CHAPTER 8 SYDNEY AREA

INTRODUCTION

The Sydney area is located in northeastern Cape Breton County, Cape Breton Island and it coincides approximately with the Sydney sub-basin of Bell (1958). The geology of the Sydney area has been described in maps and reports by Bell and Goranson (1938), Hayes and Bell (1923), and Bell (1958 and 1961a,b). This work forms the basis of the geology of the Carboniferous rocks in the Sydney area. Bell under the direction of L. H. Cole worked as a consultant on the salt-potash exploration program carried out on behalf of Morton Chemical of Canada Limited (Cole, 1961). This exploration in the East Bay area between 1961 and 1962 constitutes the only data on salt in the Sydney area.

GENERAL GEOLOGY

Because of the occurrence of significant coal deposits, the Sydney area has received much attention directed at the geology of the Carboniferous rocks. The Sydney area has a similar basic geological configuration to that described in other Carboniferous depocentres in Nova Scotia. Major structures in the area, as emphasized by the Upper Carboniferous Morien Group, define a series of northeasterly to easterly trending gently plunging folds. To the northeast the rocks are submerged beneath the Atlantic Ocean. To the southwest, older Carboniferous rocks are successively exposed and flank pre-Carboniferous basement blocks forming distinct highlands such as Boisdale Hills, Coxheath Hills and East Bay Hills. These older Carboniferous rocks seem to be represented mainly by Windsor Group with minor outcrop areas of Canso Group (Point Edward Formation), in the area of the Sydney Harbour Syncline and the Bridgeport Anticline. In the area of the Coxheath Hills the major fold structures are complicated by smaller folds including the Dutch Brook Syncline which trends slightly north of east and plunges gently to the east (Fig. 8-1).

Windsor Group rocks form broad outcrop belts in the southwestern part of the area. Contacts with the older pre-Carboniferous basement rocks are locally major faults including the George River Fault on the southeastern border of the Boisdale Hills, and MacKenzie fault on the southeastern border of the Coxheath Hills (Bell, 1958) (Fig. 8-1). Lower Carboniferous Horton Group rocks were not recognized in the area. In the normal position of the Horton Group, Bell and Goranson (1938) recognized a conglomerate sandstone and shale nonmarine facies of the Windsor Group which they named the Grantmire Member. These rocks are situated adjacent to pre-Carboniferous basement areas including the Coxheath Hills and the northern part of the East Bay Hills. In addition Bell and Goranson (1938) mapped the Grantmire along St. Andrews Channel on the northwestern side of the Boisdale Hills. This unit was extended into adjoining map areas by later workers including Kelley (1967b) who mapped it as Horton Group. Much confusion related to the basal Carboniferous clastic rocks has arisen and a summary of these problems was outlined in the Canso-Bras d'Or area. According to Bell and Goranson (1938), the thick conglomerate deposits, where they lie below marine limestone or sandstone of lower Windsor age and form the base of the Group, were mapped as the Grantmire Member. Weeks (1954) subsequently raised the Grantmire to formation status and applied it to all Windsor conglomerate members that form the base of the Group regardless of whether they were Upper or Lower Windsor age. Bell and Goranson (1938) reported a computed thickness of about 1067 m (3500 ft.) of Grantmire Member in the Coxheath area. It is probable that the Grantmire is mainly assignable to the Horton Group. The unit is indicated by Bell (1958) to be succeeded in the Point Edward area by approximately 230 m (750 ft.) of Upper Windsor marine limestone, red conglomerate and shale (Fig. 8-2).

BOULARDERIE DEPOSIT

LOCATION

The Boularderie deposit is located near Kempt Head at the southern end of Boularderie Island (Figs. 8-3, 8-4 and 1-10) Victoria County, Cape Breton Island (NTS 11K/02E). The area is situated approximately 50 km southwest of Sydney.

The area is readily accessible by paved and unpaved roads connected with Trans-Canada Highway 105 and is bordered on the northwest by Great Bras d'Or Lake and on the southwest by St. Andrews Channel which connect with the Cabot Strait.

The terrain on the Island is gently rolling with hills reaching up to 140 m in elevation.

GEOLOGY

The Boularderie deposit was discovered in a stratigraphic test hole (NSDME Kempt Head 84-1) drilled by the Nova Scotia Department of Mines and Energy in 1984 (Figs. 8-3 and 8-4).

