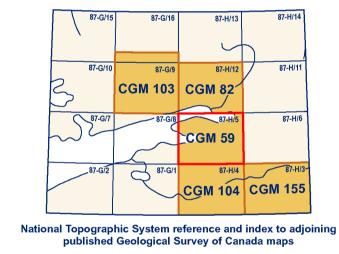
DESCRIPTIVE NOTES

The map area (NTS 87-H/5) lies within the Minto Inlier, a ~300 km long by 100-150 km wide belt of gently folded sedimentary and igneous rocks of early Neoproterozoic (late Tonian-early Cryogenian) age. The Neoproterozoic sedimentary strata belong to the Shaler Supergroup, an approximately 4 km thick succession of shallow marine carbonate rocks and evaporite rocks with interbedded terrigenous rocks that were mainly deposited in a shallow intracontinental epeiric sea, referred to as the Amundsen Basin (Rainbird et al., 1994; Rainbird et al., 1996a; Thorsteinsson and Tozer, 1962; Young, 1981). The basin is considered to have formed within the supercontinent Rodinia and exposures of similar rocks, in what are now the Mackenzie Mountains of the northern Cordillera, suggest that it extended for more than 1000 km to the southwest (Long et al., 2008; Rainbird et al., 1996a). The sedimentary succession is intercalated with mafic sills of the ca. 720 Ma Franklin igneous event (Heaman et al., 1992). The sills are of variable thickness up to 100 m, but most are 20–60 m thick. In many cases, individual sills extend for 20 km or more along-strike with little significant change in thickness. Sills constitute anywhere from 10 to 50 per cent of the stratigraphic section. Sills of similar type and age also occur in the Coppermine Homocline, Brock Inlier and Duke of York Inlier to the south (Rainbird et al., 1996b; Shellnutt et al., 2004) and coeval, geochemically similar intrusions and volcanic rocks associated with the Franklin event extend from Greenland to the western Yukon (Denyszyn et al., 2009; Heaman et al., 1992; Macdonald et al., 2010). The Shaler Supergroup in Minto Inlier is capped by a succession of flood basalt flows and interflow sedimentary rocks (Natkusiak Fm), more than 1 km thick, which are the extrusive equivalent of the sills (Baragar, 1976; Jefferson et al., 1985). Rare north-northwest-striking dykes are interpreted to have intruded along syn-magmatic normal faults, to feed sills and possibly the flood basalts (Bédard et al., 2012). Three magma populations are identified in the lavas, which have correlatives in the different sill subtypes. The oldest sills and corresponding basal lavas are enriched in incompatible trace elements and may have olivine-enriched bases. Younger diabasic sills correspond to the major sheet-flow units of the lava succession. Basal strata of the Shaler Supergroup (Rae Group) are exposed only at the northeastern end of Minto Inlier, near Hadley Bay, where they unconformably overlie Paleoproterozoic sedimentary rocks, which, in turn, unconformably overlie Archean granitic rocks (Campbell, 1981 Rainbird et al., 1994). The irregular edge of Minto Inlier is defined by an erosional unconformity that separates the Neoproterozoic rocks from Lower Cambrian sandstone and siltstone that pass upward into a thick succession of mainly dolomitic carbonate rocks, ranging in age from Cambrian to Devonian (Thorsteinsson and Tozer, 1962). Structurally, the Minto Inlier is relatively simple, composed of the open, northeast-trending Holman Island syncline and the smaller Walker Bay anticline to the northwest. Beds typically dip no more than 10° and there is generally no penetrative cleavage or other apparent outcrop-scale fabric. The origin of the folding is unknown but it occurred after deposition of the early Neoproterozoic rocks and before uplift, erosion and deposition of overlying lower Cambrian siliclastic rocks, which are not folded. All rocks are dissected by east-northeast to east-trending faults that form a horst and graben system with up to 200 of metres of stratigraphic separation on individual faults. The zone of faulting is about 100 km wide and stretches from the head of Minto Inlet in the west to Wynniatt Bay in the east and is spectacularly imaged as prominent lineaments on recently published aeromagnetic maps (e.g. Kiss and Oneschuk, 2010).

