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Detailed surficial mapping in selected areas of the southern Slave Province, Northwest Territories

V.N. Rampton and D.R. Sharpe

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Publications in this series have not been edited; they are released as submitted by the author.

Introduction and Rationale

This open file presents 13 detailed maps (Appendix I; Maps 1-3) produced by industry to aid in mineral exploration for diamonds. The maps illustrate practical, conceptual prospecting models that will aid exploration in the Slave province and adjacent terrain north of sixty.

Reliable geological information allows industry to invest in areas with the best potential for success in exploring for mineral resources. Accordingly, the Geo-mapping for Energy and Minerals (GEM) Program of the Geological Survey of Canada aims to provide industry with modern geological maps and related geological models to facilitate prospecting opportunities. These detailed geological maps fill a critical information gap in the knowledge base needed to focus exploration effort.

The presented maps were produced under contracts from BHP, Diamondex, and Winspear by Rampton Resource Group Inc. (formerly Terrain Analysis, Carp Ontario) to frame sampling and property-scale exploration. Mapping was carried out at a 1:25,000 to 1:50,000 scale and therefore reveals greater geological detail than previous mapping at 1:125,000 or 1:250,000 scales (**Fig. 1**). Mapped features and terrain elements were used to design sampling grids and to identify sample media and locations to improve mineral tracing in glaciated terrain. The maps cover several areas across southern Slave province but focus on mapping near the Lac de Gras (**Map 1**) and Snap Lake areas (**Map 2**) (Table 1). Both of these areas are well known prospective terrains for diamonds and have operating, or pending, diamond mines.

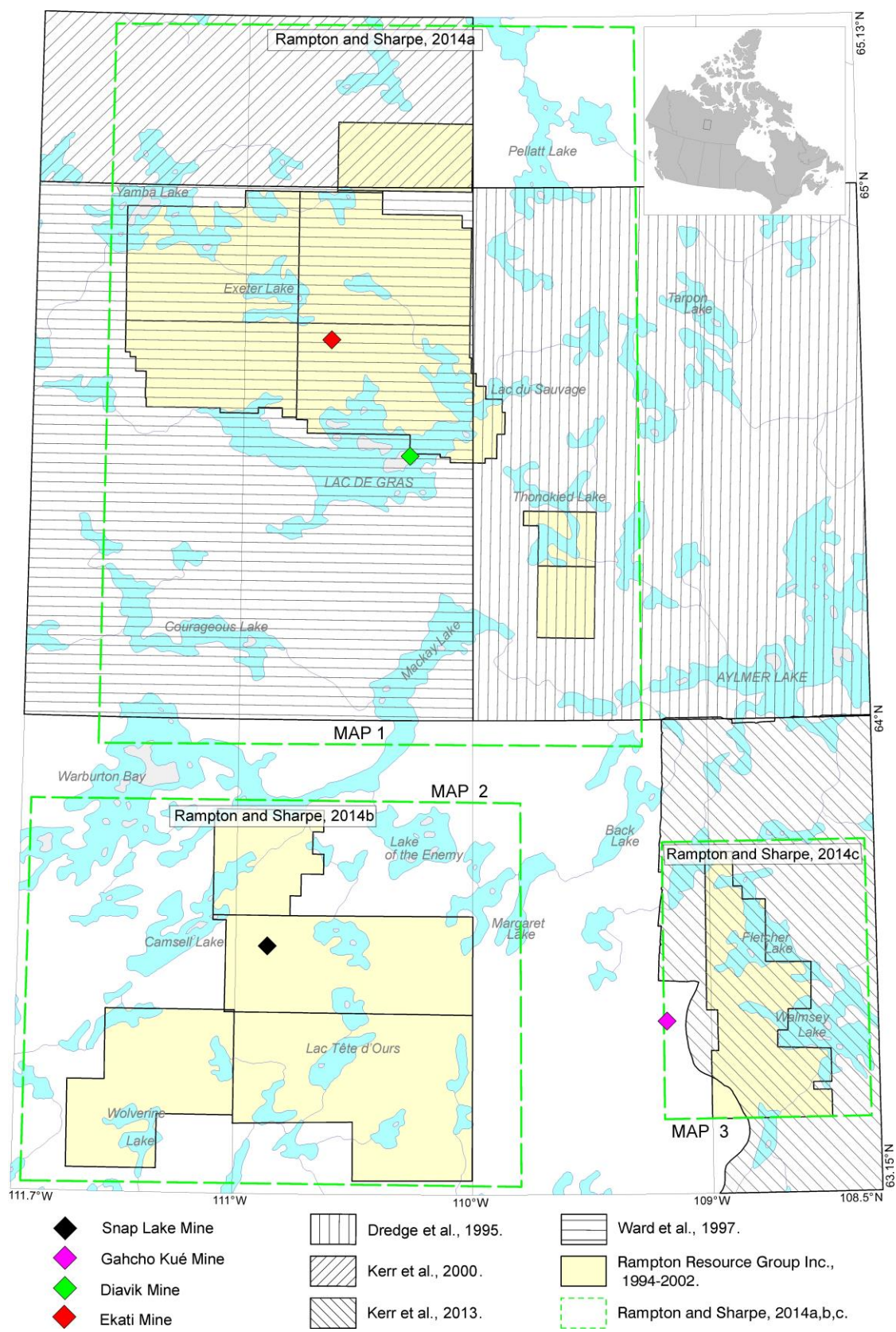


Figure 1. Location of the map areas in southern Slave Province.

Table 1. Detailed map areas in southern Slave Province

Map Area	km²	Company Report	Field sites	Comment
Ajax	250	Diamondex, 2002	76	indicators in GF sediment
Bearhead	1740	Diamondex, 2002	115	dispersal train, 262°
Carat	465	Winspear, 1998	130	transport 270-300°
Camsell Lake I, II	670/ 440	Diamondex, 1995	70/60	dispersal train, 260°
Diamet 1-Alymer	560	BHP, 1994	na	NW transport
Diamet 2- Exeter Lake	3500	BHP, 1994	na	NW transport
Kesley (Snap Lake)	840	Diamondex, 2001	135	dispersal train, 262°
Hilltop	~500	Diamondex, 2000	647	glaciofluvial dispersal
King	435	Diamondex2002	105	flow: 208-240°; 230°

Note: - all studies based on 1:20,000 (colour) and 1:60,000 (BW) air photographs; map scale = 1:50,000
 - Exeter Lake consist of 4 separate maps
 - GF = glaciofluvial sediment
 - na = not available

Regional geology

Southern Slave is mainly underlain by composite granite-greenstone terrane consisting of volcano-sedimentary successions overlying older sialic basement (Armstrong and Kjarsgaard, 2003). A broad belt of Yellowknife Super-group meta-sediments arranged as narrow belts of meta-volcanic rocks and meta-sediments occur within granodiorite and gneissic rocks. Northwest-trending diabase dikes are common.

Previous and existing surficial mapping

Progress in surficial mapping in the region advanced quickly with the advent of aerial photographs seventy years ago. Wilson (1939) mapped a semi-continuous, westward-radiating, glacial-esker flow-network from Thelon River to the southern Slave Province. The availability of glacial sediment led him to link esker size and continuity to sediment cover. He concluded that eskers are predominantly composed of locally derived sediments.

Folinsbee (1952) noted a similar esker network with regional esker flow parallel to striations, with a fanning outward pattern of the esker network down flow. Zones near eskers were washed free of sediment to expose more bedrock in erosional corridors. Lord and Barnes (1954) noted erosion zones containing eskers extending down flow or northwesterly to Aylmer Lake

Craig (1965) also described an esker network and ice flow patterns from the Thelon River westward to southern Slave. Meltwater flow scoured sediment from rock surfaces along prominent trunk esker paths and adjacent to esker ridges (e.g. plate VII, Craig, 1965). He also linked esker form (e.g. knobs, ridges, flat-tops, kettle holes and pits) to glacial hydrostatic conditions.

Alysworth and Shilts (1989) mapped regional glacial landforms that display westward-expanding flow patterns. Eskers occur between thick drumlin /fluted uplands and they appear to cut across drumlin uplands. This regional mapping reveals considerable terrain with little glacial sediment cover in southern Slave.

Recent surficial geology mapping in Lac de Gras and East Arm was completed at a scale of 1:125,000 (**Fig. 1**; e.g. Ward et al., 1997; Dredge et al., 1995; Kerr et al., 2013). These workers reported regional ice-flow patterns based on mapping striations including early ice flow to the southwest, a later flow to the west followed by northwestward flow. Because the eroded surfaces appear fresh and show little weathering, the striation record likely represents three phases of ice flow during the last glaciation. The late-glacial northwest flow, as mapped from glacial striations, is parallel to the trend of eskers and meltwater corridors. Regional context for the map area is provided by *Flowline map of Canada* (Shaw et al., 2010a, b; Fig. 2).

Till is the most extensive mapped deposit. It occurs with silty sand to sand matrix and surface clast content varies from 5 to 40%, generally 25% (Ward et al., 1997; Dredge et al., 1995; 1997). The upper 0.5-1 m of till in the area has been extensively modified by washing, cryoturbation and solifluction. Ward et al. (1997) highlight areas of washed till, associated with areas of meltwater scour and boulder concentrations, and interpreted these as lags. Till has been classified according to thickness and surface morphology: veneer (0-2m), blanket (2-10 m), and hummocky (5-30m). Till is inferred to form one stratigraphic unit (Ward et al., 1997).

Related till-like sediment is widespread on the Slave landscape. Its loose, surface, sandy to gravelly nature has little if any fine-grained, silt matrix. Clasts are sub-rounded to sub-angular. Such sediment in both the Slave and Churchill glacial terrains has been described as ablation till (e.g., Aylsworth and Shilts, 1989).

