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TEBESJUAK LAKE

Nunavut

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Cover Illustration

Quartz vein (epithermal or reactivated) in Pitz Formation rhyolite east of Tebesjuak Lake, Nunavut. Photograph by T.D. Peterson. 2012-07-22

ABSTRACT

The map area is underpinned by three Archean terranes from west to southeast: the Snow Island Suite of 2.6 Ga granite-rhyolite (AS), the Marjorie Hills assemblage of metasedimentary and granitoid gneiss (AMH), and orthogneiss of the Chesterfield block (unit Agn). The AS-AMH boundary is the Wharton Lake fault system, initially a southwest-dipping detachment. The AMH-Agn boundary is the dextral extensional Tulemalu Fault. Brittle reactivations of these faults localized sub-basins of the Baker Lake Group and hosted coeval intrusions of Martell Syenite (minette / ~1.83 Ga Hudson Granite mix). A Hudson Granite plug intrudes the AMH. Early gabbro/anorthosite (~1.77 Ga) of the Kivalliq igneous suite was intruded by Nueltin granite, co-magmatic with bimodal Pitz Formation lavas and the ~1.75 Ga, 015° McRae Lake diabase dyke swarm and compositionally related 075° Thelon River dyke swarm. Cu-Pb veins and replacements formed near mafic centres and Au-Ag-bearing quartz veins near felsic centres.

RÉSUME

La région cartographiée s'appuie sur trois terranes archéens disposés du nord-ouest au sud-ouest : la Suite granitique-rhyolitique de l'île de Snow remontant à 2,6 milliards d'années (AS), l'assemblage de gneiss métasédimentaires et granitoïdes des collines de Marjorie (AMH), et les orthogneiss du bloc de Chesterfield (unité Agn). La frontière AS AMH est la faille du lac Wharton, initialement un décollement à pendance vers le sud-ouest. La frontière AMH Agn est la faille d'extension dextre de Tulemalu. Les réactivations fragiles de ces failles ont localisé les sous-bassins du groupe du lac Baker et ont reçu les intrusions concomitantes de syénite de Martell (mélange de minette et de granite hudsonien vieux d'environ 1,83 Ga). Un bouchon de granite hudsonien pénètre dans l'assemblage des collines de Marjorie. Les anorthosites gabbroïques précoces (env. 1,77 Ga) de la suite ignée de Kivalliq se sont mélangées après avoir été pénétrées par des granites de Nueltin, comagmatiques avec les laves bimodales de la formation Pitz et l'essaim du dyke de diabase 015° du lac McRae vieux d'environ 1,75 Ga et l'essaim de la rivière Thelon 075° proche sur le point de la composition. Les filons et les filons de remplacement cupro-plombifères sont formés près des centres mafiques et les filons de quartz auro-argentifères près des centres felsiques.

ABOUT THE MAP

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ABOUT THE GEOLOGY

Descriptive Notes

The Tebesjuak Lake map area (NTS 65-O) contains three distinct Archean domains juxtaposed by two major fault systems: the here-proposed Wharton Lake fault system and the Tulemalu Fault (Eade, 1986). The westernmost domain is unconformably overlain by the early Paleoproterozoic metasedimentary Amer Group (<2.3 Ga; >1.87 Ga: Rainbird et al., 2010; Pehrsson et al., 2013). All three domains are overlain unconformably by a series of gently to moderately dipping volcanic and sedimentary rocks of the Dubawnt Supergroup (Gall et al., 1992) which fill the middle to late Paleoproterozoic Baker Lake Basin (Fig. 1). The Dubawnt Supergroup in this area includes volcanic, volcaniclastic and sedimentary rocks of the Baker Lake Group (ca. 1.84–1.79 Ga: Rainbird et al., 2006), overlain by volcanic and volcaniclastic rocks of the Wharton Group (ca. 1.76–1.74 Ga: Rainbird and Davis, 2007), and by a sliver of the younger sedimentary Barrensland Group (<1.75 Ga; >1.54 Ga: Rainbird and Davis, 2007; Chamberlain et al., 2010). The area also hosts intrusive rocks emplaced during the two time intervals coinciding with volcanism in the Baker Lake Basin. Plutons of the Hudson intrusive suite (Peterson et al., 2002; Fig.1) are coeval with Baker Lake Group volcanic rocks, and high level intrusions of the Kivalliq igneous suite (Peterson et al., submitted), which includes Nueltin granites (Fig.1), are coeval with the Wharton Group.

