Descriptive Notes

This region is mostly covered by the Smallwood Reservoir, which was created in 1974 with the damming of the Churchill River at Churchill Falls, and now occupies the former basins of Ossokmanuan, Lobstick, and Michikamau lakes.

Three general phases of glacial erosion trends consistently occur in the map-area. An oldest flow that flowed to the northeast, a strong radial flow phase (from the Ancestral Labrador divide of the Laurentide Ice Sheet) to the southeast, and streamlined mega-scale glacial lineations from an ice-stream corridor that flowed to the east. Eskers were deposited during glacial retreat, after the ice streams shut down. Landforms mapped within the reservoir are visible during lower reservoir levels.

A large shallow glacial lake that filled the basin of the current Smallwood Reservoir, with maximum glaciolacustrine washing limits at about 480 m above sea level (about 8 metres above current reservoir levels) is here recognized for the first time. This glacial lake, south of the Quebec–Labrador drainage divide, is named glacial Lake Low, after A.P. Low of the Geological Survey of Canada, who first recognized that the final disintegration of the continental ice sheet occurred in this region (Low, 1896). Areas affected by the inundation of this glacial lake are defined by winnowed till deposits, strandlines, wave-cut benches in glacial landforms, and littoral beach deposits.

Acknowledgments

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References

Clark, P.U. and Fitzhugh, W.W.,1990. Late deglaciation of the central Labrador coast and its implications for the age of glacial lakes Naskaupi and McLean and for prehistory; Quaternary Research, 34, p. 296–305.

Henderson, E.P., 1959. A glacial study of central Quebec-Labrador; Geological Survey of Canada, Bulletin 50, 94 p. doi:10.4095/123901

Jansson, K.N., Kleman, J., and Marchant, D.R., 2002. The succession of ice-flow patterns in north-central Québec-Labrador; Quaternary Science Reviews, 21, p. 503–523.

Klassen, R.A. and Paradis, S., 1990. Surficial geology of western Labrador: NTS 23A, 23B, 23G, 23J, 23I and portions of 13L, 22P, and 23H; Geological Survey of Canada, Open File 2198, 8 maps, scale 1:250 000. doi:10.4095/130817

Klassen, R.A. and Thompson, F.J., 1989. Ice flow history and glacial dispersal patterns, Labrador; *in* Drift Prospecting, (ed.) R.N.W. DiLabio and W.B. Coker; Geological Survey of Canada, Paper 89-20, pp. 21–29. doi:10.4095/127361

Klassen, R.A. and Thompson, F.J., 1993. Glacial history, drift composition, and mineral exploration, central Labrador; Geological Survey of Canada, Bulletin 435, 82 p. doi:10.4095/183906

Klassen, R.A., Paradis, S., Bolduc, A.M., and Thomas, R.D., 1992. Glacial landforms and deposits, Labrador, Newfoundland and eastern Québec; Geological Survey of Canada, Map 1814A, scale 1:1 000 000. doi:10.4095/183872

Low, A.P., 1896. Report on exploration in the Labrador Peninsula along the East Main, Koksoak, Hamilton, Manicuagan and portions of other rivers in 1892-93-94-95; Geological Survey of Canada, Annual Report, 1895, 8, Part L, 387 pp. doi:10.4095/293888

Occhietti, S., Govare, É., Klassen, R., Parent, M., and Vincent, J.S., 2004. Late Wisconsinan—Early holocene deglaciation of Québec-Labrador; *in* Quaternary glaciations — extent and chronology, Part II. North America, (ed.) J. Ehlers and P.L. Gibbard, Elsevier B.V., Amsterdam, Development in Quaternary Science Series, v. 2, p. 237–267.

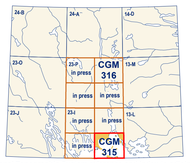
Veillette, J.J., Dyke, A.S., and Roy, M., 1999. Ice-flow evolution of the Labrador Sector of the Laurentide Ice Sheet: a review, with new evidence from northern Quebec; Quaternary Science Reviews, 18, p. 993–1019.