NTS 87-H/5 is underlain by stratigraphic units from the upper Minto Inlet, Wynniatt and lower Kilian formations of the Shaler Supergroup. Together with diabase sills the strata comprise the gently south-dipping northern limb of the Holman Island Syncline. Exposures of the Minto Inlet Formation are limited to a few small outcrops near the southern shore of Minto Inlet in the northern part of the map area. Rocks are crumbly weathering, thin- to thick laminated white gypsum with interbedded grey-green calcisiltite, gypsiferous siltstone and nodular gypsum. Some of the best exposures of the Wynniatt Formation in the western Minto Inlier are located in this map area. The lower carbonate member (nPw1) and black shale member (nPw2; for descriptions, see legend) are best exposed in two creek sections located at UTM, 537945E, 7926620N and UTM, 542231E, 7928002N. The stromatolitic member (nPw3; see legend) outcrops well at UTM, 552845E, 7930500N and the lower part of the upper carbonate member (nPW4; see legend) occurs along a canyon downstream from a spectacular waterfall at UTM, 563391E, 7926880N. The upper part of the upper carbonate member is quite recessive but part of it is well exposed along a creek at UTM, 565510E, 7920837N. The contact with the Kilian Formation occurs near the top of a hill that is about 2 km north of Qiqittiivik (approx. UTM, 549293E, 7912967N. To the south of this lake is a good section through the carbonate-evaporite member (nPK1) of the Kilian (see legend). The overlying clastic carbonate-member (nPK2) is partly exposed on the west side of a narrow canyon located along the southern border of the map sheet at UTM, 560597E, 7906343N. Approximately 10–12 diabase sills occur within the map area and generally are spaced at regular intervals within the host sedimentary rocks. Most sills are of the type 2 (diabasic) described in the legend. There is a greater concentration of thicker sills in the southeast part of the map area. Cross-cutting, dyke-like bodies occur in the southwest part of the map area (South Feeder Dyke Complex of Bédard et al., 2012) and are observed to feed upward into one of the aforementioned sills at UTM, 547642E, 7908530N. Dykes occupy normal faults with variable senses of motion. A single occurrence of the type 1 (high Ce/Yb) magma type occurs in a brecciated dyke tip of the Southern Feeder Dyke Complex (UTM, 544426E, 7911257N). Most of the northern half of the map area is affected by the block faulting described above. An east-west fault in the middle of the map is truncated by a series of northeast-trending faults that define gräben,which preserve significant sections of Cambro-Ordovician sedimentary rocks, including all four units described in the legend. An unconformity between the Wynniatt Formation and the Cambrian lower clastic unit is well exposed at UTM, 554990E, 7926029N. Here an extensive paleokarst with paleo-caverns infilled with quartzarenite is developed over a broad area (Mathieu et al, 2013). Overlying crossbedded quartzarenite exhibits soft-sediment deformation, water-escape cylinders and other collapse features. Excellent exposures of the Cambro-Ordovician stratigraphy include a creek section at UTM, 542899E, 7922716N, a section that begins just east the paleokarst occurrence and ends on a hill (Uvayualuk), and a hill section in the northeast corner of the map area.

NTS 87-H/5 is underlain by the upper Minto Inlet, Wynniatt and lower Kilian formations of the Shaler Supergroup. Together with diabase sills, the strata comprise the gently south-dipping northern limb of the Holman Island Syncline. The best exposures of the Wynniatt Formation (bedded-carbonate and shale) in the western Minto Inlier are located here. The lower half of the Kilian Formation (carbonate+evaporite) is intermittently exposed in the southern part of the sheet. Diabase sills are of diabasic type 2 (see legend). A dyke-like mafic intrusion occurs in the southwest part of the map area. The northern half of the area is affected by east-west block faulting, which preserves Cambrian sandstone and siltstone and a thick section of recrystallized Ordovician(?) dolostone (Victoria Island Formation). An unconformity between the Wynniatt Formation and the Cambrian lower clastic unit reveals extensive paleokarst with paleo-caverns infilled with feuillet est affectée par des failles orientées est-ouest, quartzarenite. The quartzarenite exhibits soft-sediment avec préservation dans des graben de grès Cambriens

