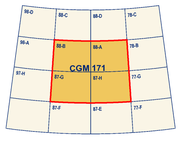
Abstract

Victoria Island is in the western Canadian Arctic Islands, Northwest Territories, Canada (parts of NTS 87-G, 87-H, 88-A, and 88-B). The bedrock consists of Cambrian to Devonian sedimentary rocks (sandstone, limestone and dolostone) that unconformably overlie Neoproterozoic rocks. Eight map units are recognized and mapped. Strata are generally flat lying or have a very gentle northwest dip. Numerous ENE-WSW oriented normal faults offset lower Paleozoic strata and locally increase the dip. At least some of these faults were active in the Early Cambrian and again in the Middle Cambrian. The faults cut a Devonian unit indicating fault movement after that time. An anomalous circular structure in the northeastern part of the map area, approximately 25 km in diameter, contains steep dips, faulting and numerous shatter cones. It is interpreted as the root of a meteorite impact crater.

Résumé

L'île Victoria se situe dans l'ouest de l'archipel Arctique canadien, dans le Territoires de Nord-Ouest (SNRC parties de 87-G, 87-H, 88-A et 88-B). Le socle se compose de roches sédimentaires (grès, calcaire et dolomite) du Cambrien au Dévonien, qui reposent en discordance sur des roches du Néoprotérozoïque. Huit unités géologiques ont été définies et cartographiées. Les strates sont généralement disposées à l'horizontale ou plongent très faiblement vers le nord-ouest. De nombreuses failles d'orientation est-nord-est – ouest-sud-ouest décalent les strates du Paléozoïque inférieur et accroissent par endroits leur pendage. Un certain nombre de ces failles ont été actives au Cambrien précoce et à nouveau au Cambrien moyen. Les failles recoupent une unité du Dévonien, ce qui témoigne de leur mouvement postérieur à ce moment. Une structure circulaire de caractère anormal dans la partie nord-ouest de la région cartographique, d'un diamètre d'environ 25 km, comprend des unités fortement inclinées, de la fracturation et de nombreux cônes de fracturation. Selon les interprétations, il s'agirait de la racine d'un cratère d'impact météoritique.



National Topographic System reference

Cover illustration
Looking west from outcrop of Victoria Island formation towards resistant outcrops of Neoproterozoic Shaler Supergroup in the distance. Near the head of Minto Inlet, Victoria Island. Photograph by B. Pratt. 2013-308

Catalogue No. M183-1/171-2013E-PDF
ISBN 978-1-100-23079-5
doi:10.4095/295530

© Her Majesty the Queen in Right of Canada, as represented by the Minister of Natural Resources Canada, 2015

