Preliminary

Preliminary

Preliminary

Table 1. AMS radiocarbon (14C) ages for two sites east of a large marine delta at 130 m above sea level (a.s.l.). They suggest the inner part of Committee Bay was deglaciated by at least ¹⁴C 6.8 ka BP. These

represents the main ice flow direction over the map area during deglaciation (Little, 2006; McMartin et al.,

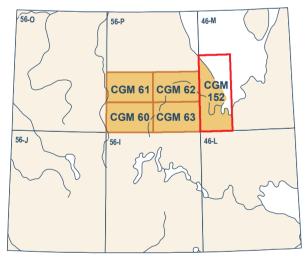
ages are comparable to deglacial ages on the eastern side of Rae Isthmus (Dredge, 2002). Map ID Sample ID Latitude Longitude Elevation (m a.s.l.) Mollusc Species Conventional 14C Age (corrected for 13C/12C) Surface of rew orked till below small beach A 10MOB-l038A02 67.21637 -87.49609 44 Hiatella arctica 6750 +/- 40 BP Surface of marine silts B 10MOB-l063A01 67.25639 -87.64787 50 Hiatella arctica complete shells in living position

Diverse Quaternary sediments and depositional environments with notable landforms characterise the map area. Till blankets and till veneers are scattered through the area but are dominant above the marine limit. Sand and gravel deposits above the marine limit mainly occur in pro-glacial outwash trains, glaciofluvial aprons/deltas and ice-contact landforms (eskers, kames) concentrated in valleys. The marine sequence includes, from the limit of marine incursion to the present-day coastline, thick deposits of deltaic sands and gravels, extensive areas of exposed and gullied clavev silts, marine offlap sands and silts, and sand and gravel littoral sediments. Sand veneers and patches of wave-washed tills are present below the marine limit. Extensive areas of exposed bedrock occur south of Committee Bay. Multiple ice-flow directions indicate a north to northwest flow that predates the dominant northeast then northward flows. Major end moraines (part of the Chantrey Moraine System) are present in the map area with divergent ice-flow directions on either side (northeast versus north). Marine limit elevation drops significantly from ~ 240 m a.s.l. north of the moraine (Giangioppi et al. 2003) to ~170 m a.s.l. in the south map area suggesting a major stillstand at the

Chantrey Moraines during deglaciation.

Divers sédiments quaternaires et milieux sédimentaires avec des formes du relief notables caractérisent la région de la carte. Des nappes et des placages de till sont dispersés dans toute la zone mais ils sont dominants au-dessus de la limite marine. Au-dessus de cette limite, les dépôts de sable et gravier se retrouvent surtout dans les traînées proglaciaires, les plaines et deltas fluvioglaciaires et les sédiments de contact glaciaire (eskers, kames) concentrés dans les vallées. Depuis la limite de l'incursion marine jusqu'à la côte actuelle, la séquence marine se compose de dépôts épais de sables et de graviers deltaïques, de grandes zones exposées et ravinées de silts argileux, du sable et du silt laissés par la régression de la mer et des sédiments littoraux sableux et graveleux. Des placages de sables et des zones de tills délavés par les vagues sont présents sous la limite marine. De grandes zones d'affleurements rocheux sont visibles au sud de baie Comité. Les multiples directions de l'écoulement glaciaire indiquent qu'un écoulement nord à nord-ouest a précédé les derniers écoulements vers le nord (nordest puis nord). De grandes moraines frontales (faisant partie du système de la Moraine de Chantrey) sont présentes dans la région et montrent des directions divergentes de l'écoulement glaciaire de part et d'autre du système (vers le nord-est et vers le nord). L'élévation de la limite marine baisse considérablement de 240 m au-dessus du niveau de la mer au nord du système morainique (Giangioppi et al. 2003) à environ 170 m dans la partie sud de la carte, ce qui suggère que le front glaciaire est resté longtemps stationnaire dans les

environs du système pendant la déglaciation.