Le Feuillet NTS 87-H/5 expose des roches de la fenêtre Protérozoïque Minto qui sont superposés en discordance par des roches sédimentaires Paléozoïques. Les roches Protérozoïques appartiennent au Supergroupe de Shaler, Formations de Minto Inlet Supérieur. Wynniatt et Kilian Inférieur; lesquelles sont injectées par des filons et filons-couches diabasiques de l'évènement Franklin. Les strates constituent le flanc nord du Synclinal Holman Island, et pendent doucement vers le sud. Le feuillet expose les meilleurs affleurements de la Formation Wynniatt (carbonates et shales) de la fenêtre Minto occidentale. La partie inférieure de la Formation de Kilian (carbonates +évaporites) est exposée localement dans la partie sud du feuillet. Les filons diabasiques sont du type 2 (voire légende). Une intrusion mafique discordante affleure dans la partie sud-ouest du feuillet. La partie nord du et de siltstones et dolomies recristallisés d'âd Ordovicien(?) de la Formation Victoria Island. L discordance entre les roches du Wynniatt et la couverture clastique cambrienne est marquée par des paléokarstes et paléo-grottes remplies par de l'arénite à quartz où l'on voit de la déformation de sédiment nonconsolidé, des structures cylindriques crées par la



Cover illustration Southeast from Minto Inlet toward Uvayualuk. In cliffface, Wynniatt Fm. black shale member overlain by orange-weathering dolostone of stromatolitic carbonate member, Victoria Island, Northwest Territories. Photograph by R. Rainbird. 2012-035

Catalogue No. M183-1/59-2011E-PDF ISBN 978-1-100-19595-7 doi:10.4095/293259

© Her Majesty the Queen in Right of Canada 2013

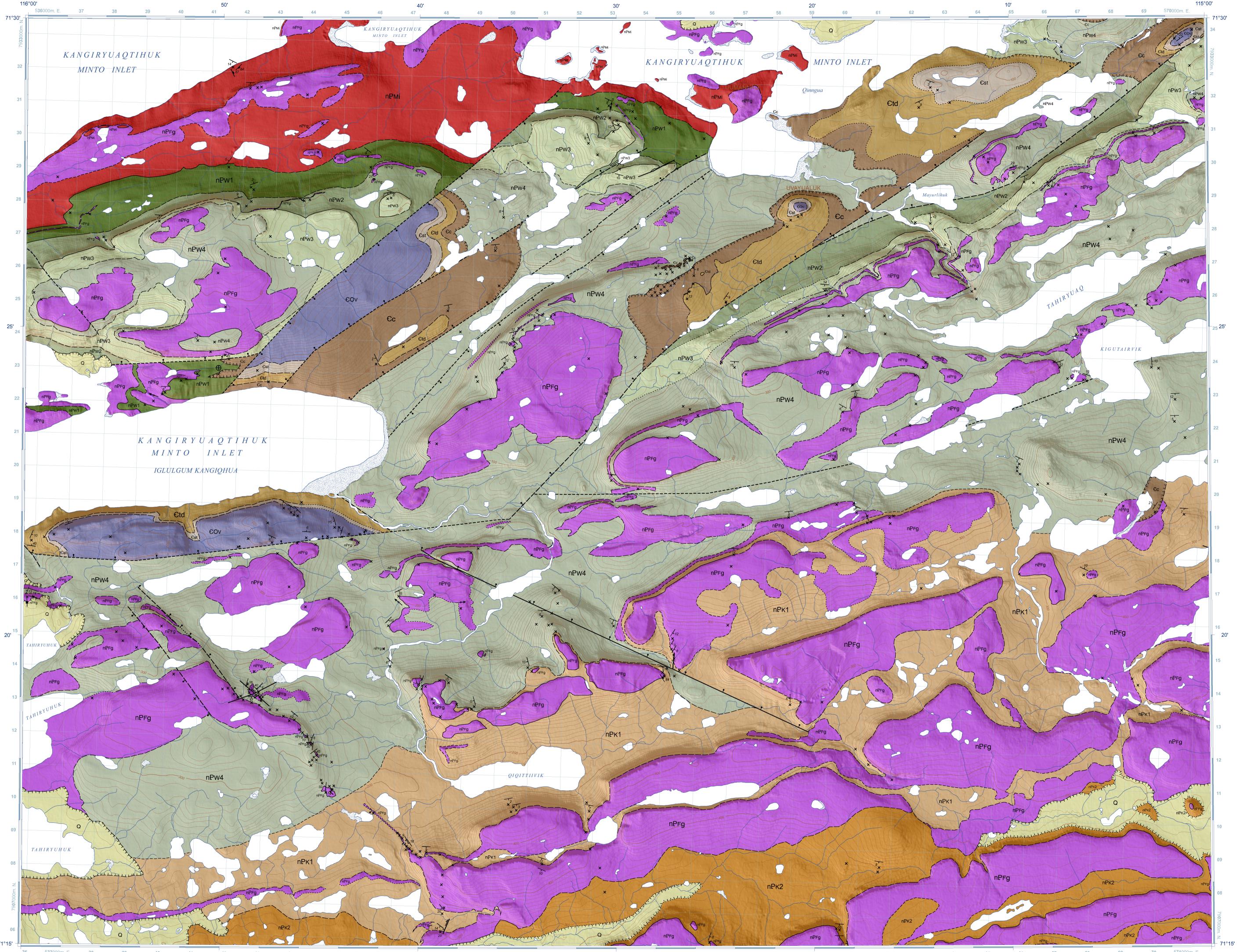
Natural Resources Ressources naturelles du Canada

