Descriptive Notes

The McCann Lake map area lies in the south Rae Craton of the Canadian Shield, in an area where the rocks are chiefly granite gneiss with substantial belts of metamorphosed sediments and basic intrusive rocks. This region of the Shield has extensive, but broken, drift cover characterized by streamlined glacial bedforms and parallel esker systems related to ice and meltwater flow during deglaciation from an ice divide located over Keewatin to the east-northeast (Prest et al., 1968; Aylsworth and Shilts, 1989; McMartin and Henderson, 2004).

Within the map area, bedrock outcrop constitutes about 15 to 20% of the surface. Exposures are distributed throughout the area, but are somewhat more common in the northwest quarter than elsewhere. Thin drift (unit Tv), where additional small exposures are common, occurs extensively in a 20 km wide belt of high ground trending south-southwest from the easternmost reach of Talston River. Elsewhere, the till is moderately thick and is extensively streamlined. Drumlins and flutings are characteristic of areas where till is thick (unit Tb). They form numerous densely packed fields, with features typically 200 to 400 m long, with some extending to lengths of 4 km. Crag-and-tail forms are characteristic of areas where rock outcrop and shallow subcrop is more common; individual tails are rarely longer than 1 km. The till is typically bouldery silty sand to sandy.

About 10 parallel subglacial meltwater corridors that are incised in the till cover trend southwest-west across the map area. They are spaced about 5 to 15 km apart, and are typically 2 to 4 km wide, several of which extend across the width (100 km) of the map area. The signature deposits of the corridors are large eskers, trains of either hummocky glaciofluvial deposits or terraced glaciofluvial deposits, and equally or more common trains of hummocky and/or ridged till. Each of these deposits repeatedly alternate along individual corridors. With the exception of the terraced proglacial deposits, the others formed subglacially. The hummocky and ridged till deposits within these corridors are a result of the subglacial meltwater flow, either as erosional till remnants of the surrounding till or a depositional diamicton features (Campbell et al., 2020). In this interpretation, much of the hummocky till formed by meltwater erosion of previously deposited streamlined till. In places (as also in NTS 75-B; Dyke et al., 2022) drumlins were not completely eroded. The hummocky till associated with the large esker nearest the northeast corner of the map area is interfingered with irregular ridges extending from the adjacent till blanket. The ridges there appear to be residuals of meltwater erosion and they retain flutings on flat tops. In form, they are transitional to Rogen moraines. Note that numerous areas of Rogen moraine mapped in this area by Aylsworth and Shilts (1989) are all interpreted instead here as hummocky till, because these deposits, with the exception noted, lack organized ridge systems of Rogen moraines. In other instances, the hummocky till within the corridors is composed of a sandy diamicton whose morphology and composition suggest a depositional genesis (Haiblen, 2017; Vérité et al., 2023).

The main deglacial ice-flow pattern is well known. Across the breadth of the map area, the flow splayed (diverged) gradually from southwestward in the southwest corner to nearly westward at the north end. The ubiquity of streamlining of the till and copious reworking by meltwater indicates that during deglaciation, at least, the ice was warm-based everywhere. In several places within and near the subglacial corridors, the main (strong) streamline pattern is overprinted by weak flutings of local extent, including, in places, fluting of glaciofluvial and till hummocks (after hummock formation). Where they occur outside the corridor they can be seen as areas of late flow convergence toward adjacent subglacial cavities, probably close to the receding ice margins.