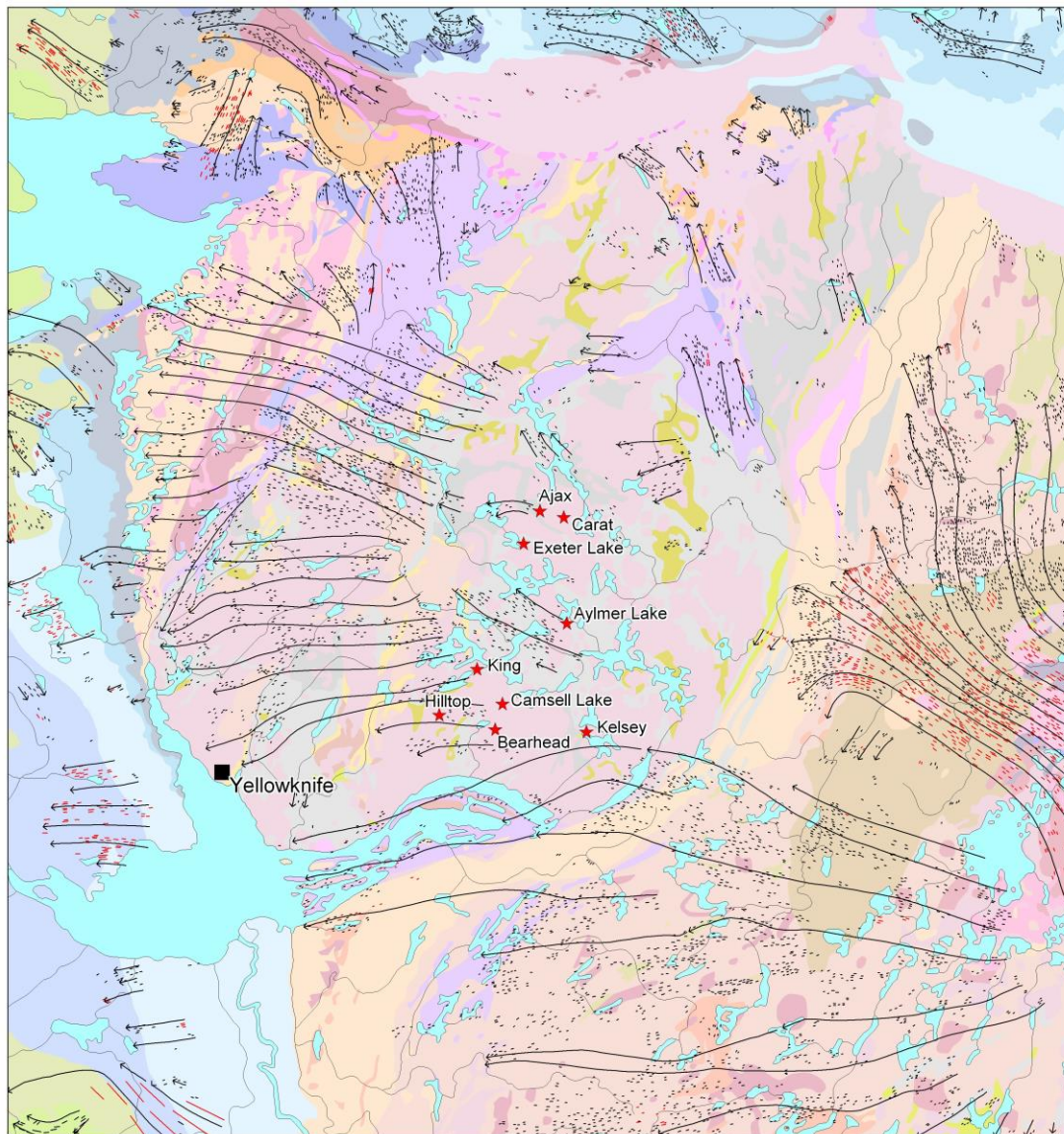


Figure 2. Context for the detailed maps within the glaciogenic flow patterns of the region (from Shaw et al., 2010a). Arrows represent flow lines based on flow directional indicators (e.g., drumlins). Generalized bedrock geology trends are in background. Red stars are areas mapped by Rampton (1994-2002).

Methods

Field preparation was based on analysis of 1:60,000 black and white aerial photographs, and where available, 1:20,000 coloured aerial photographs. Field work involved low elevation helicopter traverses to evaluate units mapped during air photo interpretation. Numerous foot traverses and hundreds of ground observations (see Table 1) were completed in conjunction with aerial reconnaissance for each map area. Many shallow test pits were dug for sampling and ground truth, and numerous photographs of terrain elements were captured. Selected test drilling was also completed for sampling (Rampton, 1998b).

Field objectives

In order to provide surficial geology maps and associated information directly applicable to mineral exploration, the following attributes were recorded in the field (Rampton, 2000b, 2001, 2002a, b, c):

- a) *field observations to test sediment distribution and various sampling strategies;*
- b) *delineate areas of bedrock versus sediment cover;*
- c) *determine directions of ice flow;*
- d) *determine directions and effects of subglacial meltwater flow, scour and transport;*
- e) *determine the nature and thickness of surficial deposits;*
- f) *determine the geomorphic and topographic setting of sediment sample sites;*
- g) *determine the origin of all surficial deposits (and any implications that all these factors might have on dispersal of mineral indicators); and,*
- h) *determine a chronological sequence of flow events.*

Map units

The scale of mapping determines the detail of identifiable maps units. Detailed mapping presented here benefitted from use of 1:20,000 scale coloured aerial photographs where available (Table 2). Both till and glaciofluvial sediments are common in the mapped areas (Fig. 3). Accurate mapping of glaciofluvial sediments requires a detailed delineation of glaciofluvial landform features and associated sediments than is usually achieved at 100-250K scale. Without detailed mapping local proglacial lakes with shoreline ridges and trim lines that often occur at ~420-380 m a.s.l. maybe overlooked. The lack of deltas and well developed beaches indicate that these features are most likely associated with short-lived lake events.

Table 2. Key map units: classification of surficial deposits in detailed maps, Slave province
(Note link between original (e.g., Ga, Rampton, 2001) and compiled units in this report (Appendix I)).

Glaciofluvial deposits: <u>Original map</u>		<u>Map compilation</u>	
Ga	=gravel bars represented as broad low knolls (with symbol)	GF	(Fig. 3a)
Gb	=blanket; semi-continuous sand and gravel sheet	GFb	(Fig. 3b)
Gh	=hillocks and ridges are irregular deposits of sand and gravel	GFh	(Fig. 3c)
Ge	=eskers displayed as sharp-crested ridges and sandy fans	GFr	(Fig. 3d)
Gk	=kame and kettle complexes	GFh	(Fig. 3e)
Gtr	=transverse ridges (rogen moraine of others) (with symbol)	GF	(Fig. 3f)
Gv	=glaciofluvial veneer; thin discontinuous cover	GFv	(Fig. 3g)
Boulder Deposits			
B	=boulders show evidence of source, transport and rounding (symbol)	GF	(Fig. 3j)
Till			
Tv	=Till veneer with boulders, especially in erosional corridors; glacial sediment < 2 m thick	Tv	(Fig. 3k)
T	=Till blanket, 1-8 m up to 12 thick; often in drumlins; may have sparse boulder cover	Tb	(Fig. 3l)
Bedrock			
R	=scoured and washed bedrock often occurs in eroded esker corridors	R	(Fig. 3i)

Till

Till is generally sandy to silty sand in matrix texture with 5-25% gravel content. Till occurs in all areas with variable thickness: thick (~5-10 m), blanket (2-5 m) or most commonly as veneer (<2 m). From this observation a key question arises: was till deposited in this distinct pattern or was it deposited more evenly over map areas, and then, eroded to leave this distinct pattern. Till is often absent or occurs as remnants in erosional corridors located adjacent to eskers (Fig. 3k; Ward et al., 1997; Rampton, 2000a). Commonly, the upper 0.3 to 1 m is re-worked till and sandier relative to till below. The presence of lenses of stratified sediment may indicate meltwater modification, or where deformed, could be related to cryoturbation. Where till is thin or absent, and on many till surfaces outside of corridors, the surface is marked by a concentration of boulders (Fig. 3j). Till veneer often has a glaciofluvial cover (Fig. 3g), or thin washed layer, and in places, streamlined or transverse gravel ridges (Fig. 3f) are observed.

Till is available for sampling in all till thickness terrains (Fig. 3l). In erosional corridors (Fig. 3m) that are common across the southern Slave (Rampton, 2000a; Map 2, Map 3), till is present but scarce, yet is often observed in the lee of scoured rock outcrops (Fig. 3i). Thick till may contain little, if any, local bedrock material in its surface layers. Consequently, sampling the surface of a thick till unit may have limited value in locating local bedrock sources of indicator minerals such as those reflective of kimberlite sources (Rampton, 2001; 2002a, b, c).

Regional glaciofluvial features

A number of glaciofluvial features were mapped across the southern Slave region: till, erosional corridors, scour zones, glaciofluvial forms and eskers.

Reported glaciofluvial features in the southern Slave area (Rampton, 2001 and Hardy in MacLachlan et al., 2001; Hardy, 2007) are similar to those mapped down flow (north) in Lac de Gras /Aylmer Lake region (Fig. 1; Ward et al., 1997; Dredge et al., 1995). This apparent down flow continuity of features may be important in identifying the scale and significance of glaciofluvial processes. A range of terrain features has been mapped across the southern Slave (e.g. Rampton, 1994-2002), as described below.

Detailed mapping of glaciofluvial features

Glaciofluvial features and sediments, mainly sand and gravel with common boulders and minor silt beds, occur as a series of related terrain elements across the Slave landscape, mostly within but also outside, erosional corridors. Mapped elements include key features (Fig.3):

Glaciofluvial veneer and blanket (Fig. 3g)	-forms thin, featureless cover on bedrock or till
Gravel bars and broad low knolls (Fig. 3a)	-sparse, <5m high ridge forms oriented parallel to flow
Transverse ridges (Rogen moraine) (Fig. 3f)	-irregular, ~5m high, bouldery ridges transverse to flow
Kame and kettle complexes, ridges (Fig. 3e)	-rolling topography or sharp hillocks and ridges
Eskers (Fig. 3d)	-forms sinuous, sharp-crested or flat-topped ridges and fans
Boulder deposits (B) (Fig. 3j)	-concentration of boulders on terrain units (5-40% cover)

Most glaciofluvial deposits and landforms have been interpreted as sediment deposited primarily in a subglacial environment from meltwater sheets and confined flows (Rampton, 2000a). For example, widespread sandy glaciofluvial sediments mapped across the Slave map areas as glaciofluvial blanket (Table 2) were interpreted as subwash, a shortened term for subglacial outwash used in previous reports (e.g., Rampton, 1994, 2000). Most source sediment, till, was eroded, reworked, transported, and deposited as glaciofluvial sediments. Kerr et al 2013 mapped more till veneer (with no corridors next to eskers) in the Fletcher and Walmsley Lake areas, whereas Rampton mapped glaciofluvial corridors (Appendix I, Map 2), which includes a glaciofluvial veneer rather than mainly till veneer.

Some source sediment may have been directly eroded from bedrock as indicated by sculpted rock surfaces carrying s-forms (Kor et al., 1991). It is also possible that eroded till with stratified lenses may indicate slurry-style mixing by subglacial ice and meltwater flow, as well as debris-flow or cyroturbation processes. Gravel bars and transverse ridges (Rogen moraine is the non-descriptive term) formed in glaciofluvial corridors (Fig. 3h, m) with their orientation (parallel and transverse to flow, respectively), appear to relate to rapid meltwater flow to explain the transport and deposition of large, rounded clasts (Fig. 3j). Kame and kettle complexes and ridges were deposited along possible subglacial, englacial and proglacial stream channels; whereas, sharp-crested esker ridges were deposited within major subglacial conduits (Fig. 3m). It is also noted that others interpreted Rogen ridges as resulting from shearing and thrusting of sediment at the base of the ice (e.g., Bouchard, 1989; Aylsworth, and Shilts, 1989), although this does not explain their strong association with meltwater corridors.