The drillhole is located near the apex (on land) of the Boularderie Syncline on the western side of the Sydney Basin. The Syncline which is defined principally by Late Carboniferous Morien Group plunges gently to the northeast, is fault bound to the northwest and is inferred to have normal contact on the southeast beneath St. Andrews Channel. The synclinal structure is also interpreted to be generally present within the Windsor Group beneath the Morien Group. Extremely deep water (exceeding 250 m) is present in an elongate trough (trench) extending through St. Andrews Channel southwest into Great Bras d'Or Lake. This is inferred to be a solution trench related to karstification and solution collapse of Windsor Group evaporites (especially salt) on the southwestern limb of the Boularderie Syncline (Fig. 8-4 cross-section).

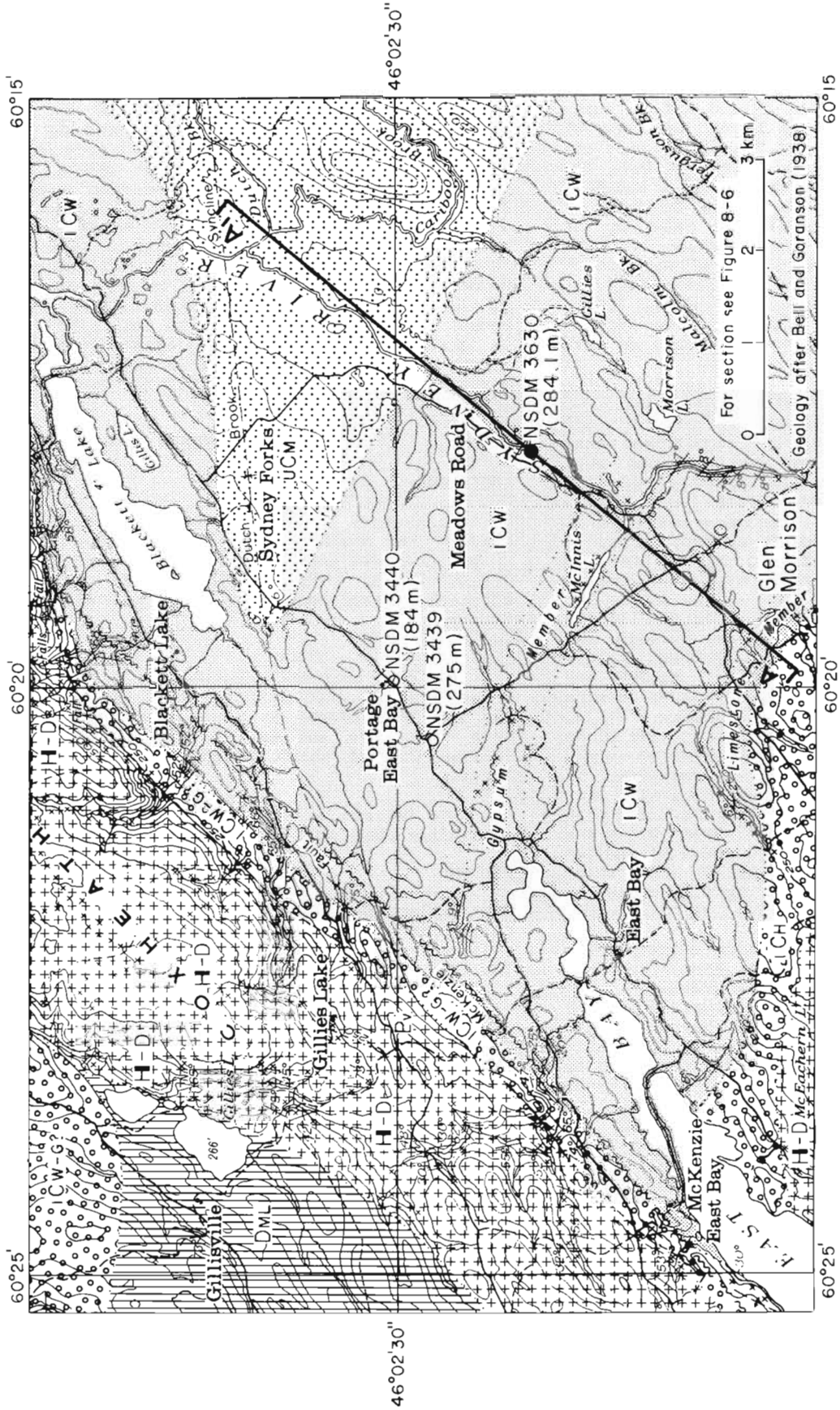

Figure 8-1. Geology in the vicinity of the East Bay occurrence, Cape Breton County, Nova Scotia.

