SASK. MINING DEVELOPMENT CORP.

QUATERNARY GEOLOGY OF THE CREE LAKE EXTENSION

Project 0022-002 August 3, 1978

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August 3, 1978

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3rd Floor Credit Union Central Building
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Attention: Dr. Lloyd A. Clark

Dear Lloyd:

Enclosed is my copy of Report 0022-002 on the "Quaternary geology of the Cree Lake Extension". If you have any questions or comments regarding the report, please don't hesitate to contact me. My association with you and your staff has been a pleasant and informative experience.

Sincerely yours,

E.A. Christiansen

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QUATERNARY GEOLOGY OF THE CREE LAKE EXTENSION

AND ADJOINING PARTS OF

74G-7,8,9, and 10 and 74H-5,11, and 12

by

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Report No. 0022-002

for

SASKATCHEWAN MINING DEVELOPMENT CORPORATION
3rd Floor Credit Union Central Building
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SUMMARY

Glacial landforms in the Cree Lake area include drumlins and fluted terrains, end moraines or rock ridges, ridged moraine, glaciofluvial terrain and ice-walled channels, strandlines of Glacial Cree Lake, and sand dunes.

These landforms occur in northwest-southeast trending belts that are perpendicular to the southwestward direction of ice movement as indicated by the trend of flutings and ispatinows. These belts are composed of a zone of glaciofluvial deposition derived mainly from the quarrying zone of the glacier and a zone of drumlinized and fluted terrain to the northeast developed in the abrasion zone of the glacier. The ice-walled channels, in which the eskers were formed, traverse the area from northeast to southwest. The quarrying zone ranges from thick glaciofluvial deposits, which almost entirely obliterate these ice-walled channels, to thin sand and gravel covers and braided eskers.

In drift prospecting, two problems must be considered: (1) search for float and (2) tracing float. Except for a few linear features of unknown origin, all such features can be attributed to glacier action. Eskers may represent lineaments as it is known that their trend is parallel with major faults of the region. Even though the eskers and ice-walled channels may represent only consequent streams associated with the glacier rather than lineaments, they are important in the search for float because these streams collected material from a band up-channel, the deposits of which now occur in the eskers.

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1. INTRODUCTION

1.1 Terms of Reference

This investigation was authorized by letter May 29, 1978 from Dr. Lloyd A. Clark, Exploration Manager, Saskatchewan Mining Development Corporation. This letter refers to the Terms of Reference set forth in Dr. Clark's letter of May 10, 1978 which states the following --- *for preparation of maps showing the distribution of glacial deposits, structural lineaments, and other features relevant to mineral exploration based on your interpretation of existing Federal Government black and white aerial photographs.*

1.2 Location

The Location of the Cree Lake Extension and Cree Lake areas are shown in Figures 1 and 2. The Cree Lake area includes 74G-7,8,9 and 10 and 74H-5 11, and 12 (Fig. 2).

1.3 Previous Work

The glacial deposits of the 74G part of the Cree Lake area were studied by Sproule (1939). He mapped the drumlins and eskers of the area and commented on their probable origins. A copy of his map will appear later in this report.

The bedrock geology of the 74G part of the Cree Lake area was studied by Gilboy and Ramaekers (1977) who published a map showing the southern boundary of the Athabasca Formation. The bedrock geology of the 74H part of the Cree Lake area was investigated by Baer (1969).

The Quaternary deposits of the Cree Lake area were studied in 1976 and 1977 by Schreiner (1977; 1978, personal comm.) as part of the study

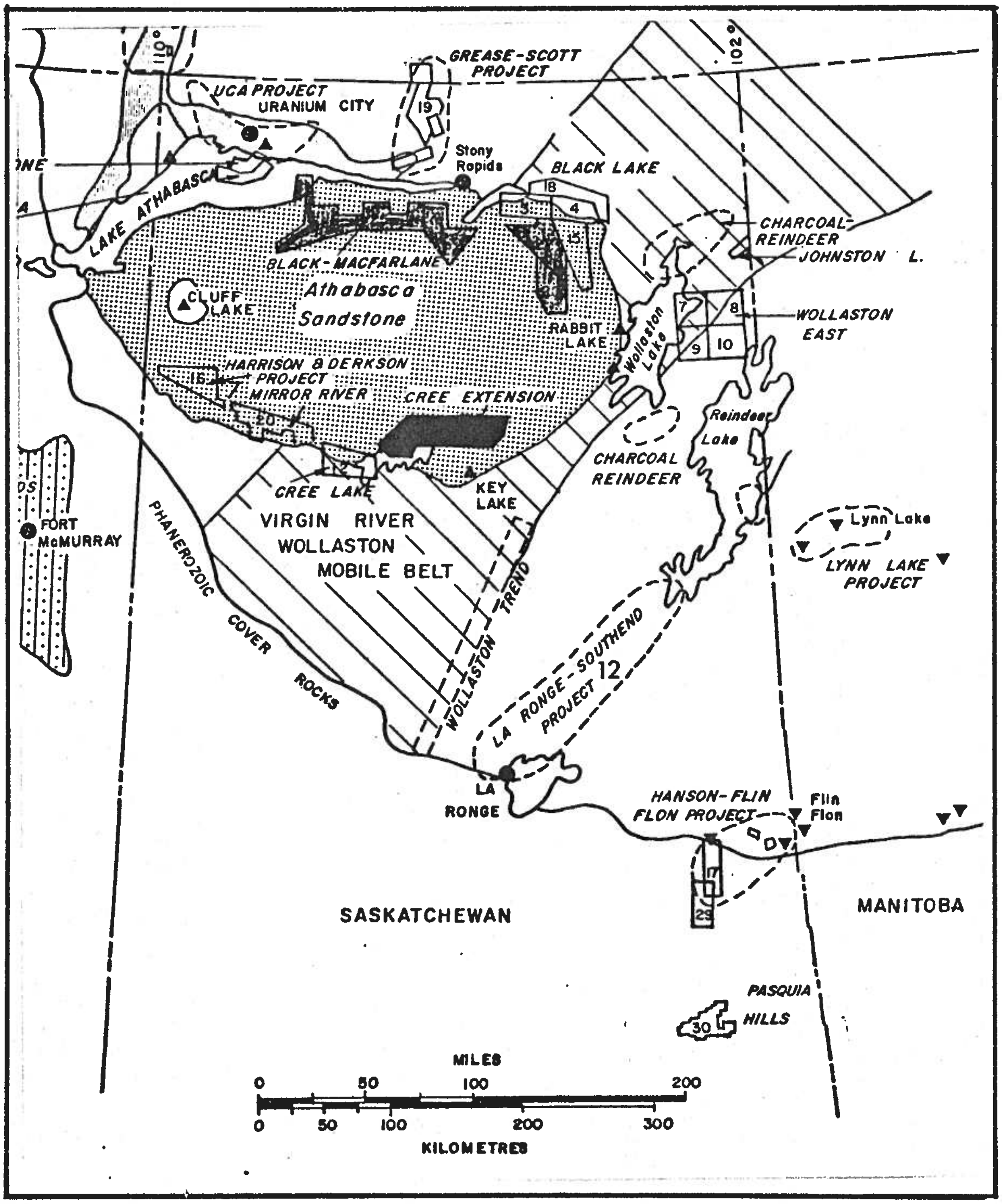

Figure 1. Location of the Cree Lake Extension area.

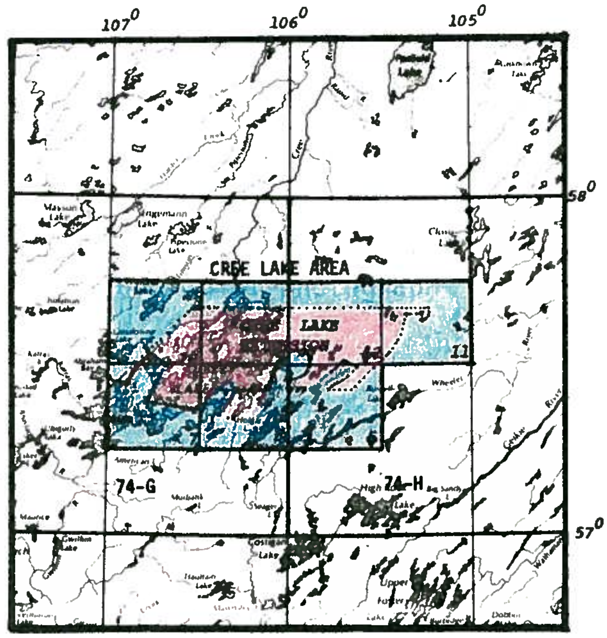

Figure 2. Location of the Cree Lake Extension and Cree Lake areas.

of the Quaternary geology of northern Saskatchewan being conducted by the Saskatchewan Research Council. The location of his Information Sites are shown on the maps (Figs. 3-9, in back). His information is currently being prepared for open file and can be obtained at a later date.

1.4 Present Study

This investigation is based on the study of black and white aerial photographs 1:30,000 to 1:35,000 taken in 1952 by the Department of Energy, Mines and Resources; on photo-mosaics 1:50,000 and 1:125,000 from the above vertical photographs; and on topographic maps 1:50,000 and 1:250,000 compiled by the same Department.

The investigation of the aerial photographs and mosaics was done as follows. To provide a rapid overview of the Cree Lake area, 1:125,000 photo-mosaics were studied in conjunction with 1:125,000 topographic maps with 10 m contour intervals. After this overview, the vertical aerial photographs were examined with the aid of a stereoscope, and the contacts were plotted on 1:50,000 mosaics which were printed from Saskatchewan Research Council negatives. This information was traced on 1:50,000 matte positive topographic maps (Figs. 3-9, in back). The information from these maps was compiled on a 1:250,000 interpretive map to explain the origin and history of the Quaternary deposits.

A draft copy of the "Quaternary geology of the Cree Lake Extension" was compiled and sent to SMDC on June 8, 1978. This draft report was compiled to provide the client with a preliminary interpretation of the Quaternary geology to assist the field exploration which was in progress.

Ground checking of the aerial photo interpretation was conducted between June 21 and 23 at which time at least one locality in each of the main map units was examined.

The preliminary report, which was based on aerial photo interpretation, has been modified to include the results of the field investigation and to include suggestions made by Dr. Clark in his letter of June 13, 1978 and by him and his staff during the field study on June 21 to 23.

2. QUATERNARY DEPOSITS

2.1 Introduction

The Quaternary deposits occur in glacial, glaciofluvial , glaciolacustrine, and eolian landforms. These landforms can be detected readily on the aerial photographs but the sediments, except where examined in five localities, are inferred from the nature of the landform.

2.2 Glacial Landforms

2.2.1 Introduction

Glacial landforms were formed directly by the glacier either by glacial deposition or erosion. They include drumlins and drumlinized terrain, flutings, fluted terrain, and end moraines.

