*Current Research (1992) Newfoundland Department of Mines and Energy,
Geological Survey Branch, Report 92-1, pages 1-12*

QUATERNARY GEOLOGY OF THE CORNER BROOK–PASADENA AREA (NTS 12A/13 AND 12H/4)

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ABSTRACT

Mapping of the Quaternary geology in the Corner Brook–Pasadena area defined both the regional ice-flow history and the distribution and characteristics of the surficial sediments. Such mapping is useful in a wide range of applications including engineering, town-planning, forestry and agriculture, as well as in mineral exploration.

Ice-flow data suggest an early southwestward flow down 'modern' Deer Lake toward the coast either through Wild Cove or the Humber gorge. As the ice mass developed, topography had less influence, and dispersal centres shifted to the Topsail Hills. This shift is indicated by the presence of clasts identified as originating from the Topsail Hills found in diamictons in the Deer Lake basin, and striation orientations.

Quaternary sediments are common across the area. On highlands underlain by metasedimentary bedrock, sediment is thin and discontinuous. Thicker sediment is common in valleys, and exposures containing more than one sediment unit are common. Generally, diamictons have similar characteristics, apart from colour, and are probably basal meltout tills. High-level deltas in the South Brook valley suggest the presence of a proglacial lake in the area. In the Humber valley, a typical sequence consists of a variable number of diamicton units, overlain by a succession of glaciofluvial, marine and postglacial fluvial sediments. Marine inundation occurred at least as far northeast as Cormack.

The wide variety of Quaternary sediments and their contrasting characteristics have implications for engineering (slope stability), land use (waste-disposal site location and their effects), hydrogeological (aquifer development) and resource management (agriculture, forestry) applications. Of the Quaternary deposits, marine muds are the most sensitive to disturbance.

INTRODUCTION

This report discusses results from the first year of a three-year study into the Quaternary geology of the Humber River basin. The glacial history of the area is complex because of the location of the basin between ice dispersal centres on the Long Range Mountains and on the Topsail Hills. As well, smaller late-glacial dispersal centres on Birchy Ridge and the southern Long Range Mountains potentially influence the region. During deglaciation, the area likely contained a large proglacial lake and, following lake drainage, was inundated by the sea at least as far northeast as Cormack. Exploration in areas of potential mineralization, such as for uranium in the Birchy Ridge area, has been hampered by the lack of adequate knowledge of the sequence of glacial events.

The range of sediment types, within the Humber River basin, resulting from the regions diverse Quaternary history have aided in the development of various resource-based activities, including agriculture and forestry. However, these same sediments also cause engineering and geotechnical difficulties, primarily in areas containing thick mud sequences.

The objectives of this project are to map the distribution of Quaternary sediments, to describe their characteristics and geomorphology, to map ice-flow indicators, and to develop a model for the glacial and postglacial history of the area. This will assist mineral-exploration activities by providing data on directions and possibly distances of transport of glacial sediment, and will also provide basic geological data of use to other projects influenced by surficial sediment.

LOCATION AND ACCESS

In 1991, the field area was most of the Corner Brook map sheet (NTS 12A/13), with the exception of Glover Island, and the southern half of the Pasadena map sheet (NTS 12H/4) (Figure 1). The field area contains the city of Corner Brook, and smaller communities including Massey Drive, Steady Brook, South Brook and Pasadena. Access was generally good either by using trucks on paved roads or ATV's on the numerous logging roads. Areas east of Corner Brook Lake and Glover Island were not examined, as they are only efficiently accessible by helicopter.

BEDROCK GEOLOGY

The use of bedrock geology to Quaternary studies is primarily in its role of aiding determination of distances and directions of glacial transport. Rock types that are visually distinctive and confined to a discrete source area are

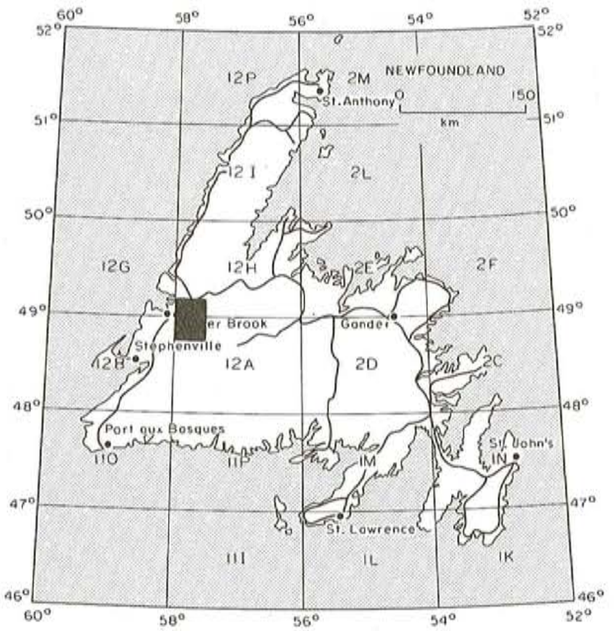

Figure 1. *Location of field area.*

particularly useful. The field area consists of Cambrian carbonates and sediments, Upper Proterozoic metasediments and metavolcanic rocks, and Carboniferous clastic sediments (Hyde, 1984; Williams and Cawood, 1989; Figure 2). Each of these rock types extend beyond the field area, and therefore, clasts from these units cannot be used for glacial-dispersal studies. The rock types surrounding the area are of greater potential use. To the north, and underlying that area affected by the Long Range ice cap, are Precambrian gneisses, whereas, the area underlying the Topsail Hills ice centre host granites and felsic volcanic rocks. Topsails granites are commonly peralkaline (Whalen and Currie, 1988).

