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CANADIAN GEOSCIENCE MAP 456

SURFICIAL GEOLOGY

DENDALE LAKE

Yukon–Northwest Territories
NTS 95-C/15

Map Information Document

Geological Survey of Canada Canadian Geoscience Maps

2023

Canada

MAP NUMBER

Natural Resources Canada, Geological Survey of Canada
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TITLE

Surficial geology, Dendale Lake, Yukon–Northwest Territories, NTS 95-C/15

SCALE

1:50 000

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ABSTRACT

This map area is situated within the Hyland Plateau and comprises the headwaters of the La Biche River. It is framed by the La Biche Range on the east, the Tlogotsho Range on the north, and an unnamed ridge along its western boundary. The map area was inundated by the Cordilleran Ice Sheet during the Late Wisconsinan glaciation, and ice advanced east to northeast across the region. Coalescence with the Laurentide Ice Sheet is considered to have occurred just east and north of this area. During deglaciation, ice retreated generally south and westwards. Prominent northward-aggrading ice-contact and proglacial deltas formed between retreating Cordilleran and Laurentide ice margins, within early stages of glacial Lake Nahanni. Well-developed cirque basins point to a prolonged glacial history that predates the Late Wisconsinan glaciation. Small lobate moraines extending into valley bottoms below these cirques suggests that during regional Late Wisconsinan deglaciation, upland ice persisted through a phase of late glacial–early Holocene alpine cirque glaciation.

RÉSUMÉ

La présente région cartographique est située à l'intérieur du plateau Hyland et comprend le cours supérieur de la rivière La Biche. Elle est délimitée par le chaînon La Biche à l'est, le chaînon Tlogotsho au nord et une crête non dénommée le long de sa limite ouest. La région cartographique a été ensevelie sous l'Inlandsis de la Cordillère pendant la glaciation du Wisconsinien supérieur, et la glace a progressé dans une direction variant de l'est au nord-est à travers la région. On considère qu'une coalescence avec l'Inlandsis laurentidien s'est produite juste à l'est et au nord de cette région. Pendant la déglaciation, la glace s'est retirée dans une direction générale variant du sud à l'ouest. D'importants deltas d'aggradation proglaciaires et juxtaglaciaires s'avançant vers le nord se sont formés entre les marges glaciaires en retrait des inlandsis de la Cordillère et laurentidien, dans les premiers stades du Lac glaciaire Nahanni. Des bassins de cirque bien développés témoignent d'une histoire glaciaire prolongée, antérieure à la glaciation du Wisconsinien supérieur. De petites moraines lobées s'étendant au fond des vallées sous certains de ces cirques suggèrent que, pendant la déglaciation régionale du Wisconsinien supérieur, des plaques de glace situées sur les hautes terres ont perduré pendant une phase de glaciation de cirque alpin ayant duré de la fin de la période glaciaire à l'Holocène inférieur.

SHEET 1 OF 1, SURFICIAL GEOLOGY

GENERAL INFORMATION

Author: I.R. Smith

Geology and geological compilation by I.R. Smith

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

Geomatics by L. Robertson, S. Eagles, and Géotech

Cartography by D. Viner

Scientific editing by A. Weatherston

Joint initiative of the Geological Survey of Canada and the Yukon Geological Survey, conducted under the auspices of the Central Foreland NATMAP project as part of Natural Resources Canada's National Mapping (NATMAP) program

Map projection Universal Transverse Mercator, zone 10
North American Datum 1983

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

Magnetic declination 2023, 18°52′E, decreasing 11.2′ annually

This map is not to be used for navigational purposes.

Title photograph: View looking north along unnamed ridge east of Dendale Lake. Extensive outcrops of Mattson Formation sandstone preserve eastward striae directions, with locally only a scattering of glacial erratic clasts, Northwest Territories. Photograph by I.R. Smith. NRCan photo 2021-952

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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:

- Geomorphology lines and Sample point symbols

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

Field investigations within this map sheet involved two fly-camps (the unnamed valley dissecting the La Biche Range in the southeast in 2000, and Dendale Lake on the west side in 2002). Additional observations were made during helicopter-supported site inspections and overflights in the 2000 to 2002 field seasons.

The map area is situated in the Hyland Plateau, bordering the Mackenzie Mountains to the east, and the Tlogotsho Range to the north. It is framed by two north-south aligned ridges of Carboniferous Mattson Formation sandstone and Devonian Besa River Formation shale formed along the Dendale and Jedhi Deh (La Biche Range) thrusts, that are separated by the Tika syncline basin, containing Permian Tika Formation limestone and dolostone, and Cretaceous Chinkeh through Sikanni formation sandstone, mudstone, shale, chert, and conglomerate (Fallas et al., 2014). The surfaces of most of the ridges, and a majority of the map area, comprise solutional- and mechanical-weathered bedrock, with a discontinuous scatter of glacially transported erratic clasts, often concealed beneath lichen-moss carpets. Till veneer and locally thicker till blankets associated with recessional moraines are found in the lower terrain and valleys. Large rotational bedrock landslides occur in areas underlain by Besa River Formation shale, and less competent Mattson Formation shale and siltstone beds. This map lies within the Extensive Discontinuous permafrost zone (Heginbottom et al., 1995), and several 1 to 2 m high palsas were observed in thicker peat-covered organic terrain around Dendale Lake. Many rock glaciers in the map area appear to be relict; however, some steeper sided lobate features with areas of less-weathered bedrock debris suggest active deformation and the presence of buried ice cores.

