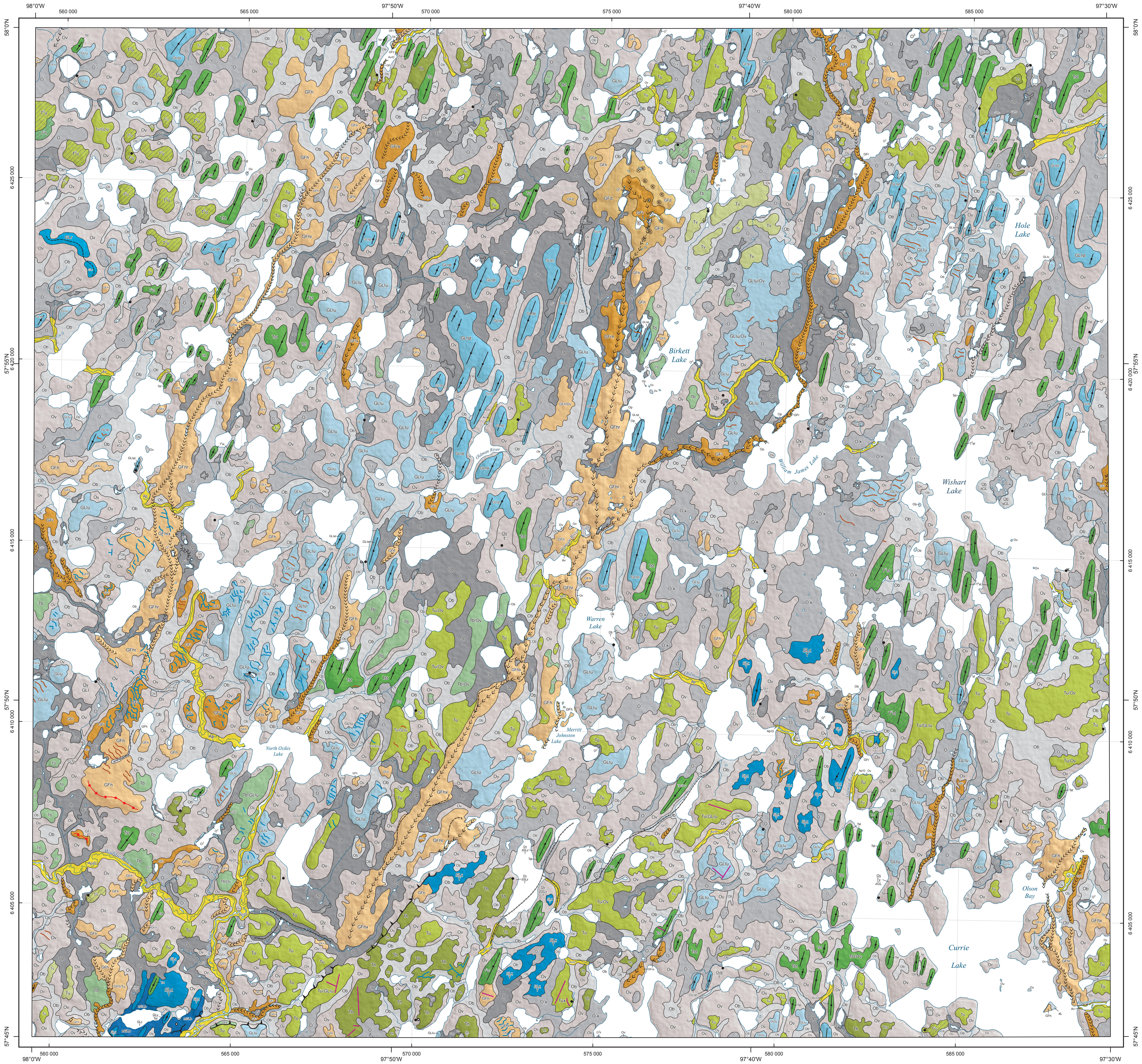
Surficial geology of the Currie Lake NTS area (64H13), Manitoba



Scale 1:50 000

0 — 5 000 — 10 000 metres

NAD1983 UTM Zone 14

QUATERNARY

Nonglacial environments

ALLUVIAL DEPOSITS: Sorted sand, silt and clay with minor gravel and organic detritus; commonly stratified; deposited along and/or within all modern rivers and streams.

