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Irvine, M.L., 2011: Living on unstable ground: Identifying physical landscape constraints on planning and infrastructure development in Nunavut communities; Unpublished M.Sc. thesis, Memorial University, St Johns Newfoundland and Labrador, Department of Geography, 239 p.

Smith, I.R., Irvine, M.L., and Bell, T., 2012; Pedgeacial and permafrost geology, Clyde River, Baffin Island, Nunavut; Geological Survey of Canada, Canadian Geoscience Map 57 (preliminary version), scale 1:10 000. doi:10.4095/289602

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Abstract

Surficial and periglacial-permafrost geology mapping was undertaken in Clyde River, Nunavut, to assess how different aspects of the physical environment pose risks and hazards to existing and future infrastructure development, and how climate change may further alter infrastructure vulnerability. This research was undertaken as part of Natural Resources Canada's Nunavut Climate Change Partnership, a joint project with the Climate Change Partnership. Most of Clyde River's town and airport are built atop thick, terraced, raised marine and glaciomarine sandy sediments that contain saline permafrost. These deposits support abundant ice wedges. Widespread thermokarst depressions indicate extensive massive and segregated ice content. Glaciofluvial and glaciomarine sediments preserve record a fore-ward and westward retreat of Late Wisconsinan glaciers. New community developments extend upslope from the coastal terraced regions on washed sandy till and moraine complexes. Granular aggregate materials suitable for infrastructure development are rare, although glaciofluvial terrace deposits offer potential.

Résumé

La cartographie géologique des dépôts meubles et périglaciaires en milieu pergélisolé a été entreprise à Clyde River, au Nunavut, afin d'évaluer les risques que présentent différents aspects du milieu physique pour l'aménagement d'infrastructures existantes et futures, ainsi que les effets accrus des changements climatiques sur la vulnérabilité des infrastructures. Cette recherche a été entreprise dans le cadre du Programme géoscientifique sur les changements climatiques de Ressources naturelles Canada et du Partenariat sur les changements climatiques du Nunavut. La majeure partie de la ville de Clyde River et l'aéroport sont construits sur des terrasses composées d'épais sédiments sableux marins et glaciomarins qui ont été surélevés et présentent des pergélisols salinisés. Ces dépôts comportent d'abondants coins de glace. Très répandues, les dépressions thermokarstiques indiquent une forte teneur en glace massive et en glace de ségrégation. Les moraines, les chenaux d'eau de fonte et les sédiments de contact glaciaire attestent du retrait, vers le fjord et vers l'ouest, des glaciers du Wisconsinien tardif. Les nouveaux aménagements de la collectivité s'étendent depuis les régions côtières en terrasses sur un dépôt de till lavé et de moraine de sable argileux et de moraine délavée. Les agrégats granulaires convenant à l'aménagement d'infrastructures sont rares, bien que les dépôts des terrasses fluvioglaciaires offrent un certain potentiel.

National Topographic System reference

Cover illustration:
Hamlet of Clyde River, Baffin Island, Nunavut.
Photograph by M. Irvine. 2011-511