Natural Resources Canada | Ressources naturelles du Canada

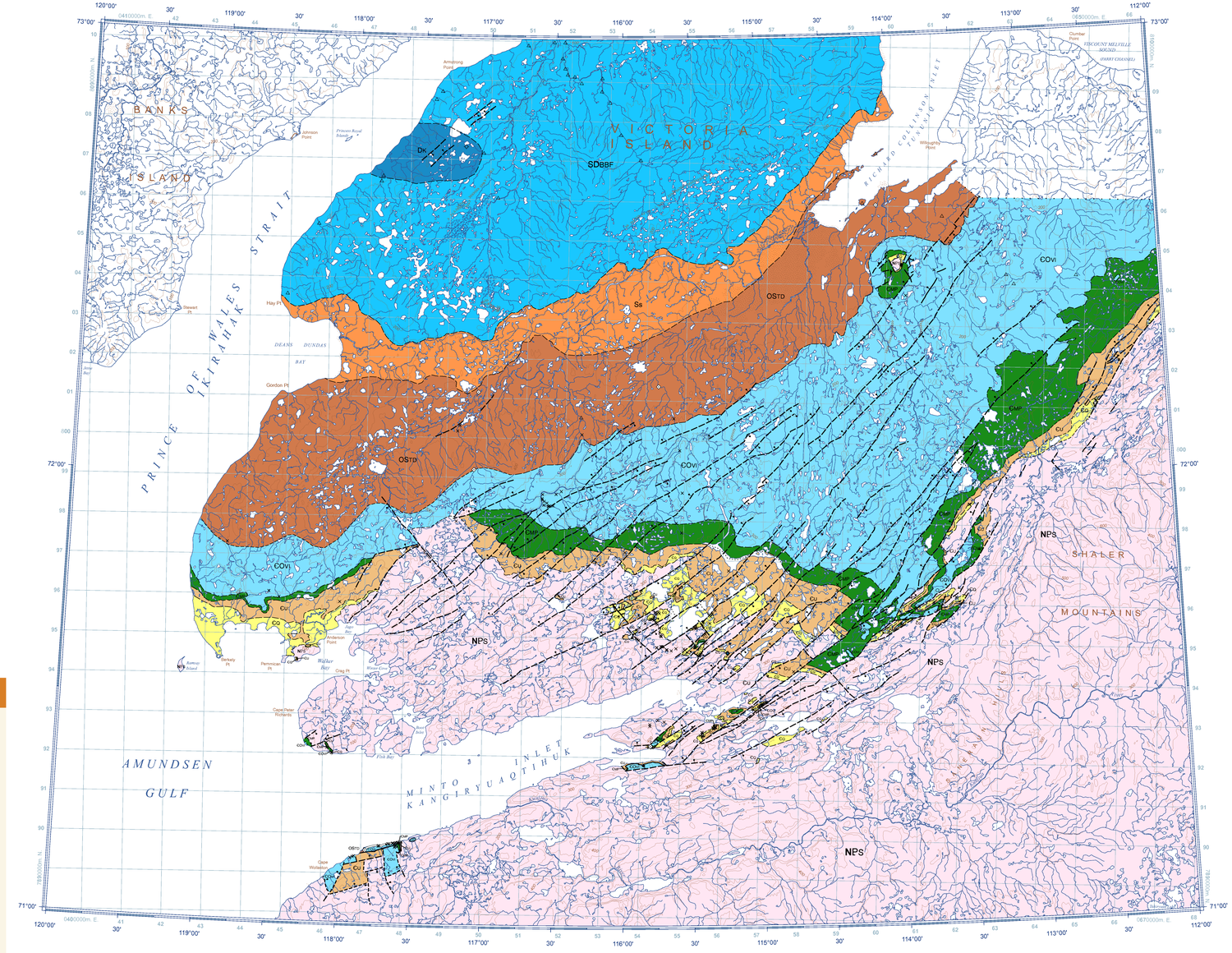
CANADIAN GEOSCIENCE MAP 171

PHANEROZOIC GEOLOGY

NORTHWESTERN VICTORIA ISLAND

Northwest Territories

1:500 000



DEVONIAN

Dk — **Kitson Formation:** Shale and argillaceous limestone, black to dark grey, poorly exposed.

SILURIAN -DEVONIAN

SDBBF — **Undivided Barlow Inlet and Blue Fiord formations:** Limestone, light grey to greenish weathering, wackestone to packstone with abundant brachiopods, corals and crinoids.

SILURIAN

Ss — **Silurian shale:** Shale, dark brown, calcareous and bituminous; interbedded with lime mudstone to wackestone, light brown. Not exposed. Inferred from well logs and topographic expression.

ORDOVICIAN-SILURIAN

OSTD — **Thumb Mountain, Allen Bay, Cape Storm, Douro formations undivided:** Poorly exposed carbonate strata of probable Silurian age, tentatively assigned to the Allen Bay Formation: dolomudstone, light grey to brown, thick bedded, fine to medium crystalline, burrow mottled, locally with large bioherms consisting of vuggy dolomudstone and rare stromatolites. Wireline logs indicate this unit is 650 m on NW Victoria Island. The Allen Bay Formation overlies fossiliferous dolostone of the Thumb Mountain Formation consisting of finely crystalline, burrow mottled, nodular to thinly bedded dolomudstone, dolowackestone and dolopackstone. Fossils include crinoids, solitary rugose and colonial tabulate corals, aulocerids, gastropods, and cephalopods. These fossils and conodonts indicate an Upper Ordovician age. Thickness estimated at 250 m. Lack of outcrop makes mapping the contact between these two units difficult in most areas.