Boulder deposits may cover till or bedrock. In contrast to angular felsenmeer clasts common in the area, mapped boulder deposits (Fig. 3j) are sub-angular to semi-rounded in shape, of variable lithology, and, are found in shallow depressions and along drainage ways (corridors) eroded into till, with associated glaciofluvial deposits. The deposits likely formed in a subglacial environment, where high-velocity, meltwater flow eroded (Rampton, 2000; Sharpe et al., 2013) and removed finer till matrix components and deposited glaciofluvial sediment downflow; while cobbles and small boulders were transported, large boulders (>0.5 m) may not have been transported and remained as lag deposits.

Conceptual models

Detailed mapping of glacial terrains provides good opportunities to develop conceptual understanding of landscape formation (e.g. Fig. 4). The following map observations in the Slave province supports a number of pertinent conceptual process models that should be helpful to mineral exploration using glacial sediments (Rampton, 2001). Conceptualization relates to a number of key observations, such as till (thickness) distribution, erosion and sediment sorting, and presence or absence of ablation till.

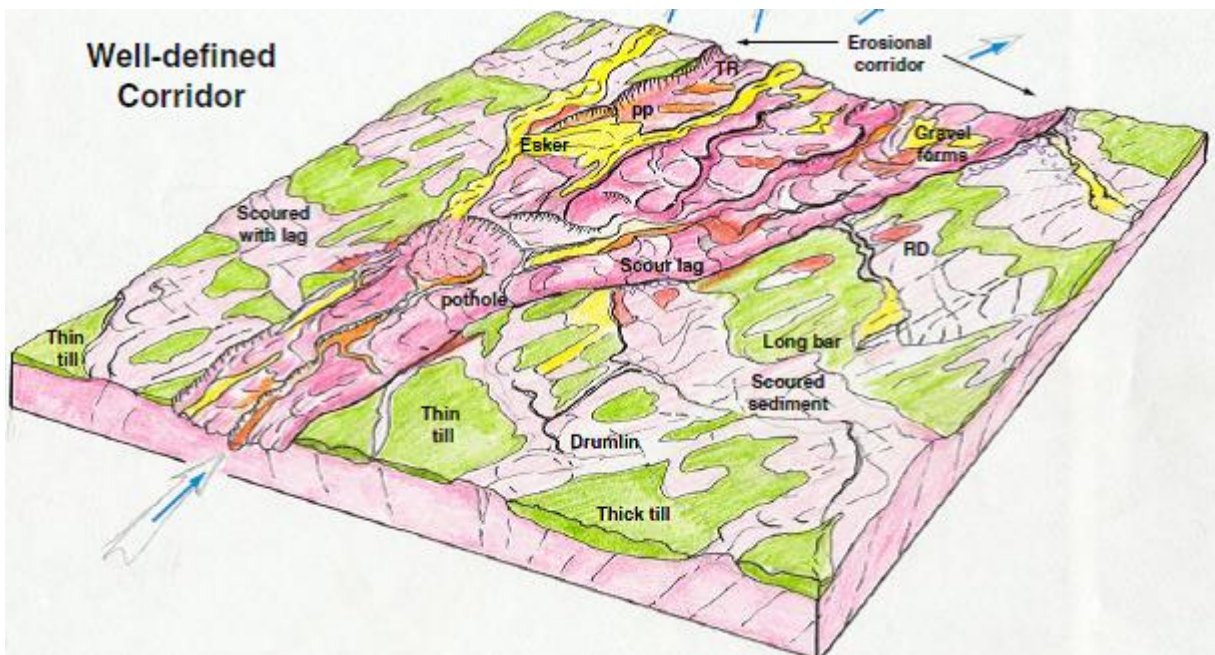


Figure 4. Conceptual model of erosional meltwater corridor (dashed erosional banks) and adjacent terrain with variable till thickness (green). Note glaciofluvial (esker) deposits (yellow) are mainly in the erosional corridor. RD represents rock drumlin; pp plunge pool; and TR is transverse ridge.

Till distribution and composition

1. Till was likely deposited over much of the area (see note and discussion below); it now occurs in zones of different thickness; i) hummocky (thick), ii) blanket and iii) veneer.
2. Where till is thin or absent, the land surface is often marked by boulder concentrations and glaciofluvial veneers.
3. Compact till is only available for sampling in areas of till veneer, or blanket, downflow of bedrock rises protected from erosion.
4. Reworked till is loose, sandy and may form a thin surface of mapped till or be mixed with glaciofluvial sediment.
5. Thick till (>5 m) is prominent in some areas and in rare depressions may reach 10s of metres in thickness (see note below); it may contain little eroded local bedrock in surface layers; hence, it may have less (limited) value in locating local sources of indicator minerals.
6. Re-worked (washed) till has a heavy mineral content per bulk sediment weight slightly more elevated than till in non-eroded areas because of reworking and concentration by meltwater.
7. Compact till, of inferred basal (traction load) glacial origin, sampled close to underlying bedrock, will be nearer to its up-glacier bedrock sources than thick till.

Note: till has been reported at thicknesses of ~45m in the area of Lac de Gras and in the eastern slave (Kerr et al., 2002).

Meltwater erosion

1. Subglacial meltwater has affected most terrain and has resulted in complex units, e.g., washed till, subwash, boulder concentrations (lags) and scoured bedrock.
2. Till was originally thicker (see discussion below) and has been eroded by subglacial meltwater flow during late stages of ice cover
3. Till forms thick remnants in places; it ranges in thickness from 2- 5m, infrequently > 5m; subwash cover is mixed with thin till.
4. Where gravel bars occur, till is thin and exposed in confined areas; elsewhere till is absent; boulder concentrations (lags?) may be present

Poorly-sorted gravel

1. Sediment in glaciofluvial veneers and blankets (on till) often consists of poorly-sorted gravel.
2. Poorly sorted gravel has been winnowed and transported. It is necessary to separate compositional data of glaciofluvial sediments from till since both sediment types have been transported and deposited by different processes (possibly different distances and directions).
3. Poorly sorted gravel represents potential sample media for mineral exploration in areas with glaciofluvial cover especially where till is not readily available for sampling.
4. Gravel bars often occur in the lee of bedrock knobs to form crag and tail landforms where the tail is primarily (sand and gravel).

Well-sorted sediment

1. Well-sorted glaciofluvial blankets and gravel bars indicate sorting and possibly significant sediment transport.
2. Mineralogical and geochemical anomalies in glaciofluvial sediments may be continuous, elongate and be traceable in a down (ice/meltwater) flow direction from source (e.g., Snap Lake, CL25, CL174; Rampton, 2000b; 2002a, b, c; Armstrong and Kjarsgaard, 2003).
3. Data from Snap Lake/CL25 demonstrate that KIMs and Kimberlite indicator elements (KIEs) can be concentrated in heads of gravel bars following glaciofluvial transport (Rampton, 2000b; 2002a,b,c).
4. Due to selective concentration of KIMs and KIEs in different parts of glaciofluvial landforms and deposits, sampling sites need to be consistently located on similar landform elements to allow meaningful comparison and interpretation of results.

Ablation till or glaciofluvial lag?

An understanding of the genesis of loose, surface, poorly-sorted, gravelly sand deposits widespread on the Slave landscape is important to the interpretation of sediment composition/ transport data applicable to mineral exploration. Are these gravelly deposits/ concentrations on the glacial landscape, glaciofluvial erosional lags, or deposits of ablation till /sediment? Ablation till was commonly inferred to occur on Slave and Churchill glacial terrain (e.g., Aylsworth and Shilts, 1989), as have ablation boulder pits (e.g. Ward et al., 1997). The ice ablation inference is, in part, due to the loose, stoney, poorly-sorted, sandy nature of shield-derived till with little if any fine-grained matrix. Ablation sediment is inferred to have been carried above the base of the ice and travelled farther before being deposited by ablating ice (Dreimanis, 1988). Accumulations of monolithic and angular boulders are clearly interpreted as frost-shattered local bedrock (felsenmeer), whereas, large, ice-fragmented erratic bedrock blocks may have been transported from afar.

Similar accumulations of gravelly sand, reported here, with rounded to sub-rounded clasts and boulders of mixed lithology, were derived and transported from eroded till and bedrock. Till and bedrock surfaces show erosional features (e.g. washed, remnant till, lags, scours, corridors, plunge pools, s-forms; Rampton, 2000 b, c; Sharpe et. al., 2013), and, are more likely associated with glaciofluvial meltwater erosion (Rampton, 2000 b, c). Outcrops of compact till, with 10 to 15% sub-angular clasts within exposed sediment, can be overlain by sub-rounded stone/boulder surface concentrations of 25 to 40% (Sharpe et al, 2013, Fig. 6.2g). This dramatic and widespread change in surface-subsurface gravel concentration appears to support the (glaciofluvial) lag interpretation for stone-covered glacial landscapes.

In the Keewatin region, Lee (1959) made observations related to ablation till by measuring striations on the underside of elongate erratics present on a polished bedrock surface. Long axes of erratics and striae on the erratics were both aligned with bedrock striations related to the latest ice movement. These relationships indicate that the observed erratics in southern Keewatin are not of ablation origin, but were transported in basal ice. Hence, Lee's observations supported the idea that scattered boulders elsewhere on the Slave landscape are less likely to be ablation deposits.

Recent observations (in the study area west of those of Lee), related to washed, remnant till, scours, meltwater erosional corridors, and s-forms measured on bedrock surfaces (Sharpe et. al., 2013; Sharpe et al., 2014) appear to support the lag interpretation made in the Slave Province. Thus, glaciofluvial erosion of rock and sediment surfaces with the resultant discontinuous cover of sub-rounded boulder concentrations more likely explain the related surface gravelly sand deposits as a glaciofluvial lags than as ablation till.

Discussion

We hypothesize that till was likely deposited over much of the area and that the present distribution in zones of different thickness, hummocky (thick), blanket and veneer, relates to modification of the till surface by preferential erosion rather than primary deposition. Meltwater erosion features are common across the landscape (Figs. 3, 4), as described in this study and by others (e.g., Dredge et al., 1995; Ward et al., 1997; Rampton, 2000a). Where till is thin or absent (in extensive areas of till veneer, particularly in meltwater corridors, Appendix I, Maps 1-3), the land surface is marked by scoured surfaces, boulder concentrations and glaciofluvial veneers (**Figs. 3h, m**). Compact till is only found in areas of till veneer, or blanket, downflow of bedrock rises protected from erosion. Atop thin till veneer, there is a common thin, reworked loose, sandy sediment (washed till) that may be mixed with glaciofluvial sediment. Areas of till blanket (**Fig. 3h**) and hummocky till display scour features and a high concentration of surface boulders (e.g., Dredge et al., 1995; Ward et al., 1997), and hence have varying degrees of glaciofluvial erosion and sub-rounded boulder lags as detailed in the East Arm area of southern Slave (Sharpe et al., 2013).