2.2.2 Drumlins and Drumlinized Terrain

The drumlins in the Cree Lake area are oval-shaped in plan with the long axis trending northeast-southwest (Fig. 10A). The widest and highest part of these features are generally in the northeastern part of the drumlins. According to Sproule (1939), the features range in length from a few yards

A

B

Figure 10. Cree Lake Drumlins. (A) Drumlin with wave-cut cliffs looking southwest, north of Chartrand Point (Fig. 3; 397000 E, 6366500 N) and (B) till from drumlin near Diabase Peninsula (Fig. 3; 387000 E, 6369300 N; Appendix 1, p-31).

to three miles and are up to 250 feet high. Most of the drumlins studied in this investigation are fluted. Where the drumlins are long and narrow, the trend of the flutings is parallel to the long axis of the drumlins. Where the drumlins are more equidemensional, the trend of the flutings tend to deviate from the long axis of the drumlins such as the drumlin 3 km east of Moon Lake (Fig. 7, 74H-5, 467000 E and 6372000 N). All ice-movement directions on Figures 3 to 9 were taken from flutings and long, narrow drumlins (ispatinows) only.

According to Sproule (1939), the drumlins are almost entirely restricted to the Athabasca Formation (Fig. 11). Sproule (1939) also discovered the drumlins are composed of moraine which the author of this report found to be the case in the one drumlin examined (Fig.10B; Appendix 1, p - 31). During the investigation of this drumlin, a one-metre depression was discovered near the top of the feature which is interpreted as a shallow kettle and which, consequently, suggests the ablation material (till, Fig. 10B) is at least a metre thick. Sproule (1939) concluded the Cree Lake drumlins are migratory drumlins formed by glacial deposition.

Gravenor (1953), in his review of the theories on the origin of drumlins, concluded that it is known that drumlins have formed by erosion, but there is no proof that drumlins have formed by deposition only. Kupsch (1955) interpreted the Dollard drumlins to be drumlinized kames of the "crag and tail" erosional origin with deposition of till in the tail downstream from the kame obstruction. Clayton and Moran (1974), in their theoretical considerations on the origin of drumlins, believe drumlins

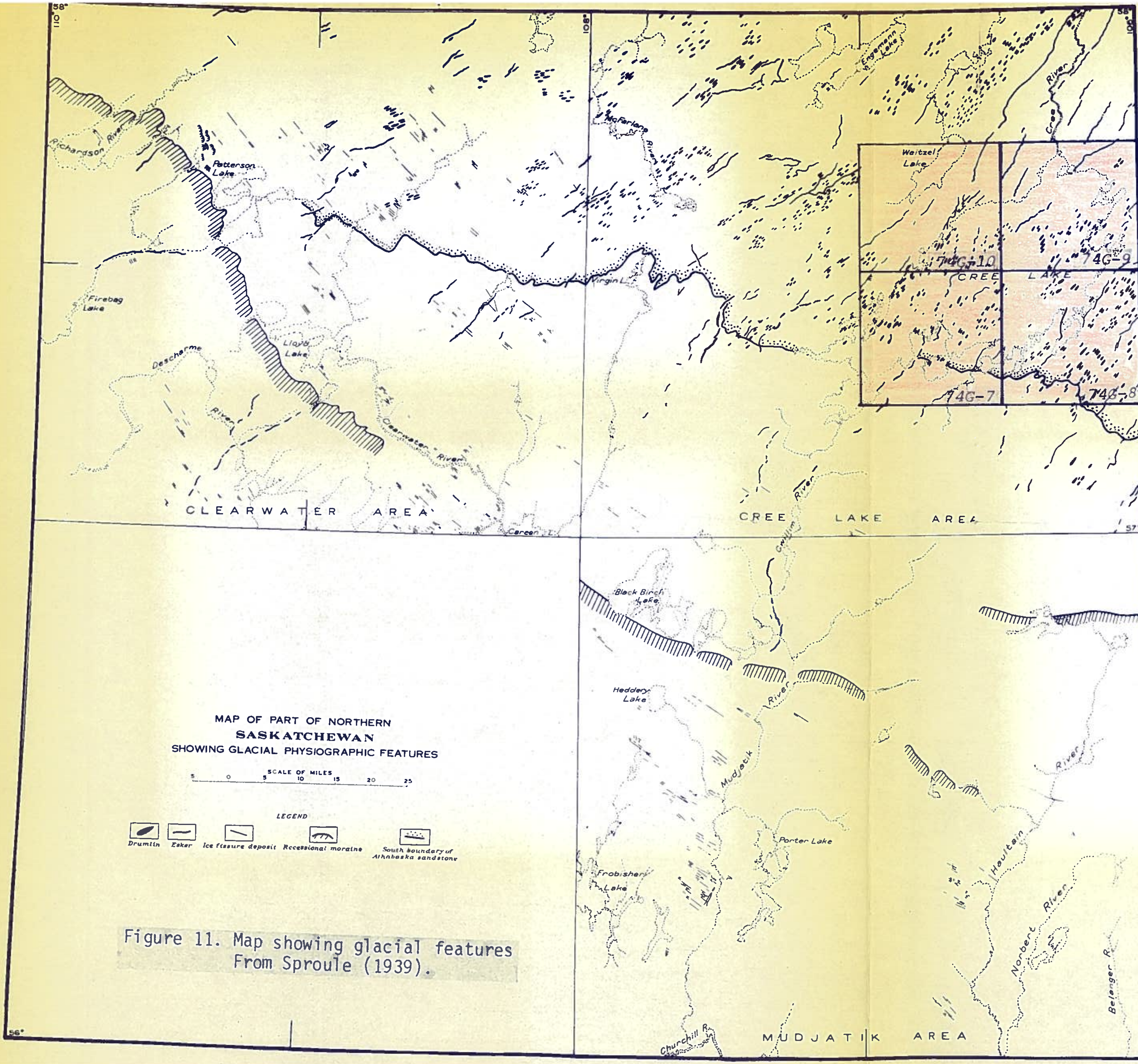

Figure 11. Map showing glacial features
From Sproule (1939).

and all related features were formed in the thawed-bed zone (abrasion zone, Fig. 12) where the glacier could slide over its bed some distance back from the frozen-bed (quarrying zone).

The following evidence suggests the Cree Lake drumlins are erosional features.

(1) Baer (1969) mapped a drumlin as an outcrop of Athabasca Formation (Fig. 8, 74H-11, 488500 E and 6398000 N).

(2) The drumlins are restricted almost entirely to the Athabasca Formation. If the drumlins were depositional in origin, they would be expected to extend beyond the southern boundary of their source, the Athabasca Formation.

(3) Flutings on the surface do not always coincide with the long axis of drumlins (Fig. 7, 74H-5, 467000 E and 6372000 N). Such an agreement would be expected in depositional drumlins.

Although this office and short field investigation suggest the Cree Lake drumlins are erosional features, further field work is required to substantiate this hypothesis.

2.2.3 Fluting and Fluted Terrain

Flutings appear on aerial photographs as a series of parallel striations and cover a large area in the vicinity of Weitzel Lake where the features are mapped as Fluted Terrain (Fig. 6). For the most part the surfaces of the drumlins are also fluted.

There is general agreement in the literature that flutings are formed by glacial erosion and that flutings and drumlins are gradational features

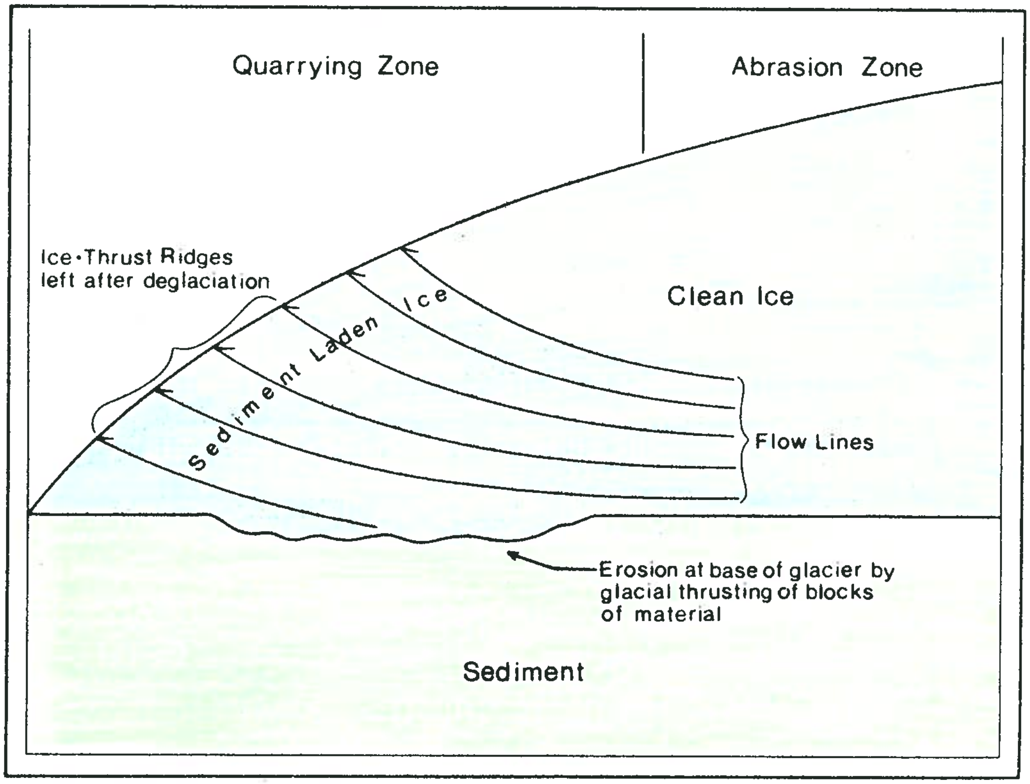

Figure 12. Schematic diagram showing quarrying and abrasion zones. From Clayton and Moran (1974).

(Clayton and Moran, 1974; Gravenor and Meneley, 1958; Lemke, 1958; Smith, 1948). More specifically according to Clayton and Moran (1974), flutings are formed at the base of the glacier in the thawed-bed zone (abrasion zone, Fig. 12).

2.2.4 End Moraine or Rock Ridges

Large ridges, which are up to 75 m high, 1 km wide, and 6 km long and which are normal to the fluting and drumlin trend (Fig. 3), are interpreted as end moraines formed along the ice margin. During the course of the field investigation, SMDC field personnel discovered rock outcrops (diabase) on the ridge on Fleming Island mapped as an end moraine (Fig. 3; 386500 E , 6361000 N). It is possible that this ridge and the other similar appearing ridges, mapped as end moraines in Figure 3, are rock ridges and not end moraines.

2.2.5 Ridged Moraine

Series of parallel ridges, perpendicular to the fluting and drumlin trend (Figs. 3,4,6), are herein called ridged moraine. Gwynne (1942), who called such features swells and swales, concluded that these features represent former positions of the ice margin.

2.3 Glaciofluvial Landforms

2.3.1 Glaciofluvial Terrain

Large areas of glaciofluvial deposits occur in Figure 3,5, and 6. Ice-walled channels extend into these deposits from the northeast and become partly or completely obscured by these sediments. The extension of these channels through the glaciofluvial deposits is marked by well-developed eskers.

The glaciofluvial terrain is hummocky and is composed of kames, kettles, eskers, and outwash which was derived from englacial material brought up into the glacier by glacial quarrying (Fig. 12). The deposit is expected to range from sand and gravel to till depending on the degree of sorting that took place when this superglacial and englacial material was released by the melting glacier. The terrain examined (Fig. 13A; Appendix 1, p - 33) is composed of sand and gravel.

2.3.2 Ice-walled Channels and Eskers

Ice-walled channels were formed either in tunnels beneath the glacier or in open ice-walled valleys in the stagnating terminal zone of the glacier (Gravenor and Kupsch, 1959). Where deposition took place in these channels, eskers resulted.

