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CANADIAN GEOSCIENCE MAP 350

SURFICIAL GEOLOGY

ABITAU LAKE

Northwest Territories
NTS 75-B

Map Information Document

Geological Survey of Canada
Canadian Geoscience Maps

2022

Canada

MAP NUMBER

Natural Resources Canada, Geological Survey of Canada
Canadian Geoscience Map 350

TITLE

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SCALE

1:100 000

CATALOGUE INFORMATION

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ABSTRACT

The Abitau Lake map area lies in the Rae Province of the Canadian Shield. Quaternary deposits are extensive and thick, with bedrock outcrop concentrated in the northwest and southwest. Till is extensively streamlined to the west-southwest by late deglacial ice flow from the Keewatin Ice Divide. The region is incised by west-southwest flowing subglacial meltwater corridors that extend across the map area, spaced 5 to 15 km apart. The ice flow chronology (Figure 1) is recorded both in the landforms and in 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, terraced outwash, ice-contact deltas, and patches of glacial lake sediments, occupied a paleodrainage area not only of Hudson Bay but possibly also the headwaters of the Mackenzie River.

RÉSUMÉ

La région cartographique d'Abitau Lake se situe dans la Province de Rae du Bouclier canadien. Les dépôts quaternaires y sont étendus et épais, avec des affleurements rocheux concentrés dans le nord-ouest et le sud-ouest. Le till présente une abondance de formes de terrain fuselées de direction ouest–sud-ouest produites par un écoulement glaciaire de la fin de la déglaciation en provenance de la ligne de partage glaciaire du Keewatin. La région est entaillée par des couloirs d'eau de fonte sous-glaciaire s'écoulant vers l'ouest–sud-ouest, espacés de 5 à 15 km dans l'ensemble de la région cartographique. La chronologie des écoulements glaciaires (fig. 1) est révélée à la fois par les reliefs glaciaires et le registre des stries. De rares mesures rendent compte d'un ancien écoulement d'orientation nord-ouest–sud-est. Des indicateurs bien définis affichant des relations de recoupement révèlent une rotation régionale de la direction de l'écoulement glaciaire dans le sens des aiguilles d'une montre, où un écoulement ancien dirigé vers le sud a évolué en un écoulement dirigé vers l'ouest à la fin de la déglaciation. Des lacs proglaciaires de courte durée, que révèlent des escarpements taillés par les vagues, des terrasses de matériaux de délavage, des deltas de contact glaciaire et des amas de sédiments glaciolacustres, occupaient le paléobassin versant, non seulement de la baie d'Hudson, mais aussi, peut-être, des sources du fleuve Mackenzie.

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SHEET 1 OF 1, SURFICIAL GEOLOGY

GENERAL INFORMATION

Authors: A.S. Dyke, J.E. Campbell, and G. Lauzon

Geology based on aerial photograph interpretation by A.S. Dyke, 2014 and fieldwork by J.E. Campbell (2014 to 2016) and G. Lauzon (2015). Revisions by J.E. Campbell (2020).

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

Geomatics by L. Robertson

Cartography by D. Viner

Scientific editing by L. Ewert

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) program

Map projection Universal Transverse Mercator, zone 13
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, 11°02′E, decreasing 4.5′ annually
Readings vary from 10°12′E in the SE corner to 11°50′E in the NW corner of the map.

This map is not to be used for navigational purposes.

Title photograph: Well defined streamlined terrains comprising drumlinoid ridges, such as west of Ivanhoe Lake, are common in the Abitau map area.
Photograph by J.E. Campbell. NRCan photo 2020-829

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:

- Meltwater channels
- Crevasse-fill ridge

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 Abitau Lake map area lies in the Churchill Province of the Canadian Shield, in an area where the rocks are chiefly granite gneiss with small areas of granite intrusions. This region of the Shield has extensive drift cover characterized by drumlin fields and parallel esker systems related to ice and meltwater flow during deglaciation from the Keewatin Ice Divide located to the east-northeast (Prest et al., 1968; Aylsworth and Shilts, 1989; McMartin and Henderson, 2004; Campbell et al., 2020).

Within the map area, bedrock outcrop is most extensive in the northwest and southwest, where thin till (unit Tv) is also most extensive, although smaller areas or bedrock outcrop occur throughout. The till elsewhere is moderately thick and is extensively streamlined and incised by broad subglacial meltwater corridors. The till has a pebbly silty sand matrix with variable boulder content.

