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CANADIAN GEOSCIENCE MAP 438

SURFICIAL GEOLOGY

ENTERPRISE

Northwest Territories
NTS 85-C/9, 10, 15, and 16

Map Information Document

Geological Survey of Canada
Canadian Geoscience Maps

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ABSTRACT

The Enterprise map area is a low-relief terrain bisected by a prominent Devonian carbonate bedrock escarpment. Ice-flow indicators show a clockwise shift in Laurentide Ice Sheet flow from southwest (230°), to west (280°), to northwest (305°). A late-stage southwestward surge from the Great Slave Lake basin is also preserved as drumlinoid ridges below the escarpment. During deglaciation, ice retreat impounded northeastern drainage forming local ice-contact lakes and areas of subaerial glaciofluvial outwash. As ice continued to retreat, the northern portion of the map area became inundated by glacial Lake McConnell, within which the Snake Creek Moraine and associated subaqueous fans formed. Prominent flights of beach ridges record the drainage of this lake. Exposed nearshore and littoral lake sediments were subsequently remobilized into eolian dunes. Bogs and fens have formed over much of the low relief landscape and display extensive thermokarst.

RÉSUMÉ

La région cartographique d'Enterprise présente un terrain au faible relief sectionné par un escarpement saillant formé de roches carbonatées du Dévonien. Les indicateurs d'écoulement glaciaire témoignent d'un changement de direction dans le sens horaire de l'écoulement de l'Inlandsis laurentidien, passant du sud-ouest (230°) à l'ouest (280°), puis au nord-ouest (305°). Une crue glaciaire de stade tardif en direction du sud-ouest, en provenance du bassin du Grand lac des Esclaves, a aussi laissé des traces au pied de l'escarpement sous forme de cannelures. Lors de la déglaciation, le retrait glaciaire a bloqué l'écoulement des eaux vers le nord-est, causant ainsi la formation de lacs juxtaglaciaires et de zones d'épandage fluvioglaciaires subaériennes. Alors que le retrait glaciaire se poursuivait, la partie nord de la région cartographique a été inondée par le Lac glaciaire McConnell, à l'intérieur duquel se sont formés la moraine de Snake Creek ainsi que des cônes subaquatiques. Des séries de crêtes de plage saillantes témoignent de la vidange de ce lac. Les sédiments exposés des zones infralittorales et littorales du lac ont ensuite été remobilisés en dunes éoliennes. Des tourbières ombrotrophes et minérotrophes se sont formées dans la majeure partie de ce paysage au faible relief, lequel est riche en thermokarsts.

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SHEET 1 OF 1, SURFICIAL GEOLOGY

GENERAL INFORMATION

Authors: G.W. Hagedorn, I.R. Smith, R.C. Paulen, and M. Ross

Geology by G.W. Hagedorn, I.R. Smith, and R.C. Paulen, based on fieldwork (2017 and 2018), air photographs (1970 and 1971; 1:60 000), and ArcticDEM (v.7) imagery.

Geological compilation by G.W. Hagedorn

Geology conforms to Surficial Data Model v. 2.4.0 (Deblonde et al., 2019).

Geomatics by L. Robertson

Cartography by N. Côté

Scientific editing by A. Weatherston

Initiative of the Geological Survey of Canada, conducted under the auspices of the GEM-2 Southern Mackenzie Surficial Project as part of Natural Resources Canada's Geo-mapping for Energy and Minerals (GEM) program.

Logistical support provided by the Polar Continental Shelf Program (PCSP) as part of its mandate to promote scientific research in the Canadian north, PCSP 057-17 and 058-18

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

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 2022, 16°52'E, decreasing 8.9' annually
Readings vary from 17°08'E in the NW corner to 16°37'E in the SE corner of the map.

This map is not to be used for navigational purposes.

