The Dazo Creek map area (NTS 94-I/SW) is situated in northeastern British Columbia, southeast of Fort Nelson. It is located within the Fort Nelson Lowland physiographic region (Holland, 1976), a generally flat, low-lying area (395–550 m above sea level (asl)). A small portion of the southwest map area is located within the Alberta Plateau physiographic region (Holland, 1976), where elevations rise from 600–740 m asl. Major fluvial systems (Fort Nelson, Sikanni Chief, and Fontas rivers) dissect the map area, with an average valley width of 1.5–2.0 km and depth of 80–120 m. The area is blanketed by Boreal forest (white and black spruce, aspen, lodgepole pine) and underlain by soils with high clay content that result in extensive, poorly drained bogs and fens. The main economic activities in the map area include oil and gas extraction and forestry.

The surficial geology of the Dazo Creek map area was interpreted from 1:60 000 scale black and white airphotos (British Columbia Integrated Land Management Bureau, 1986). Prior to the field season, preliminary surficial geology interpretations were made, and then subsequently ground-truthed. Aspects of the regional surficial geology were also interpreted from shuttle radar topography mission (SRTM) imagery (3-arc second, 90 meter resolution), and to a lesser extent, light ranging and detecting (LiDAR) imagery. Field data were obtained during a vehicle traverse of the new Elleh Road extension in the northwest, a traverse by rail truck along the CN rail line, and by jet boat along the Fort Nelson and Sikanni Chief rivers in the summers of 2004. In 2005, fifteen remote sites in the map area were field-checked by means of helicopter access. Six samples of diamict were submitted for trace element geochemistry to provide a preliminary characterization of tills in the area (Trommelen, 2006).

The bedrock in the map area consists of horizontally bedded Lower Cretaceous Fort St. John Group shales and sandstones (Buckinghorse, Sikanni, and Sully formations; Thompson, 1977).

The bedrock in the map area consists of horizontally bedded Lower Cretaceous Fort St. John Group shales and sandstones (Buckinghorse, Sikanni, and Sully formations; Thompson, 1977). Outcrops are rare in the map area, except along steep river cuts where there is little or no Quaternary cover. In several regions in the map area, bedrock is overlain by a thin veneer (1–2 m) of glacial drift (till, glaciofluvial and glaciolacustrine sediments), otherwise it lies largely below a blanket of glacial

Till is the most extensive surficial material in the Dazo Creek map area and is a clayey-silt diamicton with a clast content varying from 5–15%. Clast lithologies consist of locally derived sandstone, ironstone, chert and shale, intermixed with Canadian Shield and Proterozoic to Paleozoic

sedimentary rocks transported from the northeast. Glacial lake sediments in the map area are primarily situated in a flat, low-lying region bounded by the Fontas and Sikanni Chief rivers and Niteal Creek. They may be more extensive, possibly occurring in the Elleh Lake region, but the dense forest cover and an absence of helicopter landing sites in the map area negated ground-truthing. Where encountered, glacial lake sediments consist of massive, well-sorted fine sand, silt, and clay. These sediments were deposited in glacial lakes that formed as a result of the damming of the regional eastward drainage by ice. One region of extensive glacial lake sediment cover along the plateau level of the modern Fort Nelson River exhibits extensive hummocky topography. These same features are also found along the Prophet River valley (NTS 94 J/SE; Trommelen, 2006). Identified on airphotos and LiDAR hillshade images (Figure 1) ground-truthing indicates that they consist of well-sorted clay, with 1-3 m of relief and diameters of 100–600 m. Across the regions covered by hummocks, topography is otherwise very flat, with 1–3 m of elevation gain over 10 km. It is unlikely that these are relic periglacial features (pingos or palsas), as the features are much larger and more pervasive than that which has been documented. It is more likely that the hummocks indicate extrusion moraine (Boulton and Caban, 1995) formed after rapid drainage of ice-dammed lakes. Further sedimentological and geomorphic study is required to confidently determine the origin of these features.

A small, inactive dune field (4 by 2 km) occurs in the eastern part of the map area, near the Fontas River, and extends into NTS 94-I/SW (Wolfe et al., 2007). Most are parabolic dunes, while other forms have either one small arm and one long arm, or only one arm (buttonhook and hairpin shapes). The dune orientation to the southeast indicates that the paleowind direction was from the northwest, and is interpreted to reflect katabatic winds, funneled between the Laurentide and Cordilleran Ice Sheets. An optically stimulated luminescence (OSL) date obtained from one dune in the field yielded an

age of 13.9 ± 1.2 ka (Wolfe et al., 2007).