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

Cover illustration Extensive marine plains composed of thick deposits of offshore marine silts and clays capped by nearshore sands are exposed in spectacular gully networks, west of Committee Bay, Nunavut Photograph by J.E. Campbell. 2014-069

Catalogue No. M183-1/152-2013E-PDF ISBN 978-1-100-22370-4 doi:10.4095/293975

© Her Majesty the Queen in Right of Canada 2014

Natural Resources Ressources naturelles du Canada

CANADIAN GEOSCIENCE MAP 152 SURFICIAL GEOLOGY

LEFROY BAY (SOUTHWEST)

Nunavut

NTS 46-M southwest 1:100 000

ess.nrcan.gc.ca



Preliminary

Canadian **Geoscience Maps**

Canada

CANADIAN GEOSCIENCE MAP 152

SURFICIAL GEOLOGY LEFROY BAY (SOUTHWEST) Nunavut NTS 46-M southwest

Authors: J.E. Campbell and I. McMartin Geology based on aerial photograph interpretation by J.E. Campbell and fieldwork during summers 2010, 2011, and 2012 by J.E. Campbell and I. McMartin. Field assistance was provided by U. Wityk (2010, 2011), F. Humber (2011), and K. Robillard (2012).

Preliminary

Initiative of the Geological Survey of Canada, conducted under the auspices of the Wager Bay surficial mapping activity, Multiple Metals-Melville Peninsula project as part of Natural Resources Canada's Geo-mapping for

Energy and Minerals (GEM) program.