PREVIOUS WORK

Reconnaissance surficial mapping of the Pasadena map sheet area was completed by Grant (1973) and of the Corner Brook map sheet area by Kirby *et al.* (1988). Batterson and Taylor (1990) described preliminary regional ice-flow indicator and clast provenance studies in the Deer Lake basin area, in an attempt to resolve conflicting interpretations of the glacial history presented by Rogerson (1979) and Vanderveer and Sparkes (1982). In coastal areas, Brookes (1974) described the deglacial history of the Bay of Islands, and identified a raised marine delta at the mouth of the Humber River near Corner Brook (Plate 1). No radiocarbon dates are available for the delta, although a date on a delta at a similar elevation at Cox's Cove was used to infer a date of about 12,600 years BP for the Humbermouth delta (Brookes, 1974). Batterson and Taylor (1990) speculated on the existence of a large proglacial lake in the Deer Lake basin during deglaciation, followed by a period of marine incursion as suggested by Batterson and Kirby (1988). The relationship of this period of marine incursion to the timing of the Humbermouth delta development is uncertain.

FIELD PROGRAM

Bedrock outcrops were examined for striae and other ice-flow indicators. Fifty-nine new striation sites were recorded to supplement those identified during previous projects. Detailed descriptions of surficial sediment were made from natural or man-made exposures, including 25 backhoe test-pits. Sedimentological properties examined included texture, compaction, sedimentary structures and clast lithology. Clast fabrics were taken from 56 diamicton exposures. In each case, 25 elongate pebbles having a length:breadth ratio of greater than 3:2 were measured. Results were plotted on a stereogram and analyzed using the Stereo™ software package for the Apple Macintosh microcomputer (MacEachran, 1990). Principal eigenvalues, which measure the strength of the fabric orientation, and K values, which measure the distribution of the clast orientations (i.e., plunges), were produced using the method outlined by Woodcock (1977). Normalized eigenvalues (S_1) can range between 0.33 (random) and 1.0 (unidirectional). The K values of less than 1.0 suggest girdle distributions. In this paper, strong fabrics are defined as those with $S_1 > 0.6$ and $K > 1.0$.

Matrix samples were taken from 156 locations for textural and possible geochemical analysis. Matrix samples (finer than 2 mm/-1ϕ) are sieved through a nest of 6 stainless-steel sieves (-1ϕ to 4ϕ), and the silt–clay fraction (finer than 4ϕ) analyzed for grain-size distribution using a Coulter Counter (Model TAII-L, 100 and 200 mm apertures). Grain-size results are not currently available. Clast samples (coarser than 64 mm/-6ϕ) of between 50 and 100 clasts were taken from 126 locations, and the rock types were identified.

ICE FLOW

Striation sites having more than one direction of flow are rare and generally confined to the Humber River valley (Figure 3). The soft Carboniferous sediments in the area rarely permit the preservation of striae, but the few striae found showed an early flow generally parallel to the valley crosscut by a later regional flow across the valley. Striae related to the early flow were found within the Humber River valley as far downstream as the eastern end of the Humber gorge (Plate 2). The direction of the later regional ice-flow event is variable across the field area. South of Corner Brook, ice flow is northeastward (310° ± 10°). North of the Steady Brook valley, ice flow is westward (270° ± 10°), and parallels major outlet valleys, e.g., Old Mans Pond (Plate 3). In the Corner Brook area, ice flow was into the Humber Arm from all sides, suggesting it was a major channel for ice.

Well-oriented clast fabrics in glacial diamictons (i.e., $S_1 > 0.6$ and $K > 1.0$) can also indicate ice movement (Harrison, 1957; Lawson, 1981; Dowdeswell and Sharp, 1986). Where found, these fabric orientations are generally consistent with the erosional evidence.

The ice-flow data suggests an early topographically controlled flow down the Humber River valley from a source to the north, possibly the Long Range mountains, as suggested by Vanderveer and Sparkes (1982). Clasts from the Long

Range, however, were not recognized. This early flow was followed by a regionally consistent ice-flow event from a source to the east of Grand Lake. Toward the coast, ice flow was affected by the orientation of major valleys.

CLAST PROVENANCE

The ice-flow pattern from striae provides data on the general direction of glacial flow, but not on the location of ice dispersal centres. Rock types identified from glacial diamictons can provide data on both direction and distance of glacial transport, if those rock types are from a discrete source area. Clast fractions in diamictons in the field area were dominated by local rock types, commonly metasediments or Carboniferous sediments. Exotic clasts commonly comprised less than 10 percent of clasts collected, and most of these had wide potential source areas. However, several rock types are diagnostic of particular provenance areas. Red, flow-banded rhyolite and silicic tuff clasts in the diamictons were probably derived from the Springdale Group. A red, medium- to coarse-grained one-feldspar-granite, and quartz–feldspar porphyry clasts were derived from the Topsails intrusive suite. Pink, medium- to coarse-grained K-feldspar porphyritic two-feldspar-granite clasts were eroded from the Hinds Lake granite. When found in association with each other, these clasts indicate an ice-dispersal centre on the Topsail Hills, centred on the Hinds Lake area. Clasts originating from the Buchans Group in the Red Indian Lake region are not found in the field area, suggesting that any ice centre was located to the west of Red Indian Lake.