An ice-walled channel in Figure 4 was examined in the field (Fig. 13B). Numerous, shallow hand-dug holes revealed well sorted sand and gravel. In addition to these glaciofluvial deposits, a segment of an esker was found to be covered with a concentration of boulders probably formed in a glacial moulin.

In the Cree Lake area, the ice-walled channels conducted meltwater in a southwesterly direction (Fig. 3-9) from the melting glacier through the glaciofluvial deposits (Figs. 3,5,6) into the proglacial area. In most places, the ice-walled channels followed pre-existing valleys but,

A

B

Figure 13. Glaciofluvial Terrain (A) Exposure of sand and gravel covered with eolian sand and buried soils and (B) ice-walled channel showing kames, kettles, and eskers (Fig. 4; 433000 E , 6369500 N).

locally, the channels crossed divides (Fig. 8, 471000 E and 6382300 N).

Eskers are the most common feature in the ice-walled channels. They appear as single ridges (Fig. 9, 467000 E and 637740 N) or as multiple ridges (Fig. 9, 443000 E and 6376000 N, mosaic) forming a braided pattern.

2.4 Glaciolacustrine Landforms

2.4.1 Glacial Cree Lake Strandlines

Well-developed, raised wave-cut cliffs surround many of the islands in Cree Lake (Fig. 10A) and some of the uplands adjacent to the lake (Figs. 3-5). Only a few examples are shown in these Figures. The Cree Lake strandlines are composed of a wave-cut cliff and a wave-cut terrace strewn with boulders (Fig. 14A). At the lakeward boundary of the raised wave-cut cliff, boulders are concentrated into piles (Fig. 14B; sketch, Appendix 1, p-32). This concentration is believed to be the result of transportation of boulders from the terrace by lake ice.

According to the topographic map (Fig. 4) and the vertical photographs, the wave-cut cliffs are up to an elevation of 530 m which is about 25 m higher than the highest outlet of Glacial Cree Lake. This lake was ice-dammed to the north and overflowed to the south through Brustad, Gwillim. and Mudjatik Rivers into the Churchill River System. The threshold on the outlet immediately south of Glacial Cree Lake ranges in elevation from about 485 to 505 m. The fact that the highest wave-cut beaches are about 25 m above the highest part of the lake outlet suggests that differential rebound took place as the ice melted.

A

B

Figure 14. Cree Lake Strandlines. (A) Wave-cut terrace strewn with boulders and (B) boulder concentration on lakeward boundary of raised wave-cut terrace (Fig. 3; 387000 E, 6369300 N).

A well stratified and sorted lacustrine sand blanket is expected over much of the low relief areas of the lake basin where erosion has been minimized. The cursory field study, however, did not reveal any lacustrine sand.

2.5 Eolian Landforms

2.5.1 Parabolic Dunes

Parabolic, u-shaped dunes occur in Figure 3 south of Snow Island (Fig. 15A) and on Espatinow Island (Appendix 1, p - 30). In parabolic dunes the horns point in the direction from which the wind blew. The Cree Lake dunes were formed, therefore, by southeasterly winds. The Physics Division, Saskatchewan Research Council are presently compiling wind rosettes for the Cree Lake weather station which will be available in a few weeks. The Cree Lake dunes are 2 to 3 metres high and are composed of fine-to medium-grained sand.

The fact the dunes are partly drowned by water which occupies the deflation basins (Fig. 15A) indicates the water table and, consequently, Cree Lake was lower when these dunes formed.

2.5.2 Buried Soils

Two buried soils, covered with eolian sand, occur in Figure 5 (Appendix 1, p - 33 ; Figs. 13A, 15B). The lower soil is well developed with a reddish brown Bm, a white Ae, and a black Ah layer, The upper soil is less well developed. These buried soils indicate at least two periods of dune activity during postglacial time.

A

B

Figure 15. Eolian Deposits. (A) U-shaped, parabolic dunes looking north and (B) eolian sand overlying buried soil on top of glaciofluvial sand and gravel. Brown color is from Bm horizon. The lower buried soil in this Figure is the same as the on in Figure 13A.

3. CREE LAKE

Cree Lake, which is a remnant of the larger Glacial Cree Lake, drains northward through the Cree River, whereas Glacial Cree Lake drained southward through the Mudjatik River. According to Rawson (1959), Cree Lake covers about 542 square miles, 96 square miles of which are represented by about 550 islands. About 175 of these islands are identified as drumlins.

Commonly, Cree Lake is less than 100 feet deep but in several places, depths exceed 150 feet (154 feet in Southwest Bay, 168 feet northwest of Grey Island, 197 feet between Diabase Peninsula and 3 Mile Island, Fig. 16). The Cree Lake basin is believed to be the result of glacial erosion. The thick glaciofluvial deposits south of Cree Lake (Fig. 3) was derived, presumably, from the material eroded from this basin.

4. LINEAR FEATURES OF UNKNOWN ORIGIN

Linear features of unkown origin are apparent on the 1:50,000 mosaics for 74G-8 and 74H-5 (Figs. 4,7). They trend in an northwesterly direction and do not appear to be glacial in origin. Poor weather and lack of time did not permit a field examination of these features.

5. GLACIAL FORM-PROCESS-TIME MODEL

5.1 Introduction

During glacial retreat, down melting of the glacier resulted in a zone of stagnant ice along the glacier margin. As the active ice moves forward

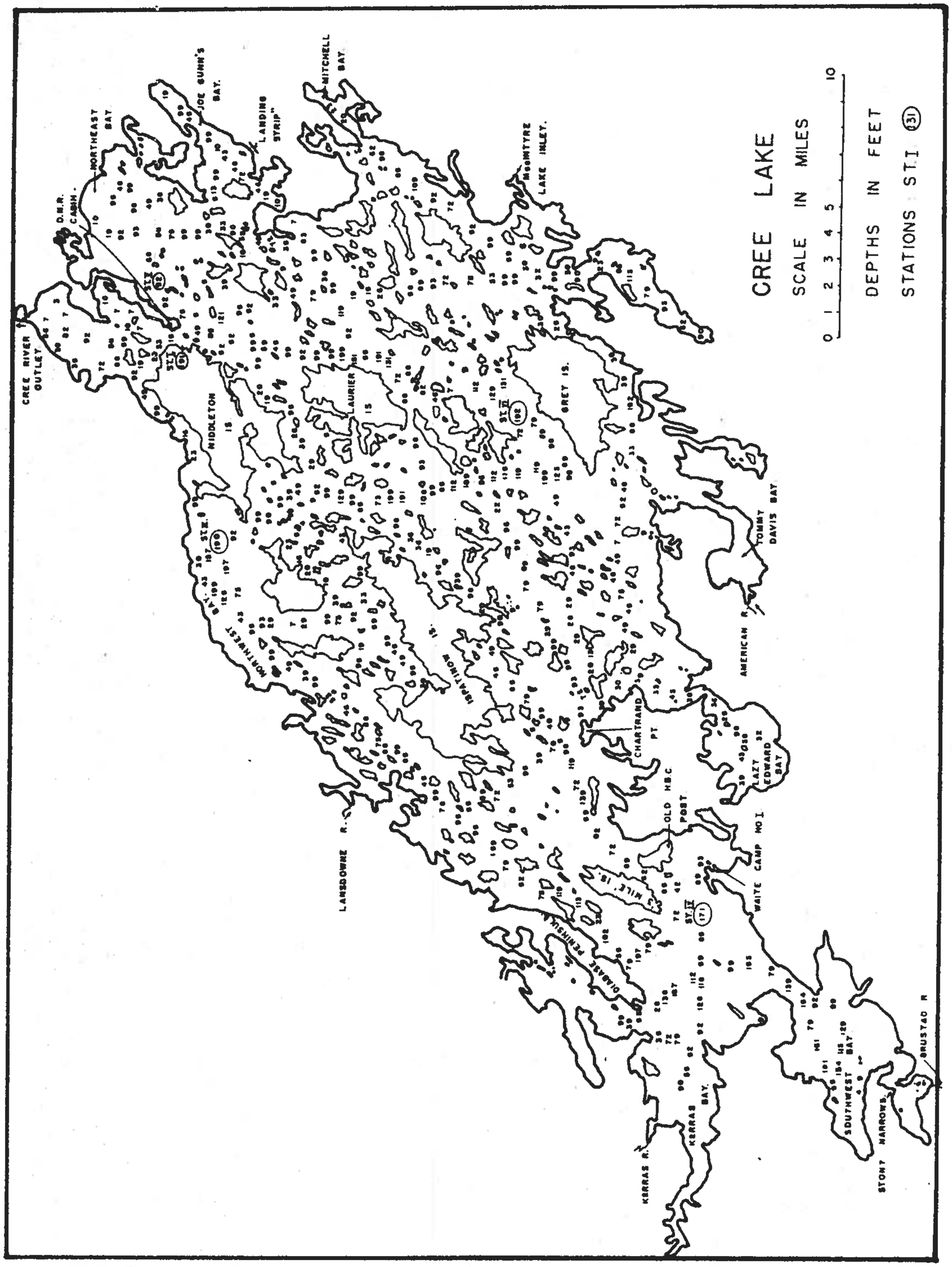

Figure 16. Depths of water in Cree Lake.

during slight re-advances, active ice is thrust over stagnant ice in the quarrying zone (Fig. 12) which results in a zone of dirty ice along the ice margin. Iceward from this zone and parallel to it, an abrasion zone (Fig. 12) is developed. When the dirty ice melts, the material is either deposited directly as till or is sorted by fluvial action to form glaciofluvial terrain and eskers.

5.2 Application of Model to Cree Lake Area

Three zones, within which the glaciofluvial deposits and tills are locally thicker, occur in the Cree Lake area (Fig. 17). The thicker drift in these zones is in the form of hummocky, glaciofluvial terrain, end moraines, and eskers, the latter of which commonly exhibit a braided pattern. These thicker drift zones are believed to have formed by overthrusting in the quarrying zone (Fig.12) during re-advance of the glacier. As the glacier melted, much of the material was sorted to varying degrees to form glaciofluvial terrain, end moraines, and eskers. Where the glaciofluvial deposits are thin or absent in these zones, fluted and drumlinized terrain, which was formed at the base of the glacier in the abrasion zone,appears at the surface.

The best-developed fluted and drumlinized terrain occurs in the abrasion zones (Fig. 17) between the quarring zones. Here the ice was clean with little or no englacial material to obliterate the subglacially fluted and drumlinized surface.

The oldest ice marginal or quarrying zone occurs in the southwest corner of Figure 17. This ice frontal position predates Glacial Cree Lake.