Title photograph: Section of the Snake Creek Moraine and glacial Lake McConnell beach ridges, northwest of Enterprise, Northwest Territories (lat. 60°36’48.79”N, long. 116°11’34.33”W). Photograph by G.W. Hagedorn. NRCan photo 2019-680

The Geological Survey of Canada welcomes corrections or additional information from users (gscpublications-cgcpublications@nrcan-rncan.gc.ca).

Data may include additional observations not portrayed on this map. *See* map info document accompanying the downloaded data for more information about this publication.

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

Map Viewing Files

The published map is distributed as a Portable Document File (PDF), and may contain a subset of the overall geological data for legibility reasons at the publication scale.

Cartographic Representations Used on Map

This map utilizes ESRI Cartographic Representations in order to customize the display of standard GSC symbols for visual clarity on the PDF of the map only. The digital data still contains the original symbol from the standard GSC symbol set. The following legend features have Cartographic Representations applied:
-Minor meltwater channel, direction known
-Moraine ridge, major

Definition Queries Used on Map

This map utilizes definition queries in order to customize the display for visualization on the PDF of the map only and does not affect the digital data. The following features have a definition query applied:
-Field stations

Descriptive Notes

The map area is located in southern Northwest Territories and includes the town of Enterprise, situated along Highway 1. The region is characterized by low relief that reflects the underlying gently southwest-dipping Devonian carbonate platform (Okulitch, 2006). A prominent southeast-northwest-aligned bedrock escarpment of Upper Devonian Twin Falls Formation limestone bisects the map area, and is paralleled by Highway 1. Exposed bedrock and thin sediment veneer (less than 2 m) characterize the surface immediately south of the escarpment edge.

Erosional ice-flow indicators (striae, grooves, p-forms) from 20 different sites on exposed bedrock show a clockwise rotation in ice flow during the last glaciation. The oldest flow trends southwest (230°) followed by an intermediary westward (280°) flow. During deglaciation, ice became increasingly topographically controlled, and is recorded by a northwestward flow (305°) down the Mackenzie River valley (Bednarski, 2008; Hagedorn et al., 2019; Paulen et al., 2019). A final southwestward surge of glacial ice out of the Great Slave Lake basin created drumlinoid ridges (220°) on the lowlands north of the escarpment. Till and other glacial sediments (greater than 10 m) blanket most of the

terrain, but sediment cover north of the escarpment is greater, reaching up to 50 m thick (Smith et al., 2019). Surface till typically has a 1:3 sand to silt-and-clay ratio with 15 weight percent clasts of mainly local bedrock lithologies with some far-travelled Canadian Shield clasts.

During deglaciation, the retreating Laurentide Ice Sheet blocked regional northeastern drainage, forcing glacial meltwater to drain westward along the ice margin. As the ice margin retreated from the Mackenzie and Hay River valleys, new outlets opened, allowing drainage northwestward, like from glacial Lake Hay to the south (Mathews, 1980; Utting and Atkinson, 2019). Glaciofluvial sediments up to 5 m thick in the southwest portion of the map area record subaerial drainage at this time.

As ice continued to retreat, a series of proglacial lakes developed along the ice margin, recorded by successive outlet channels, beach ridges, and discontinuous glaciolacustrine sediment cover. Eventually, glacial Lake McConnell formed in the isostatically depressed Great Slave Lake basin, inundating much of the northern part of the map sheet (Craig, 1965; Lemmen et al., 1994; Smith, 1994). Glacial Lake McConnell's extent and progressive drainage are marked by flights of prominent subparallel ridges (<2 m high) composed of open-framework pebbles and cobbles in a sand matrix and discontinuous, thin (<1 m) sandy nearshore lake sediments. Elsewhere, till was washed, producing thin (<0.5 m) boulder and cobble lags. Calving of the ice margin into proglacial lakes created northwest-southeast trending iceberg scours.