A variety of widespread glaciofluvial features, especially scour zones and meltwater corridors have been observed in the field across the southern Slave (e.g., Lord and Barnes, 1956; Craig, 1965; Dredge et al., 1995; Ward et al., 1997; Rampton, 2001). Nevertheless, interpretations of widespread meltwater processes

have not been generally endorsed (e.g. Ward et al., 1997), despite the implications for the transport of indicator minerals in glaciofluvial sediment (e.g. Rampton, 2000b; Owen, 2000; Rampton and Sharpe, 2010, and Table 1). For example, we theorize that long linear dispersal trains that characterize the southern Slave Province (Armstrong and Kjarsgaard, 2003) may have resulted from dispersion of materials by subglacial meltwater erosion and transport. For example at Snap Lake (Rampton, 2001), prominent glaciofluvial erosion is linked to enhanced KIMs collected in glaciofluvial sediment compared to those in till, and arranged in a narrow, linear dispersal pattern. Thus it may be prudent to assess other linear dispersal patterns in the Slave (Armstrong and Kjarsgaard, 2003).

The true identity of the sampled medium within these trains was possibly not recorded, or perhaps a glaciofluvial influence was not recognized in re-worked till, depending on the knowledge and expertise of field samplers. Shallow surface sediment may have incorporated KIMs and/or KIEs from glaciofluvial mixing directly, or from frost churning where samples were taken from a 'mud-boil'.

Erosional corridors, prominent in this series of maps (Appendix I, Maps 1-3), represent an important terrain element for sediment sampling related to mineral exploration in northern glaciated terrain. For the following reasons, corridors are potentially an important terrain for prospecting and sediment sampling:

- corridors expose more bedrock than adjacent terrain;
- well exposed bedrock improves the precision of lithologic mapping and facilitates the measurements of erosional flow indicators at the scale of an semi-contiguous outcrops;
- thin till remnants in corridors are easy to sample and likely characterize local bedrock, and, allow for comparison of locally-sourced bedrock indicators with nearby sediment samples
- the top surface of adjacent (drumlinized) thick till is likely composed of farther-travelled debris; the lower part of these tills, is likely composed of locally derived debris, yet cannot be easily sampled and compared to samples collected from thin till areas;
- corridors trend roughly E-W to NW (Table 1), often across the structural grain of many Slave Province rock sequences, and hence, they source a greater variation of bedrock lithologies

In addition, for systematic sampling programs, it is recommended that samples from all sites be collected with descriptions that indicate the sampled terrain feature (e.g. corridor, washed till, glaciofluvial sediment Cummings et al., 2011, etc.); include photographs of all terrain features and the sample pit stratigraphy to aid in interpretation of formation, inferred genesis, secondary modification (e.g., glaciofluvial reworking, cryoturbation). The mode of erosion and deposition should be characterized in order to improve the assessment and interpretation of dispersal patterns and anomalies. Field procedures for till sampling and the collection of field observations are outlined in Spirito et al. (2011). Terrain mapping at a scale of 1:10,000 or 1:20,000 helps determine the distribution of materials in areas where detailed glacial sediment sampling is being undertaken to locate kimberlite based on mineralogical or geochemical sediment composition.

In areas where kimberlites are believed to underlie lakes or drift-covered depressions, it is useful to sample the immediate periphery of these lakes or depressions. Due to potential erosion, transport and deposition of kimberlite by glacier ice and meltwater, all materials should be sampled in the downflow direction (e.g., Kjarsgaard et al., 2013) in order to determine the probability of the presence of a sub-lake/depression kimberlite. For example, if samples on the down-ice /meltwater flow direction are significantly higher in mineral or geochemical indicators than those on the up-flow direction, it would suggest the possibility of a kimberlite under the lake.

Tables

1. Detailed map areas in southern Slave Province
2. Key map units: classification of surficial deposits in detailed maps, Slave province

Figures

1. Location of the map areas in southern Slave Province.
2. Context for the detailed maps within the glaciogenic flow patterns of the region (from Shaw et al., 2010a).
3. Slave map photo legend (map symbol shorthand in brackets):
 - a)** gravel bars (GF), set within a channel that erodes a till upland; **b)** gravel blanket (GFb) deposits with some boulder lag from eroded till; **c)** hillocks and ridges (GFh) in a glaciofluvial washed landscape; **d)** eskers (GFr) with adjacent eroded terrain with exposed bedrock and till veneer; **e)** kame (mound) and kettle (dark depression) complex; **f)** transverse ridges (GF) adjacent to esker ridge; **g)** glaciofluvial veneer (GFv) shows as grey tone, gravel on eroded till; **h)** aerial photograph illustrates scoured till blanket uplands (green tone), scour pits (sp), gravel deposits with inset eskers defining meltwater corridors (grey tone); **i)** bedrock (R) exposed in scoured corridor (within dashed lines) with till veneer outside corridor; **j)** boulder deposits (GF) with mainly rounded stones; **k)** thin sediment, < 2m thick, till veneer (Tv) adjacent to eroded bedrock; **l)** till blanket (Tb) is 1-8 m thick has a cover of boulders; **m)** vertical aerial photograph (from Rampton, 2000) shows meltwater corridor (MC) with inset eskers (E), remnant till (t), scoured rock (s) and rogen ridges (R); note drumlin (D) in modified till zone (TM) next to poorly-modified till (T);
4. Conceptual model of erosional meltwater corridor (dashed erosional banks) and adjacent terrain with variable till thickness (green). Note glaciofluvial (esker) deposits (yellow) are mainly in the erosional corridor. RD represents rock drumlin; pp plunge pool; and TR is transverse ridge.

Appendix I

Map 1

Surficial geology of the Exeter Lake area, Northwest Territories

Map 2

Surficial geology of the Lac Tête d'Ours area, Northwest Territories

Map 3

Surficial geology of the Fletcher Lake area, Northwest Territories

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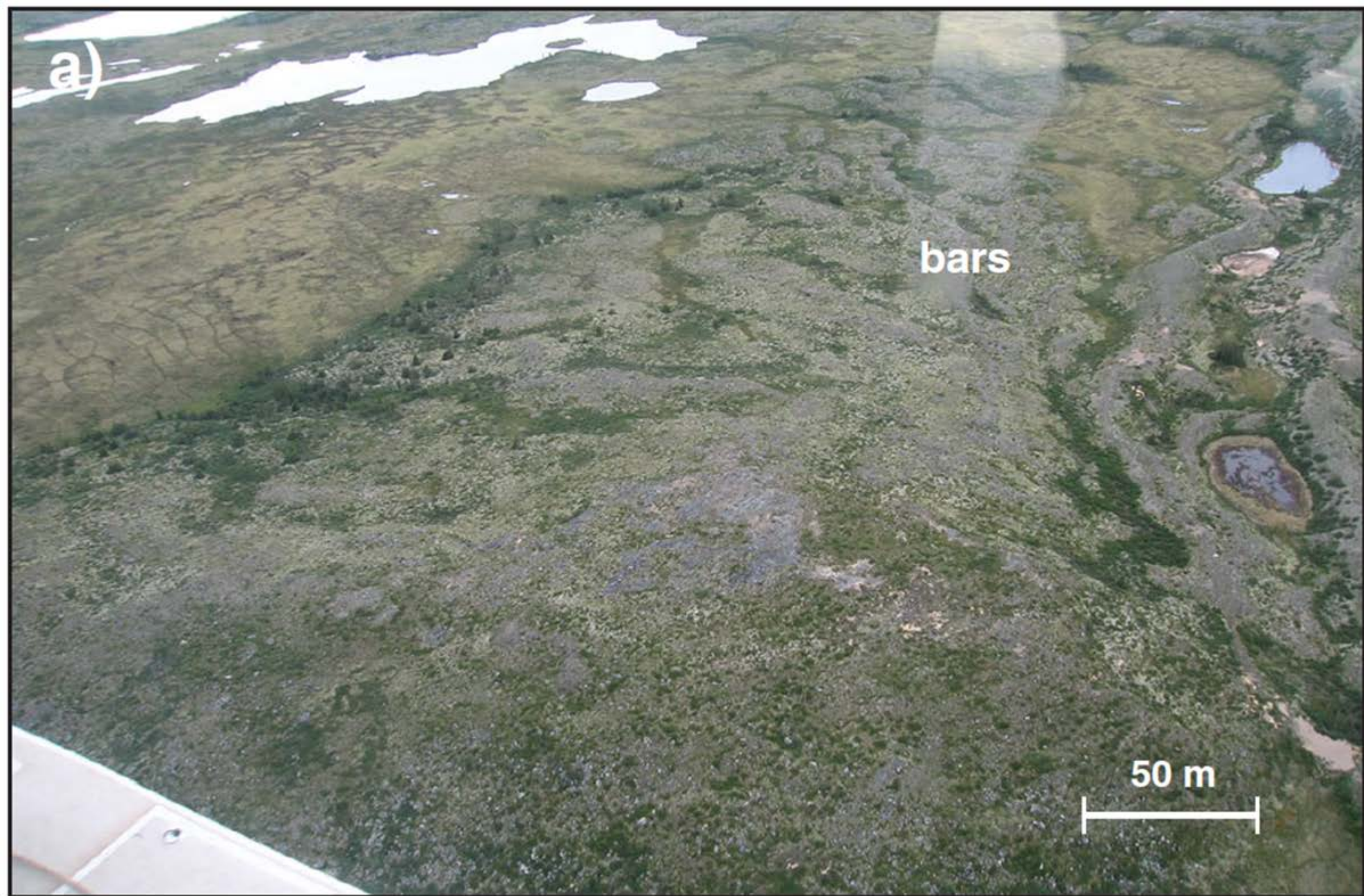


Figure 3a. Gravel bars (GF) set within a channel that erodes a till upland.