LEGEND

UPPER CARBONIFEROUS

MORIEN GROUP

uCM — Undivided: sandstone, conglomerate, shale and coal

PICTOU GROUP

uCI — *INVERNESS FORMATION:* sandstone, shale and coal

RIVERSDALE GROUP

uCR — Undivided: sandstone, conglomerate, shale and coal

CANSO GROUP

uCCp-m — *MABOU FORMATION:* sandstone, siltstone and shale

uCCp — Undivided: sandstone, siltstone and shale

uCg — Gabbro, diabasic gabbro

LOWER CARBONIFEROUS

WINDSOR GROUP

lCw — Undivided: siltstone, gypsum, anhydrite, halite and limestone

lCw-U — Upper: siltstone, gypsum, anhydrite and limestone

lCw-L — Lower: gypsum, anhydrite, siltstone and limestone

lCw-G — *GRANTMIRE FORMATION:* conglomerate and sandstone

lCw-m — Marginal basin beds (Weeks, 1954): conglomerate, sandstone and limestone

HORTON and/or WINDSOR GROUP(S)

lCw-H — Marginal facies: conglomerate and sandstone

HORTON GROUP

lCH-SA — *STRATHLORNE-AINSLIE FORMATION:* sandstone, conglomerate and shale

lCH — Undivided: conglomerate, sandstone and shale

DEVONO-CARBONIFEROUS

DCFB — *FISSET BROOK FORMATION:* mafic and felsic volcanic rocks, conglomerate and sandstone

DEVONIAN

DML — *McADAM LAKE FORMATION:* conglomerate, sandstone, shale and tuff

Dg — Granite, diorite, granodiorite

CAMBRO-ORDOVICIAN

€Os — Undivided: conglomerate, grit, sandstone and shale

PROTEROZOIC

Pgd — gd, granodiorite; qd, quartz diorite; v, volcanics

HADRYNIAN

Hg,gd — Granite, granodiorite

HF — FOURCHU GROUP
Undivided: volcanic and sedimentary rocks

HGR — GEORGE RIVER GROUP
Undivided: metasedimentary rocks

HADRYNIAN-DEVONIAN

H-D — Undivided (may include lCH)

SYMBOLS

Heavily drift-covered area	
Rock outcrop, area of outcrop	x x 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	F
Spore sample	S
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		