- **Av** — **Floodplain deposits:** sorted sand, silt, clay, minor gravel and organic detritus less than 1 m thick; forming active floodplains close to river and stream level.
- **Af** — **Fluvial fan:** sorted sand, silt, clay, minor gravel and organic detritus, forming a fan deposit where a stream channel enters a larger water body.
- **Ap** — **Floodplain deposits:** sorted sand, silt, clay, minor gravel and organic detritus greater than 1 m thick; forming active floodplains close to river and stream level; includes terraces too small to show at this map scale.
- **At** — **Fluvial terraces:** inactive terraces above modern floodplain; greater than 2 m thick; consisting of gravel, sand, and overbank silt and organic detritus.

ORGANIC DEPOSITS: undifferentiated peat and muck; 0.3 to greater than 3 m thick; formed by the accumulation of plant material in various stages of decomposition; generally occurs as flat, wet terrain (swamps and bogs) over poorly drained substrates. Fibric fens are present along some water channels. Permafrost is commonly present underlying/within organic deposits. Small, unmapped deposits commonly occur in most terrain units. Peat mantles most geological units.

- **Ov** — **Veneer:** thin accumulations of peat, 0.3 to less than 1 m thick, which drape the existing topography.
- **Ob** — **Blanket:** continuous peat between 1 and 2 m thick, which drapes the existing topography. Some polygons include hummocky mounds and plateaus underlain by discontinuous permafrost.
- **Op** — **Plain:** flat to gently undulating plain of peat, greater than 2 m thick, that contains numerous small thermokarst ponds and depressions.
- **O¹** — **Wetland – bog:** flat to gently undulating plain of peat, greater than 2 m thick, that contains hummocky mounds and plateaus underlain by discontinuous permafrost. **O¹k** includes thermokarst terrain related to melting ground ice.
- **O²** — **Wetland – fen:** flat to gently undulating plain of fibric vegetation, often floating, that mask the underlying topography.

LACUSTRINE DEPOSITS

- **L** — **Undifferentiated deposits:** massive to stratified, sorted sand, silt, clay and minor organic detritus deposited adjacent to and/or within modern ponds and lakes. This unit is common along the shores of Partridge Breast Lake and the Churchill River, where drainage was diverted away ('Churchill River Diversion') in 1977.
- **Lv** — **Lacustrine veneer:** thin accumulations of lacustrine sediments, 0.3 to less than 1 m thick, which drape the existing topography.

Proglacial and glacial environments

GLACIOLACUSTRINE DEPOSITS: massive to laminated (rhythmically bedded) silt, clay and sand, with areas of ice-rafted stones, granules or waterlain diamicton, deposited into littoral and deep-water environments of glacial Lake Agassiz. These deposits are of variable thickness (0.2 to 3 m), and drape both till deposits and bedrock. Around some of the larger lakes, the glaciolacustrine sediments have been removed from the shoreline by Holocene wave-washing, and thickness increases inland.

GLACIOLACUSTRINE, ICE CONTACT: Weakly to noncalcareous, massive to weakly stratified fine sand, silt and minor clay, commonly contains ice-rafted stones and diamict beds (massive with 1–5% granules to small pebbles of carbonate and crystalline rock). Deposited beneath and/or reworked by ice near the margin at the contact zone between the glacier and Lake Agassiz. Includes areas of iceberg scour and De Geer moraines.

- **GLIv** — **Veneer:** 0.2 to 1 m thick, imperfect to moderately drained, underlying topography is discernible.
- **GLIb** — **Blanket:** 1 to 3 m thick, imperfect to moderately drained, continuous cover forming flat to undulating topography that locally obscures underlying geomorphology.
- **GLIu** — **Undulating:** 0.2 to 3 m thick, imperfect to well drained, forms undulations and hummocks that rise up out of the surrounding organic terrain. Can be overlain by a thin veneer of sandy diamict with 20 to 30% clasts. Includes DeGeer moraines– minor moraines formed due to subglacial sediment advection to the ice margin during temporary halts in grounding-line retreat.
- **GLIst** — **Streamlined:** greater than 2 m thick, glaciolacustrine littoral sand and silt draped by a thin veneer of clast-rich sandy diamict; moulded beneath the glacier into linear ridges and/or furrows parallel to ice flow (drumlinoid ridges).