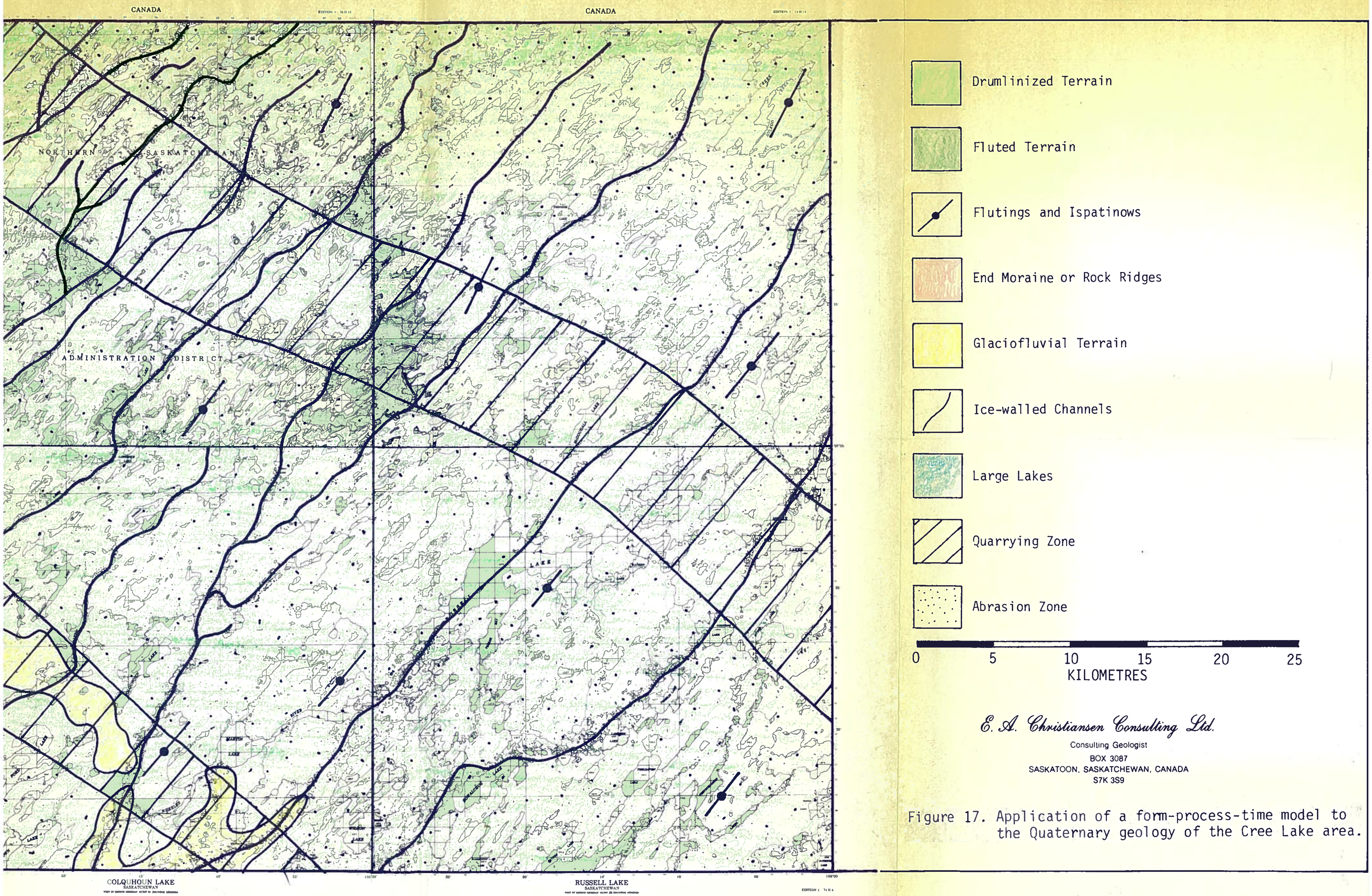

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Figure 17. Application of a form-process-time model to the Quaternary geology of the Cree Lake area.

When the ice retreated northeastward from this position, Glacial Cree Lake came into existence. Fine grained sand was deposited on the glaciofluvial, fluted, and drumlinized terrains, and wave-cut cliffs and terraces were built during this time. The glacier continued to retreat northeastward and readvanced sequentially to the central and northeastern ice marginal positions to form the alternating quarrying and abrasion zones shown in Figure 17. As the glacier retreated, differential rebound took place,and the wave-cut cliffs were differentially uplifted to elevations higher than the lake outlet.

Since glaciation, a few parabolic dunes have formed by southeast winds, and some sedimentation is taking place in the lakes, swamps, and marshes.

6. DRIFT PROSPECTING

6.1 Introduction

Drift prospecting is concerned with two aspects: (1) the search for float and (2) the tracing of float.

6.2 Search for Float

Faults and joints in the Athabasca Formation of the Cree Lake area, along which uranium could have migrated, are targets for uranium prospecting. Such structural features (lineaments) would appear in the present surface as both elongated depressions and ridges. Where the rocks have been weakened by faulting of jointing, elongated depressions tend to form, particularly if the trend of the lineaments is in the direction of ice movement.

The northeast-southwest ice-walled channels have the same trend as the major faults in the region (Haites, 1960), and their trend may have been controlled by such structures. On the other hand, the ice-walled channels would trend in this direction without structured control because the gradient on the surface of the glacier was to the southwest.

Where such faults or joints were injected with diabase, rock ridges would form if the diabase is more resistant to glacial erosion than the Athabasca Formation country rock. Diabase Peninsula and the ridges mapped as end moraine in Figure 3 (386500 E , 6361000 N), where SMDC personnel recently discovered diabase outcrops, may owe their origin to diabase dikes. If this ridge is a diabase ridge rather than an end moraine,then the other ridges mapped as end moraines, which are similar in appearance, are also likely to be diabase ridges following joints or faults in the Athabasca Formation.

It must be remembered, however, that elongated depressions can be formed by glacial erosion in homogeneous rock. Where the rock is weakened and more susceptible to glacial erosion, such depressions will be deeper, but a weak rock is not a pre-requisite for their formation.

Linear features that may be lineaments occur in Figures 4 and 7. During the authors brief field investigation,time and weather did not permit an investigation of these features.

Comparision of the Athabasca Formation and the older Precambrian terrain show a great contrast in the nature and number of lineaments. In these older rocks, a mosaic of lineaments is readily visible on aerial photographs. On the Athabasca Formation of the Cree Lake area, however, most lineaments would be inferences and if mapped should be referred to as linear features because of the uncertainty of whether they are structural elements.

Whether ice-walled channels follow lineaments or not, they are potentially important in the search for float because they represent a collector of material from a relatively broader band up-channel. Examination of sands and gravels, sufficiently coarse for the uranium to withstand the physical and chemical weathering, should be an efficient approach to the search for float in the Cree Lake Extentsion.

6.3 Tracing Float

6.3.1 Introduction

In tracing float , the direction and distance from the float to the source must be determined. In the Cree Lake area, the direction of movement is well recorded in the flutings and narrow drumlins (ispatinows). The distance to source depends on the nature of the sediment in which the float occurs.

In the Cree Lake area mineralized material may occur in lodgment till deposited at the base of the glacier, in ablation till which was carried within the glacier and which is released during melting, in glaciofluvial deposits of ablation origin grading from stratified drift to till, in eskers, and in boulders in bouldery terraces along wave-cut cliffs and in moulins deposits.

6.3.2 Lodgment Till

Lodgment till is likely to be the most locally derived Quaternary deposit in the Cree Lake area. If the drumlins are erosional in origin, lodgment till, deposited by the last glacier, will probably occur in the leeward end of the drumlin (southwest end).

6.3.3 Ablation Till

Ablation till is derived from the melting glacier. Such till is thrust into the ice in the quarrying zone. Ablation till is generally partly sorted by meltwater released from the retreating glacier.

6.3.4 Glaciofluvial Deposits

Most of the glaciofluvial deposits in the Cree Lake area are ice-contact in origin and have been formed similar to the ablation till except they are better sorted. These sediments have been transported by ice and by water.

6.3.5 Eskers

The eskers are more numerous in the quarrying zones (Fig. 17) than in the abrasion zones. In the quarrying zone they commonly exhibit a braided pattern. The material in these eskers was initially thrust up into the glacier in the quarrying zone, released from the glacier by melting, and transported by meltwater in ice-walled channels. These deposits were probably transported the farthest of the glacial and glaciofluvial deposits in the Cree Lake area. The better the sorting and the finer the texture, the farther the sediment was propably transported. Where kames and knobs of poorly sorted glaciofluvial deposits and till occur in association with the eskers in ice-walled channels, less distance of transport is indicated.

6.3.6 Boulder Concentrations

Boulder concentrations were observed on wave-cut terraces and eskers examined. Such boulder concentrations may facilitate the exploration of mineralized boulders.

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APPENDIX 1. Field notes.

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GEOLOGIST–SITE		NAME OF SITE	PROJECT NO.
EAC	00052	CREE LAKE	0220

N T S	UTM – ZONE	UTM–EASTING (M)	UTM–NORTHING (M)
74G/07	13	403850	6372050

1/4	LSD	S	T	R	M	LATITUDE	N,S
					W	° '	

LONGITUDE	E,W	TYPE OF OBSERVATION	DAY	MO.	YEAR
° '		DUGHOLE	21	06	1978

ELEVATION (M)		SOURCE OF ELEVATION	AERIAL PHOTOGRAPH NO.	
500		TOP MAP 10		

METRES: 0, 5, 10, 15 — FEET: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50

Sample at head of u-shaped dune, 60 cm below surface. Sloughs in blow-outs, ridge about 2-3 m high.

Sloughs in blow-out depression indicate groundwater levels were lower.

Sand, fine to medium, well rounded, very pale brown (10YR7/3, dry).

EAC.
SIGNATURE

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GEOLOGIST–SITE		NAME OF SITE	PROJECT NO.
EAC	00053	CREE LAKE	0022

N T S	UTM – ZONE	UTM–EASTING (M)	UTM–NORTHING (M)
74G/07	13	387150	6369350

1/4	LSD	S	T	R	M	LATITUDE	N,S
					W	° '	

LONGITUDE	E,W	TYPE OF OBSERVATION	DAY	MO.	YEAR
° '		DUGHOLE	22	06	1978

ELEVATION (M)	SOURCE OF ELEVATION	AERIAL PHOTOGRAPH NO.
515	TOP MAP 10	

The profile on the east side of the drumlin is shown on page 2. Boulders are strewn on the wave-cut terrace with very heavy concentrations on the slope at the lower end of the terrace. Some of these boulders appear to be derived from the wave-cut terrace.

Sample taken from 1 m below surface from top of drumlin

Till, sandy and bouldery, pinkish gray (5Y6/2, dry), noncalcareous.

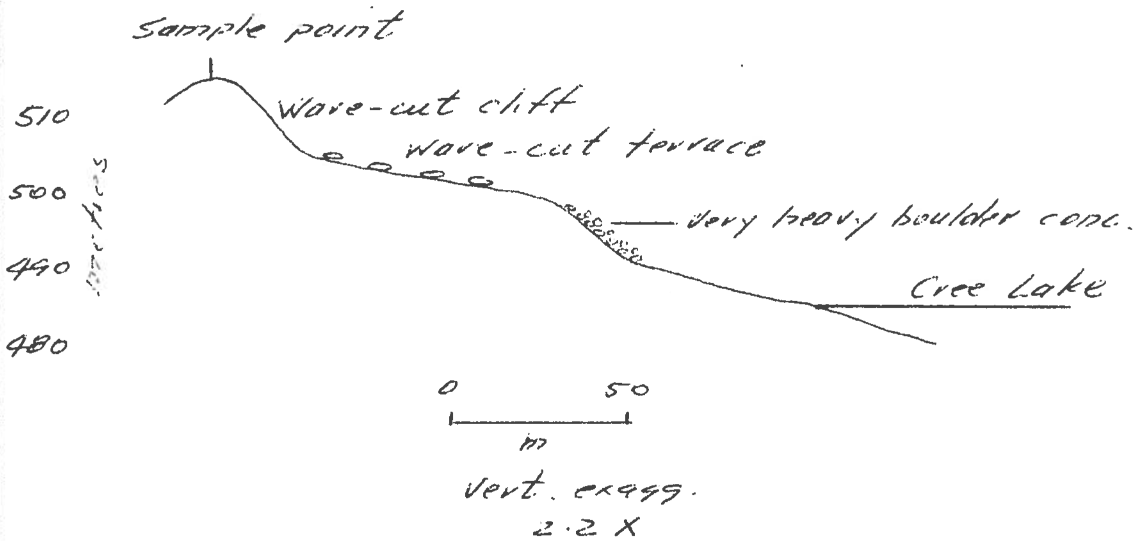
North of sample site on west-slope of drumlin is a depression about 1 m deep suggesting the ablation till is at least this deep.