Colluvial and glaciolacustrine sediments, and shale bedrock, are present along all river valleys and most stream cuts. The map area is susceptible to slope movement and there are records of large landslides, especially along fluvial channels where cutbanks incise thick (> 10 m) Quaternary sediment, and poorly-indurated shale.

Permeability of the surficial sediments is low, which combined with low topographic gradients, has lead to widespread development of organic bog and fen vegetation. Because the resultant peatlands are so large and well-developed in the eastern half of the map area, permafrost is present in many areas. This permafrost occurs primarily as peat plateaus (unit 0¹h), 50–300 m², which preserve thermokarst collapse scars (Figure 2A). Clusters of lakes, typically 200–800 m wide, and surrounded by bog or fen, can be found in the eastern half of the map area. These lakes exhibit sculpted edges and some appear to have joined/grown together (Figure 2B). They are interpreted as thermokarst lakes, recording ongoing melting and re-forming of permafrost in the substrate.

The Laurentide Ice Sheet inundated northeast British Columbia up to the eastern margin of the Rocky Mountains front during the Late Wisconsinan glaciation (Mathews, 1980; Dyke, 2004; Trommelen, 2006; Bednarski and Smith, 2007). West to west-southwest ice-flow direction in the Dazo

Trommelen, 2006; Bednarski and Smith, 2007). West to west-southwest ice-flow direction in the Dazo Creek map area is recorded by flutings and streamlined bedrock hills. Chronological constraint on the advance of ice is provided by a radiocarbon date of 24 400 ± 150 ¹⁴C years BP on wood recovered from gravel underlying Late Wisconsinan till, five kilometres west-northwest of the map area (Levson et al., 2004). Retreat of ice from the area is considered to have occurred between 11 500–11 000 ¹⁴C years BP (Mathews, 1978, 1980; Dyke, 2004), although the OSL date of 13.9 ± 1.2 ka from the Fontas dune field (Wolfe et al., 2007) suggests ice may have retreated earlier.

During retreat, the Fort Nelson Lowland was occupied by a large lobe of continental ice. Multiple curvilinear ice margins are identified using assemblages of southeasterly trending morainal

ridges, subaerial meltwater channel system initiation points, and extents of glaciolacustrine sediments. Several areas of closely-spaced crevasse-squeeze ridges, commonly 50–150 m long and 10–40 m wide with a linear, zig-zag, or cross-cutting morphology (60°, 90°, or 120° angles to each other), record periods of ice stagnation during retreat. Retreat of the Laurentide Ice Sheet temporarily blocked eastward-flowing drainage patterns, leading to the formation of proglacial lakes. Lake levels existed at progressively lower elevations due to emergence and evolution of westward-draining spillways. The western margin of early glacial Lake Hay occurs in the southwest part of the Dazo Creek map area along Niteal Creek. Although no shorelines were recognized, deposits of glaciolacustrine sediments occur up to 465 m asl in the map area. At a very late stage, the Fontas—Fort Nelson steep-walled meltwater channel was perhaps used as an outlet (perhaps catastrophically) for glacial Lake Hay during the glacial Lake Peace Late Clayhurst, or Indian Creek stage (Mathews, 1980).

The map region is dominated by the presence of clast-poor tills and massive clays and silts unsuited for aggregate use beyond road-bed material. A very extensive mantle of organics throughout the study area adds difficulty in identifying aggregate resources. Possible aggregate sources are limited to glaciofluvial gravels adjacent to meltwater channels, or occurring as glaciofluvial terraces. While no gravel pits occur in the study area, a significant, large aggregate deposit occurs just to the north at Elleh Creek (NTS 94 J/09). Other new aggregate potential northwest of the map area includes a glaciofluvial outwash deposit at Klua Creek (NTS 94 J/09).