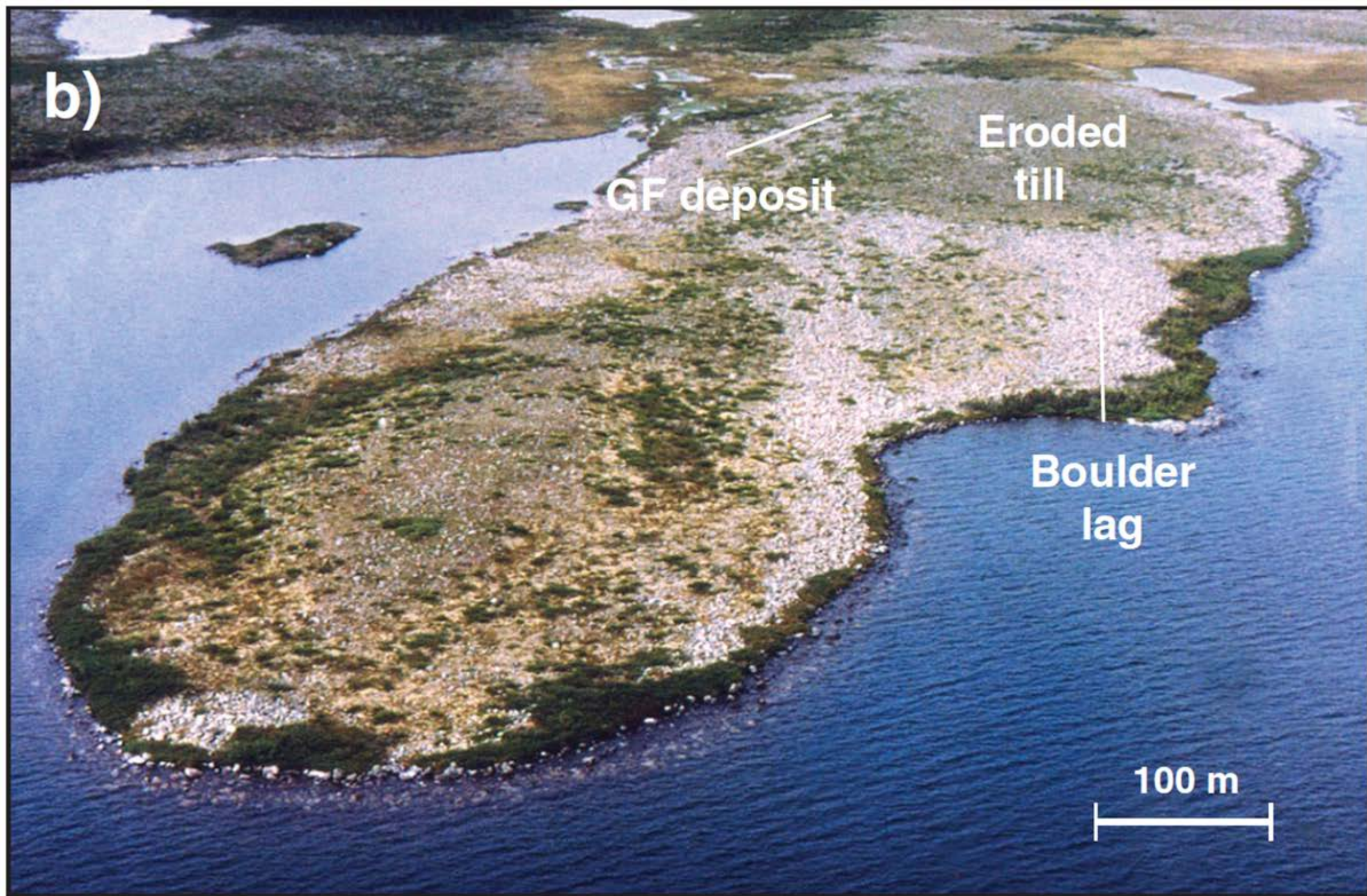


Figure 3b. Gravel blanket (GFb) deposits with some boulder lag from eroded till.

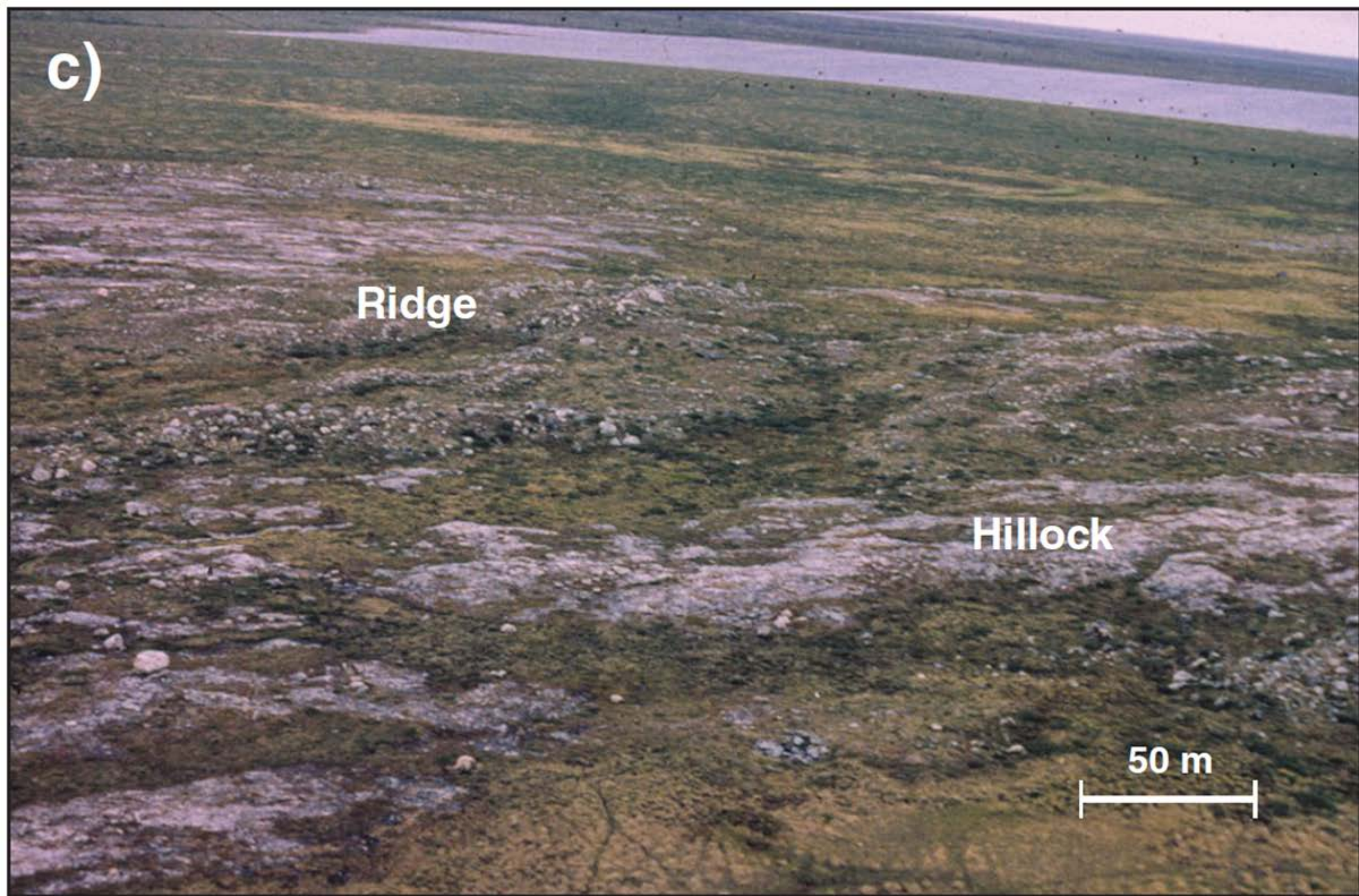


Figure 3c. Hillocks and ridges (GFh) in a glaciofluvial washed landscape.



Figure 3d. Eskers (GFr) with adjacent eroded terrain with exposed bedrock and till veneer.

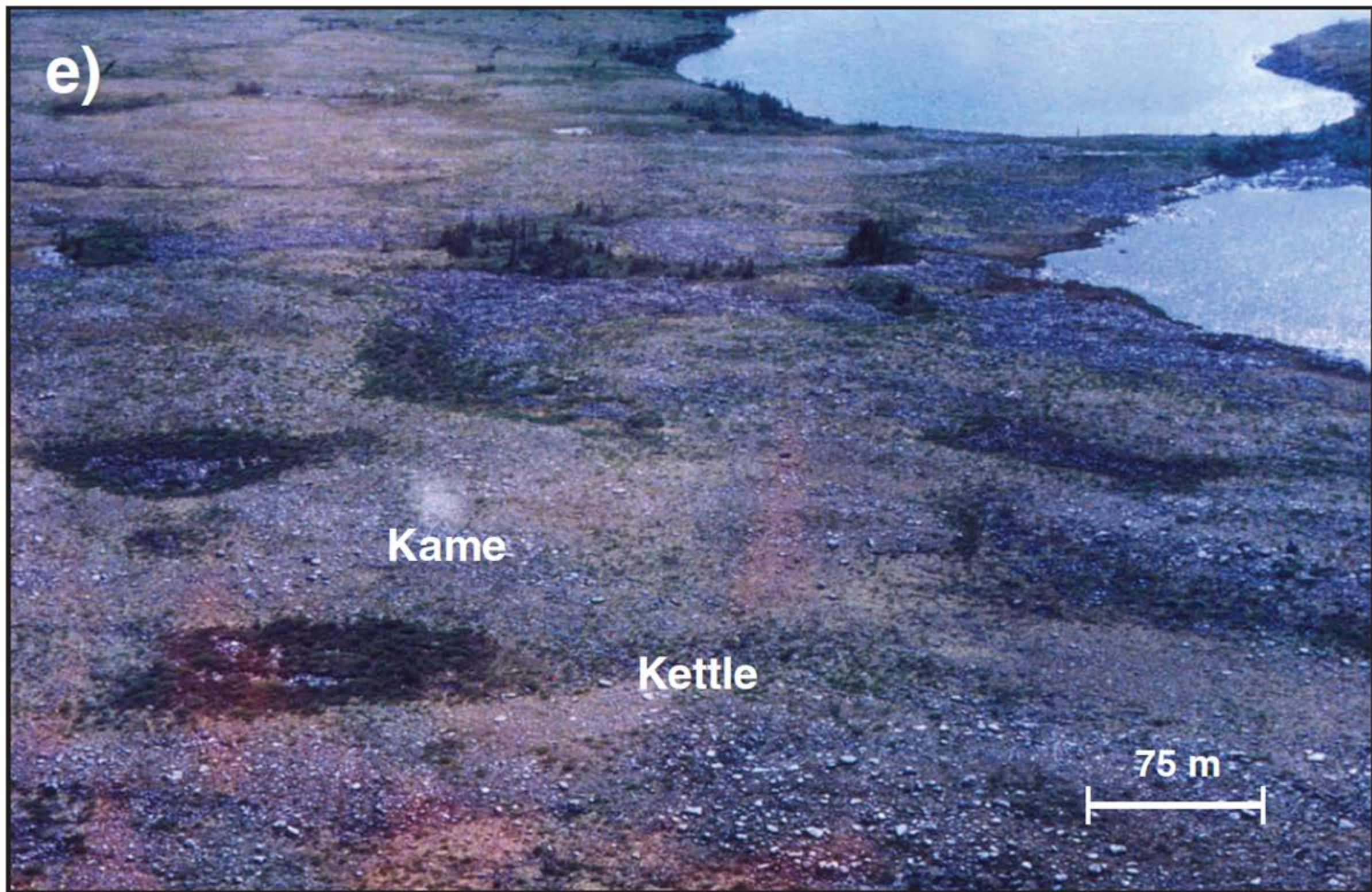


Figure 3e. Kame (mound) and kettle (dark depression) complex.