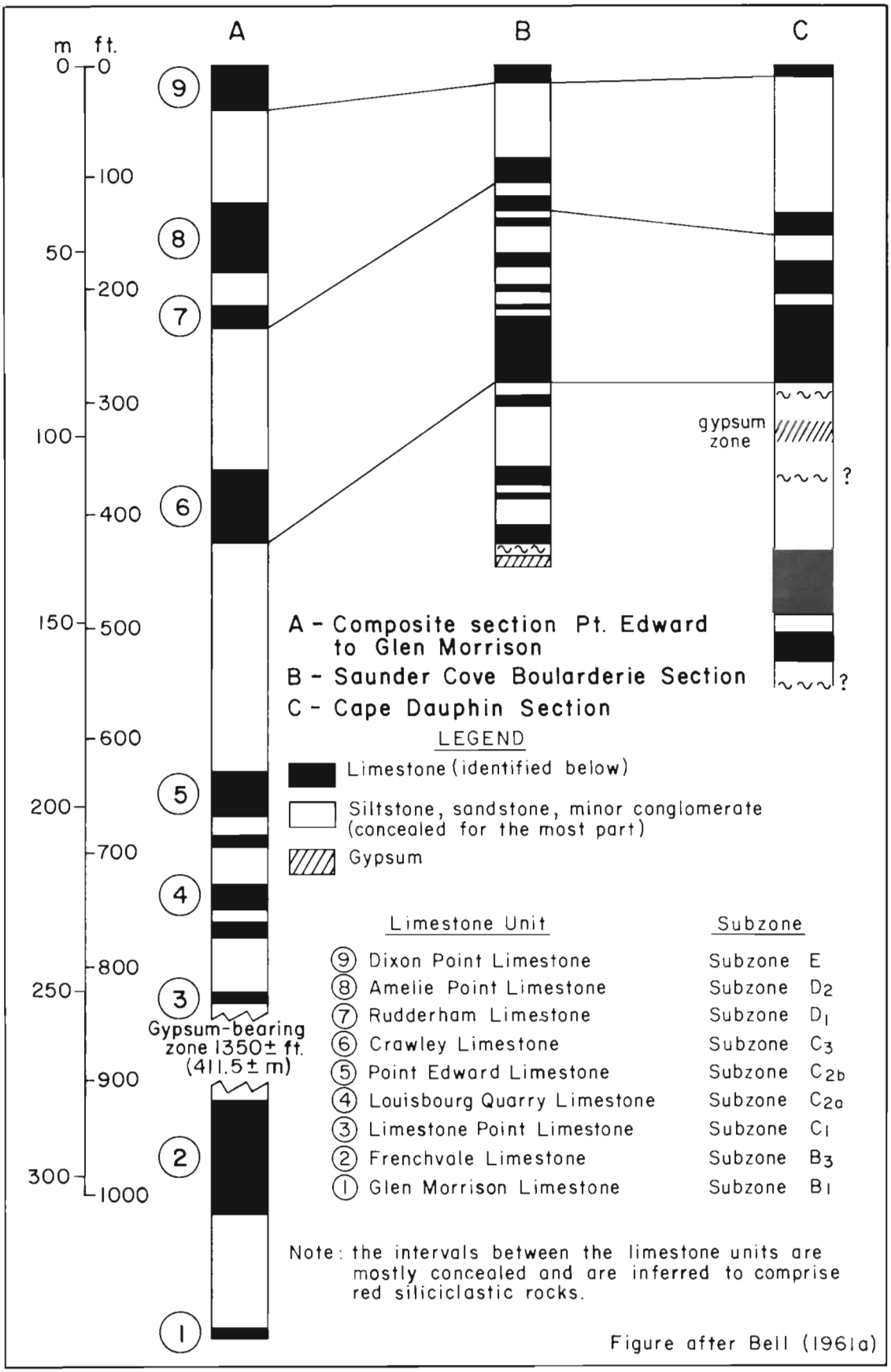

Figure 8-2. Correlation and stratigraphy of Windsor Group limestone units in the Sydney Area, Cape Breton.