GLACIOLACUSTRINE, LITTORAL: Glacial sediments reworked by wave action; forms moderately well sorted isolated or a series of ridges, 1 to 3 m in height, including beaches, bars and spits; blankets of sand grading basin-ward into silt and clay, commonly less than 1 m thick.

- **GLr** — **Ridged sediments:** 0.5 to 2 m thick, moderate to well-drained sandy beach ridge.
- **sGLv** — **Veneer:** 0.2 to 1 m thick, moderate to imperfectly drained blankets of fine sand and silty sand; underlying topography is discernible.

GLACIOLACUSTRINE, DEEP WATER: calcareous to noncalcareous, massive to rhythmically bedded, well sorted, moderately dense, milk-chocolate brown clay and rarer silt; glaciolacustrine clay was observed underlying a veneer of till north of Clee Lake and just east of Majury Lake (NTS 64H12N)

- **GLv** — **Veneer:** 0.2 to 1 m thick, imperfect to poorly drained, underlying topography is discernible.
- **GLb** — **Blanket:** 1 to 3 m thick, imperfect to very poorly drained, continuous cover forming flat to undulating topography that locally obscures underlying geomorphology. Typically mantled by peat of variable thickness.

GLACIOFLUVIAL DEPOSITS: orange to tan, moderately to poorly-sorted, silt, sand, gravel and diamicton deposited behind, at or in front of the ice margin by flowing glacial meltwater. Where the suffix 'x' has been added to the terrain-unit label (i.e., GFrx), it indicates the sediments have had significant surface reworking by glacial Lake Agassiz.

- **GFv** — **Veneer:** discontinuous sand and gravel cover, less than 1–2 m thick; underlying topography is discernible.
- **GFb** — **Blanket:** continuous sand cover greater than 2 m thick; forming flat to undulating topography that locally obscures underlying units and associated geomorphic patterns; typically formed by redistribution of glaciofluvial sands in a shallow water environment.
- **GFh** — **Ice contact sediments:** undifferentiated deposits; poorly sorted sand and gravel with minor diamicton, deposited by glacial meltwater in direct contact with the glacier, 1 to greater than 10 m thick; forming gently undulating to hummocky topography related to melting of underlying ice. Features include kettles, kames and ridges.
- **GFr** — **Eskers, esker systems and crevasse fills:** massive to stratified sand, and minor gravel, deposited by meltwater flow within tunnels beneath or within the glacier; present as 1 to 20 m high ridges; some esker ridges are below the glaciolacustrine limit and exhibit subdued heights with some wave-washed re-distribution of sand adjacent to the ridges. Crevasse fills occur as 3 to 5 m high sand, gravel and diamict ridges that form a reticulate pattern; deposited near the ice margin in fractures within a thinning ice mass.
- **GFd** — **Ice contact delta:** well to moderately stratified sand and gravel deltaic deposit, formed where a meltwater channel entered a glacial lake during regression and lowering of lake levels; surface is kettled and landform has a steep front.

GLACIAL DEPOSITS: unsorted to poorly sorted diamictons (till) deposited in subglacial environments. There is a wide range in the composition of the till, with significant variable proportions of eastern- and/or northeastern-sourced (Paleozoic and Proterozoic), 'locally'-sourced (greenstone belt), regional (granitoids) and northern-sourced (Dubawnt Supergroup) clast concentrations.