CANADIAN GEOSCIENCE MAP 59 GEOLOGY

QIQITTIIVIK Victoria Island, Northwest Territories



KANGIRYUAQTIHUK MINTO INLET KANGIRYUAQTIHUK $M \ I \ N \ T \ O \qquad | \ I \ N \ L \ E \ T$ IGLULGUM KANGIQHUA déshydratation, et d'autres structures d'effondrement. TAHIRYUHUK



CANADIAN GEOSCIENCE MAP 59

Contact: depositional, depositional-conformable, intrusive. metamorphic, or undefined type Defined / Approximate / Inferred Concealed Contact; depositional-unconformable Defined イブトーイ Approximate رم^{۲۱۲}۲۶۰۲۰٬ Concealed Fault, generic, steep dip — Defined ———— Approximate ----- Inferred Fault, normal; upright, or upright - assumed from archival data, or not applicable ____ Defined **─┬─·** Approximate

Ground observation

Axial plane, horizontal

Glacial striation or groove

Igneous layering

Geological Survey of Canada, Paper 76-1A, p. 347-352.

Geological Survey of Canada, Paper 85-1A, p. 203–214.

Bulletin, v. 124, p. 723–736. doi 10.1130/B30450.1

of Canada, Paper 81-1A, p. 15-22.

Science Letters, v. 109, p. 117–131.

Fault plane or small, minor shear fault. Showing dip. Arrow shows

direction of relative horizontal displacement

Flute, tool mark, or prod mark; measured at station

REFERENCES

Baragar, W.R.A., 1976. The Natkusiak basalts, Victoria Island, District of Franklin, in Current Research, Part A;

Bédard, J.H., Naslund. H.R., Nabelek, P., Winpenny, A., Hryciuk, M., Macdonald, W., Hayes, B., Steigerwaldt, K.,

Hadlari, T., Rainbird, R., Dewing, K., and Girard, É., 2012. Fault-mediated melt ascent in a Neoproterozoic

Campbell, F.H.A., 1981. Stratigraphy and tectono-depositional relationships of the Proterozoic rocks of the

Denyszyn, S.W., Halls, H.C., Davis, D.W., and Evans, D.A.D., 2009. Paleomagnetism and U-Pb geochronology

Heaman, L.M., LeCheminant, A.N., and Rainbird, R.H., 1992. Nature and timing of Franklin igneous events,

