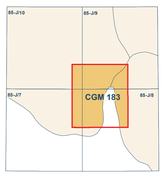
Abstract

Yellowknife Bay was covered by the Laurentide Ice Sheet, with generally southwestward ice flow, during the Late Wisconsinan glaciation until about 10,000 BP. With ice retreat, Glacial Lake McConnell inundated the area, which was replaced by ancestral Great Slave Lake as water levels declined. Surficial geology includes widely-exposed bedrock, and a dominance of fine-grained sediments within low-lying areas deposited within deep glaciolacustrine and shallow post-glacial lake settings. Other sediments include extensive subaqueous outwash deposits of sand and gravel, re-sorted at the surface by wave-action. Wave-washed bedrock is also common, with occasional perched boulders on bedrock and lithe if any exposed till. Vegetation consists mainly of open to dense forests of black spruce, jack pine, and paper birch mixed with marshes, fens and peat bogs in low-lying areas. Permafrost is extensively discontinuous in the area, occurring within most organic deposits as well as alluvial and glaciolacustrine sediments.

Résumé

Pendant le Wisconsinien tardif jusqu'à environ 10 000 ans avant le présent, la baie de Yellowknife était recouverte par l'Inlandsis laurentidien avec écoulement glaciaire général vers le sud-ouest. Avec le retrait de la glace, le lac glaciaire McConnell inonda la région et, avec la baisse du niveau des eaux, fut remplacé par le proto-Grand lac des Esclaves. La géologie de surface présente des affleurements rocheux étendus et, dans les terres basses, une prédominance de sédiments fins qui se déposèrent dans les environnements glaciolacustres profonds et des lacs postglaciaux peu profonds. Parmi les autres sédiments, se trouvent de grands dépôts fluvioglaciaires subaquatiques de sable et de gravier, retriés en surface par l'action des vagues. On voit beaucoup de roche-mère érodée par les vagues et, occasionnellement, des blocs perchés sur la roche-mère et peu de till exposé. La végétation se compose principalement de forêts ouvertes ou denses d'épinettes noires, pins gris et bouleaux, au milieu de marais et de tourbières minérotrophes et ombrotrophes dans les terres basses. Le pergélisol est discontinu et se trouve dans la plupart des dépôts organiques ainsi que dans les sédiments alluvionnaires et glaciolacustres.



National Topographic System reference

Cover illustration
City of Yellowknife, Northwest Territories, as viewed from Yellowknife Bay, Yellowknife, Northwest Territories. Photograph by S.A. Wolfe, 2014-025

Catalogue No. M183-1/183-2014E-PDF
ISBN 978-1-100-23415-1
doi:10.4095/293725

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CANADIAN GEOSCIENCE MAP 183

SURFICIAL GEOLOGY

YELLOWKNIFE AREA

Northwest Territories

parts of NTS 85-J/7, NTS 85-J/8, NTS 85-J/9, and NTS 85-J/10

1:25 000

SURFICIAL DEPOSITS

QUATERNARY

HOLOCENE

NONGLACIAL ENVIRONMENT

H — **Anthropogenic deposits:** undifferentiated deposits, variable thickness, areas disturbed by human development; anthropogenic areas may also coincide with regions mapped as glaciofluvial sediments.

O — **Organic deposits, undifferentiated:** fen, bog, variable thickness.

Ap — **Alluvial floodplain sediments:** silt, sand, and gravel, variable thickness, may be seasonally flooded and terraced and overlain by organics, deposited along the Yellowknife River and its ancestral precursor.

A — **Alluvial sediments, undifferentiated:** silt, sand, and gravel, variable thickness, commonly overlain by organics, deposited along the Yellowknife River and its ancestral precursor.

HOLOCENE AND PLEISTOCENE

NONGLACIAL AND PROGLACIAL ENVIRONMENT

GL — **Glaciolacustrine sediments, undifferentiated:** silty clay to fine sand, up to 10 m or more thick, commonly overlain by organics, deposited in glacial Lake McConnell and capped by sediments deposited in ancestral Great Slave Lake.

GLACIAL ENVIRONMENT

GF — **Glaciofluvial sediments, undifferentiated:** sand and gravel to cobbles, variable thickness, includes subaqueous outwash fans and ice-contact deposits, may be reworked by glacial meltwater or wave action, may include small areas of bedrock or glaciolacustrine sediments; the extent of some glaciofluvial regions is based on interpretation of air photographs prior to human disturbance.