ARCHEAN–EARLY PALEOPROTEROZOIC

Archean domains are described in detail by LeCheminant et al. (1979a; 1980; 1981), and, from west to southeast, are referred to as the Pukiq domain, central domain, and southeastern domain.

The Pukiq domain primarily comprises intrusive igneous rocks of the ~2.6 Ga Snow

Island Suite (Peterson and Lee, 1995), which include gneissic to weakly foliated, dioritic to granitic gneisses (unit ASg) and highly foliated K-feldspar megacrystic monzonitic augen gneiss (unit ASm). The Pukiq Lake Formation (unit ASPr) is a fine grained quartz-feldspar porphyry. Dated at 2610 +11/-13 Ma, the rhyodacite is similar in age to 2595 +14/-13 Ma augen granitoid gneiss at Wharton Lake north of the area and to other 2.61–2.58 Ga megacrystic granites regionally (LeCheminant and Roddick, 1991).

Two isolated remnants of metasedimentary rocks correlated with the early Paleoproterozoic Amer Group (unit PA) are exposed in the Pukiq domain. A narrow band of ridge-forming quartzite, subarkosic meta-arenite, and quartz-rich metaconglomerate occurs west of Wharton Lake, and extends southwest and northeast of the map area.

Planar crossbeds occur locally in the meta-arenites. Clasts of deformed granitoid rock, in addition to jasper, imply these metasediments were deposited unconformably upon Archean basement.

In the second metasedimentary remnant, quartzites are interbedded with calc-silicate rocks, unconformably overlain by the Christopher Island Formation and intruded by rapakivi granite. A narrow diopside-rich skarn developed in carbonate-rich lenses along the granite contact (Roberts, 1981). Primary textures are preserved within 5 m of the contact. The succession dips moderately northeast, faces up, and consists of massive grey quartzite overlain by a mixed zone of laminated quartzite and calc-silicate rock which contains stromatolites silicate and white quartzite overlie the stromatolitic beds. LeCheminant et al. (1981) noted that boulders of quartzite and calc-silicate rock are widely distributed in the area, indicating that more quartzite and carbonate and algal mats. Massive quartzite, succeeded by calc- might underlie the till cover.

The central domain is occupied by the Marjorie Hills assemblage (unit AMH: Jefferson et al., *in* prep.). The AMH consists of strongly foliated orthogneiss and paragneiss. The paragneiss component includes metagreywacke, rare iron formation, and amphibolite, and is either tectonically interleaved with or intruded by gneissic tonalite-granodiorite, two-mica granite, migmatite, and possibly ortho-amphibolite. Peak metamorphic grade reached amphibolite facies and higher, and granoblastic textures suggest that metamorphic recrystallization outlasted regional deformation. Gneissosity in the AMH throughout most of the central domain has variable strikes and moderate to gentle dips.

Along the southwest boundary of the central domain between Tebesjuak and Wharton lakes, NW- to N-striking, retrogressive mylonitic to cataclastic foliations that dip moderately southwest to west, follow the bend of the Wharton Lake fault system, and overprint earlier fabrics of the AMH. This deformation zone and subsequent brittle faults define the boundary between the AMH and Pukiq domain. Locally, the boundary is obscured by overlying supracrustal rocks and by granite intrusions.

The AMH in the south part of the central domain is juxtaposed against the southeastern domain along the steeply dipping Tulemalu Fault (Eade, 1986). The southeastern domain belongs to the Chesterfield block (Berman et al., 2007), part of the Rae geological domain that was previously included in the northwest Hearne domain (e.g., Davis et al., 2006). Undivided Archean gneisses (unit Agn) in this domain include migmatitic granitoid gneisses, intercalated with thinly layered leucocratic to locally mafic gneisses, and cut by NE-trending metadiabase dykes. The gneisses were affected by polyphase folding under amphibolite facies conditions, and later crosscut by narrow greenschist facies shear zones, and by late NE- and NW-trending faults. Gneisses are intensely fractured near the basal unconformity with the overlying Baker Lake Group and near faults, where carbonate veins and chlorite-epidote-quartz alteration are well developed. They are cut by numerous compositionally diverse mafic lamprophyre

(minette) to microsyenite (bostonite) dykes. LeCheminant et al. (1980) describe two diatremes exposed on small islands near the southwest shore of Nutarawit Lake, containing angular to subrounded fragments of gneiss, amphibolite, and metadiabase in a matrix of pulverized gneiss and biotite lamprophyre.