Jefferson, C.W., Nelson, W.E., Kirkham, R.V., Reedman, J.H., and Scoates, R.F.J., 1985. Geology and copper

Kiss, F. and Oneschuk, D., 2010. First vertical derivative of the magnetic field, Minto Inlier Aeromagnetic Survey,

occurrences of the Natkusiak basalts, Victoria Island, District of Franklin; in Current Research, Part A;

Victoria Island, NTS 87 H/SW, Northwest Territories; Geological Survey of Canada, Open File 6707;

Long, D.G.F., Rainbird, R.H., Turner, E.C., and MacNaughton, R.B., 2008. Early Neoproterozoic strata

(Sequence B) of mainland northern Canada and Victoria and Banks islands; a contribution to the Geological

Atlas of the Northern Canadian Mainland Sedimentary Basin; Geological Survey of Canada, Open File 5700,

Canada: implications for a late Proterozoic mantle plume and the break-up of Laurentia; Earth and Planetary

of Franklin dykes in high arctic Canada and Greenland: A revised age and paleomagnetic pole constraining block rotations in the Nares Strait region; Canadian Journal of Earth Sciences, v. 46(9), p. 689–705.

Hadley Bay area, northern Victoria Island, District of Franklin; in Current Research, Part A; Geological Survey

continental flood basalt province, the Franklin sills, Victoria Island, Canada; Geological Society of America

micro-karsted exposure surfaces, and microbial lamination indicating a shallow marine, subtidal to intertidal setting. Mudstones contain Middle Cambrian trilobites. The lower contact is covered in most places. Thickness ranges Tan dolostone unit: Light brown dolomudstone to dolarenite. Thrombolite mounds are locally well developed and together with metre-scale ----- Inferred cross-stratification suggest a shallow marine setting. Although no fossils were ····I····· Concealed

Planar structure

Linear structure

recovered from this unit, the lower contact is gradational with mudstones that contain Early Cambrian trilobites. Thickness is 30-45 m. Clastic unit: Red-brown to orange weathering fine to coarse grained quartz arenite and mudstone at the base of the Paleozoic succession. Sedimentary structures are lamination, wave and current ripples, and 10 cm to 2 m thick cross-stratified beds. Reactivation surfaces and foresets with rounded tops indicate an influence by tidal currents. Depositional environment is considered to be shallow marine. Mudstones contain Lower Cambrian trilobites. Distribution and thickness are variable; thickness ranges from 0 m to 90 m. NEOPROTEROZOIC

Victoria Island formation: Light grey to almost white weathering, fine to

northwestern Victoria Island. Locally preserved primary structures include

norizontal bedding, crossbedded oolitic grainstone beds, thrombolite and

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. Some vugs contain

conglomerate. Fossils are rare but include silicified gastropods. Silicification is

crystalline quartz. Depositional environment is interpreted as a broad, shallow

carbonate platform. The lower contact is gradational with the Stripy unit with

the contact 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

Stripy unit: Thin- to medium-bedded red mudstone-siltstone interbedded with

Sedimentary structures include mudcracks, wave ripples, small stromatolites,

green dolomudstone. Outcrops have a distinctive stripy appearance.

between 15-95 m.