QUATERNARY SEDIMENTS AND FEATURES

A wide range of sediment types were found including tills, subaqueous fan deposits, lacustrine, marine and fluvial sediments. Brief descriptions of these sediments follow.

DIAMICTON

Diamicton is common across the whole area, except within the Humber River valley (Figure 4). The character of diamictons is mainly influenced by the underlying bedrock geology. On the uplands, underlain by metasediments to the south of Corner Brook, diamictons are thin and discontinuous. They have a Munsell colour of light olive brown (2.5Y 5/4) to dark yellowish-brown (10YR 4/4) when moist, and light grey (2.5Y 7/2) when dry, and have a dominantly sandy matrix with less than 20 percent silt and clay. Clasts are mostly granules to boulders of local provenance, with the largest clasts up to 60 cm diameter, subrounded to subangular, rarely striated, and commonly have a weak to moderate clast fabrics. Exotic clasts account for less than 5 percent of clasts and are commonly derived from the Topsail Hills. In section, these diamictons commonly appear structureless, although thin (< 2 mm), irregular-shaped sorted lenses are common beneath clasts.

Diamictons, on sedimentary bedrock on the uplands around Old Mans Pond, are generally thin and discontinuous. They have a Munsell colour of olive (5Y 5/3) to dark greyish-brown (2.5Y 4/2) when moist, and light yellowish-brown (2.5Y 6/4) to pale yellow (5Y 7/3) when dry, and have silty sand matrices with 20 to 50 percent silt and clay. Clast characteristics are similar to those described for the Humber River valley, with clasts commonly originating from the Topsail Hills.

Those diamictons in areas dominated by Carboniferous bedrock have a silty sand matrix with 20 to 45 percent silt and clay, and have Munsell colours of grey brown (2.5Y 5/2) to reddish-brown (5YR 4/4) when moist, and very pale brown (10YR 7/3) to reddish-yellow (7.5YR 6/6) when dry. The clast content is dominated by local rock types, although clasts from the Topsail Hills are common.

Generally, diamictons derived from Carboniferous bedrock are thicker than in other areas, and in several places, more than one diamicton was exposed at a single site. In each case, the internal character of the diamicton units is different, and therefore, the regional significance of diamicton distribution cannot currently be assessed. Typical is a section, 100 m northeast of the Pasadena dump, where three different diamictons are exposed (Plate 4). The lower diamicton is dark brownish-grey (10YR 4/2, moist) and structureless. Clast fabrics are aligned parallel to the regional ice-flow direction and are strong (S_1 = 0.79 and 0.92 and K = 1.21 and 1.61). The middle diamicton is olive grey (5Y 4/2, moist) having a silty sand matrix and 38 percent fines. The unit has a blocky structure. Clasts are subangular to subrounded, commonly striated and of predominantly local origin. Small, irregular-shaped lenses of medium to coarse sand are common beneath clasts. Clast fabrics are aligned with the regional ice flow and are strong (S_1 = 0.73 and 0.72 and K = 5.32 and 8.40). The upper diamicton is reddish-brown (5YR 4/2, moist) having similar characteristics to the underlying unit. Clast fabrics are similar as immediately above and are moderate to strong (S_1 = 0.69 and 0.74 on 2 fabrics) with inconsistent K-values (0.51 and 3.65). The diamictons become more consolidated with depth, although grain size remains fairly uniform.

The characteristics of the diamictons described above and those found elsewhere are generally consistent with a subglacial origin, possibly meltout till (Lawson, 1981; Haldorsen and Shaw, 1982; Shaw, 1982; Dowdeswell and Sharp, 1986; Dreimanis, 1988). The striated clasts, their subrounded form and well-oriented clast fabrics are consistent with basal transport. The presence of sorted layers beneath clasts suggests the presence of water during deposition. Clast fabrics are variable across the field area. Using the methods of Mark (1974) and Woodcock (1977), fabrics were plotted on the graph illustrated in Figure 5. Fabrics with a strong cluster plot on the top left of the graph, and those with girdle fabrics plot on the lower right. Rappol (1985) suggests that fabrics that cluster are consistent with undisturbed basal meltout and lodgement tills, whereas those that have girdle distributions are consistent with disturbed basal tills and debris flows. Figure 5 shows that disturbed and undisturbed sediments are found in the field area. Most of the fabrics