Systematic mapping of predominantly small erosional ice-flow indicators (e.g. striations) reveal at least five phases of ice flow (Campbell et al., 2020). Old flow(s) of unknown sense, to the southeast to south-southeast and/or the northwest to north-northwest were recorded at a few sites. This ice-flow event likely predates-Late Wisconsin glacial maximum and may represent flow from an ancestral Keewatin ice centre located to the northwest (e.g. Dyke and Prest, 1987). Well defined indicators (both landforms and striations) in crosscutting relationships indicate a regional clockwise rotation in ice-flow directions evolving from an old southward to a late deglacial westward flow (Fig. 1). These ice-flow indicators are grouped into four events based on the dominant recorded orientation. Ice-flow indicators of each event vary by 15 to 20 degrees. The south flow (185° to 200°; phase 1 in Fig. 1) is interpreted as an early flow, likely prior and during the Last Glacial Maximum (LGM). The dominant regional flow directions were to the southwest, possibly at LGM or early deglacial (~212° to 230°; phase 2 in Fig. 1) shifting to west-southwest (~239° to 254°; phase 3 in Fig. 1) followed by a late, overprinting westward (260° to 280°; phase 4 in Fig. 1) flow. The southwest-to-west regional flowsets (phases 2, 3, and 4) are attributed to the deglaciation.

In the landform record, the locally older southwest-oriented flowsets in this area are recorded by large bedforms of 2 to 4 km length, overprinted by distinctly smaller bedforms. In places, the reworking of the older bedforms has resulted in en echalon sets of younger drumlins (Ely et al., 2022). The widespread preservation of older southwest bedforms indicates that reworking of the drift sheet during the formation of the youngest flowset was far from complete. Hence, much of the drift dispersion is related to the older event(s), including the Phase 1 flow, which is preserved in the striae record (Campbell et al., 2020). The major topographic grain of the map area is aligned northeast-southwest, suggesting that these event(s) may have been more erosive.

Evidence of glacial lakes occurs in both major drainage systems. Most of the map area is in the Mackenzie River drainage basin. The Taltson River traverses the area from the southeast to the northwest, discharging to Great Slave Lake, which, during deglaciation, was occupied by glacial Lake McConnell (Craig, 1965; Smith, 1994). The northeast corner of the map area, about 10% of it, is in the headwaters of the Thelon River drainage, which flows towards Hudson Bay. Prior to the present work, there were no glacial lakes indicated in this region (Prest et al., 1968; Aylsworth and Shilts, 1989; Stokes and Clark, 2004). Nonetheless, there is widespread evidence of an ever-changing sequence of proglacial lakes in the form of shoreline features, esker deltas, lake spillways, and deltas and perched outwash terraces at the mouths of spillways and meltwater channels. Multiple strandline levels (highest ~445 m a.s.l.) and spillway sequences indicate complexities of lake evolution that are not currently resolved.

In the Thelon headwaters, fragmentary shoreline features, generally only a few kilometres in length, occur 10 to 40 m above modern lake levels. This is high enough to divert drainage into the Taltson River. No distinct spillway is evident at the low point between the two drainages. This may indicate that water levels were contiguous across the drainage divide, which seems possible from shoreline levels between McArthur and Penylan lakes. Within the Taltson River drainage, evidence of glacial lakes at many levels is seen in shoreline features and more spectacularly in the form of spillways that opened up with progressive ice-marginal recession, the largest sequence of which is located south of McArthur Lake. Most, perhaps all, of these lakes occurred simply because the major tributaries of the Taltson River drain northeastward, toward the receding ice margin. The spillways terminate close to or just above modern lake/river levels, and glaciofluvial terraces graded to baselines slightly above modern lake levels, as well as low shorelines, indicate that sections of the river's gradient may have been isostatically reversed. An unusual set of 19 parallel northwest-trending meltwater channels occurs about 10 km north of McArthur Lake. These channels are interpreted as ice marginal or possibly lake spillways although there are no shorelines associated with their onsets.

Extensive bogs occupy nearly all topographic basins. They record paludification of about 20% of the surface. Some are fringed by shoreline features, which suggests that they may be underlain by lake sediment. If lake sediment is absent, then postglacial paludification has been a very effective geomorphic agent.