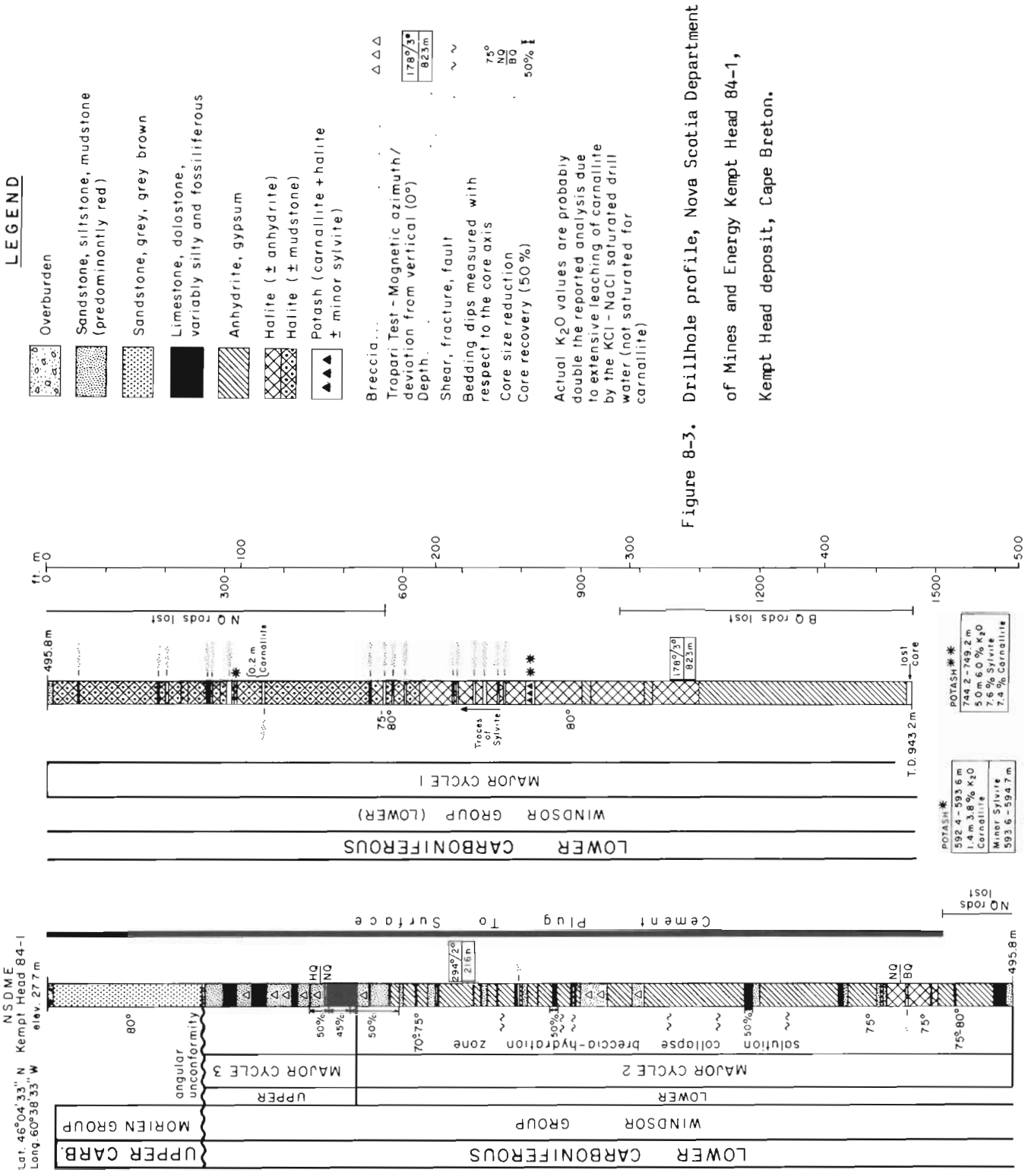

Figure 8-3. Drillhole profile, Nova Scotia Department of Mines and Energy Kempt Head 84-1, Kempt Head deposit, Cape Breton.