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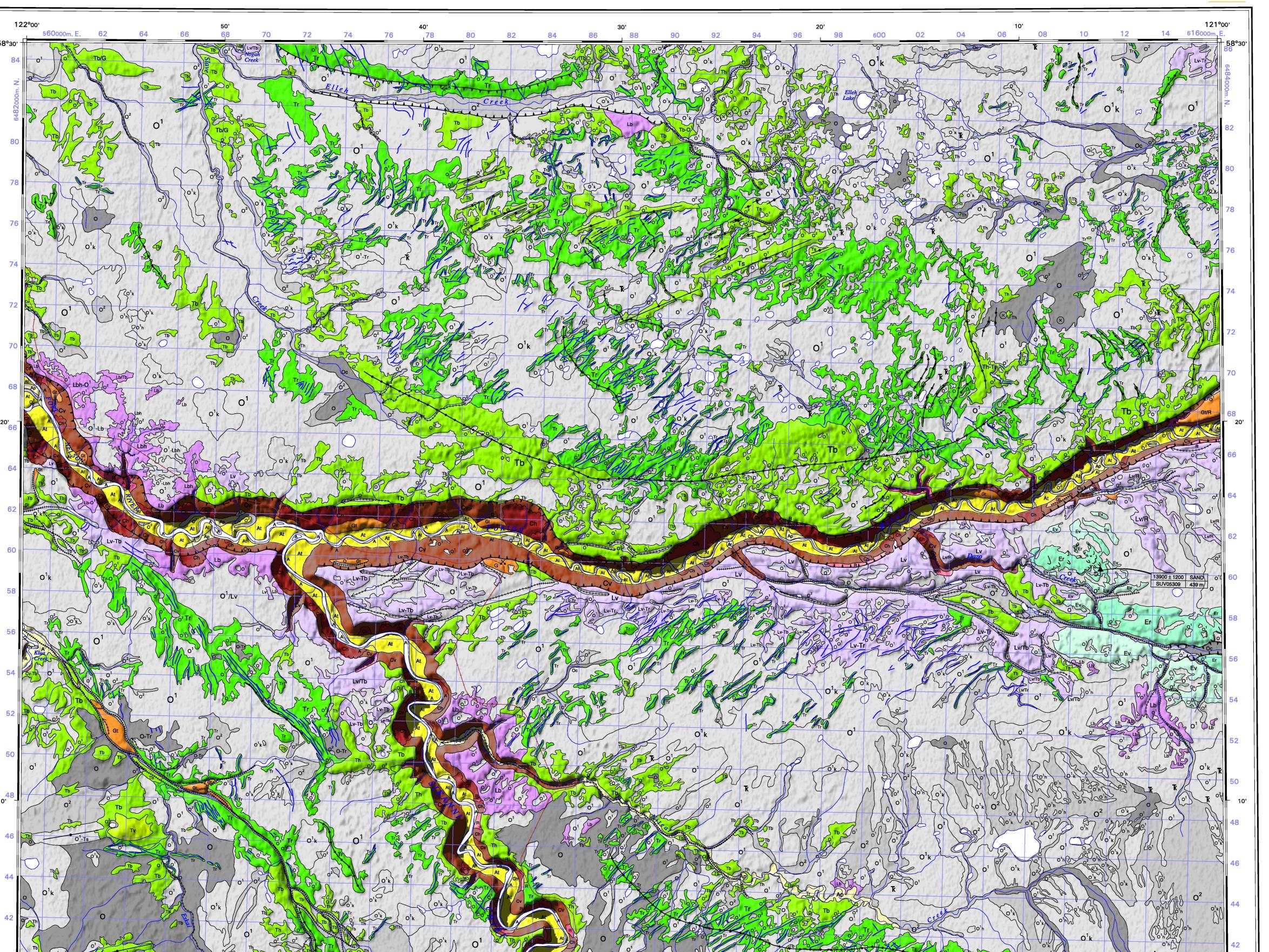
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LOCATION MAP

Authors: M. Trommelen and I.R. Smith

Geology by M. Trommelen, University of Victoria, 2004–2005

Geological compilation by M. Trommelen and I.R. Smith, 2004–2006

Digitizing and digital cartography by Géotech, Geomatic services

Digital cartography by M.J. Coulthart, Data Dissemination Division (DDD)

BCMEMPR MAP 2007-1
SURFICIAL GEOLOGY

DAZO CREEK
BRITISH COLUMBIA

Scale 1:100 000/Échelle 1/100 000

netres 2 0 2 4 6 8 kilomètres

Universal Transverse Mercator Projection Projection transverse universelle de Mercator Système de référence géodésique nord-américain, 1983

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GSC OPEN FILE 5527

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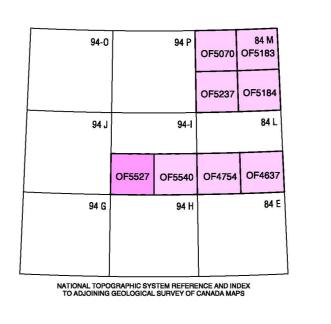
Any revisions or additional geological information known to the user would be welcomed by the Geological Survey of Canada

Digital base map from data compiled by Geomatics Canada, modified by DDD

Shaded relief image prepared by DDD, derived from the digital elevation model suppied by I.R. Smith, based on 3arc_second SRTM imagery Illumination: azimuth 310°, altitude 25°, vertical factor 4.8x

Mean magnetic declination 2007, 21°41'W, decreasing 21.6' annually.