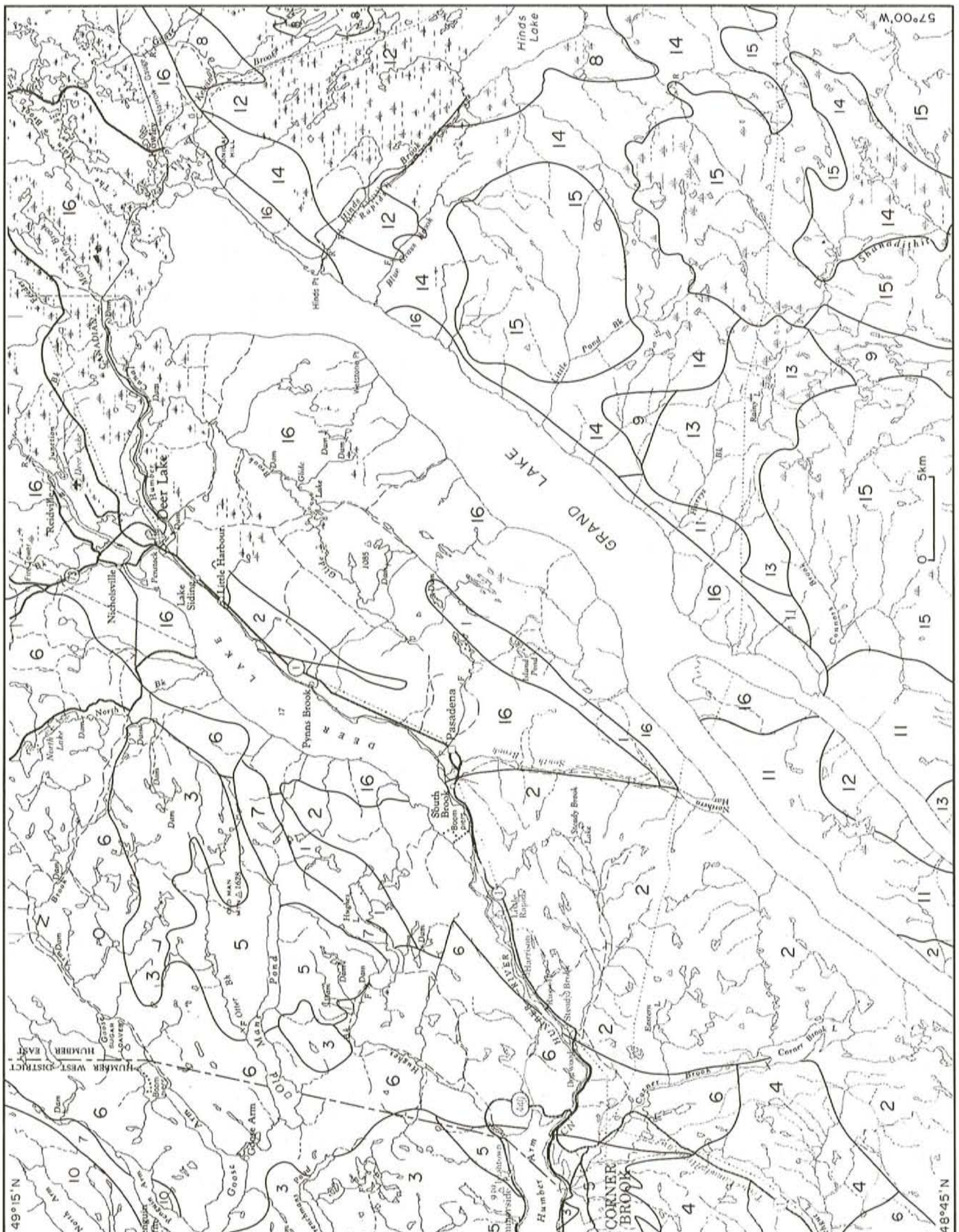

Figure 2. *Bedrock geology map. Modified from Hyde (1984), Whalen and Currie (1988) and Williams and Cawood (1989).*

LEGEND (for Figure 2)

CARBONIFEROUS

16 *Carboniferous clastic sedimentary rocks*

SILURIAN

15 Topsails Intrusive Suite: *rhyolite, one-feldspar and two-feldspar granites; some have peralkaline affinities*

14 Springdale Group: *flow-banded rhyolite, tuff and basalt*

13 Rainy Lake Complex: *gabbro, diorite and granodiorite*

ORDOVICIAN

12 *Massive to slightly foliated granite and granodiorite*

11 Glover Group: *basalt, diabase, tuff and conglomerate*

10 *Grey to black scaly shale*

9 *Massive to moderately foliated granodiorite and minor tonalite*

8 Hungry Mountain Complex: *moderately to strongly foliated gabbro to granite*

CAMBRIAN

7 *Grey to black shale and light grey platy limestone*

6 *Shale, limestone and dolostone (includes Reluctant Head Formation)*

5 *Grey to black shale and thin white quartzite*

4 *Crystalline limestone and phyllite*

UPPER PROTEROZOIC TO LOWER CAMBRIAN

3 *Greywacke, quartzite*

2 Mount Musgrave Group: *psammitic and pelitic schist*

1 Hughes Lake Complex: *metavolcanic rocks and granite*

Plate 1. *Raised marine delta at the eastern end of the Humber Arm near Corner Brook. The delta has a surface elevation of about 51 m asl and was probably formed about 12,600 years BP.*

indicative of disturbed sediments are found in the Wild Cove valley and other areas of steep slopes. Fabrics from diamictons in the Pasadena dump section plot mostly in the undisturbed basal till area. In lodgement tills, well-oriented clast fabrics result from friction with the substrate, whereas in meltout tills, clast fabric is inherited from the glacial transport process (Dreimanis, 1988). In both cases, the resultant fabric is commonly parallel to ice movement, although Lawson (1981) suggests that resedimentation during and following deposition may weaken clast fabrics. Evidence was not found to suggest that the diamicton units exposed at the Pasadena dump site or elsewhere represent more than one glacial episode.