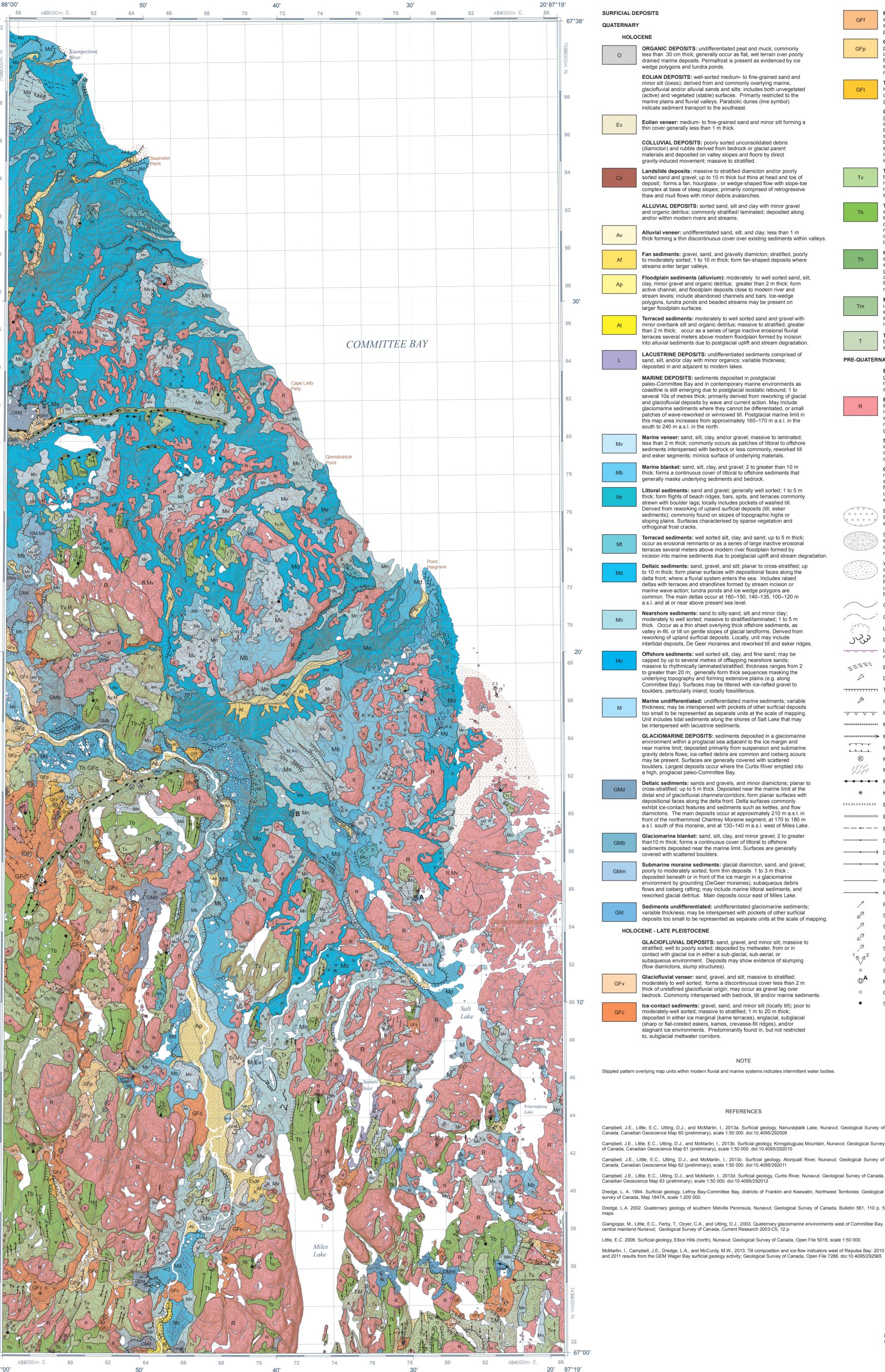
Preliminary

Logistical support provided by the Polar Continental Shelf Program as part of its mandate to promote scientific research in the Canadian North. PCSP 006-10, 013-11 and 015-12.

Map projection Universal Transverse Mercator,

Preliminary publications in **CANADIAN GEOSCIENCE MAP 152**

NTS 46-M southwest



SURFICIAL DEPOSITS

QUATERNARY

HOLOCENE ORGANIC DEPOSITS: undifferentiated peat and muck; commonly less than 30 cm thick; generally occur as flat, wet terrain over poorly drained marine deposits. Permafrost is present as evidenced by ice

CANADIAN GEOSCIENCE MAP 152

wedge polygons and tundra ponds. **EOLIAN DEPOSITS:** well-sorted medium- to fine-grained sand and minor silt (loess); derived from and commonly overlying marine, glaciofluvial and/or alluvial sands and silts: includes both unvegetated (active) and vegetated (stable) surfaces. Primarily restricted to the marine plains and fluvial valleys. Parabolic dunes (line symbol) indicate sediment transport to the southeast.

Eolian veneer: medium- to fine-grained sand and minor silt forming a thin cover generally less than 1 m thick.

COLLUVIAL DEPOSITS: poorly sorted unconsolidated debris (diamicton) and rubble derived from bedrock or glacial parent materials and deposited on valley slopes and floors by direct

gravity-induced movement; massive to stratified. Landslide deposits: massive to stratified diamicton and/or poorly sorted sand and gravel; up to 10 m thick but thins at head and toe of deposit: forms a fan, hourglass-, or wedge-shaped flow with slope-toe complex at base of steep slopes; primarily comprised of retrogressive thaw and mud flows with minor debris avalanches. ALLUVIAL DEPOSITS: sorted sand, silt and clay with minor gravel

and organic detritus; commonly stratified/laminated; deposited along and/or within modern rivers and streams

Alluvial veneer: undifferentiated sand, silt, and clay; less than 1 m thick forming a thin discontinuous cover over existing sediments within valleys.