Readings vary from 21°25'E in the SE corner to 21°57'E in the NW corner of the map



LEGEND

POSTGLACIAL OR LATE WISCONSINAN

PROGLACIAL AND GLACIAL ENVIRONMENTS

aciolacustrine veneer: thin and discontinuous; <1 m thick.

10 m thick; Gd, glaciofluvial delta deposits; 1 to >30 m thick.

and sandstone erratics; clast content is typically low (<10 %).

ummocky till: >1m thick; hummocky till surface.

and along meltwater channel and canyon walls.

relief usually >2 m; interspersed with minor fens.

represents a potential aggregate source.

>30 m thick, surface marked by kettles.

obscures underlying units.

including flutes and drumlins.

PRE-QUATERNARY

Major moraine

Meltwater channel or underfit channel, small

(paleoflow direction known, unknown)

Meltwater channel, large (paleoflow direction unknown)

GLACIOLACUSTRINE DEPOSITS: fine sand, silt, and clay, with minor debris-flow

diamicton, deposited in glacier-dammed lakes in valleys and along the margin of the

retreating Laurentide Ice Sheet; usually overlain by organic deposits in lowlands.

Glaciolacustrine blanket: >1 m thick; Lbh, hummocky glaciolacustrine sediments,

>1 m thick; forming circular hummocks and hills surrounded by depressions with a

GLACIOFLUVIAL DEPOSITS: well to poorly stratified sand and gravel; minor

diamicton; deposited behind, at or in front of the ice margin by glacial meltwater;

Proglacial outwash: cross-stratified gravel and sand deposited in front of the ice

floors and surfaces adjacent to glacial meltwater channel margins; Gt, outwash

terrace deposits, generally associated with meltwater channels and canyons; 1 to

ice-contact stratified drift: poorly-sorted sand and gravel with minor diamictons;

deposited in contact with the retreating glacier; 1 to >20 m thick; Gih, hummocky

topography relating to melting of underlying ice; Gik, surface marked by kettle holes;

Gir, esker ridges; Git, kame terraces; Gid, ice-contact glaciofluvial delta deposits; 1 to

TILL: diamicton deposited directly by the Laurentide Ice Sheet; sandy to clayey matrix

Till blanket: >1 m thick, continous till cover forming undulating topography that locally

Streamlined and fluted till: >1 m thick, till surface marked by streamlined landforms

Ridged till deposits: >1 m thick, moraines or crevasse fillings forming a ridged

Till veneer: <1 m thick, discontinuous till cover, underlying bedrock topography is

Sedimentary bedrock: Cretaceous Fort St. John Group shales (including the

Shaftesbury Formation) and Dunvegan Formation sandstone exposed in highlands

with striated clasts of various lithologies, including many Canadian Shield, carbonate

margin; Gp, outwash plain deposits, generally 1 to 5 m thick, generally mantle valley

This legend is common to GSC Open File maps produced for NTS sheets 84L, 84M, 94I, and 94P. Not all map units in the

NOTE: 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. O-Tr). Where buried aggregate deposits (sand and gravel - commonly associated with Gt or Gd surficial units) are known, or suspected, areas are coloured according to the overlying unit and labelled in the following manner:

SURFICIAL DEPOSITS QUATERNARY

POST LAST GLACIATION

NONGLACIAL ENVIRONMENTS

ANTHROPOGENIC DEPOSITS: culturally-made or modified geological materials such that their original physical properties (e.g., structure, cohesion, compaction) have been drastically altered; >2 m thick.

ORGANIC DEPOSITS: peat and muck; 1 to 3 m thick on average; formed by the

as flat, wet terrain (swamps and bogs) over poorly drained substrates.

Bog peat: sphagnum or forest peat formed in an ombrotrophic environment; wet terrain; may be treed or treeless; O¹h, hummocky, mounds and plateaus; area may be underlain by ground ice or shallow permafrost conditions; O¹k, thermokarst terrain

accumulation of plant material in various stages of decomposition; generally occurs

Fen peat: peat derived from sedges and partially decayed shrubs in a eutrophic environment; forms relatively open peatlands with a mineral-rich water table that persists seasonally near the surface; generally covered with low shrubs and an occasional sparse layer of trees.