CAMBRIAN-ORDOVICIAN

COVi — **Victoria Island formation:** Dolostone, light grey to almost white weathering, fine- to coarsely-crystalline, fabric destructive. Locally preserved primary structures include horizontal bedding, crossbedded oolitic grainstone beds, thrombolite and stromatolite bioherms, microbial lamination, and intraformational conglomerate. Fossils rare but include silicified gastropods. Silicification widespread in the upper two-thirds of the unit. Chert occurs as prominent white-weathering beds and nodules, 5 to 60 cm thick, and composed of microcrystalline chert or as silicified stromatolites. The lower contact is gradational with the Shaler unit with the contact placed at the highest shale interbed. The upper contact is sharp and inferred to be unconformable. Early Ordovician conodonts occur in samples directly below the upper contact. Thickness is 550 m on the south shore of Minto Inlet.

CAMBRIAN

CMP — **Mount Phayre formation:** Thin- to medium-bedded red mudstone-siltstone interbedded with green dolomudstone. Outcrops have a distinctive stripy appearance. Sedimentary structures include mudcracks, wave ripples, small stromatolites, micro-karsted exposure surfaces, and microbial lamination. Mudstones contain Middle Cambrian trilobites. The lower contact is covered in most places. Thickness ranges between 15–95 m.

Cu — **Uvayualuk formation:** Dolomudstone to dolarenite, light brown, mottled to bioturbated. Thrombolite mounds are locally well developed and together with metre-scale cross-stratification suggest a shallow marine setting. Locally present at the base is a grey mudstone unit 3 to 5 m thick with a gradational contact to the dolostone. Early Cambrian trilobites were recovered from the lower mudstone beds. Thickness is 30–45 m.

Cq — **Quyuk formation:** Quartz arenite and minor mudstone, red-brown to orange weathering, sandstone fine- to coarse-grained. Sedimentary structures include lamination, wave and current ripples, and 10 cm to 2 m thick cross-stratified beds. Skolithos. Reactivation surfaces and foresets with rounded tops indicate an influence by tidal currents. Mudstones contain Early Cambrian trilobites. Distribution and thickness are variable; thickness ranges from 0 m to 90 m.

NEOPROTEROZOIC

NPS — **Shaler Supergroup:** Carbonate, sandstone, shale, and sulphate evaporite rocks of the Shaler Supergroup, basalt of the Natkusiak Formation, and diabase sills and dykes of the Franklin Igneous Event.

DESCRIPTIVE NOTES

Victoria Island is located in the western Canadian Arctic Islands. Despite being the ninth largest island in the world, slightly smaller than Great Britain, Victoria Island has received scant attention from geologists due to its remoteness, coupled with poor outcrop and the lack of economic potential. The objective of this project is to determine the thickness and ages of the lower Paleozoic stratigraphic units, and to map their distribution.

Compilation Methods

Lower Paleozoic strata from northwestern Victoria Island were originally described by Thorsteinsson and Tozer (1962). The only other stratigraphic information comes from industry reports submitted to the National Energy Board or the Northwest Territories Geoscience office. One hydrocarbon exploration well has been drilled on Victoria Island. The Murphy et al. Victoria F-36 well was drilled on northwestern most Victoria Island to a depth of 2457 m. The well history report (Batten, 1975) provides sample descriptions and wireline logs. One mining exploration core penetrates the lower Paleozoic succession (Morgan, 2007). Data from the maps of Rainbird et al. (2013a,b) were used to constrain the extent of Paleozoic strata.

This map is based on thirteen weeks of field work over three field seasons in 2009–2011. Outcrop on Victoria Island is generally poor and confined to the coast, along rivers, and isolated outcrops. Drift cover is extensive, hence, contacts are generally inferred.