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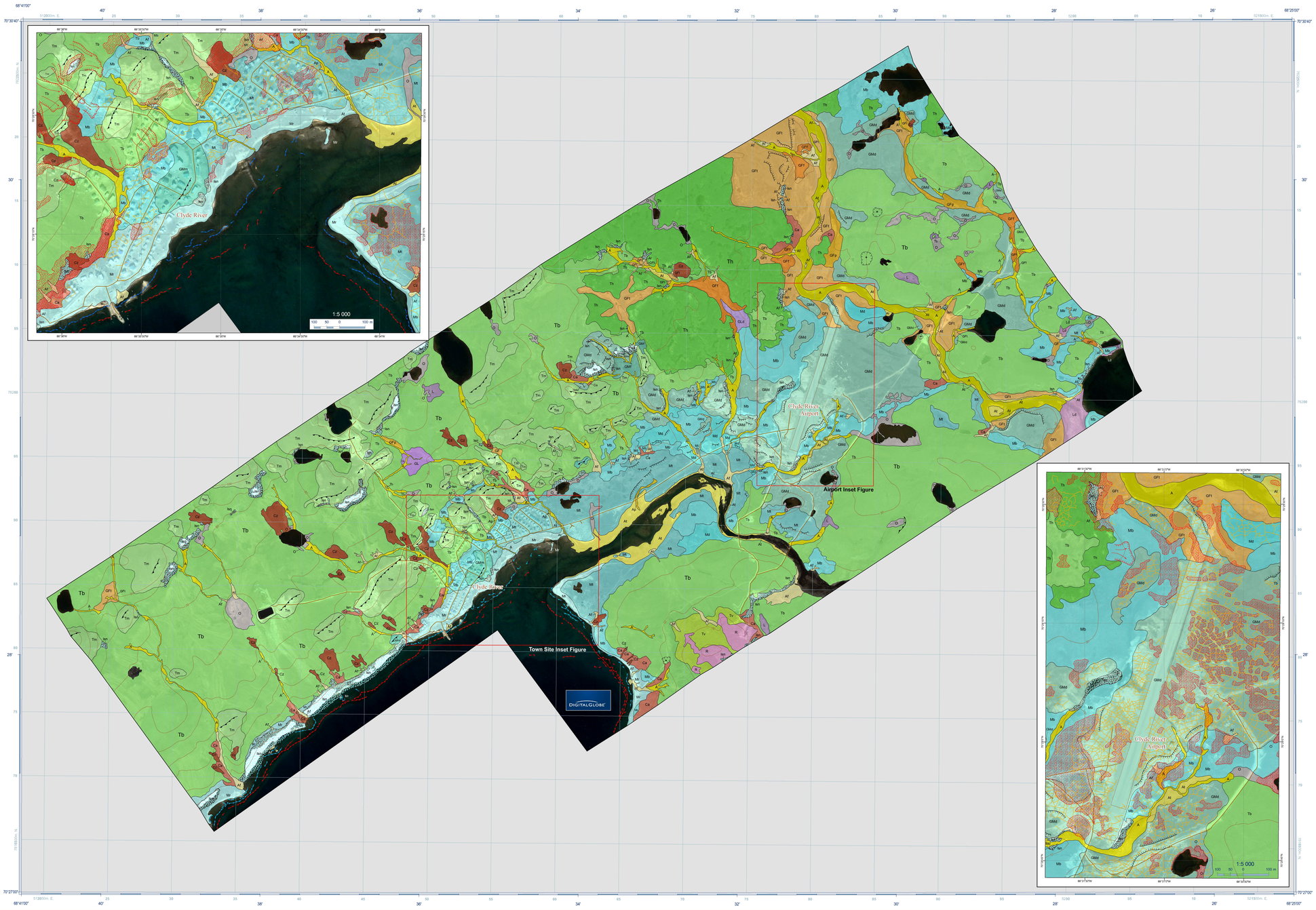
CANADIAN GEOSCIENCE MAP 58
(preliminary version)
SURFICIAL GEOLOGY
CLYDE RIVER
Baffin Island, Nunavut
1:10 000



QUATERNARY
SURFICIAL DEPOSITS
HOLOCENE – POST LAST GLACIATION
NON GLACIAL ENVIRONMENTS

Snow packs: *perennial accumulations of wind-drifted snow and firn in lee-side depressions.*

Colluvial deposits

Cs — ***Colluvial apron:*** *scree (talus) blocky bedrock debris and unconsolidated materials derived from cliff-fall and slope wash forming debris ramps 1 to 10s of metres thick; blocky debris at angle of repose.*

Cl — ***Landslide deposit:*** *accumulations of unconsolidated materials and bedrock debris derived from active layer detachments, slumps, or debris flows.*

Organic deposits

O — ***Organic material (undifferentiated):*** *accumulations of peat and other organic matter in low-lying, often seasonally wet areas, with thicknesses <0.5 to 2 m.*

Alluvial deposits

Af — ***Alluvial fan:*** *sand-silt-gravel, with detrital organic layers; formed by steep gradient streams and at the base of debris flows.*

Ap — ***Alluvial plain:*** *sand-silt-gravel 1–5 m thick; deposited within the floodplain bounds; inclined surface.*

At — ***Alluvial terrace:*** *sand-silt-gravel 1–5 m thick; marks former floodplain levels, below which the river has incised; flat to gently inclined surfaces, generally situated along lateral margins of the modern river.*

A — ***Alluvial sediments (undifferentiated):*** *sand-silt-gravel 1–5 m thick; contains both floodplain and terrace deposits that cannot be resolved at scale of mapping.*

Lacustrine deposits

Ld — ***Deltaic sediments:*** *sand-silt-gravel 1 to >10 m thick deposited by rivers into modern lakes; forms flat to gently inclined surfaces (sometimes terraced) extending from river mouths to below waterline.*

L — ***Lake sediments (undifferentiated):*** *silt-clay-sand and organic sediments deposited in lakes and exposed by fluctuations in water level.*

Marine deposits

Mv — ***Marine beaches:*** *raised beach ridges and the modern transgressive beach; typically comprised of sand and gravel, can have a coarse sediment surface washed lag and ice-pushed boulders.*

Md — ***Marine delta:*** *raised deltaic accumulations of sand-silt-gravel; flat to gently inclined surfaces; deposited by the Clyde River into former higher sea levels during the period of post-glacial isostatic uplift.*

Mt — ***Marine terrace:*** *flat to gently sloped terrain of sand-silt-gravel deposited and reworked in intertidal and estuarine regions during periods of post-glacial isostatic uplift.*