stromatolite bioherms, microbial lamination, and intraformational

coarsely crystalline fabric destructive dolostone that is widespread throughout

CAMBRO-ORDOVICAN

Franklin intrusions: Typically massive, laterally extensive, diabasic sills with columnar jointing (~3–50 m thick, rarely up to 100 m). Some sills are composite with internal intrusive contacts. Two types: 1) An older, more primitive type is commonly layered, with microdiabasic lower and upper border zones and olivine-enriched basal cumulate (olivine gabbro to feldspathic wehrlite) that may be capped by a thin, (1-2 m) feldspathic pyroxenite cumulate. The olivine cumulate is commonly covered with bright orange lichen, weathers chocolate brown, and shows a characteristic layer-parallel ribbed weathering. Upper ½ to ¾ of sills composed of massive olivine and pigeonite gabbros, a magnetite gabbro with common pitted weathering (magnetite oikocrysts) and a granophyric horizon containing abundant ocelli of granophyre and coarse, bladed clinopyroxene crystals. 2) Younger (based on cross cutting relationships), more evolved, diabasic sills showing enrichment in magnetite, ilmenite, quartz and alkali feldspar towards their cores, but are rarely layered. Some sills are porphyritic and contain 10–15% plagioclase>clinopyroxene>olivine phenocrysts and glomerocrysts up to 5 mm. Less common, 1–40 m wide dykes. Irregular to very linear (generally oriented NNW). Commonly associated with fault breccias or drag folds in host metasediments. Dykes commonly connect to sills; some associated with calc-silicate contact metamorphic rocks (reddish garnet rimmed by bright green vesuvianite), black Fe-oxide skarns, and minor sulphides.

Shaler Supergroup (nPMi-nPK2) Kilian Formation (nPK1-nPK2) Clastic-carbonate member: Variegated (red, green, grey and black) oin-stripe-laminated mudstone and siltstone, particularly at its base. Desiccation cracks common in mudstone and wavy bedding and ripple crosslamination in coarse siltstone-fine sandstone interlayers. Wavy-flaser bedded and small-scale crossbedded, 4 m thick, buff-weathering, fine-grained quartzarenite near top. Wavy-bedded dolosiltite and laterally linked stromatolite interbeds are common and increase upsection. ~120 m thick. Carbonate-evaporite member: Alternating, decametre-scale subunits of evaporite and carbonate-dominant lithofacies; evaporite: laminated red

mudstone and dolomitic mudstone with interbedded nodular anhydrite and laminated gypsite and anhydrite, minor stromatolitic dolostone. Carbonate lithofacies: dolostone and minor limestone lutite/siltite rhythmite capped by arenite/rudite laterally linked stromatolites, forming repetitive metre-scale cycles. Molar-tooth structure common. Wynniatt Formation (nPw1–nPw4) **Upper carbonate member:** Base characterized by distinctive nodular, black

calcareous shale, overlain by thin, rhythmically bedded and normally graded, quartz-sandy calcarenite. Upper, metre-scale alternations of stromatolitic dolostone and crossbedded intraclast grainstone. Local herringbone crossbedded quartz arenite and microbially laminated lime mudstone. Chert is common. Approximately 300 m thick. Stromatolitic carbonate member: Stromatolitic dolostone with build-ups that

have local synoptic relief of several meters; main build-up contains oncoids up to 20 cm. Interbedded intraclast grainstone with rip-ups and scours; mudstone/dololutite with molar tooth structure. Parallel or microbially laminated dololutite with mudcracks, and teepee structures. Sharp, erosive upper contact. Approximately 160 m thick. Black shale member: Dark grey parallel-laminated siltstone and silty mudstone

with discontinuous to continuous beds of ripple-topped quartz arenite common near top. Structures include flute and gutter casts, ball and pillow structures, channel and fill structures, and climbing ripples in siltstone. Carbonate nodules and pyrite are present throughout. Up to approximately 200 m thick. Lower carbonate member: Lower parallel-laminated dolosiltite and calcilutite with mudcracks, teepee structures and chert; minor carbonaceous mudstone. Middle hummocky cross-stratitified dolarenite and calcilutite with scours, rip-ups and molar-tooth structure; stromatolitic dolostone, intraclast dolograinstone. Upper stromatolitic dolostone, intraclast dolograinstone and carbonaceous siltstone capped by regionally extensive orange-weathering

stromatolitic dolostone, up to 10 m thick. Approximately 120 m thick. Minto Inlet Formation: Four informal members in ascending stratigraphic order: maroon-green gypsiferous siltstone-calcilutite, dark grey limestone, bedded white gypsum, and cyclical calcisiltite to nodular gypsum. Evaporite lithofacies include laminated to thin-bedded and cross-laminated white gypsite and grey anhydrite, red gypsiferous siltstone and buff to grey calcisiltite. Chickenwire, nodular anhydrite and crosscutting satinspar veinlets common in upper

evaporite as are up to 2 m thick beds of crystalline gypsum. Carbonate

with molar-tooth and fine-grained dolarenite with hummocky

cross-stratification. Approximately 250 m thick.

