

ACKNOWLEDGMENTS

This work was produced under the Nunavut Climate Change Partnership Project (Mate and Reinhart, 2011) and supported through collaboration between the Canada Nunavut Geoscience Office, Université Laval and Natural Resources Canada (Geological Survey of Canada). It also benefited from geoscience, logistical, and helicopter support from the Geo-mapping for Energy and Minerals (GEM) Program, Cumberland Peninsula project. In particular the authors would like to thank Dr. M. Sarbonne-Barris, Dr. A. Dyke, and M. Young from the GEM Cumberland Peninsula project. The authors would also like to express their thanks to the community of Pangnirtung, in particular to Messrs R. Mongeau, J. Unishagak, N. Maniak, and S. Akpalatuk. This work formed the basis of a M.Sc. thesis (A.-S. Carboneau, in prep.).

REFERENCES

- Carboneau, A.-S., in prep. Évolution géomorphologique holocène et caractérisation du pergélisol dans la communauté de Pangnirtung, Île de Baffin, Nunavut. Mémoire de maîtrise, Université Laval, Québec, Québec.
Dyke, A.S., 2011. Surficial geology, Clearwater Fjord-Pangnirtung south, Baffin Island, Nunavut. Geological Survey of Canada, Canadian Geoscience Map 18 (preliminary version), scale 1:100 000, doi:10.4095/289543
LeBlanc, A.-M., Allard, M., Carboneau, A.-S., Oldenborger, G.A., L'Hérault, E., Sladen, W.E., Gosselin, P., and Mate, D., 2012. Assessing permafrost conditions and landscape hazards in support of climate change adaptation in Pangnirtung, Nunavut. Geological Survey of Canada, Open File 6968, 65 pages, doi:10.4095/289548
Mate, D. and Reinhart, F. (ed.), 2011. Nunavut Climate Change Partnership Workshop, February 15-16, 2011, Geological Survey of Canada, Open File 6977, 1 CD-ROM, doi:10.4095/289545

Abstract

The map of surficial geology and periglacial features in Pangnirtung was done to help decision-makers, planners and engineers to better adapt the community to the impacts of climate change. The dominant surface unit on the map consists of colluvium deposits which are ice-rich sandy sediments deposited by overland-flow during snowmelt. Buried soils as old as 7000 cal BP were found embedded in a colluvium layer. In the eastern sector of town, colluvium 1 to 4 metres thick covers till and a network of ice wedges. It also covers ice-rich marine silts and bedrock in the western sector. The central sector of town is occupied by a coarse, boulder-rich, Holocene outwash fan deposited by the Duval River. An alluvial terrace with boulders and some eroded channels were incised by the river in the fan. Bedrock and thick till deposits are found in the upper river valley and on the slopes of the fjord.

Résumé

La carte des conditions du pergélisol et des formes périglaciaires de Pangnirtung a été produite pour aider les décideurs, les urbanistes et les ingénieurs à mieux adapter la communauté aux impacts des changements climatiques. Des colluvions sableuses riches en glace et mises en place lors du ruissellement printanier occupent le plus grande superficie sur la carte. Des lits de matière organique enfouis et datant 7000 cal BP y sont interstratifiés. Dans le secteur est du village, les colluvions, d'une épaisseur de un à quatre mètres, recouvrent un dépôt de till et un réseau de coins de glace. Les colluvions recouvrent des dépôts marins sableux et le roc dans le secteur ouest. Un paléo-cône de déjection d'âge holocène et composé de sable et de gravier a été mis en place par la rivière Duval dans le centre du village. Ce cône a ensuite été incisé par la rivière, entaillant une terrasse alluviale et des chenaux fluviaux. Un épais dépôt de till et du roc sont retrouvés en amont de la rivière, ainsi que sur les versants de la vallée glaciaire.