- **T** — The dominant till is a Keewatin-Hudsonian calcareous to highly calcareous hybrid till, with silty sand to clayey silt matrix, which contains 5–50 ct. % (average 26 ct. %) Paleozoic carbonate-bearing clasts mixed with Proterozoic, Precambrian and Archean clasts (granitoid, gneissic and greenstone rocks); the matrix is calcareous (1.5–42 wt. % total carbonate and 1.7–17.6 wt. % CaO); this till was deposited by ice flowing west from the Quebec-Labrador ice sector of the Laurentide Ice Sheet, and later variably reworked by ice flowing southwest and south from the Keewatin sector, or an ice saddle overlying southeastern Hudson Bay; where the suffix ôxö has been added to the terrain label (e.g., Tvx, Tbx, Tstx, Tux), it indicates that the sediments have had significant surface reworking by lacustrine or fluvial waters.
- **T²** — **KEEWATIN-DOMINANT TILL:** weakly to noncalcareous till, with silty sand to clayey silt matrix, that contains 0–5% (average 1.1%). Paleozoic carbonate-bearing clasts, mixed with Precambrian and Archean clasts (granitoids, gneisses, greenstone rocks); the matrix may contain up to 8% total carbonate and 4.5 ppm CaO. This till is predominately sourced from ice flowing south and southwest from the Keewatin ice sector of the Laurentide Ice Sheet.
- **Tv** — **Till veneer:** discontinuous till cover 0.2–1 m thick; underlying topography is discernible. Where not otherwise noted, bedrock is assumed to be the underlying material.
- **Tb** — **Till blanket:** continuous till cover greater than 1 m thick; forming flat to undulating topography that locally obscures underlying units and associated geomorphic patterns; occasional thinner patches of till may occur.
- **Th** — **Hummocky till:** till greater than 2 m thick with hummocky topography (2–5 m swales), either moulded beneath the glacier or as a result of supraglacial meltout (ablation) tills deposited by melting of stagnant ice; loose, texturally variable sandy to gravelly matrix, some sorting; angular to subangular clasts.
- **Tu** — **Undulating till:** till greater than 2 m thick, moulded beneath the glacier into undulating topography (0.1–2 m swales).
- **Tst** — **Streamlined till:** greater than 2 m thick, subglacial till moulded beneath the glacier into linear ridges and/or furrows parallel to ice flow; drumlins, drumlinoid ridges, flutings. Ridges are typically 0.1–0.5 km long and 0.5–10 m high.

PRE-QUATERNARY

- **R** — **Precambrian rocks:** metasedimentary, metavolcanic rocks and associated intrusive rocks; may be overlain by a thin, discontinuous veneer of till and or glaciolacustrine clay in upland areas.

NOTES

This legend is common to MAP2014-1, -2, -3 and -4. Not all units and symbols shown in the legend will appear on this map.

In areas where the surficial cover forms a complex pattern, the area is coloured according to the dominant unit and labelled in descending order of cover (e.g., R/Tv). Where underlying stratigraphic units are known, areas are coloured according to the overlying unit and labelled in the following manner:

$\frac{\text{GLv}}{\text{Tst}}$ means glaciolacustrine veneer overlies streamlined till.

Multiple modifiers may be combined to clarify the detailed geology (e.g. Tbx, T²ux)

Symbols

Kettle	Beach ridge	Esker, washed, direction unknown
Mass movement	Crag-and-tail landform	Iceberg scour
Outcrop	Crevasse ridge	Major moraine
Field site with till sample	De Geer moraine	Meltwater channel
Field site without till sample	Drumlin	Meltwater corridor
Roche moutonée	Drumlinoid ridge or fluting	Minor moraine undifferentiated
Striae, direction known, poorly preserved	Dune	Rogen moraine (pristine)
Striae, direction known, well preserved	Esker, direction known	Scarp
Striae, direction unknown, poorly preserved	Esker, direction unknown	Streamlined bedrock
Striae, direction unknown, well preserved	Esker, washed, direction known	Trimline (Scarp)

DESCRIPTIVE NOTES

Surficial geology of the Gauer Lake–Wishart Lake area (NTS 64H4, 5, 12, 13)

Methods

The surficial geology of the Gauer Lake–Wishart Lake area was interpreted from 1:60 000 scale black and white airphotos obtained from Natural Resources Canada. Aspects of the regional surficial geology were also gleaned from Shuttle Radar Topography Mission imagery (30 and 90 m resolution; United States Geological Survey, 2002) and SPOT orthoimages (Geobase®, 2012). Field studies were conducted by helicopter in July 2013. This project includes data from 244 field sites, from which 155 till samples were analyzed for geochemical and clast composition (Trommelen, 2015). This new mapping builds on previous 1:250 000 scale surficial mapping completed in the 1980s (Klassen and Netterville, 1980, 1985).

Physiography

The study area is mantled by glacial and postglacial sediments. Elevation varies mainly from 240 to 360 m above sea level (asl) and local relief is up to 30 m. The drift cover is generally thick, though bedrock outcrops along the shores of most major lakes in the region. The area is part of the extensive discontinuous permafrost zone (Sladen, 2011), and permafrost was encountered beneath organic deposits at most sites. In 1977, Manitoba Hydro completed construction of a diversion that saw water from the Churchill River system enter the Burntwood and Nelson river systems. As a result, water levels were lowered along the Churchill River and within Partridge Breast and Missinipi lakes.