Fan sediments: gravel, sand, and gravelly diamicton; stratified, poorly to moderately sorted; 1 to 10 m thick; form fan-shaped deposits where streams enter larger valleys. Floodplain sediments (alluvium): moderately to well sorted sand, silt, clay, minor gravel and organic detritus; greater than 2 m thick; form active channel, and floodplain deposits close to modern river and

stream levels; include abandoned channels and bars. Ice-wedge polygons, tundra ponds and beaded streams may be present on larger floodplain surfaces. Terraced sediments: moderately to well sorted sand and gravel with minor overbank silt and organic detritus; massive to stratified; greater

than 2 m thick; occur as a series of large inactive erosional fluvial terraces several meters above modern floodplain formed by incision into alluvial sediments due to postglacial uplift and stream degradation. **LACUSTRINE DEPOSITS:** undifferentiated sediments comprised of sand. silt, and/or clay with minor organics; variable thickness;

deposited in and adjacent to modern lakes.

south to 240 m a.s.l. in the north

orthogonal frost cracks.

MARINE DEPOSITS: sediments deposited in postglacial paleo-Committee Bay and in contemporary marine environments as coastline is still emerging due to postglacial isostatic rebound; 1 to several 10s of metres thick; primarily derived from reworking of glacial and glaciofluvial deposits by wave and current action. May include glaciomarine sediments where they cannot be differentiated, or small patches of wave-reworked or winnowed till. Postglacial marine limit in this map area increases from approximately 160-170 m a.s.l. in the

Marine veneer: sand, silt, clay, and/or gravel; massive to laminated; less than 2 m thick; commonly occurs as patches of littoral to offshore sediments interspersed with bedrock or less commonly, reworked till and esker segments; mimics surface of underlying materials.

Marine blanket: sand, silt, clay, and gravel; 2 to greater than 10 m thick; forms a continuous cover of littoral to offshore sediments that generally masks underlying sediments and bedrock. Littoral sediments: sand and gravel; generally well sorted; 1 to 5 m thick; form flights of beach ridges, bars, spits, and terraces commonly strewn with boulder lags; locally includes pockets of washed till. Derived from reworking of upland surficial deposits (till, esker sediments); commonly found on slopes of topographic highs or

Terraced sediments: well sorted silt, clay, and sand; up to 5 m thick; occur as erosional remnants or as a series of large inactive erosional terraces several meters above modern river floodplain formed by incision into marine sediments due to postglacial uplift and stream degradation Deltaic sediments: sand, gravel, and silt; planar to cross-stratified; up to 10 m thick: form planar surfaces with depositional faces along the delta front; where a fluvial system enters the sea. Includes raised deltas with terraces and strandlines formed by stream incision or

sloping plains. Surfaces characterised by sparse vegetation and

Nearshore sediments: sand to silty-sand, silt and minor clay; moderately to well sorted; massive to stratified/laminated; 1 to 5 m thick. Occur as a thin sheet overlying thick offshore sediments, as valley in-fill, or till on gentle slopes of glacial landforms. Derived from reworking of upland surficial deposits. Locally, unit may include intertidal deposits, De Geer moraines and reworked till and esker ridges.

Offshore sediments: well sorted silt, clay, and fine sand; may be

capped by up to several metres of offlapping nearshore sands; massive to rhythmically laminated/stratified; thickness ranges from 2

a.s.l. and at or near above present sea level.

marine wave-action; tundra ponds and ice wedge polygons are

common. The main deltas occur at 160–150, 140–135, 100–120 m

to greater than 20 m; generally form thick sequences masking the underlying topography and forming extensive plains (e.g. along Committee Bay). Surfaces may be littered with ice-rafted gravel to boulders, particularly inland; locally fossiliferous. Marine undifferentiated: undifferentiated marine sediments; variable thickness; may be interspersed with pockets of other surficial deposits

Unit includes tidal sediments along the shores of Salt Lake that may be interspersed with lacustrine sediments GLACIOMARINE DEPOSITS: sediments deposited in a glaciomarine environment within a proglacial sea adjacent to the ice margin and near marine limit; deposited primarily from suspension and submarine gravity debris flows; ice-rafted debris are common and iceberg scours may be present. Surfaces are generally covered with scattered boulders. Largest deposits occur where the Curtis River emptied into

too small to be represented as separate units at the scale of mapping.