SUPRACRUSTAL ROCKS: DUBAWNT SUPERGROUP

BAKER LAKE GROUP

About a third of the map area is underlain by the Baker Lake Group, Dubawnt Supergroup, which overlies Archean basement of all three domains and was deposited during faulting along and parallel to the Tulemalu and related faults. The Baker Lake Group is preserved in three sub-basins of the Baker Lake Basin as defined by Rainbird et al. (2003): 1) the north end of the Angikuni sub-basin is exposed in the SE; 2) the southwest end of the Baker Lake sub-basin extends NE-SW across the centre of the area; and 3) the Wharton sub-basin is exposed in the NW. The Baker Lake Group in NTS 65-O comprises Christopher Island Formation potassic volcanic to volcaniclastic rocks (unit PDBCv), underlying basal sedimentary rocks (unit PDBCs), and the overlying sedimentary Kunwak Formation (unit PDBK).

PDBCs is exposed on both sides of the Tulemalu Fault in the Angikuni sub-basin. The unit consists of poorly bedded polymictic conglomerate with rounded to subrounded clasts of basement gneiss and granodiorite in a maroon chloritic matrix, grading upward to grey to light pink medium grained arkose (LeCheminant et al., 1979a). These sedimentary rocks are correlated with the South Channel and Kazan formations of the Thirty Mile and Baker Lake areas to the east (LeCheminant et al., 1979b; Rainbird et al., 1999), but are undivided here. Silicification and sericitization, commonly accompanied by quartz stockworks, affects the arkose both in the upper parts of the succession and where it is in fault contact with basement gneisses. The PDBCs conformably underlies volcanics and volcaniclastics of the PDBCv as described below, and beds in both sequences dip moderately northwest, except locally next to the Tulemalu Fault.

Thick PDBCs strata are missing in the Baker Lake and Wharton sub-basins in NTS 65-O. PDBCv overlies Archean rocks directly or is faulted against them. A regolith with an arkosic matrix which grades downward into unaltered basement was observed locally at the base of the Wharton sub-basin (LeCheminant et al., 1981). The regolith is overlain by potassic flows in some areas, and elsewhere grades into discontinuous lenses of poorly sorted gneiss pebble to boulder ortho-conglomerate <20 m thick, interpreted as alluvium related to faulting during initial volcanism.

The PDBCv is similar in all three sub-basins, and consists of homoclinal successions of thick minette lava flows, minette breccia, pyroclastic flows, and interbedded volcaniclastic rocks. Beds in the Baker Lake and Wharton sub-basins dip gently to moderately northeast, except locally in the Pukiq domain adjacent to granite intrusions and in the northeast near basal contacts with Archean gneiss. Lava compositions of the PDBCv fall in the geochemical fields of minette and lamproite and match the compositions of the minette dykes that intrude PDBCv and older units (Peterson et al., 1994). Maroon to dark red brown mafic minette flows contain phenocrysts of phlogopite and subordinate clinopyroxene, with feldspar confined to the groundmass. Maroon to grey felsic minettes and welded crystal tuffs containing phenocrysts of feldspar and minor biotite also occur but are less abundant (LeCheminant et al., 1979a; 1981). Felsic minettes with two feldspars are present near the bottom and near the top

of the thickest and most complete section south of the Kunwak River (LeCheminant et al., 1979a). A felsic-mafic-felsic sequence is also observed at Dubawnt Lake to the west (Peterson, 2006) and east of NTS 65-O (Rainbird et al., 2003). Flows are massive, flow margins are brecciated, and pillows and hyaloclastites are absent, suggesting subaerial eruption from a series of vents (LeCheminant et al., 1979a, 1980).

Interflow sediments include immature para- and ortho-conglomerate and breccia, red sandstone, and siltstone characterized by lithic and crystal fragments derived from the minette, as well as clasts of granitoid gneiss and quartz, and are the product of debris flows, alluvial and shallow water fluvial processes. Local thin red siltstones and mudstones with mud curls and desiccation cracks indicate periodic subaerial exposure.

