25	80.59			13.61				
1005 -1015	75.69	77.93	1.46	2.58	16.13	0.15	0.02	-0.0007*	-0.0004
1015 -1025	80.27	76.38			14.67				
1025 -1035	50.82	57.82			38.83				
1035 -1045	71.12	73.71			18.69				
1045 -1050	42.80	43.87	0.72	3.65	46.72	0.16	0.02	-0.0007	-0.0004
1050 -1060	77.85	78.21			15.37				
1060 -1070	40.39	40.51			49.11				
1095 -1105	61.09	59.68	0.64	3.61	29.98	0.09	0.02	-0.0007	-0.0004
1105 -1115	80.13	82.27			10.09				
1115 -1125	83.57	84.12	1.60	2.32	9.14	0.13	0.02	-0.0007	-0.0004
1125 -1135	77.22	77.65			14.35				
1135 -1145	76.19	78.49			15.15				
1145 -1155	82.29	82.71			10.62				
1155 -1165	78.23	80.47			12.45				
1165 -1175	77.98	77.37			13.63				
1175 -1185	82.30	83.84			12.90				
1185 -1195	77.98	80.47	1.37	2.37	11.94	0.11	0.03	-0.0007	-0.0004
1195 -1200	75.95	77.09			14.73				

**Analyst K. S. MacLean, Nova Scotia Research Foundation, Dartmouth, Nova Scotia (Shaw, 1969).
*less than