This map area was fully inundated by the Cordilleran Ice Sheet during the last (Late Wisconsinan) glaciation, over-topping summits that extend up to ~1950 m above sea level (a.s.l.). Sparse erratics and minimal till accumulations, along with deep (≤3 cm) solutional-weathered bedrock and very well developed sorted nets and stone circles along summit ridges, suggest that ice cover over the La Biche Range and Tlogotsho Range may have been extensively cold-based, preserving an older periglacial landscape. These upland areas are also heavily dissected by cirque basins, suggesting antiquity beyond the Late Wisconsinan glaciation (e.g. Nelson and Jackson, 2003). Small, lobate moraines extend down-valley in many of the cirque basins, in places overriding and crosscutting regional deglacial landforms. These are interpreted to represent preservation of alpine-sector ice and local cirque glaciation that persisted after regional deglaciation (<13 ka; Bednarski, 2008).

In the northern map extents, ice-contact and proglacial glaciolacustrine deltas mark different stages of deglacial ice retreat, impoundment between retreating ice margins, and deposition within glacial Lake Nahanni. In the northeast corner of the map area, an ice-contact, northeast-aggrading delta (1300 m a.s.l.) records impoundment along upper Jackfish River between the westward retreating Cordilleran Ice Sheet and the north and eastward-retreating Laurentide Ice Sheet (Smith, 2003a). In the northern center of the map, outwash glaciolacustrine deltas descend from ~1010 to 925 m a.s.l. Southward-descending, nested lateral meltwater channels northeast of here indicate an earlier stage of ice flowing from the Liard River basin in the north. This is interpreted as evidence of the northern and eastward retreat of Laurentide ice from the Liard River basin. Therefore, these glaciolacustrine deltas also formed between these two retreating ice sheet margins, and likely marks the progressive development, and stepwise drainage of glacial Lake Nahanni as outlets emerged along the eastward retreating Laurentide Ice Sheet margin (Bednarski, 2008). In the northwest corner of the map, large ice-contact and outwash glaciolacustrine deltas formed between 940 and 895 m a.s.l., and are also considered to mark separating ice margins and deposition within glacial Lake Nahanni. Raised glaciolacustrine deltas (up to 1220 m a.s.l.) in the valley west of Dendale Lake (southwest map area) requires impoundment of drainage between retreating Cordilleran ice margins blocking the Tika Creek valley and those to the west (Smith, 2022), and would have resulted in drainage northwards across the divide into the Nahanni River basin.

In the southeast unnamed valley that bisects the La Biche Range, nested, westward-descending moraines record late deglacial retreat of a valley glacier eastward towards the upper Kotaneelee River (Smith, 2003a, b). In a northern side-valley draining into this unnamed valley, a large section of diamict, up to 20 m thick and 150 m long, was exposed by a debris flow. The lowermost section comprises 4 to 8 m of dark, shale-rich diamict, and has a clast content of <8%. Shale bedrock is exposed locally in the valley, but also occurs in the Cretaceous strata immediately to the west. This lower unit is interpreted to be a till deposited by the Cordilleran Ice Sheet during full-glacial time, and has a clast fabric–defined ice-flow direction of 95° (S1=0.59, S2=0.23). Overlying this is a 5 to 10 m thick, tan-coloured, moderate to well-stratified deposit with closed-work cobble-boulder layers and a sandy matrix that progrades down-valley. This unit is interpreted to be an outwash facies that has reworked Cretaceous and Devonian sandstone-rich till and weathered bedrock, and is considered to relate to the deglacial retreat of remnant alpine-sector ice and a former cirque glacier. Up to 10 m of chaotic diamict, containing angular boulders, overlies this, and is regarded to be a valley-side colluvial deposit.

ACKNOWLEDGMENTS

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Coordinate System

Projection: Universal Transverse Mercator
Units: metres
Zone: 10
Horizontal Datum: NAD83
Vertical Datum: mean sea level

Bounding Coordinates

Western longitude: 125°00′00″W
Eastern longitude: 124°30′00″W
Northern latitude: 61°00′00″N
Southern latitude: 60°45′00″N

Software Version

Data has been originally compiled and formatted for use with ArcGIS™ desktop version 10.8.2 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