SIGNATURE

GEOLOGIST–SITE		NAME OF SITE	PROJECT NO.
EAC	00053	CREE LAKE	0022

DIAGRAM OF EAST SIDE OF DRUMLIN

based on 1:50,000 topographic map and field study



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PAGE 1 OF 1

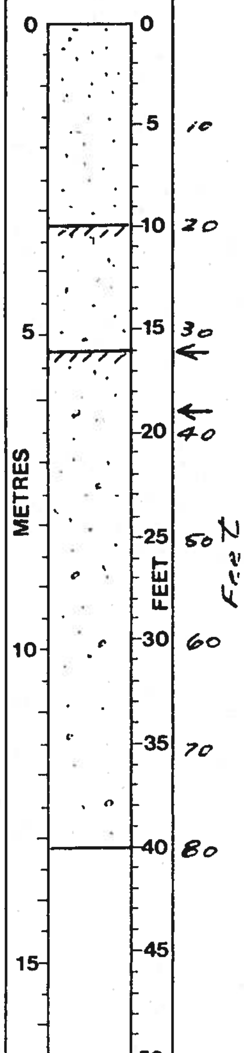
GEOLOGIST–SITE		NAME OF SITE	PROJECT NO.
EAC	00054	CREE LAKE	0022

N T S	UTM – ZONE	UTM–EASTING (M)	UTM–NORTHING (M)
74G/09	13	411200	6389200

1/4	LSD	S	T	R	M	LATITUDE	N,S
					W	° '	

LONGITUDE	E,W	TYPE OF OBSERVATION	DAY	MO.	YEAR
° '		EXPOSURE	22	06	1978

ELEVATION (M)		SOURCE OF ELEVATION	AERIAL PHOTOGRAPH NO.	
500		TOP MAP 10		



Eolian sand

Buried soil, poorly developed Bm.

Eolian Sand

Buried soil, well devel. Ah, Ae, and Bm

C14 Sample of Ah horizon

Sample Point

Sand, coarse, well rounded, very pale brown (10YR 7/3, dry), noncalcareous.

Glaciofluvial sand

The slope developed in this glaciofluvial sand is strew with pebbles, cobbles and boulders. These "lag" stones are etched and polished by wind blown sand grains

Base of section is Cree Lake

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GEOLOGIST–SITE		NAME OF SITE	PROJECT NO.
EAC	00055	CREE LAKE	0022

N T S	UTM – ZONE	UTM–EASTING (M)	UTM–NORTHING (M)
74G/08	13	428750	6368850

1/4	LSD	S	T	R	M	LATITUDE	N,S
					W	° '	

LONGITUDE	E,W	TYPE OF OBSERVATION	DAY	MO.	YEAR
° '		LANDFORM	22	06	1978

ELEVATION (M)	SOURCE OF ELEVATION	AERIAL PHOTOGRAPH NO.
525		

METRES: 0, 5, 10, 15 — FEET: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50

Till sample taken from top of ridge above highest wave-cut cliff

Three well-developed wave-cut cliffs and terraces strew with lag boulders are present.

Till, noncalcareous, sandy and silty, pinkish white (5YR 8/2, dry)

Depth of sample 55 cm

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PAGE 1 OF 1

GEOLOGIST–SITE		NAME OF SITE	PROJECT NO.
EAC	00056	MacINTYRE LAKE	0022

N T S	UTM – ZONE	UTM–EASTING (M)	UTM–NORTHING (M)
74G/08	13	432600	6368750

1/4	LSD	S	T	R	M	LATITUDE	N,S
					W	° '	

LONGITUDE	E,W	TYPE OF OBSERVATION	DAY	MO.	YEAR
° '			23	06	1978

ELEVATION (M)	SOURCE OF ELEVATION	AERIAL PHOTOGRAPH NO.
485	TOP MAP 10	

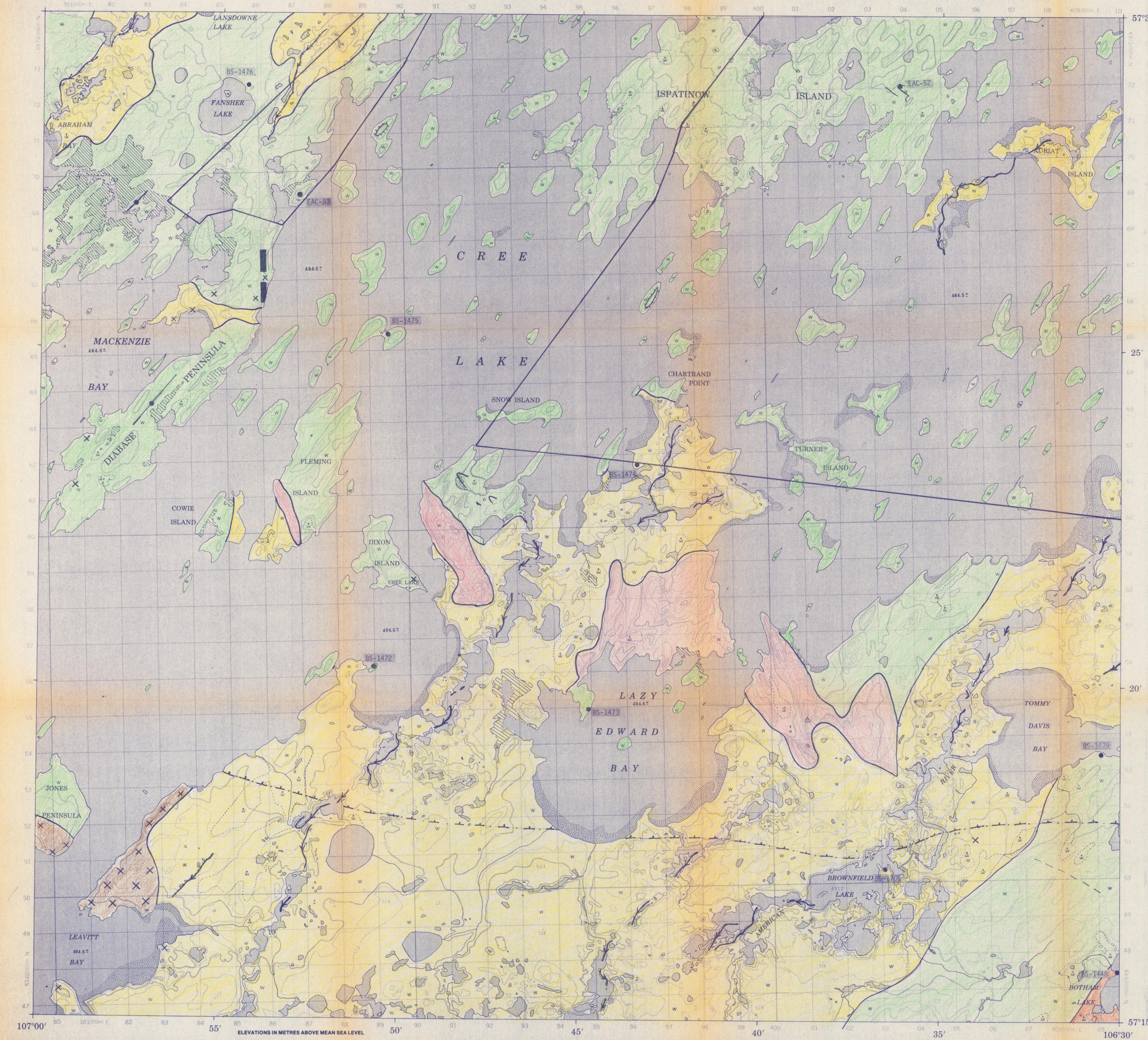
METRES: 0, 5, 10, 15 — FEET: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50

Traversed from small kettle-pond at above site to northwest side of ice-walled channel. This ice-walled channel is covered with eskers, kames, and glacio-fluvial plains. The sediment on the surface of these landforms is mainly sand. The eskers are about 20m high. Locally, the esker is composed of a conical hill of boulders probably deposited in a moulin in the glacier. Kettles are common also in these ice-walled valleys.

SIGNATURE

CANADA

EDITION 1 74 G/7



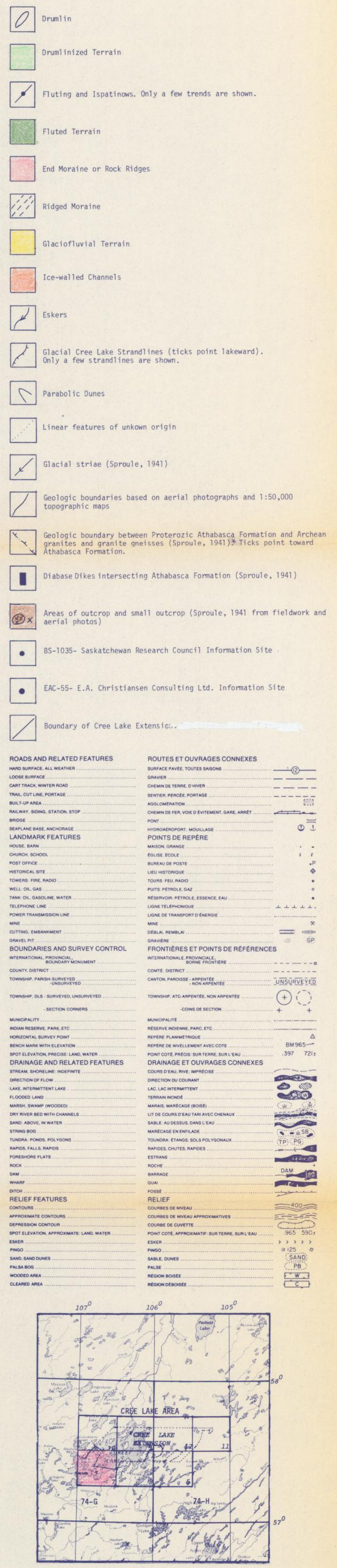


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FIGURE 3. QUATERNARY GEOLOGY OF 74G-7.

ELEVATIONS IN METRES ABOVE MEAN SEA LEVEL
CONTOUR INTERVAL .... 10 METRES

NORTH AMERICAN DATUM 1927
TRANSVERSE MERCATOR PROJECTION

ISPATINOW ISLAND
SASKATCHEWAN

Scale 1:50,000 Échelle

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* Reference should read Gilboy and Ramaekers (1977).