In the absence of end moraines, ice-marginal recession is assumed to have occurred in a roughly parallel manner up the deglacial flowlines. In this map area, that assumption is confirmed by numerous ice-contact escarpments that trend across meltwater corridors on the ice-proximal sides of esker nodes, esker deltas, or outwash terraces; by heads of outwash trains; by points of egress of proglacial meltwater channels; by trends of lake spillways that opened along the receding margin; and here and there by sets of crevasse fillings. Furthermore, some short "eskers" that join larger systems at high angles may be interpreted as features that formed along crevasses parallel to ice margins. Taking these features together, numerous short segments of ice margins can be recognized. Along the 100 km lengths of two most continuous eskers near the north and south ends of the map area, there are about 30 such features. The spacing is highly irregular and the average spacing of 3.3 km is several times the long-term average rate of recession across the area behind the Cree Lake Moraine, as approximated by Dyke (2004). Nevertheless, where features are closely spaced, 0.5 to 1 km apart, they provide a reasonable approximation of an annual recession rate in an area devoid of end moraines.

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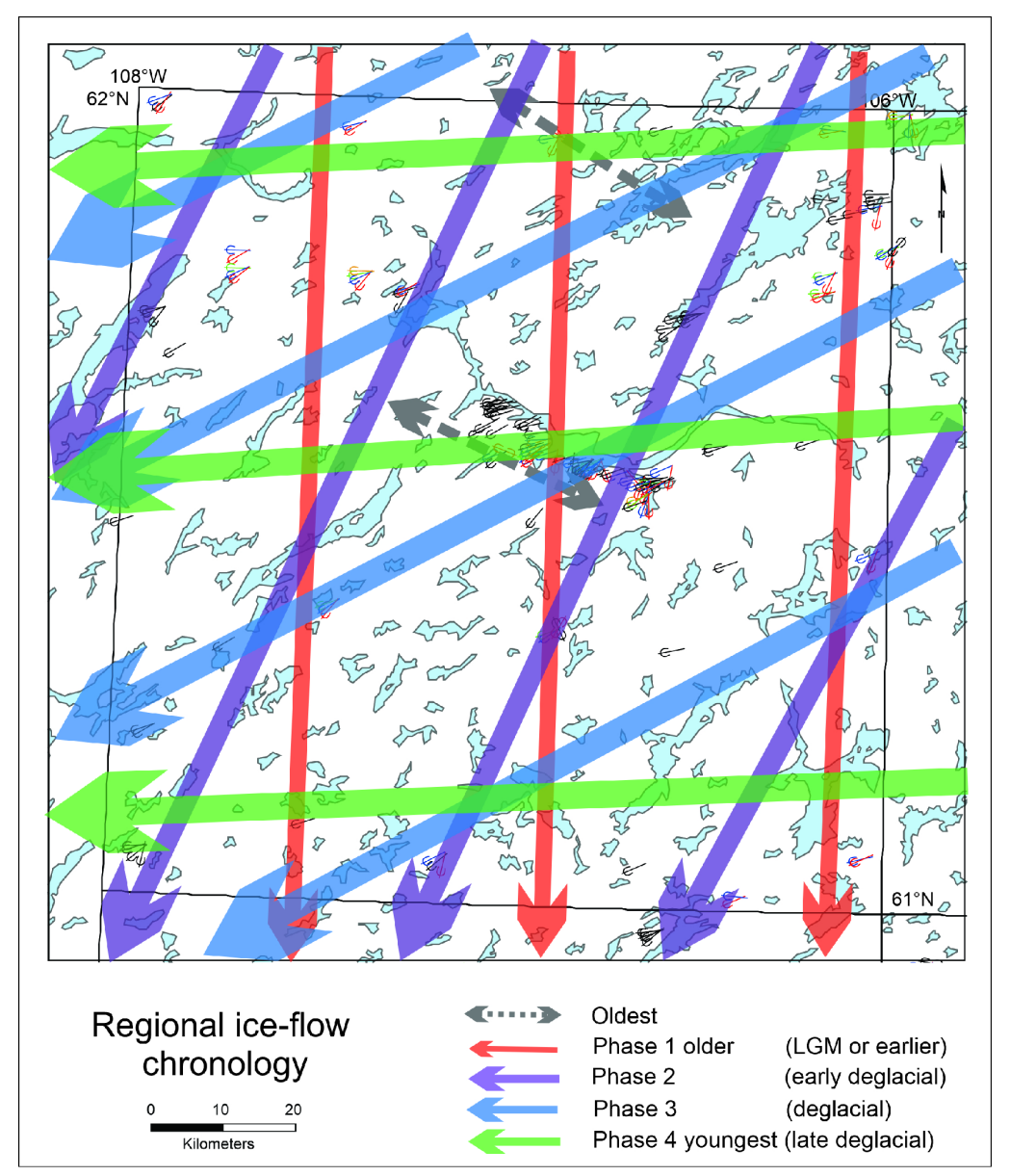