National Topographic System reference

Cover illustration: The beautiful landscape surrounding the hamlet of Pangnirtung. Photograph by A.-S. Carboneau, 2011-013

Printed map: Catalogue No. M183-185-2011E ISBN 978-0-660-20141-2
Digital map: Catalogue No. M183-185-2011E-PDF ISBN 978-1-100-19001-5

© Her Majesty the Queen in Right of Canada 2012 doi:10.4095/289504

Natural Resources Canada Ressources naturelles Canada

CANADIAN GEOSCIENCE MAP 65 (preliminary version) SURFICIAL GEOLOGY AND PERIGLACIAL FEATURES PANGNIRTUNG

Nunavut 1:5 000

ess.nrcan.gc.ca

Canadian Geoscience Maps Cartes géoscientifiques du Canada



Four trim marks around perimeter of map sheet. Trim map sheet first, then fold at folding marks.

Cover and additional panels are 17cm wide when folded.

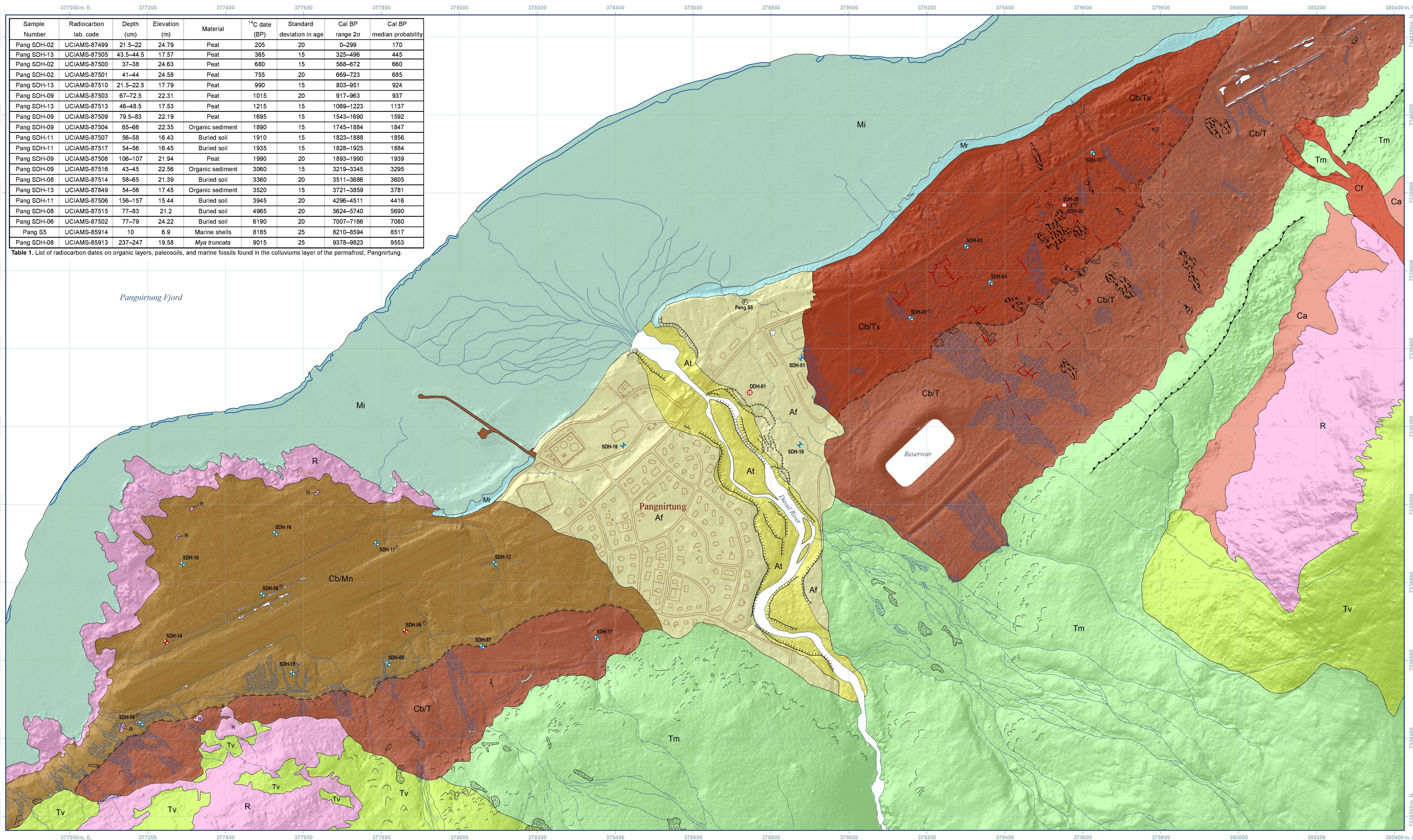


Table 1. List of radiocarbon dates on organic layers, paleosols, and marine fossils found in the colluviums layer of the permafrost, Pangnirtung.

Table with 11 columns: Sample Number, Radiocarbon lab code, Depth (cm), Elevation (m), Material, 14C date (BP), Standard deviation in age, Cal BP range 2σ, and Cal BP median probability. It lists 20 samples with their respective data.

QUATERNARY

- HOLOCENE SEDIMENTS
Colluvial deposits
Ca: Talus; generally active accumulations of blocks and rubble, as much as 50 m thick forming talus (scree) aprons at angle of repose below cliffs derived from rock falls.
Cb/T: Boulder debris flow; blocky to gravelly debris-flow accumulations mixed with silt, 1-50 m thick, traversed by narrow channels and debris levees; intercut slope slopes (Ca) at the exits of prominent debris hopper in cliff; surface slopes less than angle of repose but steeper than those of alluvial fans.
Cb/Mn: Colluvial blanket (Cb) over littoral to nearshore sediments (Mn); colluvium made of sand and gravel layers up to 4 m thick. The underlying marine sediments are composed of gravel, sand and silt, 2-15 m thick depending on the bedrock topography, formed near or at the ice margin.