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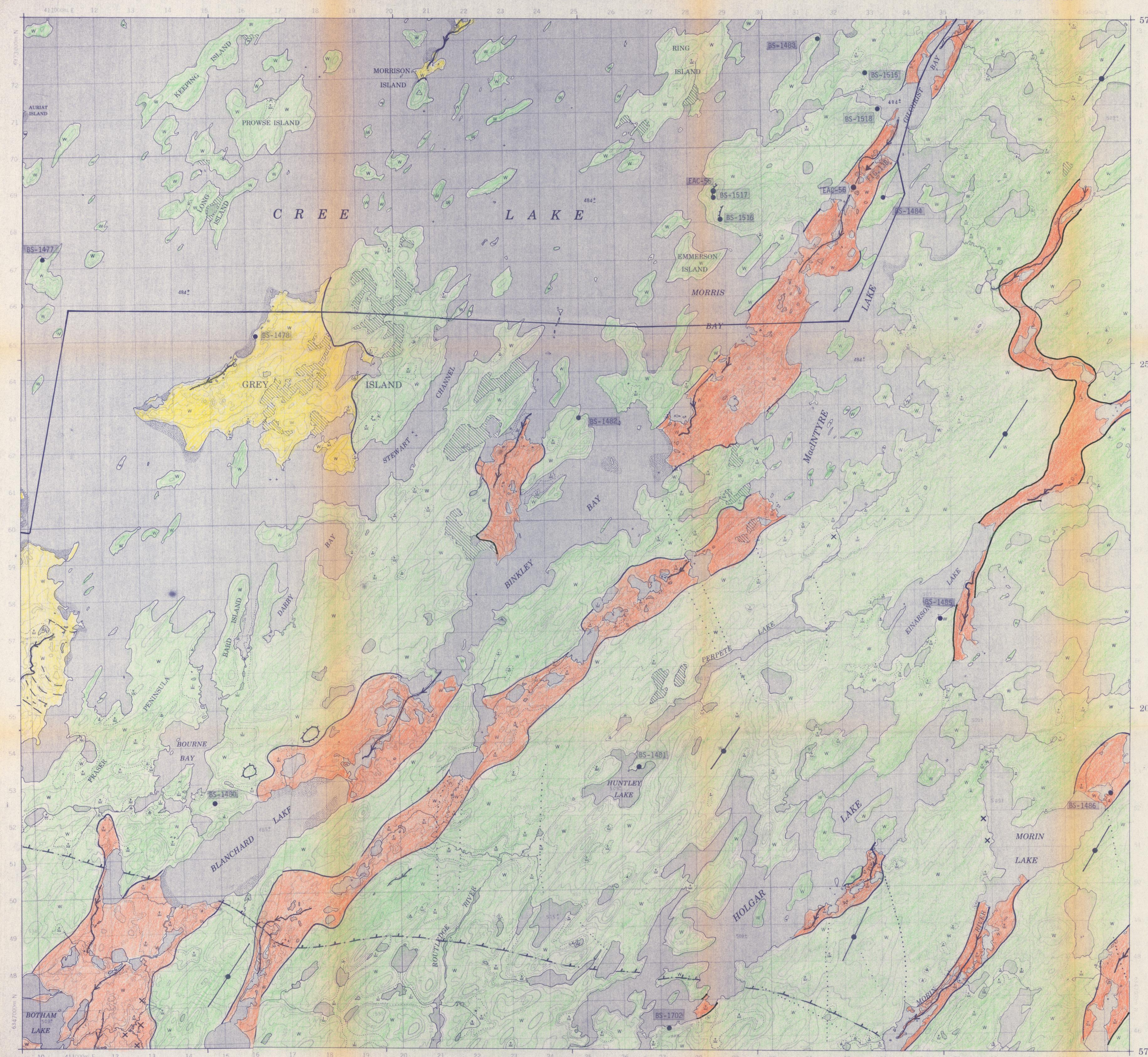
EDITION 1 74 G/8



106°30′ 25′ 20′ 15′ 10′ 05′ 106°00′

57°30′ 25′ 20′ 57°15′

ELEVATIONS IN METRES ABOVE MEAN SEA LEVEL

CONTOUR INTERVAL .... 10 METRES

NORTH AMERICAN DATUM 1927

TRANSVERSE MERCATOR PROJECTION

MacINTYRE LAKE

SASKATCHEWAN

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Drumlin

Drumlinized Terrain

Fluting and Ispatinows. Only a few trends are shown.

Fluted Terrain

End Moraine or Rock Ridges

Ridged Moraine

Glaciofluvial Terrain

Ice-walled Channels

Eskers

Glacial Cree Lake Strandlines (ticks point lakeward). Only a few strandlines are shown.

Parabolic Dunes

Linear features of unkown origin

Glacial striae (Sproule, 1941)

Geologic boundaries based on aerial photographs and 1:50,000 topographic maps

Geologic boundary between Proterozic Athabasca Formation and Archean granites and granite gneisses (Sproule, 1941)*. Ticks point toward Athabasca Formation.

Diabase Dikes intersecting Athabasca Formation (Sproule, 1941)

Areas of outcrop and small outcrop (Sproule, 1941 from fieldwork and aerial photos)

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EAC-55- E.A. Christiansen Consulting Ltd. Information Site

Boundary of Cree Lake Extension.

ROADS AND RELATED FEATURES	ROUTES ET OUVRAGES CONNEXES
HARD SURFACE, ALL WEATHER	SURFACE PAVÉE, TOUTES SAISONS
LOOSE SURFACE	GRAVIER
CART TRACK, WINTER ROAD	CHEMIN DE TERRE, D'HIVER
TRAIL, CUT LINE, PORTAGE	SENTIER, PERCÉE, PORTAGE
BUILT-UP AREA	AGGLOMÉRATION
RAILWAY, SIDING, STATION, STOP	CHEMIN DE FER, VOIE D'ÉVITEMENT, GARE, ARRÊT
BRIDGE	PONT
SEAPLANE BASE, ANCHORAGE	HYDROAÉROPORT, MOUILLAGE
LANDMARK FEATURES	POINTS DE REPÈRE
BOUNDARIES AND SURVEY CONTROL	FRONTIÈRES ET POINTS DE RÉFÉRENCES
DRAINAGE AND RELATED FEATURES	DRAINAGE ET OUVRAGES CONNEXES
RELIEF FEATURES	RELIEF

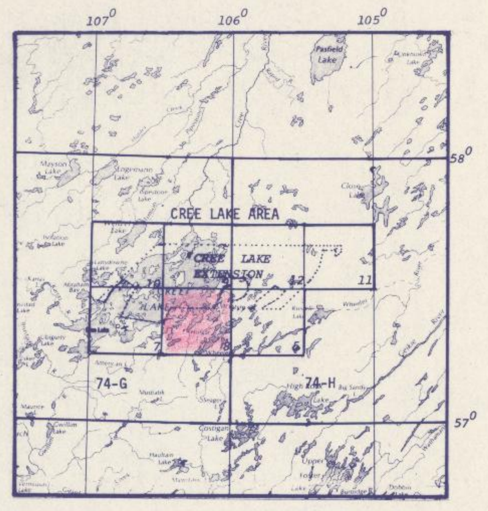

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FIGURE 4. QUATERNARY GEOLOGY OF 74G-8

Scale 1:50,000 Échelle

Miles 1 0 1 2 3 Milles

Metres 1000 0 1000 2000 3000 4000 Mètres

Yards 1000 0 1000 2000 3000 4000 Verges

* Reference should read Gilboy and Ramaekers (1977).

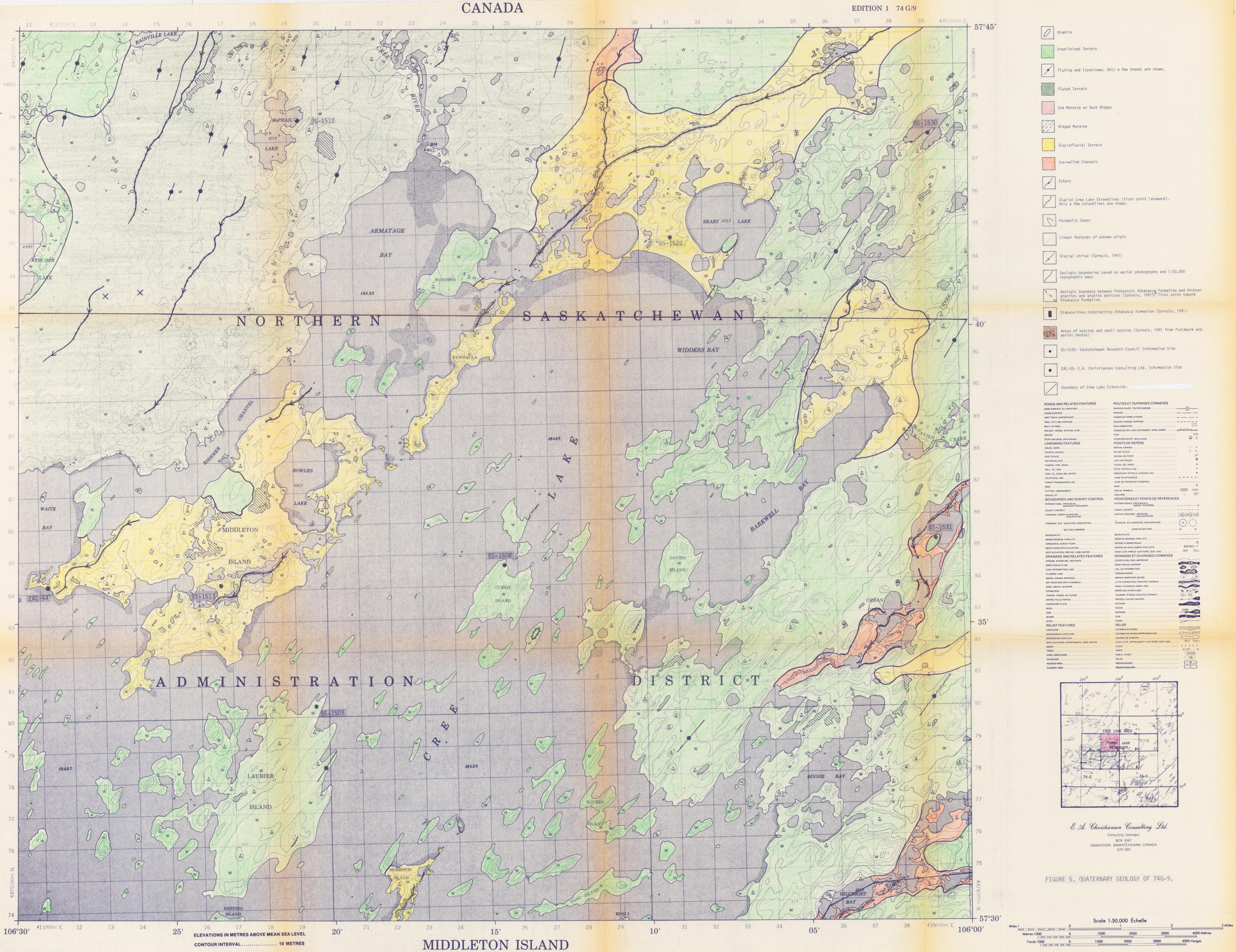

FIGURE 5. QUATERNARY GEOLOGY OF 74G-9.