Deltaic sediments: sands and gravels, and minor diamictons; planar to cross-stratified; up to 5 m thick. Deposited near the marine limit at the distal end of glaciofluvial channels/corridors; form planar surfaces with depositional faces along the delta front. Delta surfaces commonly exhibit ice-contact features and sediments such as kettles, and flow diamictons. The main deposits occur at approximately 210 m a.s.l. in front of the northernmost Chantrey Moraine segment, at 170 to 180 m a.s.l. south of this moraine, and at 130-140 m a.s.l. west of Miles Lake.

a high, proglacial paleo-Committee Bay.

Glaciomarine blanket: sand, silt, clay, and minor gravel; 2 to greater than10 m thick; forms a continuous cover of littoral to offshore sediments deposited near the marine limit. Surfaces are generally covered with scattered boulders. Submarine moraine sediments: glacial diamicton, sand, and gravel; poorly to moderately sorted; form thin deposits 1 to 3 m thick;

deposited beneath or in front of the ice margin in a glaciomarine environment by grounding (DeGeer moraines), subaqueous debris flows and iceberg rafting; may include marine littoral sediments, and reworked glacial detritus. Main deposits occur east of Miles Lake.

Sediments undifferentiated: undifferentiated glaciomarine sediments; variable thickness; may be interspersed with pockets of other surficial deposits too small to be represented as separate units at the scale of mapping. **HOLOCENE - LATE PLEISTOCENE**

GLACIOFLUVIAL DEPOSITS: sand, gravel, and minor silt; massive to stratified; well to poorly sorted; deposited by meltwater, from or in contact with glacial ice in either a sub-glacial, sub-aerial, or

subaqueous environment. Deposits may show evidence of slumping (flow diamictons, slump structures). Glaciofluvial veneer: sand, gravel, and silt; massive to stratified;

moderately to well sorted: forms a discontinuous cover less than 2 m thick of undefined glaciofluvial origin; may occur as gravel lag over bedrock. Commonly interspersed with bedrock, till and/or marine sediments **Ice-contact sediments:** gravel, sand, and minor silt (locally till); poor to moderately-well sorted; massive to stratified; 1 m to 20 m thick;

deposited in either ice marginal (kame terraces), englacial, subglacial (sharp or flat-crested eskers, kames, crevasse-fill ridges), and/or stagnant ice environments. Predominantly found in, but not restricted to, subglacial meltwater corridors.

Observation site Sample site

Stippled pattern overlying map units within modern fluvial and marine systems indicates intermittent water bodies.

REFERENCES

Campbell, J.E., Little, E.C., Utting, D.J., and McMartin, I., 2013a. Surficial geology, Nanuraqtalik Lake, Nunavut; Geological Survey of Canada, Canadian Geoscience Map 60 (preliminary), scale 1:50 000. doi:10.4095/292009 Campbell, J.E., Little, E.C., Utting, D.J., and McMartin, I., 2013b. Surficial geology, Kinngalugjuaq Mountain, Nunavut; Geological Survey of Canada, Canadian Geoscience Map 61 (preliminary), scale 1:50 000. doi:10.4095/292010 Campbell, J.E., Little, E.C., Utting, D.J., and McMartin, I., 2013c. Surficial geology, Atorquait River, Nunavut; Geological Survey of Canada, Canadian Geoscience Map 62 (preliminary), scale 1:50 000. doi:10.4095/292011 Campbell, J.E., Little, E.C., Utting, D.J., and McMartin, I., 2013d. Surficial geology, Curtis River, Nunavut; Geological Survey of Canada, Canadian Geoscience Map 63 (preliminary), scale 1:50 000. doi:10.4095/292012 Dredge, L. A. 1994. Surficial geology, Lefroy Bay-Committee Bay, districts of Franklin and Keewatin, Northwest Territories; Geological

Dredge, L.A. 2002. Quaternary geology of southern Melville Peninsula, Nunavut; Geological Survey of Canada, Bulletin 561, 110 p, 5 Giangioppi, M., Little, E.C., Ferby, T., Ozyer, C.A., and Utting, D.J., 2003. Quaternary glaciomarine environments west of Committee Bay, central mainland Nunavut; Geological Survey of Canada, Current Research 2003-C5, 12 p.