Figure 3f. Transverse ridges (GF) adjacent to esker ridge.

g)



Figure 3g. Glaciofluvial veneer (GFv) shows as grey tone, gravel on eroded till.

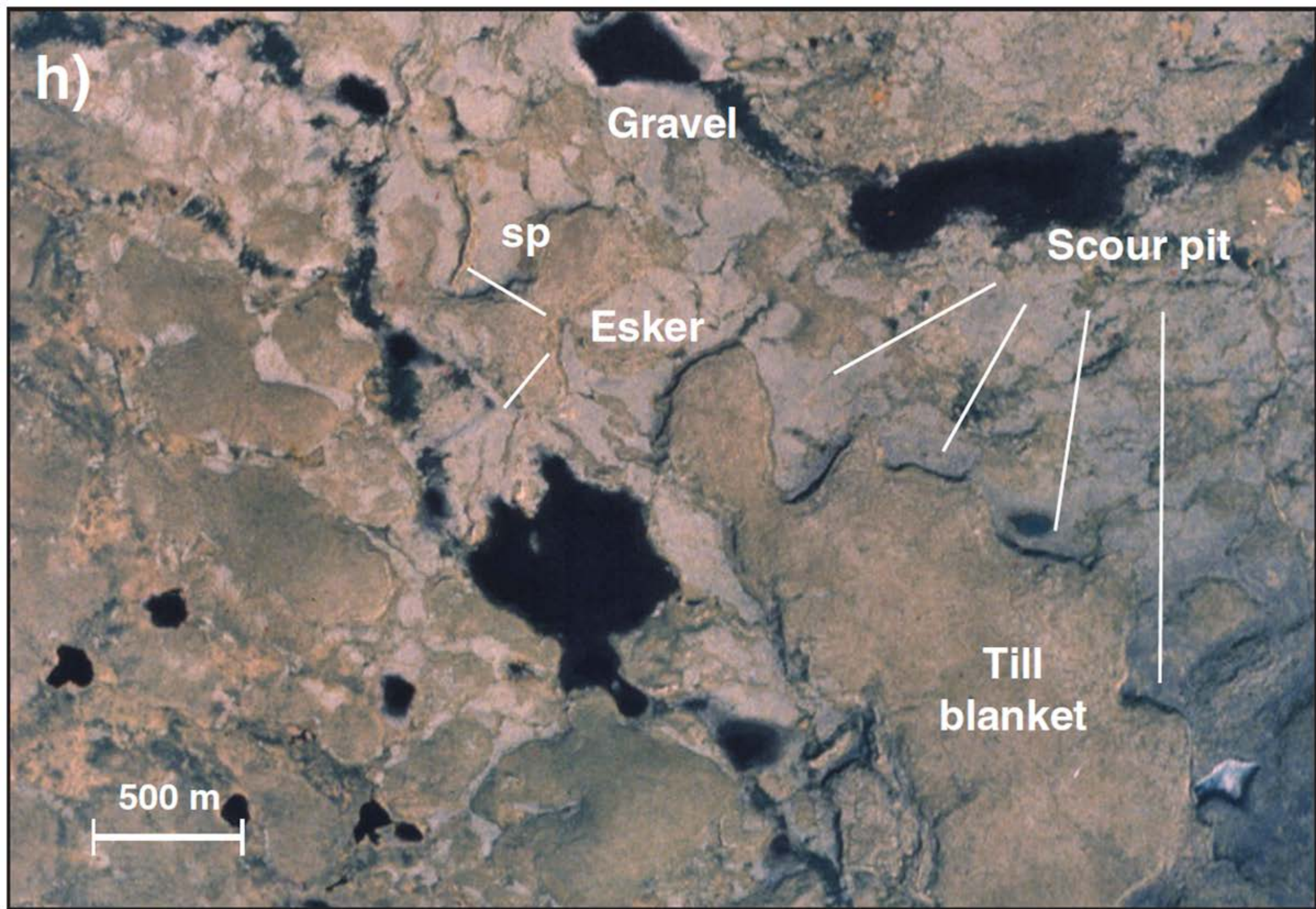


Figure 3h. Aerial photograph illustrates scoured till blanket uplands (green tone), scour pits (sp), gravel deposits with inset eskers defining meltwater corridors (grey tone).

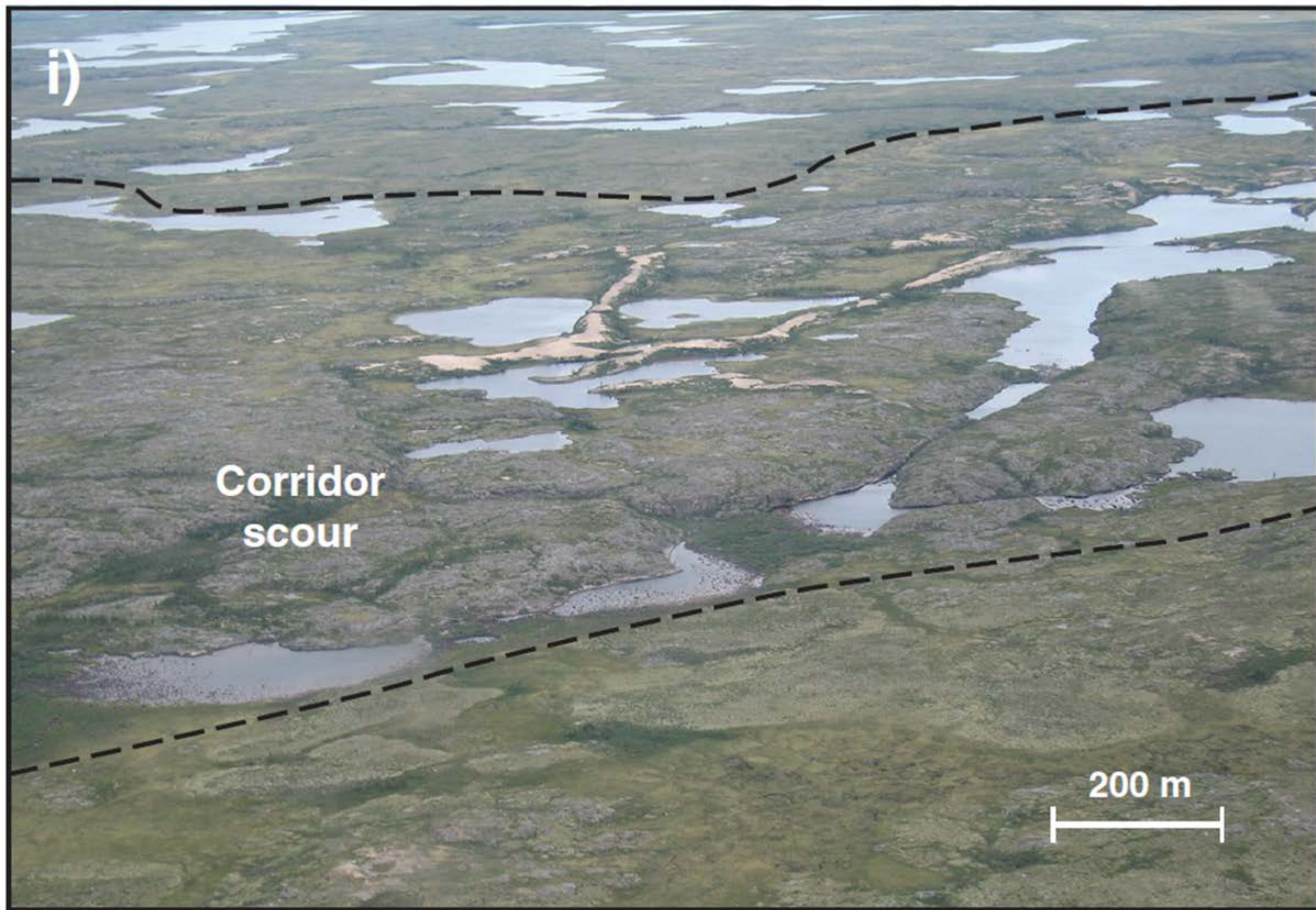


Figure 3i. Bedrock (R) exposed in scoured corridor (within dashed lines) with till veneer outside corridor.

j)