GLACIOFLUVIAL AND FLUVIAL SEDIMENTS

Glaciofluvial and postglacial fluvial sediments are common within the Humber River valley, and in isolated areas within the South Brook valley and near Old Mans Pond (Figure 4). However, exposures through this sediment are relatively rare, being confined to small deposits in the South Brook valley and at the western end of the Humber gorge. Little detailed sedimentological analysis has yet been completed on these sediments and, therefore, only a brief

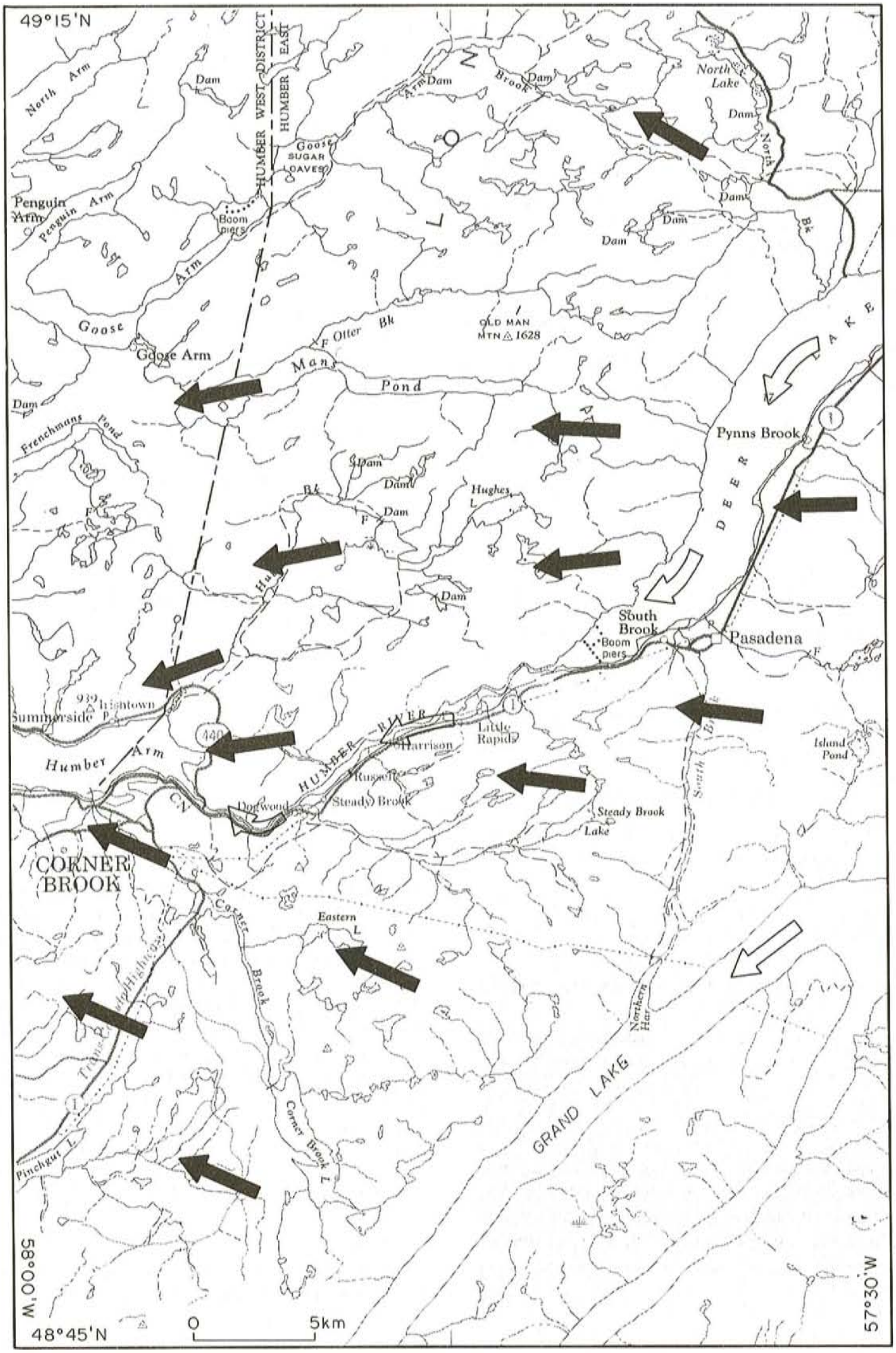

Figure 3. *Map showing ice-flow directions from striae in the field area. Open arrows are the oldest flow and solid arrows are the youngest ice flow event.*

Plate 2. *View of Humber gorge near Corner Brook. The valley has evidence of ice flow through it, although most flow was likely through the Wild Cove valley to the north. Ice remaining in the gorge during deglaciation may have impounded a large proglacial lake and following its drainage was inundated by the sea.*

Plate 3. *View of Old Mans Pond looking east. This valley was a major outlet of ice from the Topsail Hills toward the coast. Sediments on the northern valley slopes are largely colluviated tills.*

overview is presented here. In Dawe's Pit, at the western end of the Humber gorge, interbedded sands and pebbly sands are exposed. The sand units are moderately to well-sorted planar beds, with some planar tabular crossbedding, indicating westward flow. Pebbly sands are roughly planar bedded, and contain subrounded clasts of mixed rock types. Normal faults are common throughout the unit, with vertical displacements of up to 15 cm. Faulting is likely the result of the collapse or settling of sediment due to the melting *in situ* of buried ice incorporated during deposition, and is common in glaciofluvial sediments (Sugden and John, 1976). Fluvial sediments commonly do not contain collapse structures such as those exposed in Dawe's Pit.

In drill core recovered from the Steady Brook area by the Department of Works, Services and Transportation (D. Brennan, personal communication, 1990), gravels are found near the base of several 50 to 60 m cores. Their stratigraphic position, underlying silts and clays of probable marine origin (as discussed further on) suggests that these sediments are glaciofluvial in origin.