Regional metamorphism has not affected the PDBC and original macroscopic textures and phenocrysts are well preserved. However, propylitic alteration of the matrix to quartz, chlorite, sericite, calcite, and albite is widespread. Quartz veins and stockworks cut the PDBCv at many localities, and contact metamorphism at the margins of younger granite intrusions resulted in biotite and biotite-hornblende hornfels.

The Kunwak Formation (unit PDBK) consists of red, alluvial arkose, lithic arenite and conglomerate with minor siltstone and mudstone. The PDBK unconformably overlies the PDBCv and basement gneisses, although the contact with PDBCv can be conformable in other areas (e.g., Peterson, 2006). Exposures of PDBK occur in isolated, locally faulted sub-basins. Basins developed and filled during the volcanic gap between deposition of the PDBCv and Pitz Formation (LeCheminant et al., 1981).

The most extensive PDBK sub-basin, the Wharton sub-basin (Rainbird et al., 2003), is located southwest of Tebesjuak Lake, and follows the bend of the Wharton Lake fault system. Sediments within the basin are described in terms of a lower sequence and an upper sequence (LeCheminant et al., 1981). The lower sequence, which lies directly on a narrow unit of PDBCv, is dominated by arkose with interbeds of massive to medium bedded polymictic orthoconglomerate and granular to pebbly arkose. Clasts include rounded to subrounded cataclastic gneiss, sheared porphyry, minette, and minor vein quartz, with the proportion of PDBCv clasts decreasing upward in the sequence. Sedimentary structures and paleocurrent directions indicate braided fluviatile deposition with variable transport directions.

The upper sequence is characterized by massive to poorly bedded, gneiss pebble to boulder conglomerate, with minor intercalated pebbly arkose and litharenite, and appears to thicken toward a late brittle fault of the Wharton Lake fault system, which truncates it. The main clast types are cataclastic granitoid gneiss with subordinate vein quartz, quartzite (unit PA?), arenite and minette, and are, in general, more angular that those in the lower sequence. Sedimentary structures and lithofacies suggest an alluvial fan to proximal braid plain depositional environment, and limited paleocurrent data indicate transport to the west and southwest away from the fault system.

A decrease in the proportion of PDBCv fragments and increase in proportion of Archean basement fragments upward in the succession may reflect progressive denudation of the Christopher Island source and exposure of Archean basement. Beds dip moderately to shallowly northeast toward the fault system suggesting rotation toward the fault, which is typical of a basin developed in response to movement on a syn-depositional detachment fault (cf. Wernecke and Burchfiel, 1982).

Like the sequence in the Wharton sub-basin, coarsening upward evolution from fluvial braidplain to alluvial fan is common in other sections of PDBK, notably in the southeast part of the area (LeCheminant et al., 1979a, 1981). Exceptions to this depositional pattern, as noted by LeCheminant et al. (1981), are seen in several fining upwards

sections that lack the alluvial component adjacent to the main Pitz outcrop area. In a sequence on the southeast shore of Tebesjuak Lake, arkose clast breccia interbedded with arkose passes upward into arkose pebble to cobble conglomerate followed by thin-bedded to medium-bedded arkose and sub-arkose. Mudcracks in the arkose suggest that the water body responsible for the deposition was ephemeral. This sequence is capped by a carbonate-rich paraconglomerate. In a N-trending, shallowly E-dipping section ~20 km south-southeast of Tebesjuak Lake, basal conglomerate is overlain by amygdaloidal dacite and laminated to thin-bedded arkose, siltstone and mudstone toward its upper contact with the Pitz Formation (LeCheminant et al., 1980). A braid plain to lacustrine depositional setting was interpreted for the upper part of this sequence, and the presence of volcanic rocks is anomalous for Kunwak Formation. This section may in fact correlate with basaltic flows considered to be equivalent to Mallery gabbro (below) which is older than any dated rhyolite in the Wharton Group.

WHARTON GROUP

The Wharton Group in NTS 65-O is represented by the Pitz Formation, a succession of mainly felsic volcanic flows and volcaniclastic rocks which unconformably overlies AMH, and PDBCv and PDBK of the Baker Lake sub-basin. The base of the succession is currently defined as the first appearance of a rhyolite flow or rhyolitic detritus (LeCheminant et al., 1981). Thick sedimentary sequences associated with block faulting mapped northeast of the area (Hadlari and Rainbird, 2001) are absent.