108°W
62°N
106°W
61°N
Regional ice-flow chronology
0
10
20
Kilometers
Oldest
Phase 1 older (LGM or earlier)
Phase 2 (early deglacial)
Phase 3 (deglacial)
Phase 4 youngest (late deglacial)

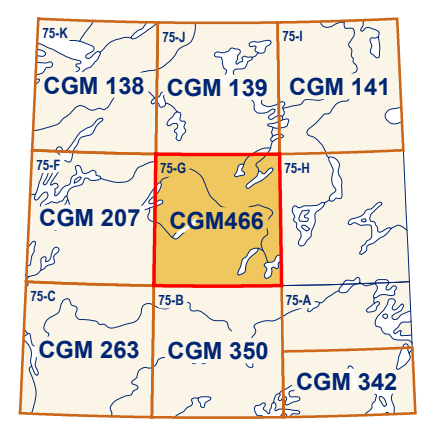
Figure 1. Simplified glacial-flow directions and relative chronology in the Abitau Lake (NTS 75-B) area derived from small-scale erosional ice-flow indicators and trends of streamlined landforms. Main ice flow is to the southwest (Campbell et al., 2020). LGM = Last Glacial Maximum

Abstract

The McCann Lake map area lies in the Rae Province of the Canadian Shield. Quaternary deposits are extensive and thick, with bedrock outcrops scattered throughout. Till is extensively streamlined to the west-southwest by late deglacial ice flow from the Keewatin Ice Divide and is incised by west-southwest-flowing subglacial meltwater corridors that extent across the map area, spaced 5 to 15 km apart. The ice-flow chronology is recorded both in the landforms and the striae record. Rare measurements record an old flowset oriented northwest-southeast. Well-defined indicators in cross-cutting relationships reveal a regional clockwise rotation in ice-flow directions evolving from an old southward to a late deglacial westward flow. Short-lived proglacial lakes, as evidenced by wave-cut scarps, beaches, terraced outwash and ice-contact deltas, and patches of glacial lake sediments, occupied paleodrainage areas to Hudson Bay and possibly headwaters of the Mackenzie River through the Taltson River system.

Résumé

La région cartographique de McCann Lake se situe dans la Province de Rae du Bouclier canadien. Les dépôts quaternaires y sont étendus et épais, et sont percés çà et là par des affleurements du substratum rocheux. Le till a largement été fuselé vers l'ouest–sud-ouest par un écoulement glaciaire de la fin de la déglaciation en provenance de la ligne de partage glaciaire du Keewatin et il est entaillé par des corridors d'eau de fonte sous-glaciaire de direction ouest–sud-ouest, espacés de 5 à 15 km, qui s'étendent à l'ensemble de la région cartographique. La chronologie des écoulements glaciaires est révélée à la fois par les reliefs glaciaires et le registre des stries. De rares mesures rendent compte d'un écoulement ancien d'orientation nord-ouest–sud-est. Des indicateurs d'écoulement glaciaire bien définis qui affichent des relations de recoupement révèlent une rotation régionale de la direction de l'écoulement glaciaire dans le sens des aiguilles d'une montre, depuis un écoulement ancien dirigé vers le sud jusqu'à un écoulement dirigé vers l'ouest à la fin de la déglaciation. Des lacs proglaciaires de courte durée, dont témoignent des escarpements sculptés par les vagues, des plages, des terrasses de délavage, des deltas de contact glaciaire, ainsi que des amas de sédiments glaciolacustres, occupaient le paléobassin versant de la baie d'Hudson, mais peut-être aussi le cours supérieur du fleuve Mackenzie, par le biais du réseau hydrographique de la rivière Taltson.