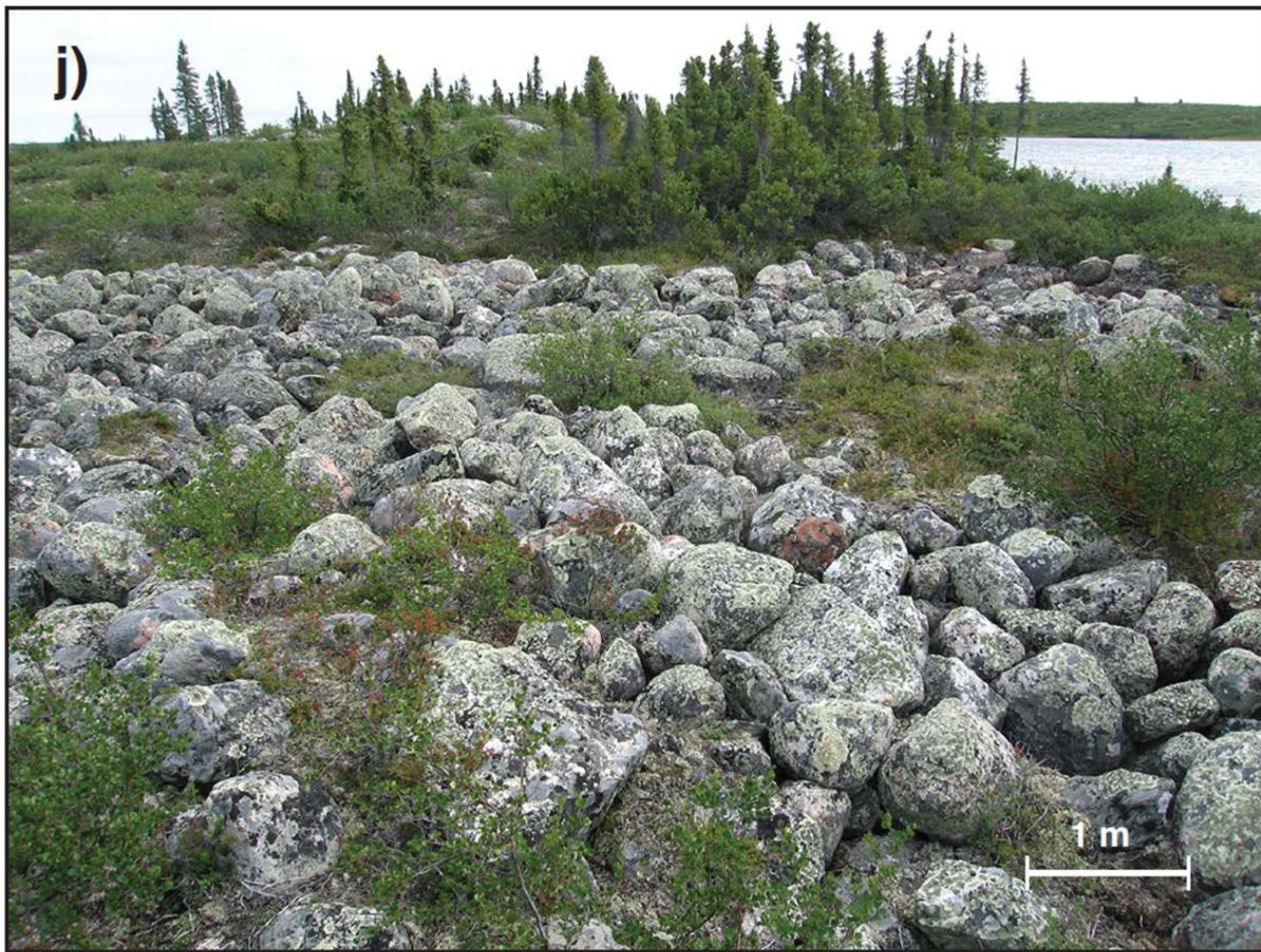


Figure 3j. Boulder deposits (GF) with mainly rounded stones.

k)

Till
Veneer

2 m

Figure 3k. Thin sediment, < 2m thick, till veneer (Tv) adjacent to eroded bedrock.

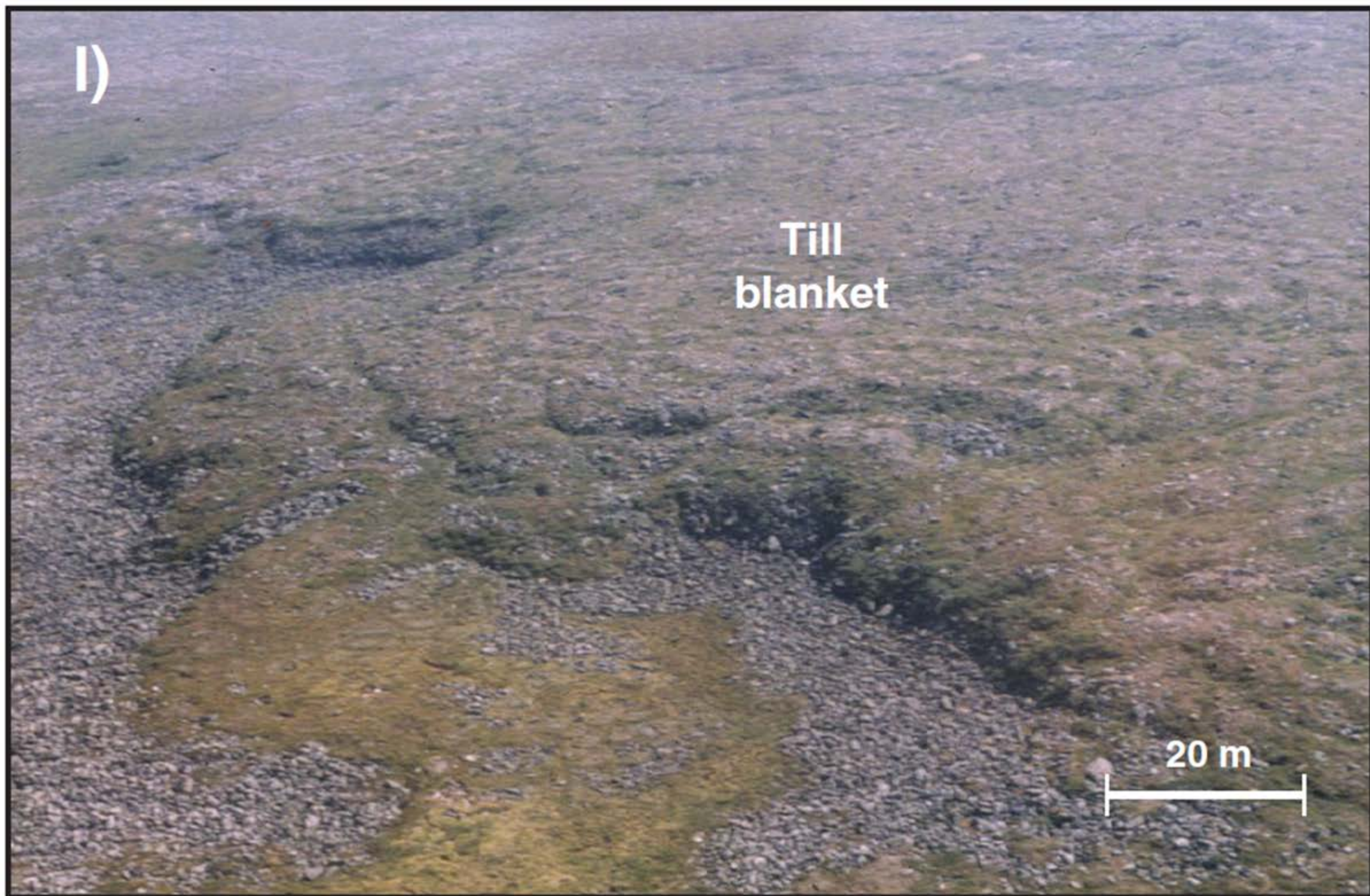


Figure 3l. Till blanket (Tb), 1-8 m thick, has a cover of boulders.