The Pitz Formation includes potassic rhyolite to dacite flows and volcaniclastic rocks (unit PDWPvc), subordinate sparsely porphyritic flow banded rhyolite (unit PDWPf), and minor basalt (unit PDWPm). Beds dip shallowly to the north. Exposures of PDWPf are located near the base of the succession, and are interpreted as small rhyolite domes. Fluorite is a common accessory mineral, and is accompanied by topaz in at least two occurrences: a hill northeast of Tebesjuak Lake and a cliff on an island near the east margin of the area. PDWPvc consists of feldspar-quartz phyric flows of rhyolite with subordinate rhyodacite and dacite, welded crystal- lithic tuffs, and intraflow rhyolite cobble conglomerate and red sandstone. Abundantly porphyritic mauve to purple flows with K-feldspar phenocrysts to 2 cm, smaller quartz eyes and minor plagioclase and altered mafic phenocrysts are the predominant lithology.

Three isolated outcrops of black amygdaloidal basalt (unit PDWPm) are exposed in the east part of the area, overlying PDWPvc and PDBK. The basalt contains flow-aligned plagioclase microphenocrysts in an altered matrix of epidote, chlorite and opaques, hosting chlorite-lined pipe vesicles filled with epidote and calcite. It is locally intercalated with laminated green siltstone (LeCheminant et al., 1980).

These rocks are not metamorphosed, but are locally affected by patches of intense epithermal alteration in the northeast half of the Pitz Formation outcrop area. Altered patches are characterized by drusy quartz, laminated agate, fluorite-rich veins, and in-situ cemented breccia. PDBCv and AMH are also affected by this alteration in the T-Rex zone south of Mallery Lake where the Pitz cover has been partly eroded. Biczok (1996, 1998) interpreted this alteration as syn-volcanic with implied potential for precious metals.

BARRENSLAND GROUP

The Barrensland Group is represented by a narrow sliver of NE-dipping Thelon Formation (unit PDBT), a buff to white conglomerate and sandstone sequence that was deposited disconformably over the PDBK and is truncated to the northeast by a late brittle fault of the Wharton Lake fault system. Basal cycles of clay-cemented

orthoconglomerate grade into medium grained subarkose and quartz arenite and are overlain by flaggy, fine to medium grained quartz arenite. An altered phosphatic layer occurs near the base of the quartz arenite (LeCheminant et al., 1981).

INTRUSIVE ROCKS: HUDSON INTRUSIVE SUITE AND KIVALLIQ IGNEOUS SUITE

HUDSON INTRUSIVE SUITE

Lamprophyre dykes and intrusions of hornblende syenite, and granite assigned to the 1.84–1.79 Ga Hudson intrusive suite (Peterson et al., 2002; van Breeman et al., 2005) are exposed in this area, and overlap in age with the Christopher Island Formation. Abundant phlogopite-clinopyroxene lamprophyre (minette) and more felsic lamprophyre (bostonite) dykes intrude Agn and PDBCv in the Angikuni sub-basin, Chesterfield block, and minette dykes cut the AMH and PDBCv in the Baker Lake sub-basin but do not cut the post-volcanic PDBK. These minettes are compositionally identical to the minettes of the PDBCv, and are considered volcanic feeders (LeCheminant et al., 1987; Peterson and Rainbird, 1990).

A large, elongated body of Martell Syenite (unit PHMs) was emplaced along the southern contact of the Baker Lake sub-basin north of the Tulemalu Fault, and smaller exposures within the Christopher Island Formation outcrop area may be connected or separate bodies. Martell Syenite was also emplaced along the locus of the fault, where it is locally foliated, and forms a small plug cutting Archean gneisses southeast of the fault. The syenite is interpreted as a mixture of minette melts with crustal melts of the ca. 1.83 Ga Hudson Suite (Peterson et al., 2002).

A massive, equigranular, white-weathering biotite granite pluton (unit PHHg), characterized by dark grey smoky quartz and accessory phases including fluorite, cuts the AMH north of the Wharton Lake fault system (LeCheminant et al., 1981). Outer margins are weakly foliated and/or subporphyritic, and contain angular xenoliths and rafts of the surrounding gneiss, and rare pegmatite. The southernmost lobe of the granite is displays a weak, SW-dipping foliation concordant with the cataclastic to mylonitic foliation of the AMH that marks early ductile deformation on the fault system.