lithofacies includes dark grey to buff-grey laminated to thin-bedded dolosiltite

Macdonald, F.A., Schmitz, M. D., Crowley, J. L., Roots, C. F., Jones, D. S., Maloof, A. C., Strauss, J. V., Cohen, P. A., Johnston, D. T., and Schrag, D. P., 2010. Calibrating the Cryogenian; Science, v. 327(5970), Mathieu, J., Turner, E.C., and Rainbird, R., 2013. Sedimentary architecture of a deeply karsted Precambrian-Research 2013-1, 15 p. doi:10.4095/292099

Cambrian unconformity, Victoria Island, Northwest Territories; Geological Survey of Canada, Current Rainbird, R.H., Jefferson, C.W., Hildebrand, R.S., and Worth, J.K., 1994. The Shaler Supergroup and revision of Neoproterozoic stratigraphy in the Amundsen Basin, Northwest Territories, in Current Research 1994-C; Geological Survey of Canada, p. 61–70. Rainbird, R.H., Jefferson, C.W., and Young, G.M., 1996a. The early Neoproterozoic sedimentary Succession B of northwest Laurentia: correlations and paleogeographic significance; Geological Society of America Bulletin,

Rainbird, R.H., LeCheminant, A.N., and Lawyer, J.I., 1996b. The Duke of York and related inliers of southern Victoria Island, District of Franklin, N.W.T.; in Current Research 1996-E; Geological Survey of Canada, Shellnutt, J.G., Dostal, J., and Keppie, J.D., 2004. Petrogenesis of the 723 Ma Coronation sills, Amundsen basin, Arctic Canada: Implications for the break-up of Rodinia; Precambrian Research, v. 129(3-4), p. 309–324.

Thorsteinsson, R. and Tozer, E.T., 1962. Banks, Victoria and Stefansson Islands, Arctic Archipelago; Geological Survey of Canada, Memoir 330, 85 p. Young, G.M., 1981. The Amundsen Embayment, Northwest Territories; relevance to the upper Proterozoic evolution of North America. in Proterozoic Basins of Canada, (ed) F.H.A. Campbell; Geological Survey of Canada, Paper 81-10, p. 203-211.

> Recommended citation Rainbird, R.H., Bédard, J.H., Dewing, K., Hadlari, T., and Thomson, D., 2013. Geology, Qiqittiivik, Victoria Island, Northwest Territories; Geological Survey of Canada, Canadian Geoscience Map 59

(preliminary), scale 1:50 000. doi:10.4095/293259

Canadian **Geoscience Maps**

Preliminary

Authors: R.H. Rainbird, J.H. Bédard, K. Dewing, T. Hadlari, and D. Thomson Geology by R.H. Rainbird and J.H. Bédard, 2010, 2011 Geomatics by É. Girard

Cartography by N. Côté

Initiative of the Geological Survey of Canada, conducted under the auspices of the Victoria Island PGE/Base Metals project, as part of Natural Resources Canada's Geo-mapping for Energy and Minerals (GEM) program. Map projection Universal Transverse Mercator, zone 11.

North American Datum 1983

GEOLOGY QIQITTIIVIK Victoria Island, Northwest Territories

CANADIAN GEOSCIENCE MAP 59

Base map at the scale of 1:50 000 from Natural Resources Canada, with modifications. Elevations in metres above mean sea level Shaded relief image derived from the digital elevation model supplied by GeoBase. Illumination: azimuth 225°, altitude 45°, vertical factor 1x Proximity to the North Magnetic Pole causes the magnetic compass to be erratic in this area. Magnetic declination 2013, 20°31'E, decreasing 55' annually.

Preliminary

The Geological Survey of Canada welcomes corrections or additional information from users Data may include additional observations not portraved on this map. See documentation accompanying the data. This publication is available for free download through GEOSCAN (http://geoscan.ess.nrcan.gc.ca/).

Preliminary

Preliminary

Preliminary publications in this series have not been scientifically edited.

Preliminary