Quaternary history

The study area was repeatedly glaciated by the Laurentide Ice Sheet (LIS) during the Quaternary. In the Late Wisconsinan, the region was affected by ice flowing southward from the Keewatin ice divide (Klassen, 1986; Dredge and Cowan, 1989) and westward from the Quebec–Labrador sector (Hudsonian ice, Dredge and Nixon, 1992; Dredge et al., 2007). The nature of interaction between ice from Keewatin and from Hudson Bay is uncertain, but a thick ice ridge (ice saddle) was likely present over southern Hudson Bay late in deglaciation (Dyke and Prest, 1987; Thorleifson et al., 1993; Trommelen et al., 2012).
Circa 8.2 ^{14}C ka, the study area was inundated by glacial Lake Agassiz (Klassen, 1983; Thorleifson, 1996). Radiocarbon dates are rare in northern Manitoba, but it is thought that this inundation was short-lived and absent by ca. 7.7 ^{14}C ka (Thorleifson, 1996; Teller and Leverington, 2004). The northern half of the study area is dominated by a lobate streamlined-landform fan (Quinn Lake ice stream; Dredge et al., 1986; Dredge and Nixon, 1992), which was thought to have been formed during a surge or readvance into glacial Lake Agassiz. These streamlined landforms also outline the deglacial-type Quinn Lake glacial terrain zone (Figure 1; Trommelen et al., 2012).

Ice-flow history

The study area contains evidence of at least six different ice-flow phases (Figure 2). Early, well-preserved southeastward (phase I; between 120 and 160°), westward (phase II; between 260 and 280°) and southwestward-trending (phase III; between 230 and 240°) ice-flow indicators are present. These ice-flow phases are rare but regionally extensive (Dredge et al., 1986; Dredge and Nixon, 1992; Kaszycki et al., 2008), and correlate to the pre-Late Wisconsinan transport of calcareous detritus to the area (Dredge, 1988). Rare but widespread striations and several roches moutonnées then document southward ice flow (phase IV; between 180 and 194°). This was followed by strong, fairly erosive, south-southwestward ice flow (phase V; between 203 and 212°). During deglaciation, ice flowed to the southwest (phase VI; between 220 and 230°) and south and southeast (phase VI; ~196°, 160°, 120°) during the Quinn Lake readvance. Drumlinoid ridge formation in the northern half of the area occurred during the Quinn Lake phase VI, whereas streamlined landforms in the southern half of the area are presumed to correlate with phase V.

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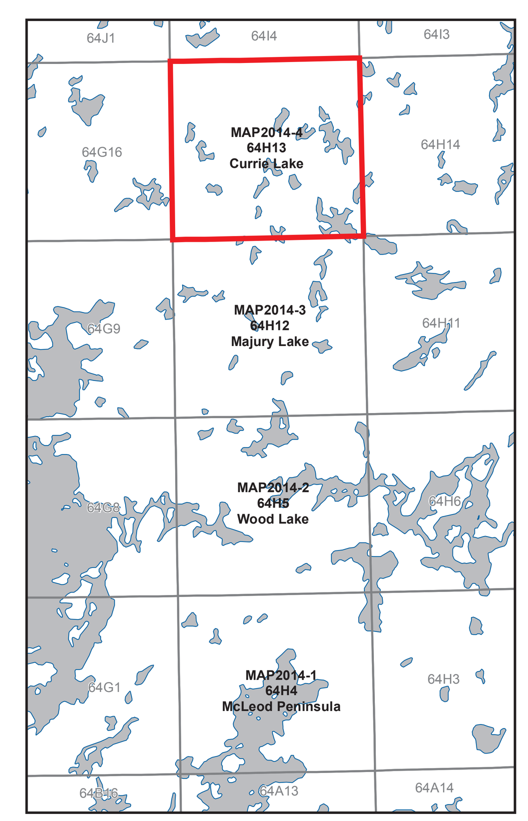
National Topographic System and index to adjoining maps