National Topographic System reference and index to adjoining published Geological Survey of Canada maps

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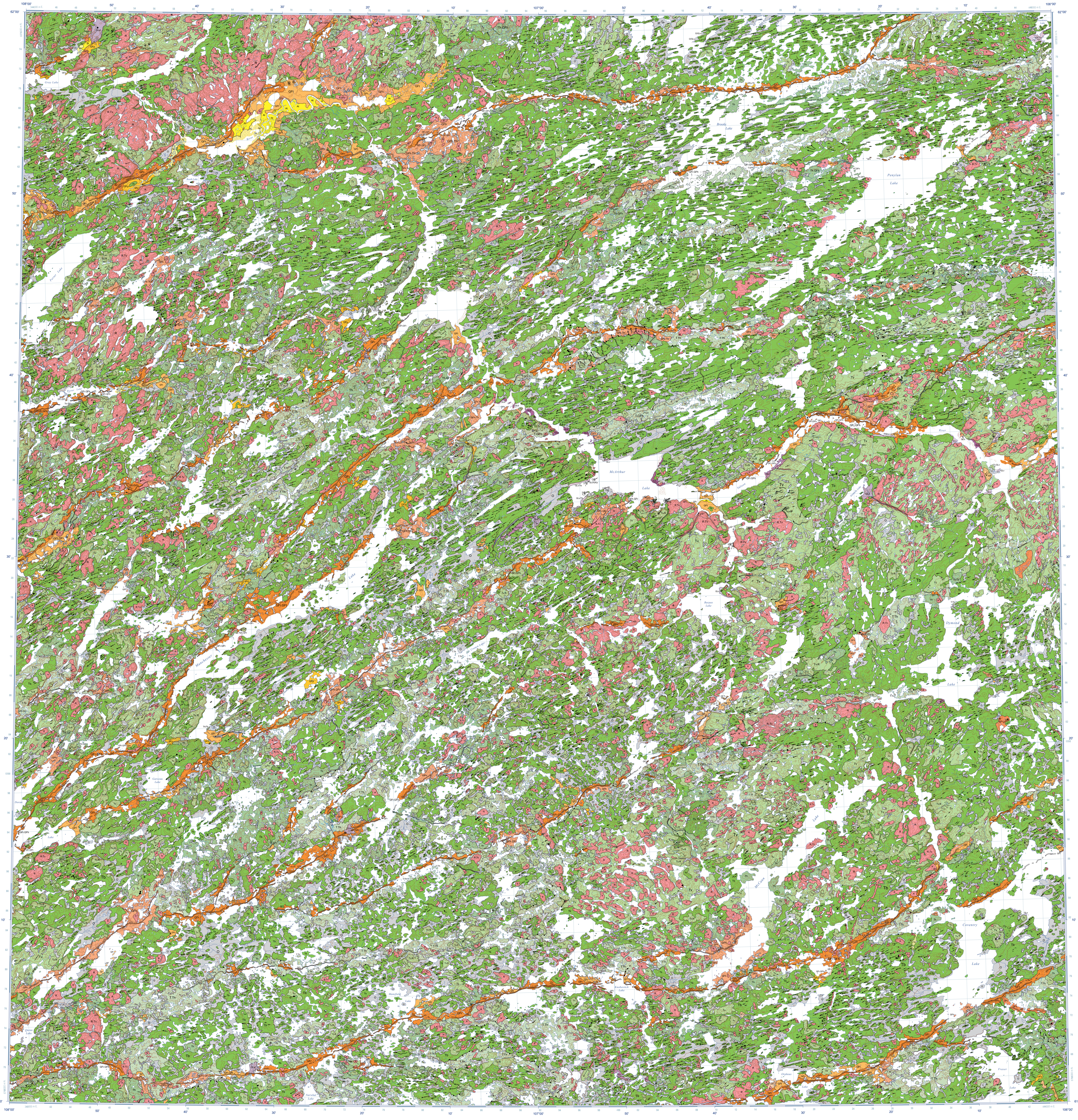
CANADIAN GEOSCIENCE MAP 466
SURFICIAL GEOLOGY
McCANN LAKE
Northwest Territories
NTS 75-G
1:100 000