General Geology

There are two physiographic regions on Victoria Island. The Shaler Mountains run diagonally across the island and are underlain by Neoproterozoic sedimentary and igneous rocks of the Shaler Supergroup. To the northwest and southeast of the Shaler Mountains are lowlands underlain by very gently dipping lower Paleozoic sedimentary rocks and covered by an extensive blanket of Quaternary sediments.

Lower Paleozoic strata are part of the Arctic Platform. The Arctic Platform covered most of the Arctic Islands from the Early Cambrian to Early Devonian and reflects sedimentation on the northern passive margin of ancestral North America (Laurentia).

Structures

Phanerozoic strata are generally flat lying or have a very gentle northwest dip. Mapping and aeromagnetic data indicate that widespread ENE-WSW oriented normal faults offset lower Paleozoic strata. At least some of these faults were active in the Early Cambrian and again in the Middle Cambrian as shown by thickness changes in Quyuk formation and Mount Phayre formation. The faults cut the Devonian Kitson Formation indicating principle movement after that time. The aeromagnetic signature of NW-trending Neoproterozoic dykes are not offset across the NE-trending faults, indicating minimal strike-slip motion. Vertical to steeply oblique slicken lines observed at a single outcrop indicate dip-slip motion of the ENE-WSW trending faults. NW-trending strike-slip faults, exhibiting near horizontal slicken lines at a single outcrop, connect the ENE-trending normal faults.

Mapping on northwestern Victoria Island revealed an anomalous structural entity in otherwise flat-lying lower Paleozoic carbonate rocks, south of Richard Collinson Inlet. The feature is roughly circular in plan view, approximately 25 km in diameter, and characterized by outward dips of ~45° in the centre, decreasing laterally. The core of the feature also exhibits local vertical dips, thrust faults, and drag folds. Shatter cones are pervasive in all lithologies in the central area, including Neoproterozoic gabbro and limestone. Their abundance drops off laterally, and none was observed in surrounding, horizontally bedded strata. This structural anomaly is interpreted as the root of a meteorite impact crater, and the dipping strata the remnants of the central peak uplift (Dewing et al., 2013). Timing of impact is unknown, but it took place after regional, hydrothermal dolomitization of the Upper Ordovician carbonates and substantial burial, thus possibly in Devonian time or later.

REFERENCES

Batten, W.H.R., 1975. Arctic well history report, Murphy Aliminex Victoria Island F-36. National Energy Board report 063-11-09-024. 66 p.

Dewing, K., Pratt, B.R., Hadlari, T., Brent, T., Bedard, J., and Rainbird, R.H., 2013. Newly identified impact structure, Prince Albert Peninsula, northwestern Victoria Island, Arctic Canada. Meteoritics and Planetary Science, v. 48, p. 211–223.

Morgan, D. (comp.), 2007. Geological, geochemical, and geophysical report in fulfillment of representational work requirements for the Victoria Island Ni-Cu-PGE and diamond project in the Minto Inlet Area, Victoria Island, Northwest Territories. Submitted to the Northwest Territories Geoscience Office assessment file 085086.

Rainbird, R.H., Bédard, J.H., Dewing, K., Hadlari, T., and Thomson, D., 2013a. Geology, Qiqiktilvik, Victoria Island, Northwest Territories; Geological Survey of Canada, Canadian Geoscience Map 59 (preliminary), scale 1:50 000. doi:10.4095/293259

Rainbird, R.H., Bédard, J.H., and Williamson, N., 2013b. Geology, Takiyuaqatlak, Victoria Island, Northwest Territories; Geological Survey of Canada, Canadian Geoscience Map 104 (preliminary), scale 1:50 000. doi:10.4095/293344

Thorsteinsson, R., and Tozer, T. 1962. Banks, Victoria, and Stefansson Islands, Arctic Archipelago. Geological Survey of Canada, Memoir 330, 85 p.