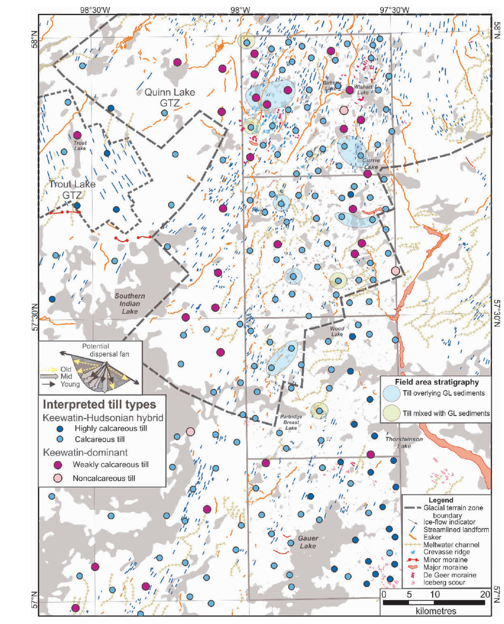


Figure 1: The study area contains a portion of the Quinn Lake glacial terrain zone (GTZ) and just to the west of study area is the Trout Lake GTZ. The Quinn Lake GTZ is classified as a deglacial-type GTZ, formed during a late deglacial surge of an ice stream into glacial Lake Agassiz. The Trout Lake GTZ was investigated during fieldwork completed by Kaszycki (1989). The boundaries are closely tied to the edges of a flowset of southeast-trending, curvilinear, streamlined landforms. Unlike the Quinn Lake GTZ, the eskers and meltwater channels within the Trout Lake GTZ clearly crosscut the streamlined-landform flowset, meaning that it is a palimpsest- or relict-type GTZ (Trommelen et al., 2012).

Interpreted till types in the study area are based on the proportion of carbonate clasts in the till matrix. Keewatin-dominant till refers to till with <5 ct. % carbonate clasts that were mainly emplaced by a younger south-southwest–flowing ice-flow phase with near-complete dilution/overprinting of calcareous detritus. Keewatin-Hudsonian hybrid till contains 5–50 ct. % carbonate clasts, and a spatially variable mixture of far-travelled calcareous detritus, which has been diluted by comminution, combined with incorporation of Precambrian shield clasts sourced from the east, northeast and north. Abbreviation: GL, glaciolacustrine.

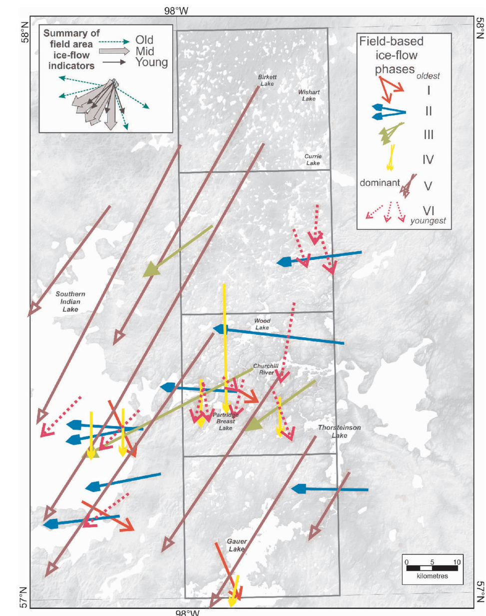
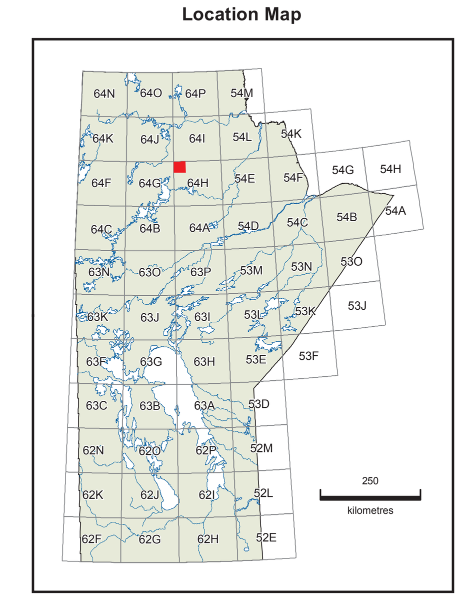


Figure 2: Compiled and interpreted ice-flow phases in the study area. The summary of ice-flow indicators (inset, upper-left) provides a depiction of possible dispersal fan orientations for the area that may be encountered during drift exploration. Background image was generated using a Shuttle Radar Topography Mission digital elevation model (United States Geological Survey, 2002).

Location Map



Geology by M.S. Trommelen (2013)

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Airphoto interpretation onto 1:60 000 scale airphotos by M.S. Trommelen.

Cartography by B.K. Lenton, P.G. Lenton and M.E. McFarlane (2012–2013).

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