QUATERNARY

HOLOCENE

NONGLACIAL ENVIRONMENT

O	**Organic deposits, undifferentiated:** fibrous organic material and soft muck; generally overlying till or glaciolacustrine sediments; estimated less than 1 m to greater than 5 m thick; includes thick, flat-to-sloping peat bogs (treed and non-treed), semi-dry thin bogs in shallow basins, and water-saturated fens; ice-wedge polygons and thermokarst ponds are common where the peat is thicker and permafrost is present; common in low-lying areas, between streamlined landforms, and around lakes and rivers; small, unmapped organic deposits occur in most terrains.
Ev	**Eolian sediments:** sand forming a veneer by wind drift over till; eroded from adjacent glaciofluvial sediments.
Ap	**Alluvial plain sediments:** sand and gravel, forming a floodplain and associated lacustrine deltas in lakes along Talston River.
At	**Alluvial terraced sediments:** sand and gravel, variable thickness, inactive sediments occurring as benches elevated above modern floodplains.

LAST GLACIATION (WISCONSIN)

PROGLACIAL AND GLACIAL ENVIRONMENT

GLACIOLACUSTRINE DEPOSITS: sand, gravel, and silt deposited into short-lived glacial lakes ponded against the retreating ice margins.

GLr	**Beach sediments:** sand and gravel estimated 1 to 3 m thick forming subdued raised beach ridges.
GLd	**Deltaic sediments:** sand and gravel estimated 1 to 10 m thick forming small perched delta terraces.
GLn	**Nearshore sediments:** sand and gravel, moderately to well sorted; massive to stratified; estimated 1 to 3 m thick; sediments derived from reworked till or glaciofluvial deposits; deposited in nearshore and littoral environments; commonly overlain by organic deposits.
GLv	**Veneer sediments:** sand and minor silt, massive to laminated; less than 2 m thick; occurs locally in patches overlying till or glaciofluvial outwash.
GLb	**Blanket sediments:** silt/clay to sand, massive to laminated; greater than 2 m thick; deposited in pro-littoral and basinal environments and mask underlying topography.

GLACIOFLUVIAL DEPOSITS: well to poorly sorted sand, gravel, cobbles with minor silt and diamicton; massive to stratified; deposited by glacial meltwater streams from (proglacial) or in contact with glacial ice (subglacial); deposits generally confined to southwest-flowing subglacial meltwater corridors and valleys.

GFp	**Outwash plain sediments:** sand and gravel; well to moderately sorted; estimated 2 to 10 m thick; generally flat to gentle sloping surfaces, often with braided paleochannels, occurring in valleys; may include terraces and ice-contact deposits.
GFt	**Terraced sediments:** gravel and sand estimated 1 to 10 m thick, forming terraces; some terraces flanking eskers likely deposited submarginally after esker formation; proglacial terraces commonly graded to former lake levels; may include small deposits of unit GFh.
GFf	**Outwash fan sediments:** sand and gravel, generally poorly to moderately sorted; estimated 1 to 5 m thick; deposited subaerially, forming fans at the ice-margin portal of subglacial meltwater channels, eskers, or glacial spillways; unit GFf2 defined as subaqueous fan.
GFh	**Hummocky sediments:** sand and gravel, minor sandy diamicton; estimated 1 to 10 m thick, commonly forming linear trains of distinct high-relief hummocks that are part of esker complexes, intermixed with hummocky moraine within subglacial meltwater corridors, or forming isolated kames.
GFc	**Ice-contact sediments:** sand, gravel, cobbles, and boulders; poorly to moderately sorted; massive to crudely stratified; estimated 2 to 5 m thick; deposited in a subglacial or englacial environment; commonly forming hummocks and kames as part of esker complexes and crevasse-fill ridges.
GFr	**Esker sediments:** sand, rounded gravel, and cobbles; moderately to well sorted; estimated 1 to 20 m thick; includes individual eskers ridges and esker complexes composed of kettles, small kames, fans and apron pads flanking esker ridges; esker ridges are represented by line symbols; predominantly found within and connecting subglacial meltwater corridors.
GFv	**Veneer sediments:** sand and gravel; massive to laminated; less than 2 m thick, locally common in some areas as a widespread veneer over bedrock or till.
GF	**Glaciofluvial sediments, undifferentiated:** sand and gravel, variable thickness; small areas lacking well developed surface expression.