Concordant SHRIMP U-Pb zircon crystallization ages of 1836 ± 1.2 Ma and 1844 ± 9.1 Ma indicate that this granite was emplaced during the Hudson intrusive event (van Breemen et al., 2005).

The Kivalliq igneous suite (KIS: Peterson et al., submitted) was emplaced during Wharton Group deposition (Peterson et al., 2002) and includes volcanic rocks of the Pitz Formation. Mafic intrusive members of this suite include the anorthositic Fish intrusion (unit PKMFga), the Mallery Lake intrusion (unit PKMMga), and the McRae Lake dyke (unit PKMd). Felsic intrusive members of this suite include the Pamiutuq granite (unit PKPg), voluminous intrusions of Nueltin granite (unit PKNg) in the west half of the area, smaller stocks of Nueltin granite to syenogranite (unit PKNgf), and numerous quartz-feldspar porphyry dykes.

The Fish intrusion (unit PKMFga) was emplaced along a NE-trending fault between the AMH and PDBCv, and extends northeast into the PDBCv. It is a distinctive coarse grained leucogabbro with abundant laths of coarse labradorite (0.5–2 cm with megacrysts up to 8 cm) in a matrix of clinopyroxene, magnetite-ilmenite, and apatite. The labradorite crystals are aligned parallel to the margins and the matrix is slightly chilled.

On Mallery Lake, a coarse grained gabbro-anorthosite (unit PKMMga) is intruded by a circular granite plug (unit PKNgf) which locally infiltrates along fractures. The gabbro is characterized by large Ti-Al augite crystals in a matrix of plagioclase, iron oxide and hornblende, and accumulations of coarse plagioclase crystals similar to those in the Fish intrusion (unit PKMFga) locally form anorthosite. A U-Pb baddeleyite age of 1769 ± 6 Ma for the Mallery gabbro identifies it as the oldest known KIS intrusion (Peterson et al., submitted). A ring-shaped aeromagnetic high surrounds the circular granite plug and coincides, in part, with this gabbro (Jefferson et al., 2013).

The circular Pamiutuq intrusion (LeCheminant et al., 1979a, 1980), a thin, subvolcanic lopolith (Booth, 1983), underlies ~700 km^2 east of Tulemalu Lake. The main pink to red porphyritic phase of the granite is homogeneous in composition and texture. Microperthitic orthoclase, plagioclase and rimmed quartz phenocrysts are set in a fine grained granophyric matrix. Clinopyroxene and pale green amphibole are the main mafic minerals. Accessory phases are chloritized biotite, magnetite, ilmenite, apatite and zircon. Xenoliths are distributed widely throughout the pluton, and include granitoid gneiss, mafic hornblende syenite, and fine grained plagioclase-phyric mafic blebs with cuspate chilled margins (Booth, 1983; LeCheminant, 1988). Plagioclase megacrysts to 5 cm, some enclosed within the mafic blebs, are sparsely distributed. The mafic inclusions exhibit features indicating they formed by rapid cooling of small globules of mafic magma within granitic magma. Booth (1983) concluded that the intrusion exhibits strong evidence of comingling of felsic with mafic magma.

The main pink to red phase of the Pamiutuq granite passes transitionally into a finer grained purple porphyritic chilled margin, typically <100 m wide, that cuts the surrounding rocks discordantly. However, along the northwestern contact the purple border phase is wider, up to 4 km in plan, where it is interpreted as the shallow dipping upper contact of the granite intruded into and beneath slightly older rhyolitic successions. Intrusive contacts with Pitz rhyolites were recognized locally, although apparent gradations between flow-banded rhyolite and purple porphyry were also noted. Subvolcanic intrusion of the Pamiutuq granite was a precursor to emplacement of the extensive suite of rapakivi granites at ca. 1.75 Ga (van Breemen et al., 2005), as confirmed by a 1752.6 ± 4.1 Ma U-Pb zircon age for the main phase of the granite (Peterson et al., *in* prep.). Intrusive contact of the granite into the overlying Pitz Formation is consistent with U-Pb zircon dates of 1757.6 ± 3.4 Ma and 1753.0 ± 1.7 Ma for Pitz rhyolites (Rainbird and Davis, 2007).