The subaqueous Snake Creek Moraine was deposited in glacial Lake McConnell during a prominent glacial still-stand and is approximately 150 km long, trending northwest-southeast (Lemmen et al., 1994). It is mapped as a moraine complex, with individual discontinuous ridges up to 4 m high and complexes of ridges up to 1.5 km wide (Fig. 1). The moraine complex also includes subaquatic fans deposited where southwestward-flowing subglacial meltwater conduits (often marked by eskers) terminated in glacial Lake McConnell. Glacialfluvial fans and eskers are potential exploration targets for granular resources, but were not inspected during fieldwork.

Eolian, alluvial, and organic sediments represent late to post-glacial changes to the landscape. Eolian dunes were deposited from westward katabatic winds and are composed of remobilized, sandy, glaciolacustine and glaciofluvial sediments. Dunes show parabolic and transverse morphologies and are typically 3 m thick, 25 m long, and 50 m wide. Alluvial sediments are primarily associated with the Hay River that has deeply incised bedrock creating terraces and colluvial deposits along the river channel. Elevated water tables formed due to flat and relatively impermeable till at surface, and have caused extensive bogs and fens to develop. The map area lies within the discontinuous permafrost zone (Heginbottom et al., 1995) and thermokarst ponds have formed over much of the bog-covered map area.

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Suggested Readings

Paulen, R.C., Smith, I.R., and Day, S.J.A. (ed.), 2019. GEM-2 Southern Mackenzie Surficial activity 2018 report: surficial geology and heavy mineral studies in southern Northwest Territories; Geological Survey of Canada, Open File 8477, 70 p. https://doi.org/10.4095/313419

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Porter, C., Morin, P., Howat, I., Noh, M., Bates, B., Peterman, K., Keesey, S., Schlenk, M., Gardiner, J., Tomko, K., Willis, M., Kelleher, C., Cloutier, M., Husby, E., Foga, S., Nakamura, H., Platson, M., Wethington, M., Williamson, C., . . . , Bojesen, M., 2018. ArcticDEM; Harvard Dataverse, V1. https://doi.org/10.7910/DVN/OHHUKH

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Additional Information

The Additional Information folder of this product's digital download contains figures and tables that appear in the map surround as well as additional geological information not depicted on the map, nor this document, nor the geodatabase.
-PDF of Figure 1

Author Contact

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Coordinate System

Projection: Universal Transverse Mercator
Units: metres
Zone: 11
Horizontal Datum: NAD83
Vertical Datum: mean sea level

Bounding Coordinates

Western longitude: 117°00'00"W
Eastern longitude: 116°00'00"W
Northern latitude: 61°00'00"N
Southern latitude: 60°30'00"N

Software Version

Data has been originally compiled and formatted for use with ArcGIS™ desktop version 10.7.1 developed by ESRI®.

Data Model Information

Surficial

The Geological Survey of Canada (GSC) through the Geo-mapping for Energy and Minerals Program (GEM) has undertaken the Geological Map Flow to develop protocols for the collection, management (compilation, interpretation), and dissemination of surficial and bedrock geology data and map information. To this end, a data model has been created.

The Surficial Data Model (SDM) was designed using ESRI geodatabase architecture. The XML workspace document provided can be imported into a geodatabase, and the geodatabase will then be populated with the feature datasets, feature classes, tables, relationship classes, subtypes, and domains.

Shapefile and table (.dbf) versions of the data are included within the data. Column names have been simplified and the text values have been maintained within the shapefile attributes. The direction columns are numerical, to display rotation for points, and the symbol fields will hold the correct values to be matched to the appropriate style file.

For a more in depth description of the data model please refer to the official publication:

Deblonde, C., Cocking, R.B., Kerr, D.E., Campbell, J.E., Eagles, S., Everett, D., Huntley, D.H., Inglis, E., Parent, M., Plouffe, A., Robertson, L., Smith, I.R., and Weatherston, A., 2019. Surficial Data Model: the science language of the integrated Geological Survey of Canada data model for surficial geology maps; Geological Survey of Canada, Open File 8236, ver. 2.4.0, 1 .zip file. https://doi.org/10.4095/315021