Little, E.C. 2006. Surficial geology, Ellice Hills (north), Nunavut; Geological Survey of Canada, Open File 5016, scale 1:50 000.

Elevations above mean sea level are expressed in metres (NTS 46-M/4,5,12) and feet (NTS 46-M/3,6) Shaded relief image derived from the digital elevation

odel supplied by the Manning Information Branch GeoData Acquisition & Management Division, Natural Resources Canada Illumination: azimuth 315°, altitude 45°, vertical factor 1x

Base map at the scale of 1:50 000 from

Natural Resources Canada, with modifications.

Preliminary

Fan sediments: sand, gravel, and minor boulders; well sorted; stratified: 1 to 5 m thick; form low-relief fans deposited either

subaerially within meltwater drainage system or at the ice margin portal of subglacial meltwater conduits in paleo Committee Bay.

Outwash sediments: sand and gravel; moderately to well sorted;

commonly with kettles and/or channel scars on the surface; represent

the distal facies of ice-contact stratified drift deposited in a proglacial,

Terraced outwash sediments: sand and gravel; 2 to 10 m thick; form

incised outwash plain with numerous erosional terraces, and scarps

generally massive; thickness can exceed 20 m in buried depressions

and streamlined landforms but is generally less than 3 m; deposited

beneath active or stagnant ice. Surface till is commonly silty sand to

boulder abundance is variable, related to either glacial deposition or

subsequent winnowing and removal of the fines by glacial meltwater

or marine wave action. Clasts are predominantly locally derived felsic

Till veneer: bouldery, silty sand to sandy diamicton; less than 1 m

rock structure; mudboils, sorted circles, and frost-heaved bedrock

a continuous cover that generally masks underlying bedrock

topography; occurs as till plains or streamlined forms such as drumlins and crag-and-tails indicating ice flows towards the northeast north, and northwest; non-sorted and sorted circles with mudboils are

common; sorted stripes and/or solifluction lines locally occur on

thick: forms a discontinuous cover over bedrock and interspersed with

rock outcrops; deposits are thin enough to reveal details of underlying

Till blanket: silty sand diamicton; 1 m to greater than 20 m thick; forms

Hummocky till: sandy and silty sand diamicton; typically with bouldery

surfaces; may contain variable amounts of ice-contact glaciofluvial sediments; poor to moderate sorting; massive to crudely stratified;

deformation features caused by gravity flows, slumping or ice meltout.

exhibit syndepositional deformation features caused by gravity flows, slumping or ice meltout; forms an end moraine in front of the ice

Till undifferentiated: undifferentiated glacial diamictons of variable

thickness interspersed with pockets of other surficial deposits too

small to be represented as separate units at the scale of mapping.

BEDROCK: Archean to Paleoproterozoic; primarily metamorphosed

granitic to intermediate intrusive, igneous and minor supracrustal

rocks. Major dykes trend NW-SE. Curving, multigenerational folds

Bedrock, undifferentiated: intact and frost-riven outcrop of various

moutonnées); flat to hilly topography; surfaces range from rough and

weathered to glacially polished and striated. Felsenmeer commonly

Stratigraphic relationship: where observed or can be confidently

of two map unit designators separated by a slash ("/") (e.g. Th/Tb

Complex units: where the surficial cover forms a complex and the

map units are too small to be mapped individually, yet constitute a

significant component of the total polygon, a dot (".") separates the

unit (e.g. T.M designates an area of undifferentiated till interspersed

Extensive gullied terrain: gully networks developed predominantly in

thick deposits of marine offshore fine-grained sediments. Exposed

Scour and/or lag deposits: exposed bedrock and/or eroded till with

eroded sediments, arêtes, table tops, and hoodoos are common.

surface boulder lags and scattered glaciofluvial sand and gravel

deposits related to meltwater drainage; locally includes scoured

Winnowed and/or reworked sediments due to marine wave and

marine sediments eroded by fluvial and/or eolian processes.

deposits such as beaches, berms, spits, and sandy patches.