Large, north-trending, lobate rapakivi granite plutons cut the Baker Lake Group and older rocks in Pukiq domain. These granites (unit PKNg) (and the Pamiutuq intrusion) belong to the Nueltin granite suite (Fig. 1), dated at ~1.75 Ga (van Breeman et al., 2005), and comprise coarse grained rapakivi granite locally intruded by finer grained inequigranular pink to red granite. K-feldspar predominates over plagioclase in both granite phases, and accessories include biotite, fluorite, zircon, hornblende, and titanite. Topaz has been reported near the contact of one of these bodies and may be more widespread. Miarolitic cavities filled with quartz, K- feldspar and fluorite were observed in a granite lobe beneath a flat contact with the PDBK of the Wharton sub-basin (LeCheminant et al., 1981). A ring-shaped aeromagnetic high coincides with this granite lobe.

Granite contacts are generally sharp and discordant, and xenoliths are lacking. Contact metamorphic effects include the development of hornfels in the PDBCv and local occurrences of wollastonite. An unusual adularia-wollastonite vein occurs in PDBCv and in gneissic basement parallel to a fault contact west of Tulemalu Lake and is interpreted to result from remobilization of fluids from the volcanics and high temperature contact metamorphism caused by the intrusion of nearby PKNg (Burton, 1981). Similarly, wollastonite reported in the matrix of calcareous arkose of the PDBK between the two PKNg lobes that intrude the Wharton sub-basin is the likely product of contact metamorphism.

In the eastern half of the area, the Nueltin Granite is represented by hypabyssal stocks of equigranular to porphyritic pink granite to syenogranite and syenite with fluorite bearing miarolitic cavities (unit PKNgf), which cut the PDBCv, PDBK, PHMs, and AMH of the central domain and Agn of the Chesterfield block. A U-Pb zircon crystallization age of 1755.4 ± 1.8 Ma was obtained on the stock that cuts the PKMMga at Mallery Lake (Turner et al., 2003). Another occurrence of wollastonite was observed adjacent to brecciated amphibolite in epithermal quartz along the southwest side of this plug.

Quartz-feldspar porphyry dykes are abundant throughout the south half of NTS 65-O, and intrude all formations of the Dubawnt Supergroup except the Thelon Formation. The dykes, ranging up to 50 m in width, are characterized by mantled ovoid K-feldspar phenocrysts and round quartz eyes in a reddish matrix. The dykes intrude the Martell syenite, fluorite-bearing granites (unit PKNgf), the Pamiutuq granite, and the Fish intrusion. One dyke which cuts the Fish intrusion is dated at 1746 ± 4.3 Ma (Peterson et al., *in* prep.). On the basis of petrological similarity, these dykes are interpreted to be comagmatic with the Nueltin rapakivi granites (LeCheminant et al., 1980).

The McRae Lake dyke (unit PKMd), an elongate 035°-trending composite intrusion 23 km long and up to 1.8 km wide (LeCheminant et al., 1980), intrudes the AMH, PDWPvc, and the east lobe of PKNg (LeCheminant et al., 1981; Tambosso, 1981). It comprises two main phases, a medium grained grey–green plagioclase-phyric gabbro which is the predominant phase in the southwest, and a grey to red weathering plagioclase glomeroporphyritic quartz monzodiorite to diorite which cuts the monzogabbro along its core, and is the predominant phase in the northeast. The gabbro displays chilled margins against all three hosts, and at the southwest end contains xenoliths of rapakivi granite as well as rafts of recrystallized orthogneiss or metasediment. The quartz monzodiorite shows sharp and subordinate gradational contacts with the gabbro, and locally contains xenoliths of AMH and rimmed quartz xenocrysts (Tambosso, 1981). Quartz-feldspar porphyry and minette dykes are reported to be truncated by the PKMd (LeCheminant et al., 1981). Tambosso (1981), however, noted that one 10–15 m wide 015°-trending quartz-feldspar porphyry dyke becomes progressively finer grained to almost aphanitic toward the dyke, and could post-date it.