Postglacial fluvial gravels are found stratigraphically above the marine muds. They were well exposed during the summer of 1991 due to road construction within the Humber gorge near Corner Brook. A typical stratigraphy consisted of a basal unit of planar bedded, moderately to well-sorted, medium to fine sand, with occasional ripples with a 10 to 15 cm wavelength and 1.5 cm amplitude. These sands are overlain by 50 to 100 cm of planar-bedded, clast-supported pebble gravel. Clasts are subrounded, of mixed rock types and have a 2- to 3-mm-surface coating of reddish-brown silty clay. Overlying this gravel unit are poorly sorted, planar-bedded sandy gravels that have a fine to medium sand matrix. The unit commonly contains ovoid, open-work gravel lenses. The stratigraphy suggests increasing current flow, possibly related to decreasing water depths within the Humber gorge associated with falling sea levels. To the east of the Humber gorge gravelly sediments are uncommon. More usual are moderately sorted, fine to medium, planar cross-stratified sands. These suggest deposition under more quiescent flow conditions.

SEDIMENTS AND FEATURES ASSOCIATED WITH HIGHER LAKE LEVELS

Batterson and Taylor (1990) suggested the possibility of a large proglacial lake covering the modern Deer Lake–Grand Lake–Sandy Lake–Birchy Lake basins. This was based on evidence of fan deltas described in the Pasadena, Grand Lake and Birchy Lake areas, all of which had similar elevations (Lundqvist, 1965; Liverman and St. Croix, 1989). Within the field area, Batterson and Taylor (1990) identified a single delta at 135 m asl in the South Brook valley, 3 km south of Pasadena. During this field season, two additional deltas were found in the South Brook valley. One was found about 1.8 km south of the previously documented site adjacent to a Hydro transmission line at a surface elevation of 135 $\pm$ 2 m asl (altimeter estimate). The second delta was at Northern Harbour on Grand Lake, at 130 m $\pm$ 2 asl (43 m above Grand Lake, altimeter estimate). Sediments associated with the proglacial lake could not be positively designated, although massive clayey silts found at several locations near the modern South Brook valley possibly represent lacustrine deposition. However, an alluvial origin for these sediments could not be discounted.

SEDIMENTS AND FEATURES ASSOCIATED WITH HIGHER SEA LEVELS

Coastal features associated with higher sea-level stands have been documented in the Bay of Islands (e.g., Flint, 1940; Brookes, 1974). Within the field area, Brookes (1974) described a prominent marine delta at Humbermouth and

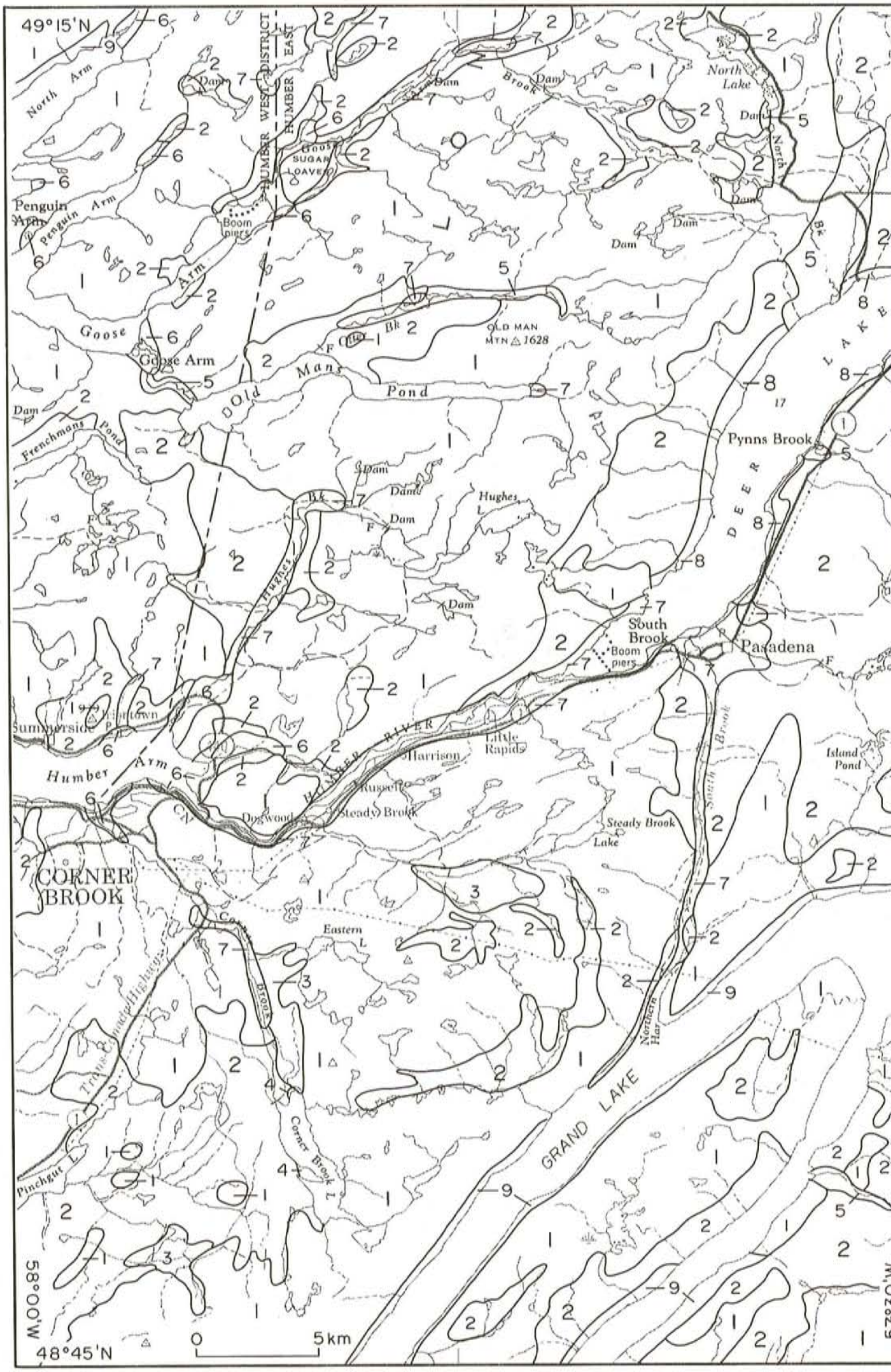

Figure 4. *Simplified surficial geology map of field area.*

LEGEND (for Figure 4)