Abstract

Approximately 60% of the map-area is covered by the Smallwood Reservoir, created in 1974 with the damming of the Churchill River at Churchill Falls. The terrain is of moderate relief, with higher elevation regions in the northeast that correspond to the southern extent of the Paleoproterozoic De Pas Batholith and Late Archean Orma domain intrusive rocks. Three general phases of ice flow are observed in the map-area: to the northeast, southeast, and east. Meltwater corridors and eskers crosscut the southeasterly oriented glacial landforms and drained to the southeast and east towards the former ice margin. A large shallow glacial lake filled the Smallwood Reservoir basin. This glacial lake was previously unmapped. This lake is herein informally referred to as 'glacial Lake Low' named after A.P. Low of the Geological Survey of Canada, who first recognized that the final disintegration of the continental ice sheet occurred in this region.

Résumé

Environ 60 % de la région cartographique est occupée par le réservoir Smallwood, créé en 1974 à la suite de l'endiguement du fleuve Churchill à Churchill Falls. Le terrain présente un relief modéré avec, dans le coin nord est de la carte, des régions de plus haute altitude coïncidant avec le prolongement sud du batholite de De Pas du Paléoprotérozoïque et les roches intrusives du domaine d'Orma de l'Archéen tardif. Trois phases générales d'écoulement glaciaire ont laissé leurs traces dans la région cartographique suivant des directions nord-est, sud-est et est. Des corridors d'eau de fonte et des eskers recoupent les reliefs glaciaires de direction sud est et drainaient les eaux en direction du sud-est et de l'est, vers l'ancienne marge glaciaire. Un grand lac glaciaire peu profond a rempli le bassin du réservoir Smallwood. Ce lac glaciaire n'avait jamais été cartographié auparavant. On lui donne ici le nom informel de « Lac glaciaire Low », en mémoire de A.P. Low de la Commission géologique du Canada, qui a été le premier à reconnaître que la désagrégation finale de l'inlandsis s'est produite dans cette région.



National Topographic System reference and index to adjoining published Geological Survey of Canada maps