* Reference should read Gilboy and Ramaekers (1977).

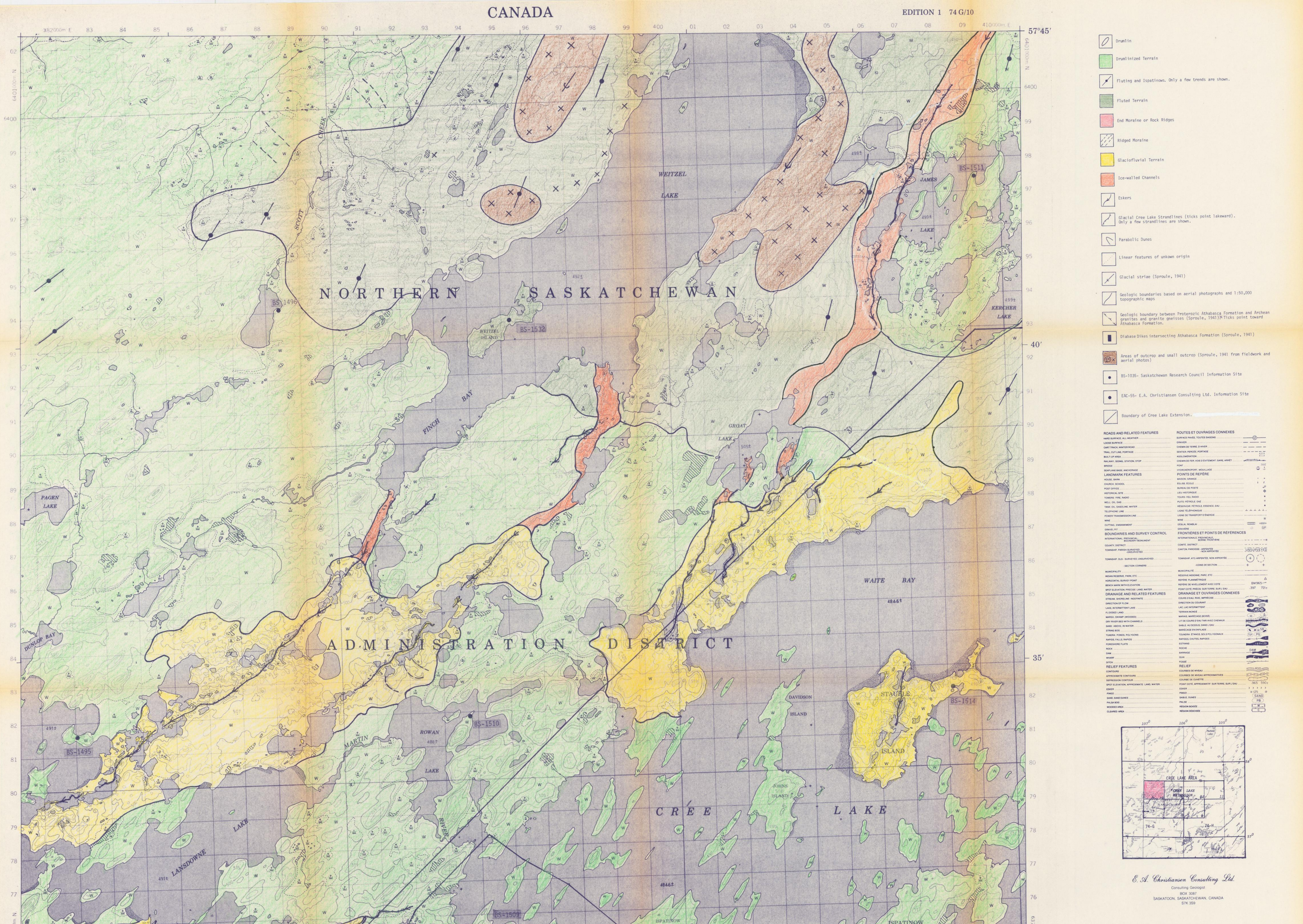

FIGURE 6. QUATERNARY GEOLOGY OF 74G-10.

* Reference should read Gilboy and Ramaekers (1977).

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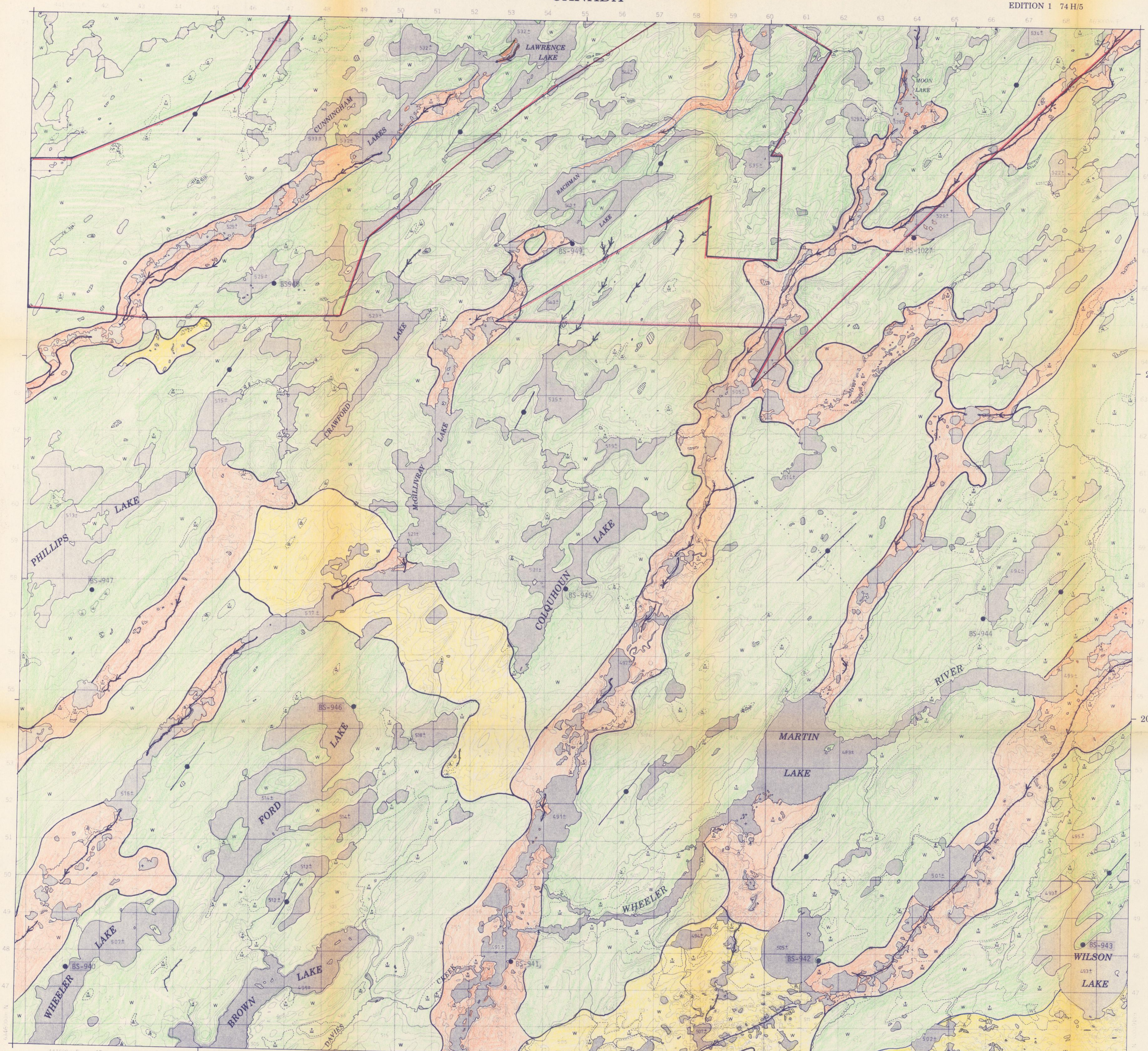
EDITION 1 74 H/5



Drumlin

Drumlinized Terrain

Fluting and Ispatinows. Only a few trends are shown.

Fluted Terrain

End Moraine or Rock Ridges

Ridged Moraine

Glaciofluvial Terrain

Ice-walled Channels

Eskers

Glacial Cree Lake Strandlines (ticks point lakeward). Only a few strandlines are shown.

Parabolic Dunes

Linear features of unkown origin

Glacial striae (Sproule, 1941)

Geologic boundaries based on aerial photographs and 1:50,000 topographic maps

Geologic boundary between Proterozic Athabasca Formation and Archean granites and granite gneisses (Sproule, 1941).* Ticks point toward Athabasca Formation.

Diabase Dikes intersecting Athabasca Formation (Sproule, 1941)

Areas of outcrop and small outcrop (Sproule, 1941 from fieldwork and aerial photos)

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Boundary of Cree Lake Extension.

ROADS AND RELATED FEATURES	ROUTES ET OUVRAGES CONNEXES
HARD SURFACE, ALL WEATHER	SURFACE PAVÉE, TOUTES SAISONS
LOOSE SURFACE	GRAVIER
CART TRACK, WINTER ROAD	CHEMIN DE TERRE, D'HIVER
TRAIL, CUT LINE, PORTAGE	SENTIER, PERCÉE, PORTAGE
BUILT-UP AREA	AGGLOMÉRATION
RAILWAY, SIDING, STATION, STOP	CHEMIN DE FER, VOIE D'ÉVITEMENT, GARE, ARRÊT
BRIDGE	PONT
SEAPLANE BASE, ANCHORAGE	HYDROAÉROPORT, MOUILLAGE
LANDMARK FEATURES	POINTS DE REPÈRE

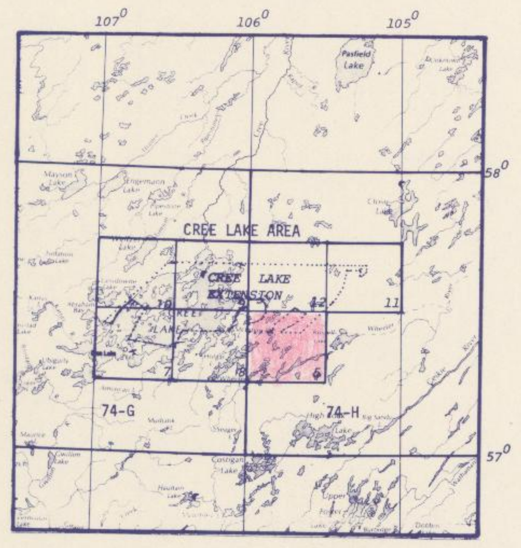

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FIGURE 7. QUATERNARY GEOLOGY OF 74H-5.