GLACIAL DEPOSITS: silty-sand to sandy diamicton (till); unsorted to poorly sorted; generally massive to texturally mottled; thickness can exceed 20 m in buried depressions and streamlined landforms, but is generally estimated to be less than 5 m; largely deposited beneath active ice; surface boulder abundance is variable; clasts are angular to subrounded and predominantly locally derived; exotic lithologies such as those of the Dubawnt Supergroup (e.g. Thelon Fm sandstones, Pitz Fm volcanic rocks) sourced from northeast of the map area are variably present throughout the map area with highest concentrations in the northeast.

Th	**Hummocky till:** sandy to silty-sand diamicton, sand and gravel; massive to crudely stratified; estimated 2 to 10 m thick; typically forming trains of distinct high-relief hummocks within subglacial meltwater corridors; also hummocky, bouldery depositional deposits between corridors.
Tr	**Ridged moraine:** boulder, silty-sand till and minor ice-contact sand and gravel; massive to crudely stratified; greater than 2 m thick; predominantly (pseudo) ribbed moraines transverse to paleo-ice-flow direction; commonly covered with perched boulders.
Tv	**Till veneer sediments:** silty-sand to sandy diamicton; commonly boulder surface; less than 2 m thick; forms a continuous to discontinuous cover with 1% to 40% bedrock exposure; may include smaller areas of till blanket; underlying bedrock topography is apparent.
Tb	**Till blanket sediments:** silty-sand to sandy diamicton; estimated 2 to 20 m thick; either concealing underlying bedrock topography or forming thick drapes; typically heavily streamlined into drumlins, flutings, and crag-and-tails indicating predominantly southwest-west ice flows; lower slopes adjacent to bogs overlain by thin peat.
T	**Till, undifferentiated:** hybrid unit comprised of several landforms–sediment assemblages which cannot be separated at the scale of mapping; composed primarily of eroded silty-sand to sandy till, boulders, and bedrock interspersed with minor deposits of sandy diamicton and sand and gravel; less than 1 to ~8 m thick; predominant erosional landforms inferred to have primarily formed by subglacial meltwater, including till hummocks, boulder lags and outcrop interspersed with depositional hummocks (units Th and GFh), short sinuous transverse ridges, and short small eskers (unit GFh); generally within the southwest-flowing subglacial meltwater corridors.

PRE-QUATERNARY

R	**Bedrock, undifferentiated:** exposed bedrock outcrop of Archean to Paleoproterozoic age; primarily metamorphosed (foliated to gneissic) felsic to intermediate intrusive rocks; major mafic dykes trend north-south (Orpheus) and northwest-southeast; bedrock structure is typically apparent; surfaces commonly glacially polished, sculpted, striated, and/or fluted (roches moutonnées); outcrops are commonly associated with a discontinuous thin till cover (10% to 40%); exposed on uplands, in subglacial meltwater corridors, and near eskers; form prominent crags of crag-and-tail ridges in streamlined terrain.

Complex units: two map-unit designators separated by a dot (.) are used where the surficial cover forms a complex area and the units are too small to be mapped individually (e.g. R.Tv designates an area of bedrock interspersed with till veneer). The map-unit polygon is coloured according to the dominant unit and labeled in descending order of cover.