POSTGLACIAL

9 Colluvium: *material derived from adjacent slopes and gravity deposited*

8 Lacustrine: *sediment 1 to 10 m thick composed of bedded sands and gravels; includes beach ridges and terraces. Common along shores of Deer Lake*

7 Fluvial: *sediment 1 to 10 m thick, composed of planar-bedded, moderately to well-sorted sands and gravels. Especially common in Humber River and Hughes Brook valleys*

6 Marine: *sediment 1 to 30 m thick composed of poorly to well-sorted sands and gravels, and rhythmically bedded silts and clays; includes marine terraces and deltas*

GLACIAL

5 Glaciofluvial deposits: *sediment 1 to 30 m thick composed of poorly to well-sorted sands and gravels*

4 Till ridges, transverse to flow: *ridges composed of subglacial diamicton; relief 2 to 5 m*

3 Till hummocks: *mounds of basal diamicton having no consistent orientation; relief 2 to 5 m*

2 Till veneer: *(< 2m thick): Sediment generally of local provenance. Numerous bedrock exposures throughout unit*

PREGLACIAL

1 Bedrock: *includes exposed bedrock and bedrock having a thin (<1m) vegetation or sediment cover*

Plate 4. *Three diamictons exposed near the Pasadena dump. The diamictons are distinguishable on the basis of colour and compaction, although textural, fabrics and clast provenance are similar between all three units.*

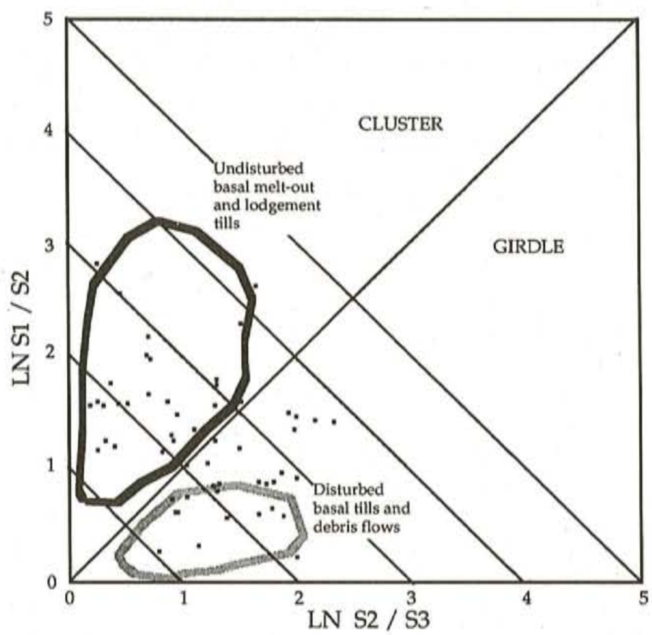

Figure 5. *Graph of fabric data following the methods of Mark (1974), Woodcock (1977) and Rappol (1985). The graph illustrates potential depositional environments for diamictons in the field area.*

assigned an age of about 12,600 years BP based on shell dates from a delta of similar elevation at Cox's Cove. The surface of this delta is 51 m asl (altimeter estimate). Features at similar elevations were found along the coast near Hughes Brook and at Irishtown. Inland deltas were identified at the head of the Wild Cove valley at about 53 m asl (altimeter estimate) and in the lower Hughes Brook valley at an elevation of about 59 m asl (altimeter estimate). The relationship of these delta surfaces to sea level is currently not clear. Within the Humber River valley several deltas have been identified. At Little Rapids a fan delta is located at about 45 m asl (altimeter estimate). The delta on which the community of Pasadena is situated has a surface elevation of 33 m asl (altimeter estimate), as is a delta at Pynn's Brook (Plate 5), and a delta near Coal Brook about 5 km southwest of Nicholsville is at 47 m asl, similar to the surface elevation of a delta at Nicholsville at 48 m asl. Several terraces have also been noted on both sides of Deer Lake (Batterson and Kirby, 1988). Precise elevations of those on the north side of Deer Lake are currently unknown, but 2 terraces on the south side have bases at 21 and 36 m asl (altimeter estimates).