Cb/Tx: Colluvial blanket (Cb) over reworked till (Tx); colluvium made of sand and gravel layers up to 4 m thick on top of pre-existing washed till deposits below the marine limit. A thin peat layer (5 to 25 cm) overlies the colluvial deposit. Affected by periglacial processes such as gelifluction lobes and frost soils. Ice wedges occasionally present in the near surface permafrost.
Cb/T: Colluvial blanket (Cb) over till (T); colluvium made of sand and gravel layers up to 4 m thick underlain by a till composed of sand gravel and boulders in a silt-sand matrix, more than 20 m thick. A thin peat layer (5 to 25 cm) overlies the colluvial deposit. Affected by periglacial processes such as gelifluction lobes, frost soils and block fields. Ice wedges occasionally present in the near surface permafrost.
Alluvial sediments
Af: Fan sediments; the fan was built by the Duval River and debris flows during the Holocene forming channels and levees, the sediment consists of gravel, sand, and boulders with detrital organic layers and buried soils.
At: Alluvial terraces; gravel, sand, and boulders in terraces; 1-10 m thick, above limit of actual flooding. Formed during the Late Holocene. Affected by tension cracks along the banks of Duval River.
Marine sediments
Mi: Intertidal sediments; silt and sandy silt deposited in the intertidal zone, mostly boulder mudflats. No permafrost is expected.
Mr: Beach sediments; littoral and nearshore sediments deposited as beaches. Permafrost may be present.

- PLEISTOCENE AND EARLY HOLOCENE
Glacial sediments (Tm): sediments deposited in subglacial and ice-marginal environments.
Tm: Lateral moraine; 5-40 m high ridges and hummocks comprised of thick till, forming lateral moraines regarded as the youngest of the Duval moraines during ice-marginal recession. Gelifluction lobes present on the slopes of the moraine. Block fields may also be present.
Tv: Till veneer; Diamictum with silty sand matrix, 0.5-2 m thick and discontinuous; insufficiently thick to mask the relief of underlying bedrock surface.