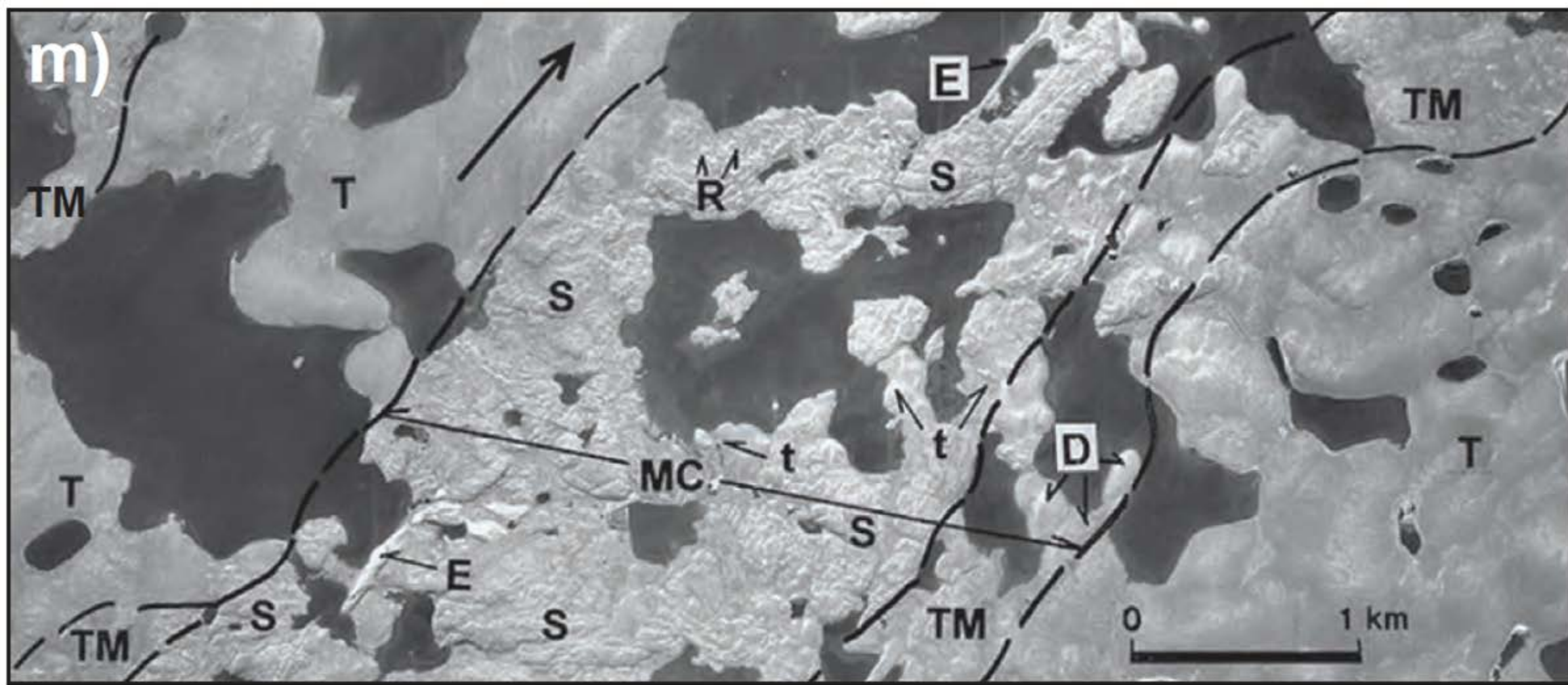
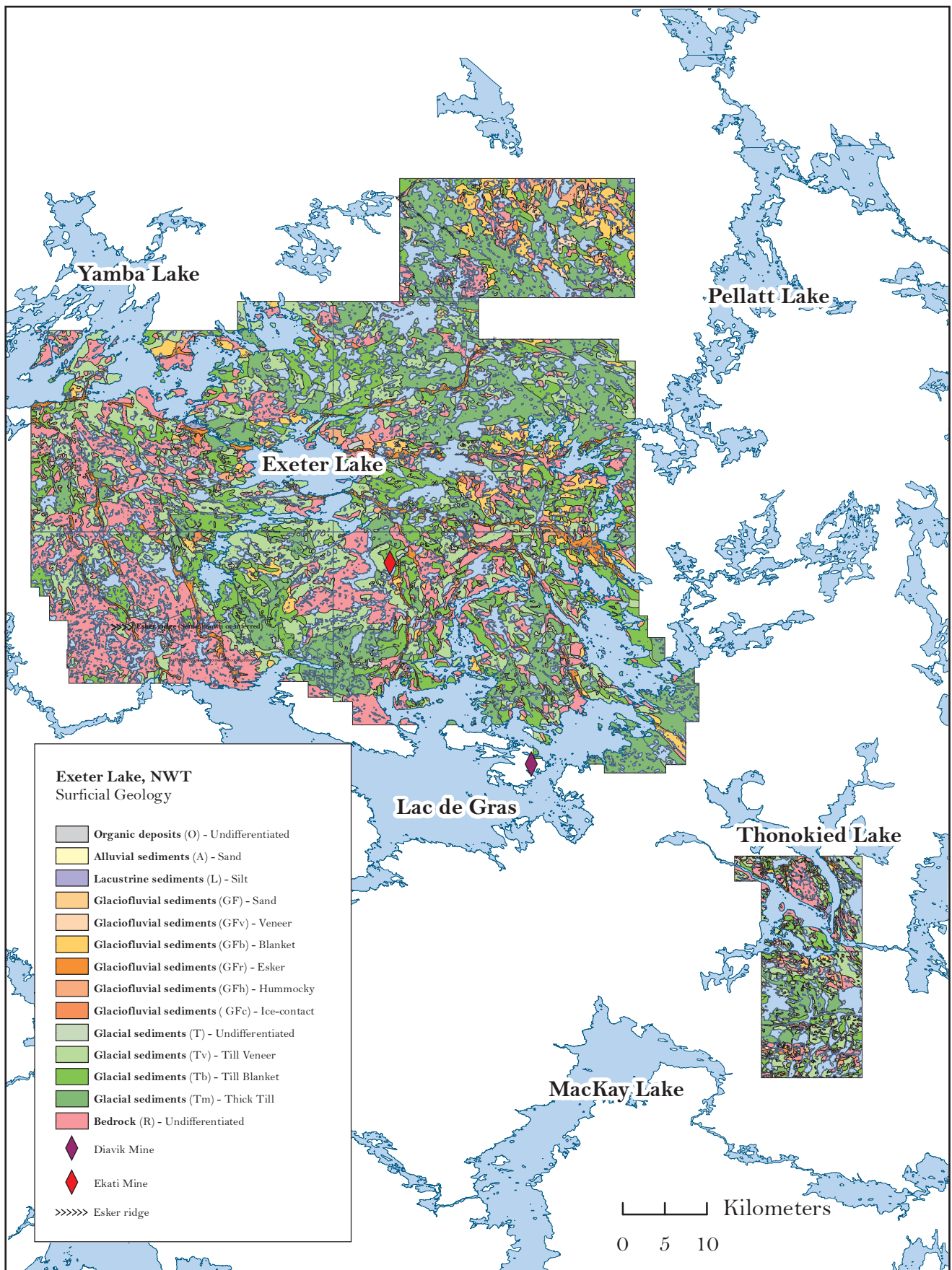
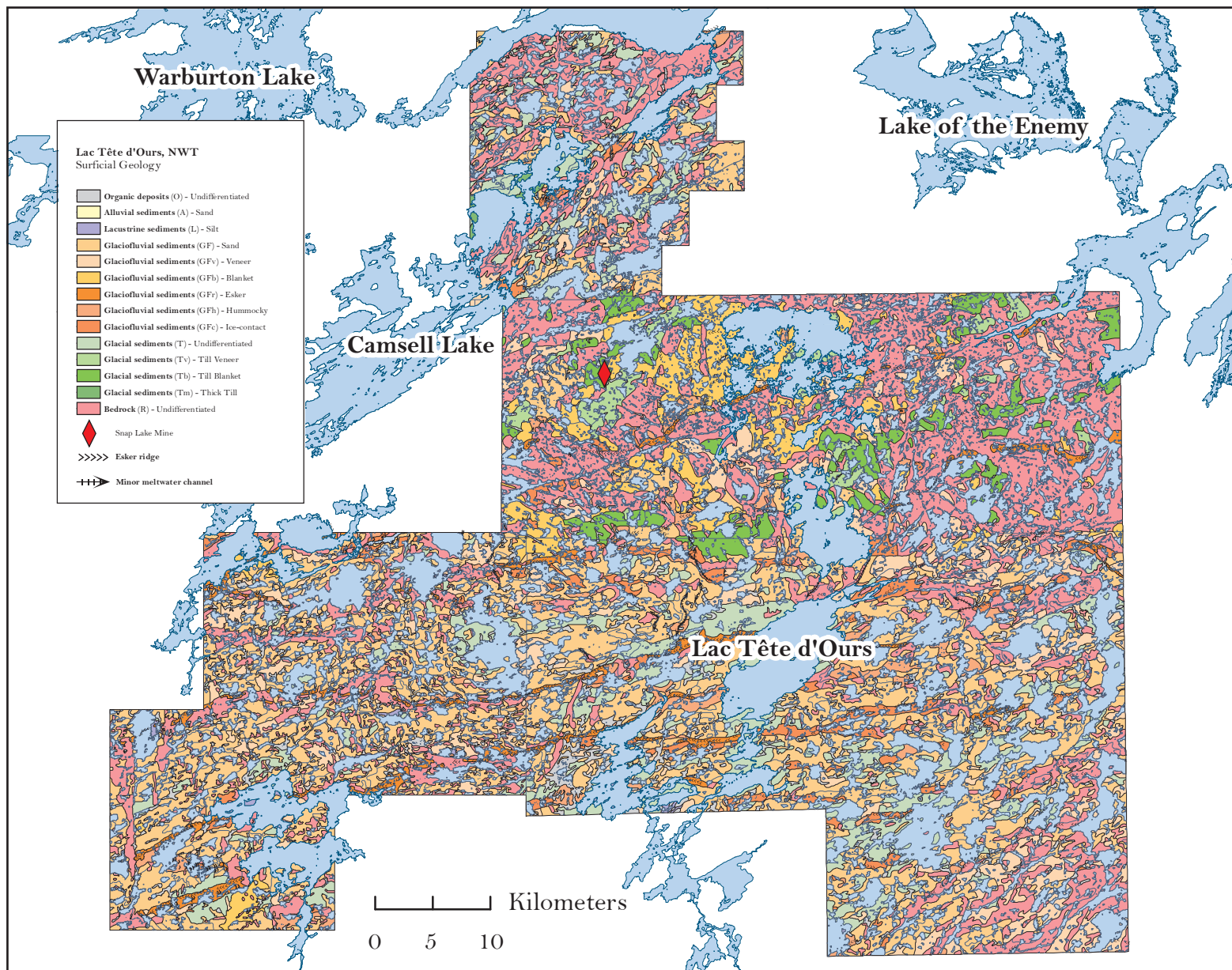


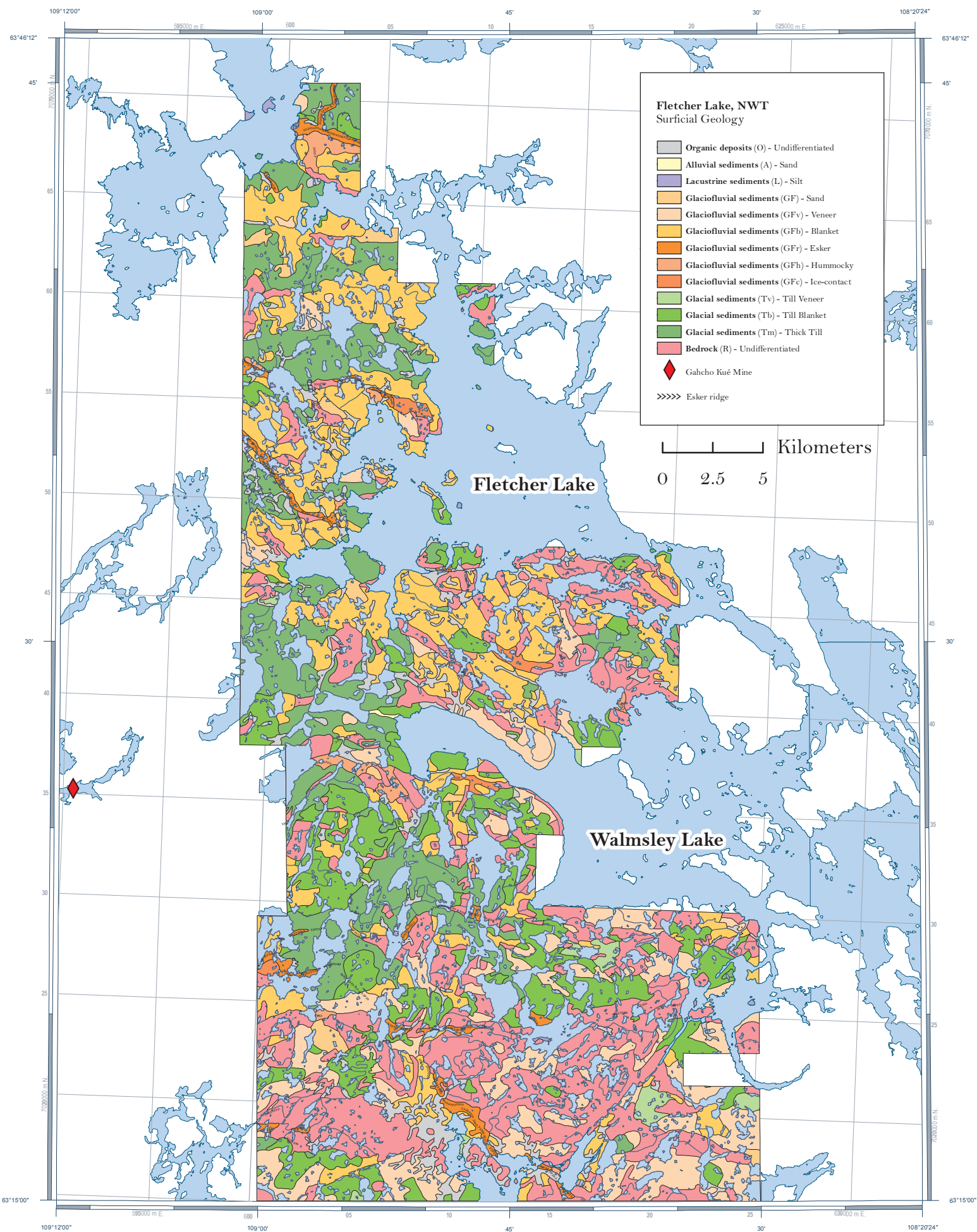
Figure 3m. Vertical aerial photograph (from Rampton, 2000) shows meltwater corridor (MC) with inset eskers (E), remnant till (t), scoured rock (s) and rogen ridges (R); note drumlin (D) in modified till zone (TM) next to poorly-modified till (T).



Map 1. Surficial geology of the Exeter Lake area, Northwest Territories



Map 2. Surficial geology of the Lac Tête d'Ours area, Northwest Territories



Map 3. Surficial geology of the Fletcher Lake area, Northwest Territories