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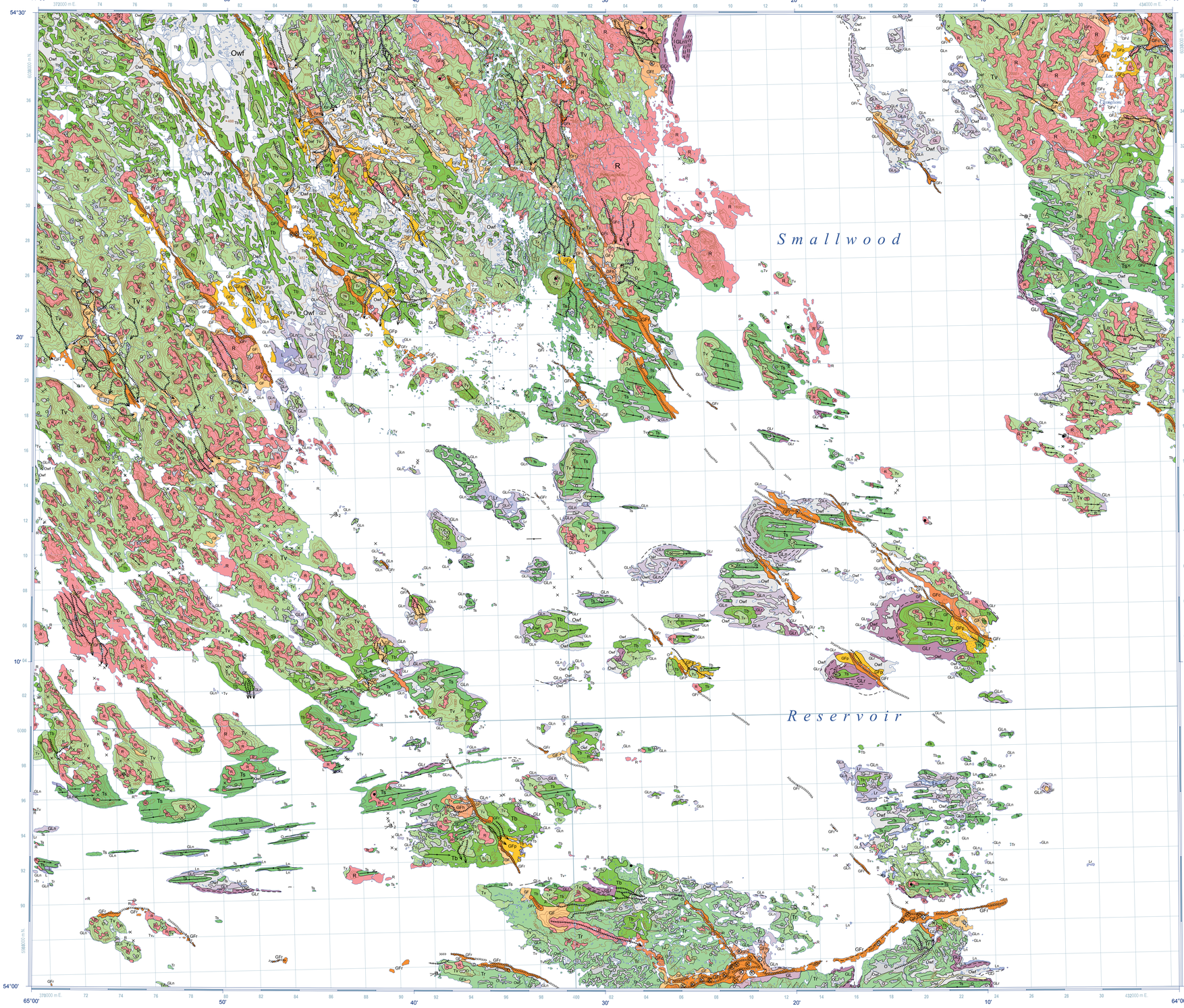
CANADIAN GEOSCIENCE MAP 315
SURFICIAL GEOLOGY
NORTHWEST SMALLWOOD RESERVOIR
Newfoundland and Labrador
NTS 23-I southeast
1:100 000



QUATERNARY

POST LAST GLACIATION

NON-GLACIAL ENVIRONMENT

ORGANIC DEPOSITS: peat and muck, 1 to 2 m thick on average; formed by the accumulation of plant material in various stage of decomposition; generally occurs as low relief, wet terrain (swamps, bogs, and fens).

Owf **Organic deposits, fen:** derived from sedges and partially decayed shrubs in a eutrophic environment; commonly forms a ribbed pattern of low shrubs transverse to drainage with ponds of open water.

O **Organic deposits, undifferentiated:** undifferentiated bog and fen deposits, area may be locally mixed or underlain with alluvial sediments; often associated with minor alluvial channels established for surface drainage.

ALLUVIAL SEDIMENTS: undifferentiated deposits of sorted gravel, sand, silt, and organic detritus; commonly stratified, variable thickness; deposited by streams and rivers.

A **Alluvial sediments, undifferentiated:** gravel to silt and organic detritus, variable thickness.

LACUSTRINE SEDIMENTS: cobble to pebble gravel, sand, silt, and minor organic detritus; >1 m thick, consisting of beach and storm deposits, ice rafted debris or formed during recent fluctuations in lake levels, deposited along the shorelines of larger lakes.

Lr **Lacustrine beach sediments:** fine sand to coarse cobble gravel; forming beach ridges of gravel up to 1 m high, sediments deposited adjacent to larger lakes.

Ln **Littoral and nearshore sediments:** fine to coarse sand beaches with minor gravel and ice-rafted debris, relief is typically <1 m, sediments formed in nearshore environment of larger lakes.