Undifferentiated bog and fen deposits: Oh, undifferentiated hummocky bog and fen deposits; area may be underlain by ground ice or shallow permafrost conditions; Ok, undifferentiated bog and fen deposits with thermokarst terrain related to melting of ground ice; Oc, undifferentiated bog and fen deposits cut by numerous subparallel channels on gentle slopes.

COLLUVIAL DEPOSITS: mass wasting debris; poorly sorted, massive to stratified debris deposited by direct, gravity-induced movement; composition dependant on

Landslide and slump debris: active and inactive landslides; hummocky topography; diamicton, generally 1 to 10 m thick, but may exceed 10 m near the toe of large

Colluvial veneer: thin and discontinuous cover of slumped and/or soliflucted material <1 m thick; overlies bedrock or till.

ALLUVIAL DEPOSITS: sorted gravel, sand, minor silt and organic detritus deposited by streams; commonly stratified.

Fluvial terrace deposits: inactive terraces above modern floodplain; >2 m thick;

Ap

Floodplain deposits: sorted gravel, sand, silt, and organic detritus >1 m thick; forming active floodplains close to river level with meander channels and scroll marks.

Undifferentiated colluvial deposits.

represents a potential aggregate source.

Ad Deltaic sediments: stratified sand and gravel underlain by silt and clay; generally 2 to 15 m thick; occuring at the mouths of streams entering lakes.

Af Alluvial fan deposits: poorly sorted gravel, sand and organic detritus >1 m thick.

Alluvium veneer: < 1 m thick; primarly as uniform sheets of slope wash on gentle slopes

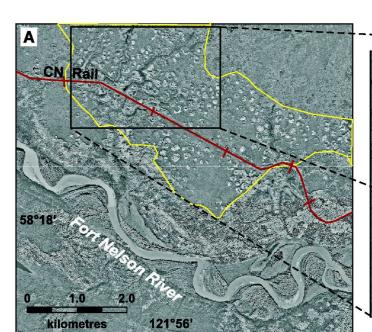
LACUSTRINE DEPOSITS: sand, silt and minor clay deposited in a former lake; >1 m thick; generally overlain by organic deposits; exposed by recent fluctuations in lake

NONGLACIAL AND PROGLACIAL ENVIRONMENTS

EOLIAN DEPOSITS: wind-deposited medium to fine sand; derived from deltaic or glaciolacustrine deposits; in some areas eolian sediments are thin or absent between

Er Ridged eolian deposits: forming dunes; generally >2m thick.

Eolian veneer: discontinuous veneer of eolian sediments; <1 m thick.



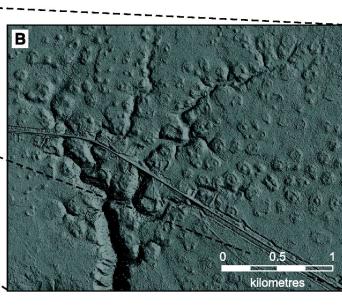


Figure 1. (A) Orthophotograph and, (B) Light Detection and Ranging (LiDAR, 2 m resolution) hillshade images showing examples of "hummocks" (mapped as unit Lbh) in glaciolacustrine clay, at plateau level, near the confluence of the Fort Nelson and Fontas rivers. The "hummocks" exhibit 1–3 m of relief over 100–600 m diameters.

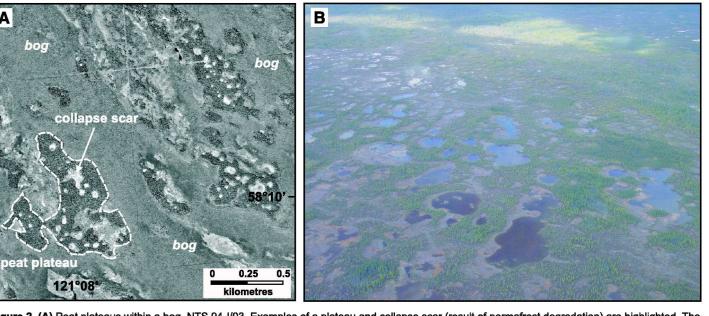


Figure 2. (A) Peat plateaus within a bog, NTS 94-I/03. Examples of a plateau and collapse scar (result of permafrost degradation) are highlighted. The region is very flat (gradient <0.2 m per km) and is thought to be underlain by glaciolacustrine clay and silt. (B) An example of thermokarst lakes in the study area (NTS 94-I/04). The lakes are typically 200–800 m wide, and are surrounded by bog and fen vegetation. Various stages of the lakes can be seen, as the lakes grow, degrade and re-form.

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2007	processus officiel de publication de la CO

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scale 1:100 000.