PRE-QUATERNARY

R — **Bedrock, undifferentiated:** Slave Craton bedrock, locally striated and fluted, may be overlain by discontinuous cover of glaciolacustrine veneer, thin glaciofluvial sediments or till veneer.

- Geological contact, defined
- Geological contact, approximate
- Terrace scarp, fluvial
- Lithalsa
- Fluted bedrock, sense known
- Striation, sense known
- Small outcrop
- Station location

NOTES

Surficial geology studies, through aerial photograph interpretation and limited legacy data, were undertaken in the greater Yellowknife area to provide an improved understanding of distribution and nature of surficial sediments. The Slave Craton is widely exposed throughout the map area. Small exposures of discontinuous till veneer may occur along the edges of some outcrops and as isolated pockets at higher elevations (Stevens et al., 2012), and therefore has not been mapped at this (1:25,000) scale. The last glacial episode was the Late Wisconsinan glaciation, which reached its maximum extent about 18,000 years ago. The Yellowknife region was ice covered to about 11,000 BP and became ice-free by about 10,000 BP (Dyke and Prest, 1987). Ice flow was generally to the southwest, as evident by striations and fluted bedrock measurements (Kerr, 2006). With the retreat of ice in the region, a large glacial lake (Glacial Lake McConnell) occupied the Great Bear and Great Slave Basins, up to an elevation of about 280 m (Craig, 1965; Smith, 1994). Subaqueous outwash sediments were deposited during this period, in the form of large sand and gravel complexes in the vicinity of the Yellowknife airport and in downtown Yellowknife (Aspler, 1978). Fine-grained sediments, present in low-lying areas, were deposited by both Glacial Lake McConnell and ancestral Great Slave Lake. Falling lake levels and drainage changes due to isostatic uplift have also resulted in widespread wave-washed bedrock and reworking of sediments. The natural drainage around Yellowknife has been influenced by the bedrock structure, and numerous small elongated lakes have formed where weaker rocks have been preferentially glacially scoured along fault lines and joints. Most streams are shallow, and few have cut into bedrock or surficial sediments. Much of the terrain is generally < 200 m a.s.l. with variable relief, commonly between < 5 m and 25 m in areas of outcrop. Vegetation consists mainly of open to dense forests of black spruce, jack pine, and paper birch mixed with marshes, fens and peat bogs in low-lying areas. The region lies within the discontinuous zone of permafrost (Wolfe, 1998), where permafrost is commonly found as pockets in ground that is otherwise unfrozen.

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Recommended citation
Wolfe, S.A. and Kerr, D.E., 2014. Surficial geology, Yellowknife area, Northwest Territories, parts of NTS 85-J/7, NTS 85-J/8, NTS 85-J/9, and NTS 85-J/10; Geological Survey of Canada, Canadian Geoscience Map 183 (preliminary), scale 1:25 000. doi:10.4095/293725

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Geology by S.A. Wolfe and D.E. Kerr

Geology based on aerial photograph interpretation, with limited field verifications.

Geomatics and cartography by L. Robertson

Initiative of the Geological Survey of Canada, conducted under the auspices of the Transportation Risk in the Arctic to Climatic Sensitivity (TRACS) activity as part of Natural Resources Canada's Climate Change Geoscience program, and the Tri Territorial Surficial Database Project as part of Natural Resources Canada's Geo-mapping for Energy and Minerals (GEM) program.

Map projection Universal Transverse Mercator, zone 11. North American Datum 1983

CANADIAN GEOSCIENCE MAP 183

SURFICIAL GEOLOGY

YELLOWKNIFE AREA

Northwest Territories

parts of NTS 85-J/7, NTS 85-J/8, NTS 85-J/9, and NTS 85-J/10

1:25 000

500 0 500 1000 1500 2000m

Base map at the scale of 1:50 000 from Natural Resources Canada, with modifications. Elevations above mean sea level are expressed in metres (NTS 85-J/7–8) and feet (NTS 85-J/9–10)

Mean magnetic declination 2014, 17°34'E, decreasing 26' annually.

The Geological Survey of Canada welcomes corrections or additional information from users.

Data may include additional observations not portrayed on this map.

See documentation accompanying the data.

This publication is available for free download through GEOSCAN (http://geoscan.ess.nrcan.gc.ca/).

This map is not to be used for navigational purposes.

Preliminary publications in this series have not been scientifically edited.

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