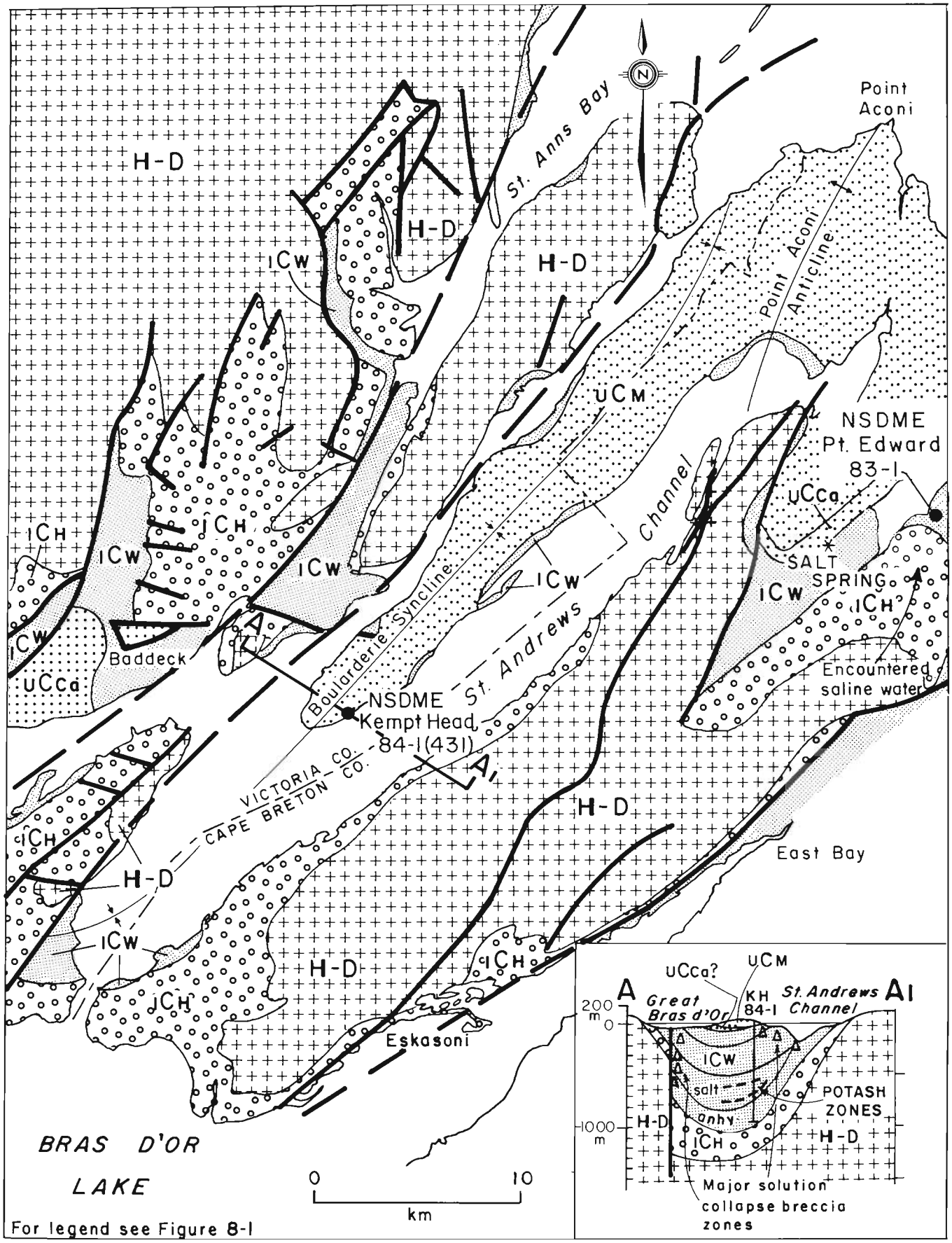

Figure 8-4. Geological map and cross-section, Kempt Head deposit, Cape Breton.

Stratified salt was intersected in Kempt Head 84-1 (Fig. 8-4) at 431.2-457.8 m (1415-1502 ft.) (Cycle 2) and the Major Cycle 1 salt section from 495.8-832.9 m (1627-2733 feet). Bedding dips in the drillhole are gentle to moderate ranging from 10°- 25°. The salt above 687 m (2254 feet) is generally of low grade (less than 70% NaCl) with mudstone the dominant impurity. The grade from 687.0 m to 832.9 m (2254-2733 feet) is estimated at 90 to 95 per cent NaCl. Two significant potash zones were intersected. One occurs at 592.2-593.6 m (1942.9-1947.5) comprising 1.4 m (4.6 ft.-apparent thickness) of carnallite and halite with minor sylvite (3.84% K_2O), and a thicker zone is located at 744.2-749.2 m (2441.6-2458.0 feet) comprising 5.0 m (16.4 ft.-apparent thickness) of carnallite, halite and minor sylvite (6.0% K_2O). These potash zones are very similar geologically to the A subzone (Major Cycle 1) potash at the Malagawatch and Orangedale deposits described by Dekker (1982). The Windsor Group structural geology however appears to be much less complicated.

Major salt horizons were not expected to be present in the Boularderie Syncline. Their presence in the discovery drillhole may indicate a wider distribution of saline evaporites in the deeper parts of the Sydney area. Minor salt is known in the East Bay occurrence and saline water was encountered in the NSDME Point Edward 83-1 drillhole near Point Edward. Further drilling and gravity surveys will be required to assess the extent and significance of salt and potash in the Boularderie area.

EAST BAY OCCURRENCE

The East Bay occurrence (NTS 11K/01) is situated approximately five kilometres east of the community of East Bay, Cape Breton County (Figs. 1-10 and 8-1). East Bay is located approximately 18 km south of Sydney.

The area is readily accessible through a series of paved and unpaved roads connected with Highway No. 4 which runs between Sydney River and Port Hawkesbury.

The terrain in the occurrence area is typical of the Carboniferous Sydney Lowlands where elevations rarely exceed 100 m in gently rolling hills. The highland areas are the Coxheath Hills to the northwest where elevations locally exceed 200 m, and the East Bay Hills to the south where elevations locally exceed 160 m.

HISTORICAL BACKGROUND

The first reported exploration for salt in the East Bay area was undertaken for Morton Chemical of Canada Limited in 1961-1962. Previous regional investigations for salt and potash, including that by Hayes (1931) did not contain references to salt springs or to exploration activity in the area.

The exploration work of Morton Chemical was carried out under the direction of Cole (1961) with W. A. Bell contracted to supervise the on-site geological work and drilling. Bell (1961b) described the basic geology in the area and correlated the stratigraphy of the rocks intersected in the three exploration drillholes with the stratigraphic section which he erected for the Sydney area (Bell, 1961a) (Figs. 8-2 and 8-5).

GEOLOGY

The geology in the East Bay area was described and mapped by Bell and Goranson (1938) (Fig. 8-1), and Bell (1961a). The major geological features in the vicinity of the occurrence (Fig. 8-1) include the Dutch Brook Syncline which comprises gently folded and gently plunging (eastward) Carboniferous strata assigned to the Windsor and Morien Groups (Fig. 8-6). The strata on the southern limb of the Dutch Brook Syncline onlap pre-Carboniferous basement granitic rocks of the East Bay Hills. Horton Group rocks were not mapped in the area. Instead, a basal terrigenous facies of the Windsor Group, the Grantmire Member, was recognized by Bell and Goranson (1938). The drilling and subsequent revision of the stratigraphy in other areas (Kelley 1967b) suggest instead that much of what was mapped as Grantmire should be assigned to the Horton Group (Fig. 8-6).