- PRE-QUATERNARY
R: Bedrock (Precambrian).
Frost boil areas
Blockfields: Localized lag concentrations of boulders due to wavewash or fluvial erosion of till matrix.
String-structured drainage networks: Poorly organized surface drainage networks.
Geological contact
Boulder barricade
Limit of glaciomarine submergence - approximate
Moraine ridge; lateral
Tension cracks caused by collapse of terrain due to thermal erosion
Fluvial terrace scarp
Frost crack (ice wedges)
Gelifluction lobe and sheet terminal margins
Rills and watertracks; running throughout all arctic summer
Rills and watertracks; running occasionally during spring melt

- Legend for symbols: Radiocarbon dated sample location, Thermistor cable location, Permafrost coring site, Permafrost coring site with radiocarbon dated sample, Permafrost coring site with thermistor cable installed, Permafrost coring site with thermistor cable installed and radiocarbon dated sample.

Note: Considering the practical importance of shallow depth geological formations and permafrost conditions, three composite map units (Cb/Mn, Cb/T, Cb/Tx) appear on the map.

Recommended citation: Carboneau, A.-S., Allard, M., LeBlanc, A.-M., L'Hérault, E., Mate, D., Oldenborger, G.A., Gosselin, P., and Sladen, W.E., 2012. Surficial geology and periglacial features, Pangnirtung, Nunavut. Geological Survey of Canada, Canadian Geoscience Map 65 (preliminary version), scale 1:5 000, doi:10.4095/289504

Authors: A.-S. Carboneau¹, M. Allard¹, A.-M. LeBlanc², E. L'Hérault¹, D. Mate², G.A. Oldenborger¹, P. Gosselin¹, and W.E. Sladen¹
¹ Université Laval, Centre d'études nordiques
² Natural Resources Canada, Geological Survey of Canada, Canada Nunavut Geoscience Office

Surficial and periglacial-permafrost geology mapping based on ground surveys (2008-2010), M. Allard, A.-S. Carboneau, E.L'Hérault, A.-M. LeBlanc, and P. Gosselin, and air photo interpretation by A.-S. Carboneau and M. Allard using 1:5000 scale black and white vertical photos, flight line A24493, August 20, 1976, photos 50-58 and 1:3000 scale black and white vertical photos, flight line A25553, August 1, 1980, photos 96-108.

Cartography by A.-S. Carboneau, P. Gosselin, and R. Boivin
This project was mandated by the Government of Nunavut.
Ground Control Points provided by Université Laval.
Map projection Universal Transverse Mercator, zone 20, North America Datum 1983
Infrastructure and base data provided through the Digital Mapping Data Base, property of the Government of Nunavut.

SURFICIAL GEOLOGY AND PERIGLACIAL FEATURES

PANGNIRTUNG

Nunavut 1:5 000



Shaded relief image prepared by A.-S. Carboneau and derived from digital elevation model created from 50 cm WorldView-2 stereo satellite images acquired July 10, 2010. 1 m DEM created using a proprietary stereo image matching process by PhotoSat Information Ltd.
Illumination: azimuth 315°, altitude 45°, vertical factor 1x.
Proximity of the North Magnetic Pole causes the magnetic compass to be erratic in this area.
Magnetic declination 2012: 33°20'W decreasing 20.2' 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 GeoHub (http://geopub.nrcan.gc.ca/). It is also available from the Geological Survey of Canada Bookstore (http://gsc.nrcan.gc.ca/bookstore).

CANADIAN GEOSCIENCE MAP 65 (preliminary version) SURFICIAL GEOLOGY AND PERIGLACIAL FEATURES PANGNIRTUNG Nunavut