Some 14 parallel subglacial meltwater corridors (including tributaries) trend across the map area (Campbell et al., 2016, 2020; Lewington et al., 2020). They are spaced 5 to 15 km apart and are typically 1 to 4 km wide. The signature deposits of the corridors are eskers, parallel trains of either hummocky glaciofluvial deposits or terraced glaciofluvial deposits, and equally common trains of hummocky till. The hummocky till is interpreted as primarily a product of subglacial meltwater erosion as it forms a contiguous landform assemblage with the esker complexes, and small eskers typically trend along the hummock trains (Campbell et al., 2016, 2020). In several places,

hummock development was arrested before meltwater erosion obliterated previously formed drumlins. Note that Aylsworth and Shilts (1989) mapped most occurrences of what are here called hummocky till as ribbed (Rogen) moraine. However, these hummocky till trains lack organized ridge systems. We recognize only a few ridges in the southeast corner of the map area as Rogen moraines, but even these are less well formed than those closer to the final position of the Keewatin Ice Divide, where closely spaced nested sets of ridges are common.

Well defined ice-flow indicators in crosscutting relationships reveal a regional clockwise rotation in ice-flow directions evolving from an old southward to a late deglacial westward flow (Figure 1) (Campbell et al., 2020). The main deglacial ice-flow pattern is well established. Across the breadth of the map area, the flow splayed (diverged) gradually from southwestward in the southeast corner to nearly westward flow (late-deglacial) restricted to the north end of the map area. The ubiquity of streamlining of the till and copious reworking by subglacial meltwater corridors indicates that during at least deglaciation, the ice was predominantly warm based. In several places, the main (strong) streamlined pattern is overprinted by weak flutings of local extent. These are invariably in the vicinity of meltwater corridors and can thus be seen as areas of late flow convergence toward adjacent subglacial cavities, probably close to the receding ice margins.

Much less conspicuous, hence not previously mapped, is evidence of older ice-flow events in both the landform and striation record (Campbell et al., 2020). Ice appears to have flowed generally toward the south then southwest at some early (pre-deglacial) time across the entire map area. Another presumably early, northwest-southeast ice-flow event is recorded by rare striations and streamlined till ridges trend.

The northeast and central parts of the map area are drained today by the Dubawnt River or by headwater streams of the Kazan River, both of which are part of the Hudson Bay watershed. Because ice retreated up the deglacial ice flowset and because isostatic delevelling steepened the topographic gradient toward Hudson Bay, that area must have been flooded by a proglacial lake. Although no previous work (e.g. Prest et al., 1968; Aylsworth and Shilts, 1989; Dyke et al., 2003) show glacial lakes extending into this area, numerous shoreline features inscribed on the sides of drumlins indicate that lake water pervasively fronted the receding ice margin. Multiple strandline levels indicate complexities of lake evolution that are not currently resolved, and a few features mapped as meltwater channels may instead be lake spillways that may eventually be important in resolving lake phases.

More problematically, relict probable shoreline features extend beyond the present Hudson-Mackenzie drainage divide and there is no obvious lake spillway crossing the divide at the head of the Dubawnt River. This may indicate that an unbroken sequence of glacial lakes covered most of the map area and that the present position of the drainage divide became established after the lakes receded. Farther west in the Mackenzie drainage, glacial Lake McConnell has long been recognized to have formed because of reversal of the drainage direction due to isostatic tilting (Craig, 1965). The same effect may have allowed Lake McConnell or a similar successor to extend farther east than previously recognized. Only parts of the headwater sections of the streams in the Mackenzie drainage need to have been reversed to account for the shorelines in the map area.

Two additional patterns also indicate that glacial lakes extensively fronted the receding ice margin. The first is a lack of proglacial outwash of any substantive length

such as might be expected in areas draining freely away from a receding ice front. Indeed, the dearth of proglacial outwash in a region with impressive subglacial meltwater deposits seems otherwise inexplicable, because clearly a great deal of meltwater and sediment was being released at the ice margin delivered by the subglacial meltwater corridors. The outwash deposits present do not seem to extend much beyond the probable ice marginal sources and typically end in terraces that appear to grade to former lake levels. The second is the extensive bogs that occupy nearly all topographic basins. These large sedimentary flats are suggestive of underlying layers of glacial lake sediment. If glaciolacustrine sediments are absent, then postglacial paludification has been a very effective geomorphic process that needs quantifying.

Campbell et al. (2020) provides field, till composition, and ice-flow indicator data from surficial investigations in NTS 75-B. McCurdy et al. (2016) provides the description and results of the 2015 lake sediment and surface waters survey.

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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 Figure1 and Table 1.

AUTHOR CONTACT

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COORDINATE SYSTEM

Projection: Universal Transverse Mercator
Units: metres
Zone: 13
Horizontal Datum: NAD83
Vertical Datum: mean sea level

BOUNDING COORDINATES

Western longitude: 108°00'00"W
Eastern longitude: 106°00'00"W
Northern latitude: 61°00'00"N
Southern latitude: 60°00'00"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