The western and northwestern border of the Dutch Brook Syncline is truncated by a major fault named the McKenzie Fault. This Fault is an extension of the Coxheath Fault which extends northeasterly into the Sydney River area.

The basic stratigraphy in the area is summarized in Figures 8-2 and 8-5 and cross-section $A-A_1$ (Fig. 8-6) summarizes the interpreted geology in the area. The Windsor Group intersected in NSDM 3439, 3440, and 3630 drilled by Morton Chemical of Canada Limited (Bell, 1961b)is an interbedded succession of evaporite (gypsum and anhydrite), red and grey-green siltstone, sandstone, locally fine conglomerate, and fossiliferous marine limestone (Fig. 8-5). Dominantly grey sandstone and shale with interbeds of anhydrite occur at the base of the section. These strata are similar to the lithology of the Meaghers Grant Formation described by Giles and Boehner (1979), and overlie a fossiliferous basal carbonate which has a bank type facies at Glen Morrison. This basal limestone unit may be correlative with the Gays River Formation of Giles et al. (1979). The stratigraphic setting in this area appears to be similar to that in the Musquodoboit Basin described by Boehner (1977b), and Giles and Boehner (1979). The main Windsor Group salt unit, if present in the East Bay area, should occur deeper in the Dutch Brook Syncline (Fig. 8-6). The thin salt intersected in NSDM 3630 at 284.1-286.8 m (632-641 ft.) is interpreted to be a thin lens or tongue of the main salt. The salt is described as a 25 per cent halite mixture with 75 per cent anhydrite, limestone and sandstone.

Geophysical and geochemical data are not available for the East Bay occurrence. Salt springs have not been reported in the area.