Stratigraphic relationship: two map-unit designators separated by a slash (/) are used where a stratigraphic relationship is observed or confidently inferred (e.g. Th/Tb designates hummocky till overlying till blanket). The map-unit polygon is coloured according to the overlying unit.

Geological contact, defined

Dune crest, large

Lag deposits: overlay on till or bedrock indicates eroded, scoured and/or reworked surfaces by meltwater drainage, surfaces have abundant boulders; form till remnants, exposed bedrock, minor glaciofluvial deposits; associated with subglacial meltwater corridors and pro-glacial channels; surfaces may be incised by small meltwater drainage channels.

Reworked sediments: sand deposits produced by wave action in a glacial lake reworking inundated till deposits; generally found below 410 m a.s.l.; most prominent in the northeast.

Terrace scarp

Paleoshorelines: beach or wave-cut notch

Kettle:
- K *Large*
- Ⓚ *Small*

Spillway:
- *Paleocurrent direction unknown or unspecified*
- *Paleocurrent direction known*

Meltwater channel:
- *Minor, sense unknown*
- *Minor, sense known*
- *Minor lateral, uphill left*
- *Minor lateral, uphill right*

Subglacial meltwater corridor margin

Moraine ridge:
- *Minor (ribbed moraine, recessional moraine ridges)*
- *Major, end moraine*

Ice-contact scarp

✳ Kame

Esker ridge:
- <><><><><><>< *Sense unknown*
- >>>>>>>>>>>>>>>> *Sense known*

Crevasse fill ridge

Drumlinoid ridge (1 = older, 2 = younger)

Drumlin (1 = older)

Crag-and-tail

Fluted bedrock:
- *Sense unknown*
- *Sense known (1 = older)*

Roche moutonnée:
- *Poorly defined (1 = older)*
- *Well defined (1 = older)*

Striation:
- *Poorly defined, direction unknown*
- *Poorly defined, direction known*
- *Well defined, direction unknown*
- *Well defined, direction known*
- *Crossed, 1 = older, 2 = younger*

× Small outcrop

Station location:
- ⌖ *Remote observation*
- ○ *Ground observation*

● Sample location: *see* database (Campbell et al., 2020)

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Geological Survey of Canada
Canadian Geoscience Maps

Authors: A.S. Dyke and J.E. Campbell

Geology based on aerial photograph interpretation by A.S. Dyke, 2014 and fieldwork by J.E. Campbell (2014–2016).

Revisions by J.E. Campbell (2024)

Geological data conforms to Surficial Data Model v. 2.5.1 (Deblonde et al., 2024).

Accompanying field site, till composition and ice-flow datasets for NTS mapsheet 75-G are available in GSC Open File 8714 (Campbell et al., 2020).

Geomatics by L. Robertson

Cartography by D. Viner and A. Page

Scientific editing by A. Weatherston

Initiative of the Geological Survey of Canada, conducted under the auspices of the South Rae Bedrock and Surficial Mapping Activity, Rae Project as part of Natural Resources Canada's Geo-mapping for Energy and Minerals (GEM-2) program

Map projection Universal Transverse Mercator, zone 13
North American Datum 1983

CANADIAN GEOSCIENCE MAP 466

SURFICIAL GEOLOGY
McCANN LAKE
Northwest Territories
NTS 75-G
1:100 000

Base map at the scale of 1:50 000 from Natural Resources Canada, with modifications
Elevations in metres above mean sea level

Mean magnetic declination 2025, 10°47′E, decreasing 7.7′ annually
Readings vary from 9°58′E in the SE corner to 11°35′E in the NW corner of the map.

This map is not to be used for navigational purposes.

Title photograph: Subglacial meltwater corridors composed of hummocks and ridges (foreground) are common in the area covered by the McCann NTS map sheet. Here, north of McArthur Lake, a corridor dissects well defined streamlined terrain composed of drumlinoid ridges (background). Photograph by J.E. Campbell. NRCan photo 2023-420

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