- Limit of marine submergence (confidence defined; environment

Reworked till generally forms a less than 1 m thick veneer over

unmodified till. Locally where sediments are thicker the deposits may

current action: occur below marine limit: interso

be notched, flat-topped, and/or terraced.

Landslide (inactive; debris flow indicated)

Geological boundary (defined)

marine or glaciomarine)

Delta (direction of flow indicated)

Ice-contact delta (direction of flow indicated)

...... Minor meltwater channel (proglacial or subglacial; sense unknown)

**************** Minor meltwater channel (proglacial or subglacial; sense known)

Major meltwater corridor (well-defined lateral limit)

(south) of an upland or crag (see accompanying database); sense indicated

Fluted or streamlined bedrock ridge (sense unknown or unspecified)

Crossed striations (number indicates relative age, 1 being the oldest)

Minor moraine ridge (De Geer, recessional)

Dune crest

• • • • • • Major moraine ridge (end)

<><><>< Esker ridge (sense unknown)

- Drumlinoid ridge

>>>>>> Esker ridge (sense known or inferred)

— — ← — Buried or weakly defined drumlinoid ridge

Fluted bedrock (sense known)

Small outcrop

Striation (well defined; sense unknown)

Striation (poorly defined; sense unknown)

Striation (poorly defined; sense known)

Radiocarbon date (See Table 1)

Striation (well defined; sense known)

Terrace scarp

Geological boundary (approximate)

first dominant map unit designator from the less abundant secondary

inferred, a map unit stratigraphic sequence is shown with a maximum

lithologies variously modified by glacial erosion (i.e. roches

ring low-relief outcrops. Locally may include patches of till,

glaciofluvial, glaciomarine, and/or marine sediments.

designates hummocky moraine overlying till blanket).

with marine sediments).

Forms ridges and chaotic hummocky terrain associated with in situ

generally greater than 2 m thick; may exhibit syndepositional

Moraine complex: sandy glacial diamicton, sand, and gravel;

margin during a stillstand in the ice retreat.

and faults form prominent topographic features.

unsorted to fair sorting; massive to stratified; 2-20 m thick; may

due to down-cutting related to base level adjustment in response to

GLACIAL DEPOSITS: diamicton (till); unsorted to poorly sorted;

sandy; greyish brown, permeable, and non-calcareous. Surface

intrusives with minor supracrustals lithologies.

planar and cross-stratified; 2 to 10 m thick; form low-relief plains

sub-aerial environment as valley trains, terraces, and fans within

meltwater channels or corridors.

glacio-isostatic uplift.

slabs are common

melt of recessional ice.

PRE-QUATERNARY

Proximity to the North Magnetic Pole causes the magnetic compass to be erratic in this area. Mean magnetic declination 2014, 19°53'W, decreasing 16.1' annually. Readings vary from 18°53'W in the SW corner

to 20°55'W in the NE corner of the map. The Geological Survey of Canada welcomes corrections or additional information from users.

Data may include additional observations not portrayed on this map.

See documentation accompanying the data. This publication is available for free download through GEOSCAN (http://geoscan.nrcan.gc.ca/).

This map is not to be used for navigation purposes.

Recommended citation Campbell, J.E. and McMartin, I., 2014. Surficial geology, Lefroy Bay (southwest), Nunavut, NTS 46-M southwest; Geological Survey of Canada, Canadian Geoscience Map 152 (preliminary), scale 1:100 000. doi:10.4095/293975



1:100 000

Field site information, sample descriptions, and analytical results are available in GSC Open File 7288 (see References McMartin et al. 2013). Geomatics and cartography by L. Robertson

zone 16. North American Datum 1983

this series have not been scientifically edited.