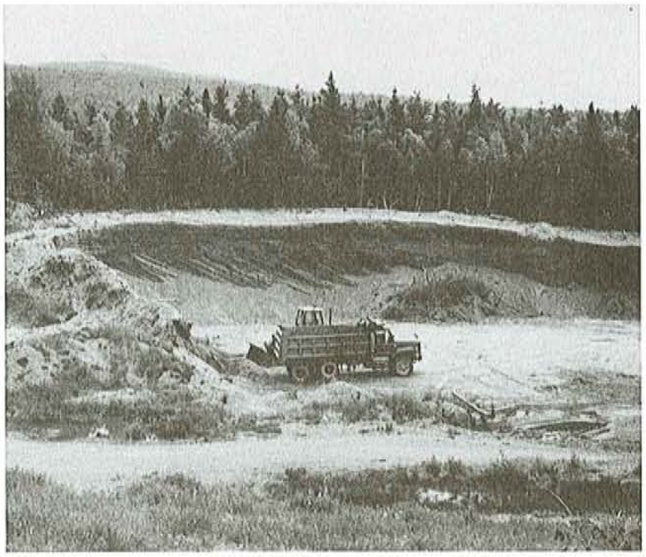

Plate 5. *Raised marine delta at Pynn's Brook, east of Pasadena. The delta has a surface elevation of 33 m asl, and was formed during a higher sea level in the modern Deer Lake basin about 12,000 to 12,500 years BP.*

Fossiliferous silty sands found in the Humber gorge suggest that many of the features at elevations below 50 m asl are likely of marine origin. The shells are *Balanus hameri*, a barnacle whose preferred environment is water deeper than 20 m, 0 to 5°C summer surface-water temperatures, and salinities in excess of 33‰ (Pilsbury, 1916). This environment would not occur adjacent to a melting ice mass, and, therefore, marine incursion through an open Humber gorge and into the Humber Valley is indicated. Terraces and deltas found at various elevations are likely related to stillstands in sea-level lowering. Sediments related to higher sea-level stands have been identified on the modern coast. Batterson and Kirby (1988) report fossiliferous silts and clays at Cooks Brook, west of Corner Brook, and shells have also been noted in the rhythmically bedded silts and clays at Wild Cove (M.J. Ricketts, personal communication, 1991). Similar rhythmically bedded silts and clays have been described from many locations in the Humber River valley (Batterson and Kirby, 1988). Although their origin is still uncertain, it is likely they have a marine origin because of their similarity to sediments found in coastal areas, and their stratigraphic position below the sandy to gravelly postglacial fluvial sediments described above.

QUATERNARY HISTORY–PRELIMINARY OBSERVATIONS

Initially, ice flow in the field area was topographically controlled. Striation evidence suggests early movement of valley glaciers down the Deer Lake and Grand Lake basins. Ice in Deer Lake probably exited to the coast through Wild Cove, although minor flow through the Humber gorge is possible. The source of this ice is unknown, although a northerly source is likely based on the striation patterns. As the ice masses developed, topography had less of an influence, and dispersal centres shifted to the Topsail Hills as indicated by striations and the wide dispersal of clasts identified as originating from the Topsail Hills. Diamictons are common across the area, although they are thin over the metasediment-dominated uplands to the south and east of Corner Brook. Thicker diamictons are found in areas underlain by Carboniferous sediments. Most glacial diamictons identified were basal tills.

In terms of surficial deposits and landforms, much of the Corner Brook–Pasadena landscape was formed by events in the immediate postglacial period. During deglaciation, when ice retreated to the highlands, a proglacial lake developed in the Deer Lake basin, and possibly in surrounding areas. Evidence for this lake within the field area is several deltas at about 130 to 136 m asl. Diamictons with girdle fabrics (Figure 4) may have been reworked during periods when they were submerged by higher lake or sea levels. Probable fans were identified on aerial photographs. These were not extensively examined in the field, but occur in the Wild Cove valley below maximum sea-level stand, and in the South Brook valley below the inferred surface of the proglacial lake described earlier. Following drainage of this lake, which was likely through the Humber gorge, marine incursion flooded the Humber River and Hughes Brook basins. As sea level fell, a series of terraces and deltas was developed in the Humber River valley and along Hughes Brook. Marine sediments were probably eroded from some areas, such as the Humber gorge, where mostly coarse-grained postglacial fluvial sediments are found. To the east of the gorge and in the Hughes Brook valley, fluvial sediments are generally finer grained, suggesting a lower energy fluvial system.

IMPLICATIONS FOR LAND-USE PLANNING

The wide range of sediment types has significant implications for land-use planning within the area. The marine silts and clays are impermeable, and therefore, downward percolation of water and/or pollutants is severely restricted. Adequate drainage of overlying sediment is essential to prevent destabilization of surface slopes. Slope failure is a potential problem in steeply sloped areas underlain by these muds. Similarly, selecting waste-disposal sites requires consideration of the underlying surficial geology to ensure that the rapid transport of effluents into local streams and groundwater systems does not occur. The current site of the Corner Brook dump at Wild Cove, which is underlain by marine clays, should be monitored to ensure that potential pollution levels in the Bay of Islands are controlled. The

Humber Valley below about 50 m asl is likely underlain by marine muds. These sediments are commonly encountered in excavations in Pasadena and other communities in the Humber River valley. They will likely be a significant engineering problem during the proposed reconstruction of the Trans Canada Highway between Corner Brook and Deer Lake. More work is required to define the distribution and physical properties of these marine sediments.

In areas south of Corner Brook, the surficial cover is thin and soil development generally poor. The rapid denudation of the forest cover is resulting in soil erosion that could ultimately result in lower potential for revegetation of these areas. Monitoring of erosion rates in recently deforested areas is recommended to ensure erosion does not proceed unabated.

ACKNOWLEDGMENTS

The authors would like to thank Wayne Ryder, Sid Parsons and Ted Hall for their administrative and expediting skills, which helped the season run relatively smoothly. John Maunder of the Newfoundland Museum is thanked for his identification of shells found in the area. The manuscript has been improved thanks to critical review by Dave Liverman and Norm Catto.

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