ACKNOWLEDGMENTS

We thank Andrew Durbano, Margaret Kanayok, Jamie Kimikaana, Gary Okeena, and Derrick Midwinter for assistance in the field; Elizabeth Turner (Laurentian University) and Lisel Currie (GSC) for stratigraphic and locality information; Brian Pratt (University of Saskatchewan) for help in the field and trilobite identification; Godfrey Nowlan for conodont identification; Tom Brent for help with digital elevation models. Arctic Char Inn (Ulukhaktok), the Okalhakomut Hunters and Trappers Committee, and the Hamlet of Ulukhaktok are thanked for their support. We thank Karen Fallas for a careful internal review. This work was part of the Western Arctic Islands project of NRCan's Geo-mapping for Energy and Minerals (GEM) program. Logistical support provided by the Polar Continental Shelf Project as part of its mandate to promote scientific research in the Canadian North. PCSP 010-10 (2010) and 018-11 (2011).

Recommended citation
Dewing K., Hadlari T., Rainbird R.H., and Bédard J.H., 2015. Phanerozoic geology, northwestern Victoria Island, Northwest Territories; Geological Survey of Canada, Canadian Geoscience Map 171 (preliminary), scale 1:500 000. doi:10.4095/295530

ess.nrcan.gc.ca

Canadian Geoscience Maps

Canada

Authors: K. Dewing, T. Hadlari, R.H. Rainbird, and J.H. Bédard

Geology by K. Dewing and T. Hadlari, based on ground and air observations 2009–2011, compilation of spectral imagery datasets 2010–2012, and compilation of Rainbird et al. (2013) maps. Also based in part on previous fieldwork reported by D.A. Ehman, J.C. Wise, 1971, W.H. Fritz, 1967 and 1971, PetroCanada Exploration Inc. 1978, B. Plauchut and G. Jutard, 1967.

Geological compilation by K. Dewing and T. Hadlari, 2010–2013

Geology conforms to Bedrock Data Model v.3.1

Geomatics by C. Deblonde

Cartography by J. Gardner and M.Le

Initiative of the Geological Survey of Canada, conducted under the auspices of the Western Arctic Islands Project as part of Natural Resources Canada's Geo-mapping for Energy and Minerals (GEM) program.

Logistical support provided by the Polar Continental Shelf Project as part of its mandate to promote scientific research in the Canadian North. PCSP 010-10 (2010) and PCSP 018-11 (2011)

CANADIAN GEOSCIENCE MAP 171

PHANEROZOIC GEOLOGY

NORTHWESTERN VICTORIA ISLAND

Northwest Territories

1:500 000

10 0 10 20 30 40 km

Map projection Universal Transverse Mercator, zone 11 North American Datum 1983

Base map at the scale of 1:250 000 from Natural Resources Canada, with modifications.
Elevations in metres above mean sea level

Proximity to the North Magnetic Pole causes the magnetic compass to be erratic in this area. Mean magnetic declination 2015, 19°58'E decreasing 57' annually. Readings vary from 15°01'E in the NE corner to 22°45'E in the SW 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 digital data. Additional descriptive notes and references are included in the map information document.

This publication is available for free download through GEOSCAN (http://geoscan.nrcan.gc.ca/).

This map is not to be used for navigational purposes.

Preliminary publications in this series have not been scientifically edited.

CANADIAN GEOSCIENCE MAP 171

PHANEROZOIC GEOLOGY

NORTHWESTERN VICTORIA ISLAND

Northwest Territories

Geological contacts
- Defined
- Approximate
- Inferred
- Concealed
- Limit of mapping

Faults
- Motion undefined, location defined
- Motion undefined, location approximate
- Normal, location defined, symbol on hanging wall
- Normal, location approximate, symbol on hanging wall
- Normal, location inferred, symbol on hanging wall
- Reverse, location defined
- Thrust, location approximate, symbol on hanging wall
- Oblique-slip, dextral, normal, location approximate
- Sinistral strike-slip, location defined (symbol may not display accurately at this scale)

Age control
- Geochronology result locality
- Fossil locality

Stations
- Visited outcrop
- Archival observation
- Aerial observation
- Measured section

Boreholes
- Mineral exploration
- Petroleum exploration well, dry and abandoned