L **Lacustrine sediments, undifferentiated:** gravel, sand, silt, and organic detritus; variable thickness.

POSTGLACIAL OR LATE WISCONSIN

PREGLACIAL AND GLACIAL ENVIRONMENTS

GLACIOLACUSTRINE SEDIMENTS: coarse gravel, sand silt, and minor clay; commonly massive to portly stratified; >1 m; derived from winnowing of till in relatively water; formed in glacial Lake Low.

GLr **Ridged beach sediments:** pebbly to coarse granular sand; moderate to well sorted, with stratification and open framework of clasts. Deposited during glacial lake inundation at a maximum elevation of 485 m.

GLn **Littoral and nearshore sediments:** sand and gravel, moderately sorted, not more than 1 m thick, commonly produced by glaciolacustrine winnowing of till.

GL **Glaciolacustrine sediments, undifferentiated:** sand silt, and minor clay; commonly overlain by organic deposits; occurs in low relief terrain.

GLACIOFLUVIAL SEDIMENTS: sand, gravel with minor silt and diamicton; well to poorly sorted, massive to stratified; deposited by glacial meltwater streams from, or in contact with, glacial ice in a subglacial, subaqueous or proglacial subaerial environment.

GFp **Outwash plain sediments:** sand and rounded gravel, minor silt; moderately to well sorted; planar and cross-stratified; form low relief plains commonly with kettle lakes and channel scars; includes minor ice-contact stratified sand and gravel deposited in proglacial and subaerial environment within meltwater corridors, too small in extent to be mapped separately.

GFf **Outwash fan sediments:** fine sand to well rounded gravel, minor silt, moderately sorted; cross-stratified, with foreset bedding; sediments fine toward distal edge of fan; deposited at the terminous of subglacial and subaerial meltwater corridors.

GFh **Hummocky sediments:** gravel to fine-sand, with minor silt, and isolated boulders; massive to crudely stratified, moderate to poor sorting; commonly formed in ice-contact meltwater environments, local relief is 2 to 4 m.

GFc **Ice-contact sediments:** moderately to poorly sorted, massive to crudely stratified; often occurring as small hummocks and ridges (1 to 4 m high); deposits usually are restricted in morphology due to overlying ice, often associated with subglacial meltwater corridors and esker networks.

GFk **Kame:** moderately to well sorted, massive to crudely stratified; often occurs as a conical hummock capped with a lag deposit of cobbles and boulders; locally, kames occur at the inception point of small eskers or meltwater channels.

GFr **Esker:** sinuous ridges of moderate to well sorted sand and gravel, cross-stratified to massive; forming ridges with crested peaks, or flat topped and winnowed by proglacial lakes; associated sand and gravel deposits often flank each side; deposited as ice-contact glaciofluvial sediments in larger subglacial meltwater corridors; can be associated with kame deposits, other ice-contact sediments and outwash fan deposits with kettle depressions and lakes.

GFv **Glaciofluvial veneer:** glacial meltwater sediments, gravels to fine-sand with minor silt; cross-stratified to massive; <1 m thick, often draping the underlying till or bedrock morphology.

GF **Glaciofluvial sediments, undifferentiated:** sand, gravel with minor silt; well to poorly sorted, massive to stratified; deposited by glacial meltwater streams from or in contact with glacial ice in a subglacial, subaqueous or proglacial subaerial environment.

GLACIAL SEDIMENTS (TILL): silty-sand to sandy diamicton; contains striated and faceted clasts of various lithologies; clast content ranges from 15 to 25%; thickness ranges from 1 to >5 m thick; till sheets and ridges have been exposed to varying degrees of washing and winnowing from meltwater channel systems and glacial Lake Low; generally thicker in the lowland regions and also as lee-side tails of streamlined glacial landforms; deposited directly by the Laurentide Ice Sheet.