Mb — ***Marine blanket:*** *offshore sand-silt-clay 1–10 m thick; often contains shell fragments.*

POST-GLACIAL OR LATE WISCONSINAN
PROGLACIAL AND GLACIAL ENVIRONMENTS

Glaciofluvial deposits

GFt — ***Glaciofluvial outwash fan:*** *sand and gravel 1–10 m thick.*

GFp — ***Glaciofluvial plain:*** *sand and gravel 1–10 m thick; deposited by deglacial rivers across a floodplain.*

GFt — ***Glaciofluvial terrace:*** *sand and gravel 1–10 m thick. Exposures along river cut banks and tributary drainage channels expose sub-surface coarse cobble and gravel material, suitable as granular aggregate material, northwest of Clyde River airport.*

GF — ***Glaciofluvial sediments (undifferentiated):*** *sand and gravel 1–5 m thick; contains both floodplain and terrace deposits that cannot be resolved at the scale of mapping.*

Glaciolacustrine deposits

GLd — ***Glaciolacustrine delta:*** *beach and delta accumulations of sand and gravel typically formed at the maximum extent of a glacier-dammed lake.*

GL — ***Glaciolacustrine sediments (undifferentiated):*** *massive to current-bedded sand and gravel, 1 to 5 m thick, deposited in a glacier-dammed lake; can infill or shape a landscape.*

Glaciomarine deposits

GMf — ***Glaciomarine fan:*** *raised submarine deposit of sand-silt-gravel often situated in the pro-deltaic environment; inclined surface.*

GMd — ***Glaciomarine delta:*** *raised deltaic accumulations of sand-silt-gravel; flat to gently inclined surfaces; deposited by proglacial rivers into former higher sea levels during deglaciation.*

GMm — ***Submarine moraine complex:*** *non-sorted sand-silt-gravel-boulders deposited as a grounding-line moraine along the lateral base of a marine-grounded glacier.*

Till deposits

Tb — ***Till blanket:*** *till sufficiently thick to obscure the relief of underlying bedrock surface; thicknesses >2 m.*

Tv — ***Till veneer:*** *till insufficiently thick to obscure the relief of underlying bedrock surface; thicknesses <2 m, often discontinuous cover.*

Th — ***Hummocky till:*** *till blanket displaying irregular hummocky surface. Associated with ice-stagnation deposits, and melt out of ice-rich till; often can abut ice-contact stratified deposits.*

Tm — ***Moraine complex:*** *till forming moraine ridges and morainal complexes. Thick till in discontinuous lateral moraines that formed during ice-marginal recession. Can contain patches of ice-contract stratified drift and outwash.*

PRE-QUATERNARY
BEDROCK

R — ***Bedrock:*** *granitic and gneissic rocky terrain exhibiting glacially scoured and weathered felsenmeer surfaces; patchy covers of thin till and colluvium.*

Inset figure location

Geological boundary

Boulder barricade, tidal platform

Boulder barricade, submerged

Moraine, lateral

Terrace scarp, undifferentiated

Karne - large

Periglacial/Permafrost Geology

Nivation hollow

Thermokarst

Gelifluction lobe

Gelifluction lobe flow direction

Ice wedge

Road, gravel

Contour line (interval 10 m)

Note:
Inset figures show detail of the Clyde River town site and airport localities, and include periglacial and permafrost related information from Smith et al. (2011) superimposed on top of the surficial geology.

Mapped coastlines reflect those identified in the 1969 airphotographs; differences between these and the 2005 satellite image reflect erosion and anthropogenic changes. A significant reduction in the modern extent of perennial snowpacks is also noted.

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Surficial and periglacial-permafrost geology mapping based on ground surveys (2007-2009; I.R. Smith, M.L. Irvine) and 1:40 000 scale black and white aerial photos by I.R. Smith using 1:8400 scale black and white vertical airphotos, flight line A21157, August 9, 1969, photos 28–51, 58–81, 126–142.

Cartography by R. Boivin

Basemap images are derived from an orthorectified, near true colour, pansharpened 24 bit QuickBird satellite image (August 21, 2005), copyrighted material of DigitalGlobe, Inc. All Rights Reserved.

CANADIAN GEOSCIENCE MAP 58
SURFICIAL GEOLOGY
CLYDE RIVER
Baffin Island, Nunavut
1:10 000

250 0 250 500 750 1000 m

Map projection Universal Transverse Mercator, zone 19; North America Datum 1983

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

Proximity of the North Magnetic Pole causes the magnetic compass to be erratic in this area.
Magnetic declination 2012, 39°28'W, decreasing 38.7' annually.

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

This publication, including digital data, can be downloaded free of charge from GeoPub (http://geopub.nrcan.gc.ca/). It is also available from the Geological Survey of Canada Bookstore (http://gsc.nrcan.gc.ca/bookstore).

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