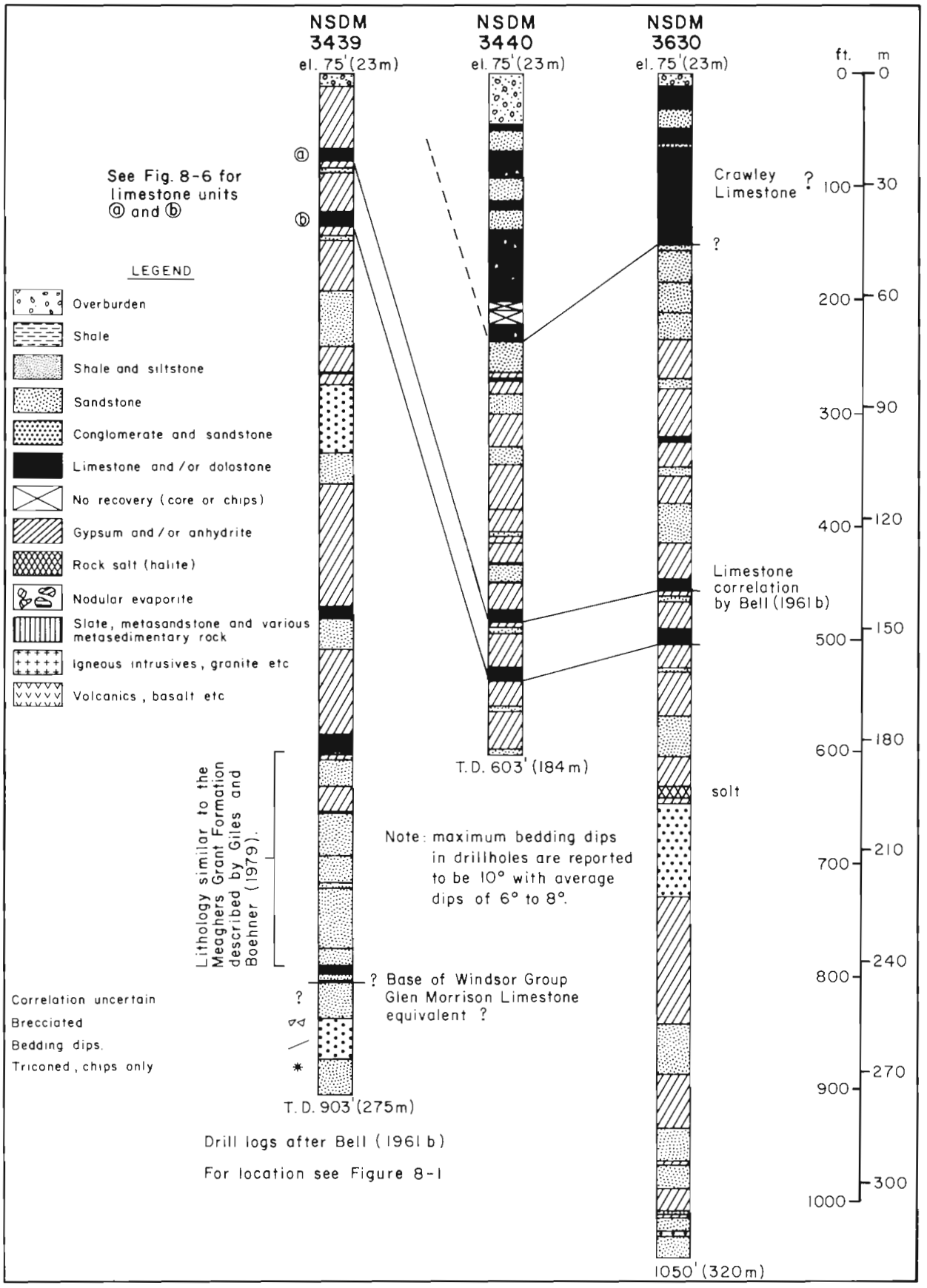

Figure 8-5. Drillhole profiles, East Bay occurrence, Cape Breton.

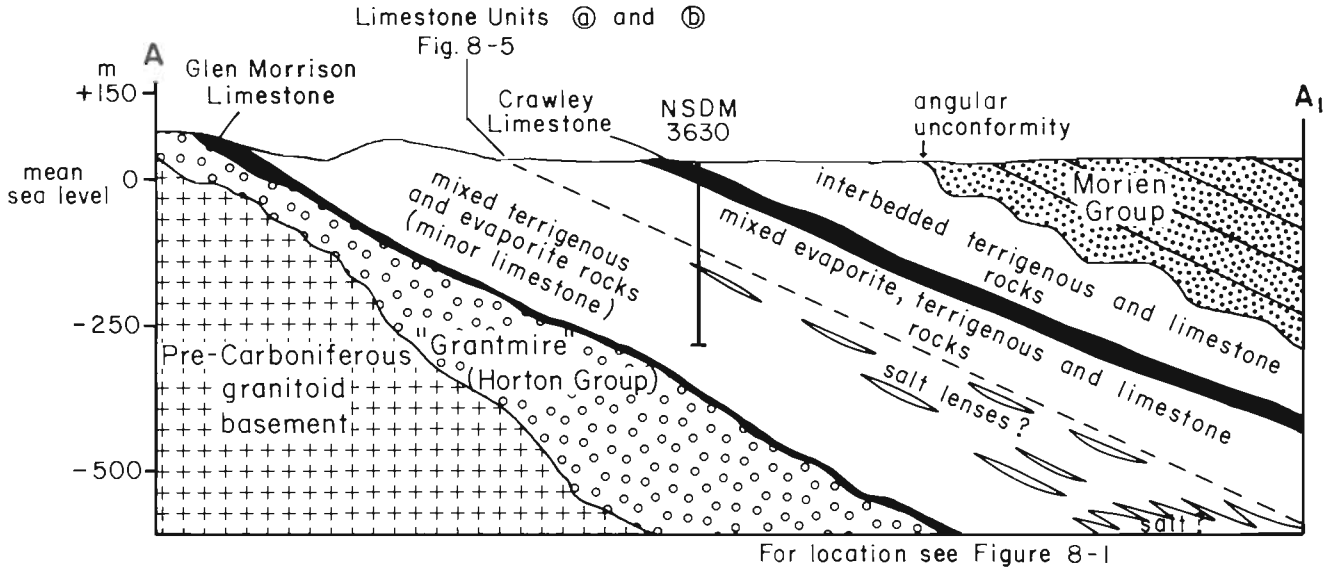

Figure 8-6 Cross-section A-A of East Bay occurrence, Cape Breton.

ECONOMIC CONSIDERATIONS

The East Bay occurrence consists of a mixture of halite, anhydrite, sandstone and limestone intersected between 284.1 and 286.8 m (932 and 941 ft.) in drillhole NSDM 3630. Two other drillholes in the area did not intersect salt. There are no salt springs known in the area.

The occurrence is considered to be of little economic significance now, but further exploration drilling would be required to determine if more salt is present deeper in the Dutch Brook Syncline.