Th **Hummocky till:** sandy diamicton characterized by rolling till plain comprised of small hummocks and intervening depressions; common as linear ridges and subdued kettle depressions and lakes which suggest in-situ mass-wasting near the former Labrador–Quebec ice centre.

Tr **Ridged till:** bouldery, silty-sand diamicton of varying thickness, characterized generally by subparallel low-relief ridges, interpreted as ribbed moraine, oriented transverse to regional ice flow.

Ts **Streamlined till:** silty-sand diamicton, deposited by active flowing ice, associated with larger landforms and former ice stream corridors; geomorphology includes mega scale glacial lineations (fluted forms with high length:width ratios), drumlinoid features, and larger crag-and-tail forms.

Tv **Till veneer:** bouldery, sandy diamicton; generally less than 1 m but up to 2 m thick locally; forms a discontinuous cover over bedrock and interspersed with many small outcrops of bedrock; geomorphology commonly mimics the underlying bedrock structure; local regions of frost heaved bedrock and boulders are frequent at higher elevations.

Tb **Till blanket:** silty-sand diamicton; >2 m thick; forms continuous cover that generally masks underlying bedrock topography and structure; frost boils and solifluction stripes are common.

PRE-QUATERNARY

R **Bedrock:** Core Zone bedrock, a composite Precambrian lithotectonic terrane of undifferentiated Archean rocks, Paleoproterozoic supracrustal rocks and plutons of variable age extensively reworked during ca. 1.8–1.9 Ga collision of the Superior and North Atlantic (or Nain) cratons.

Winnowed sediments and localized thin (<1 m) sorted sediments of sand, gravel, and cobble lag deposits; surface may exhibit meltwater channels or minor littoral features.

Kettle

Geological boundary (confidence defined)

Terrace scarp

Beach crest

Meltwater channel:

Minor, sense unknown

Minor, sense known

Major scarp (direction indicated)

Other moraine ridge, minor

Esker ridge (direction known or inferred)

Drumlinoid ridge

Crag-and-tail ridge

Striations:

Direction known

Crossed, relative ages given (1 = oldest)

Small outcrop

Sample location

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Geological Survey of Canada
Canadian Geoscience Maps

Authors: R.C. Paulen, J.M. Rice, and M.B. McClenaghan

Geology based on air photo interpretation and fieldwork by R.C. Paulen, J.M. Rice and M.B. McClenaghan, 2014–2016

Geological compilation by R.C. Paulen, 2014–2016

Geology conforms to Surficial Data Model v. 2.2

Geomatics by L. Robertson

Cartography by D. Viner

Canada

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Logistical support provided by the Polar Continental Shelf Program as part of its mandate to promote scientific research in the Canadian north. PCSP 05915 (2015) and 06016 (2016)

Map projection Universal Transverse Mercator, zone 20. North American Datum 1983

Base map at the scale of 1:50 000 from Natural Resources Canada, with modifications.
Elevations above mean sea level are expressed in feet (NTS 23-I/1,2,8) and metres (NTS 23-I/7)

CANADIAN GEOSCIENCE MAP 315
SURFICIAL GEOLOGY
NORTHWEST SMALLWOOD RESERVOIR
Newfoundland and Labrador
NTS 23-I southeast

1:100 000

2 0 2 4 6 8 km

Mean magnetic declination 2017, 21°15'W, decreasing 13.1' annually. Readings vary from 21°02'W in the SW corner to 21°28'W in the NE corner of the map.

This map is not to be used for navigational purposes.

Title photograph: A southeast-trending sinusoidal esker within the Smallwood Reservoir, 23-I/01 (54°11'31" N / 64°28'38" W), Newfoundland and Labrador. Photograph by R.C. Paulen. 2017-037

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

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

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Preliminary publications in this series have not been scientifically edited.

CANADIAN GEOSCIENCE MAP 315
SURFICIAL GEOLOGY
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Newfoundland and Labrador
NTS 23-I southeast