ELEVATIONS IN METRES ABOVE MEAN SEA LEVEL

CONTOUR INTERVAL .... 10 METRES

NORTH AMERICAN DATUM 1927

TRANSVERSE MERCATOR PROJECTION

COLQUHOUN LAKE

SASKATCHEWAN

WEST OF SECOND MERIDIAN - OUEST DU DEUXIÈME MÉRIDIEN

Scale 1:50,000 Échelle

Miles 1 0 1 2 3 Milles

Metres 1000 0 1000 2000 3000 4000 Mètres

Yards 1000 0 1000 2000 3000 4000 Verges

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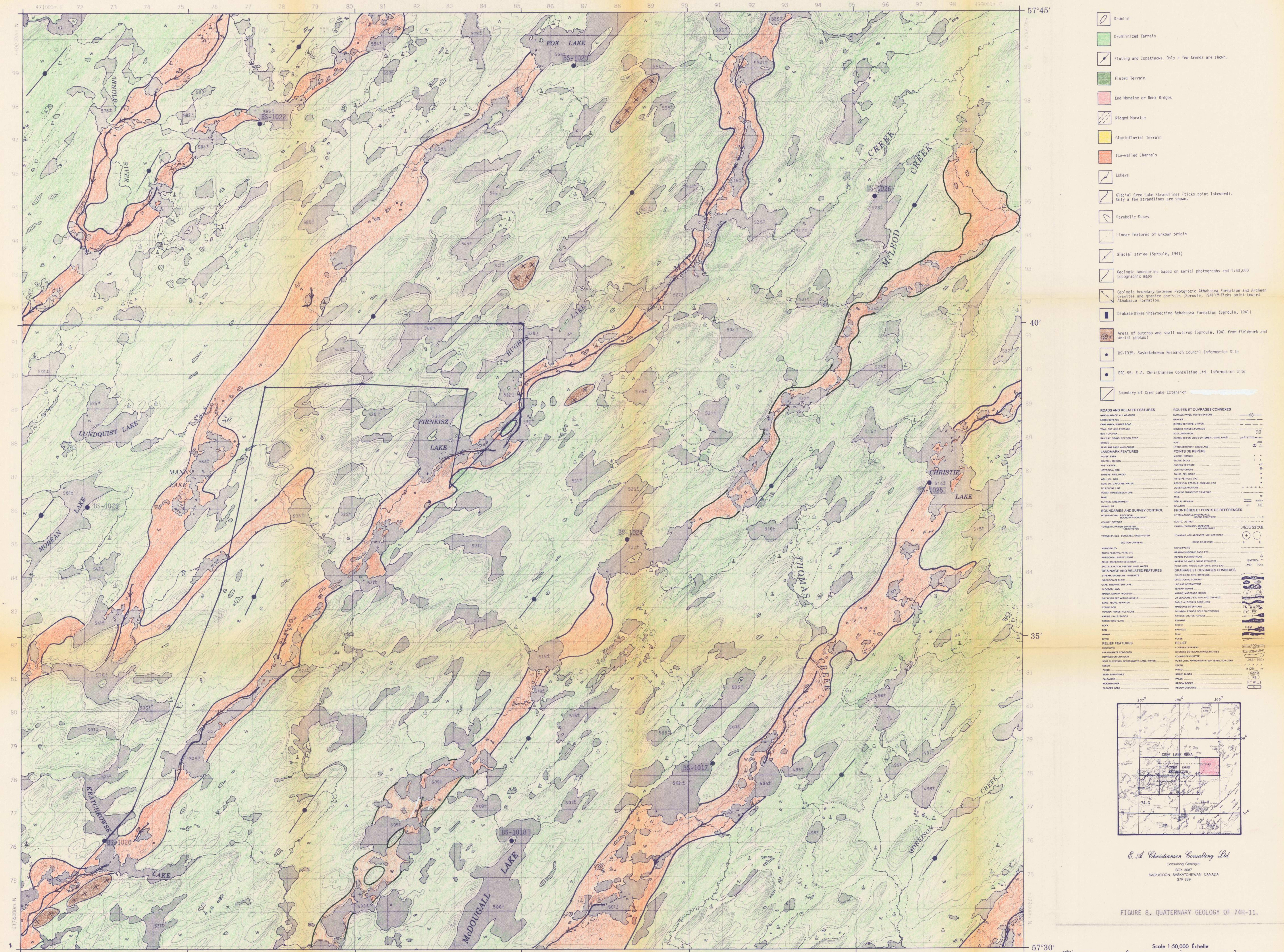
EDITION 1 74 H/11



ELEVATIONS IN METRES ABOVE MEAN SEA LEVEL

CONTOUR INTERVAL .... 10 METRES

NORTH AMERICAN DATUM 1927

TRANSVERSE MERCATOR PROJECTION

HUGHES LAKE

SASKATCHEWAN

WEST OF SECOND MERIDIAN - OUEST DU DEUXIÈME MÉRIDIEN

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FIGURE 8. QUATERNARY GEOLOGY OF 74H-11.

Scale 1:50,000 Échelle

Miles 1 0 1 2 3 Milles

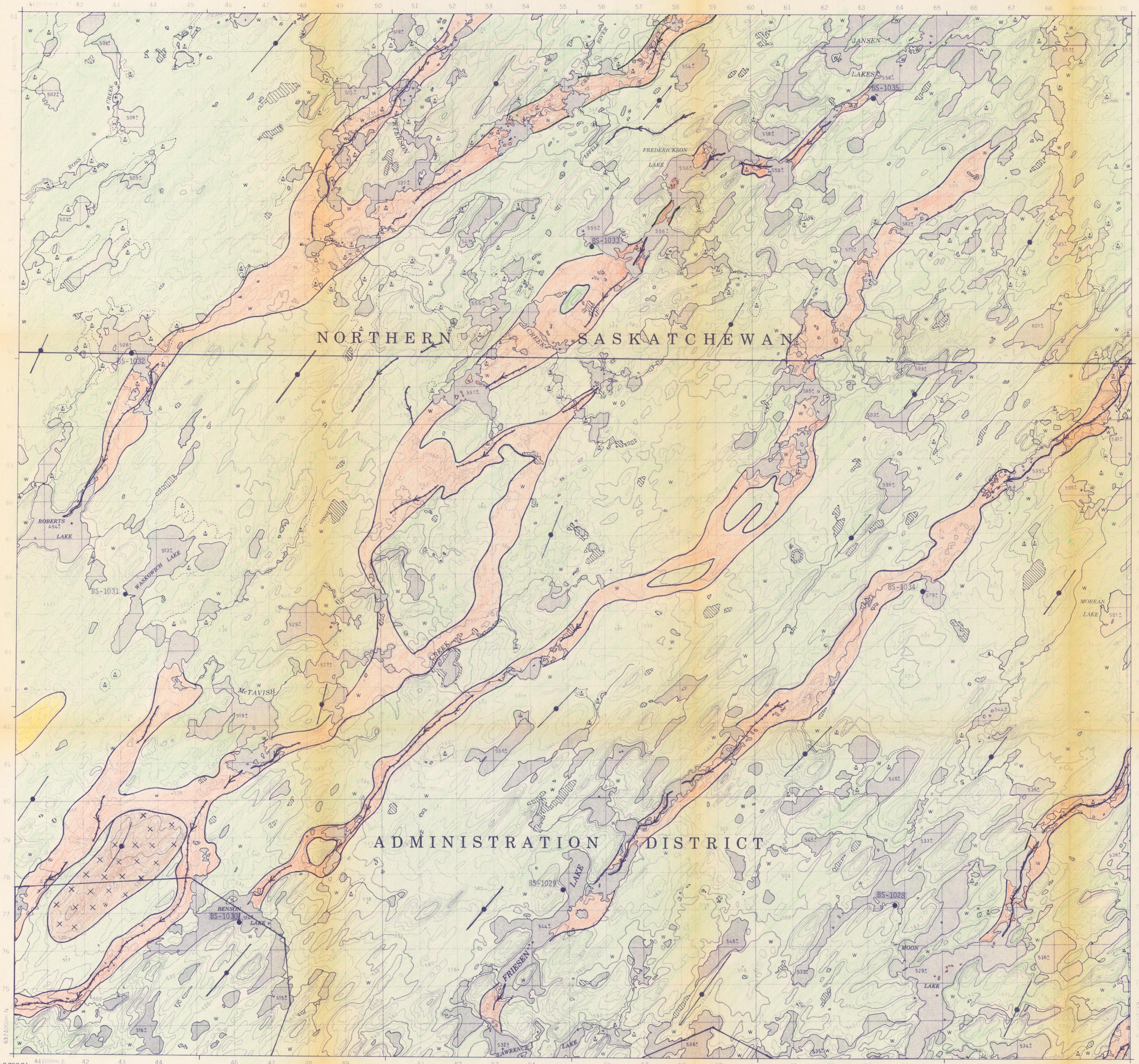
Metres 1000 0 1000 2000 3000 4000 Mètres

Yards 1000 0 1000 2000 3000 4000 Verges

* Reference should read Gilboy and Ramaekers (1977).

CANADA

EDITION 1 74 H/12



Drumlin

Drumlinized Terrain

Fluting and Ispatinows. Only a few trends are shown.

Fluted Terrain

End Moraine or Rock Ridges

Ridged Moraine

Glaciofluvial Terrain

Ice-walled Channels

Eskers

Glacial Cree Lake Strandlines (ticks point lakeward). Only a few strandlines are shown.

Parabolic Dunes

Linear features of unkown origin

Glacial striae (Sproule, 1941)

Geologic boundaries based on aerial photographs and 1:50,000 topographic maps

Geologic boundary between Proterozic Athabasca Formation and Archean granites and granite gneisses (Sproule, 1941)* Ticks point toward Athabasca Formation.

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Boundary of Cree Lake Extension.

ROADS AND RELATED FEATURES	ROUTES ET OUVRAGES CONNEXES
HARD SURFACE, ALL WEATHER	SURFACE PAVÉE, TOUTES SAISONS
LOOSE SURFACE	GRAVIER
CART TRACK, WINTER ROAD	CHEMIN DE TERRE, D'HIVER
TRAIL, CUT LINE, PORTAGE	SENTIER, PERCÉE, PORTAGE
BUILT-UP AREA	AGGLOMÉRATION
RAILWAY, SIDING, STATION, STOP	CHEMIN DE FER, VOIE D'ÉVITEMENT, GARE, ARRÊT
BRIDGE	PONT
SEAPLANE BASE, ANCHORAGE	HYDROAÉROPORT, MOUILLAGE
LANDMARK FEATURES	POINTS DE REPÈRE
HOUSE, BARN	MAISON, GRANGE

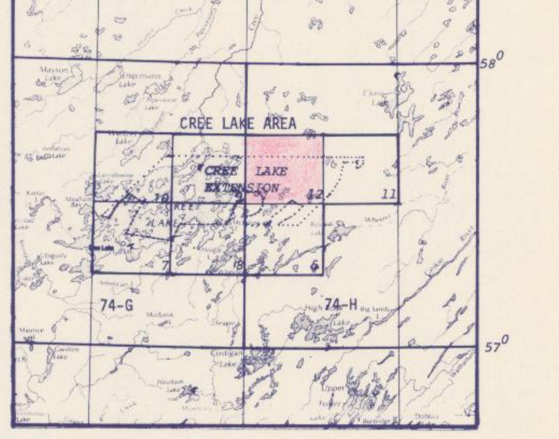

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FIGURE 9. QUATERNARY GEOLOGY OF 74H-12.

Scale 1:50,000 Échelle

Miles 1 0 1 2 3 Milles
Metres 1000 0 1000 2000 3000 4000 Mètres

ELEVATIONS IN METRES ABOVE MEAN SEA LEVEL

CONTOUR INTERVAL .... 10 METRES

NORTH AMERICAN DATUM 1927

TRANSVERSE MERCATOR PROJECTION

FRIESEN LAKE

SASKATCHEWAN

WEST OF SECOND MERIDIAN - OUEST DU DEUXIÈME MÉRIDIEN

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