Contact relationships between the gabbro and monzodiorite and their petrography suggest multiple magma emplacement, with early gabbro intrusion followed by intrusion of more leucocratic magma from the same chamber (Tambosso; 1981). Both phases are mineralogically similar, with laths of zoned plagioclase (labradorite to andesine) up to 6 mm in length as the predominant phenocryst phase, accompanied by subordinate alkali feldspar, quartz, and altered clinopyroxene grains set in a micrographic matrix. The phases differ mainly in the proportion of plagioclase, which is 55–65 vol. % in the

gabbro and 35–45 vol. % in the quartz monzodiorite, and in the greater amount of micrographic intergrowth and finer grain size of the monzodiorite matrix. Baddeleyite from the gabbro yields a crystallization age of 1753 ± 1.2 Ma which overlaps in age with the Pamiutuq intrusion (Peterson et al., *in* prep.).

Raub (2008) presented paleomagnetic results from Pitz Formation rhyolites and associated conglomerate exposed west of the McRae Lake dyke, and also measured magnetizations for both McRae Lake dyke phases. Paleomagnetic poles, demonstrated to be primary, represent both magnetic polarities at ca 1.75 Ga, permitting paleomagnetic comparisons with other regions.

A high aeromagnetic signature coincides with the McRae Lake dyke, which is cut off abruptly in the northeast by a NW-trending east-side-down normal fault (Tambosso, 1981). Narrow, discontinuous NNE-trending linear aeromagnetic highs northeast of the fault indicate that dykes related to the gabbro extend to Mallery Lake and beyond. Narrow, plagioclase-phyric dykes are exposed on the shoreline of Mallery Lake and cut the Mallery Lake gabbro. The NNE-trending dykes in NTS 65-O are interpreted to be part of the regionally extensive NNE-trending McRae Lake dyke swarm (Buchan and Ernst, 2013). Another swarm of buried ENE-trending diabase dykes are traced north of Tebesjuak Lake using aeromagnetic signatures from high resolution geophysics contributed by Bayswater Uranium Corporation as part of the Geophysical Compilation and Interpretation, Northeastern Thelon Basin Region consortium agreement (Tschirhart et al., 2011). These dykes are assigned to the Thelon River swarm of Buchan and Ernst (2013).

The youngest intrusion mapped in this area is a NW-trending diabase dyke, part of the 1267 Ma Mackenzie swarm (Baragar et al., 1996; LeCheminant and Heaman, 1989). This dyke, traced for the most part from the regional aeromagnetic data, is exposed near the east side of NTS 65-O (LeCheminant et al., 1980).

REGIONAL FAULTS

The Tulemalu Fault and the Wharton Lake fault system are the key domain boundaries in NTS 65-O, and both record multistage displacements that overlap in time with development of the Baker Lake Group.

The steeply dipping, NE-trending Tulemalu Fault is an extensive regional fault that juxtaposes the North Rae Archean basement against Archean gneisses of the Chesterfield block (Fig.1). To the southwest, the main fault is reported to be associated with numerous parallel faults and splays (Eade, 1986). Further southwest, Archean rocks displaying high temperature–high pressure ductile deformation were exhumed along the Tulemalu Fault prior to the deposition of the Christopher Island Formation (Tella and Eade (1986). Eade (1986) reported a combination of southeast side down displacement with a minor dextral component just south of map area. Martell syenite along the Tulemalu Fault is foliated, unlike the massive syenites to the north. The Tulemalu and other NE-trending faults in the area are key to the development of the Baker Lake Basin in an overall extensional-transtensional tectonic setting (Hadlari and Rainbird, 2001; Rainbird et al., 2003). Late, brittle NW-trending faults overprint the Tulemalu Fault, the PDBCs and PDBCv, causing minor offsets.

The Wharton Lake fault system (new here-proposed name) includes an early ductile-brittle shear zone of inhomogeneous deformation first recorded by LeCheminant et al. (1981), superimposed gradationally on the Marjorie Hills assemblage (unit AMH) under greenschist facies conditions. Foliations in the AMH, which are variable throughout most of the central domain, become consistently moderately SW- to W- dipping in this zone, following the bend in the Wharton sub-basin. Moderately plunging down-dip lineations occur locally. The south lobe of the Hudson granite (unit PHHg) was weakly affected by this foliation. It is proposed here that the shear zone may represent the footwall of an early detachment fault. Kunwak Formation sediments were deposited directly over the Christopher Island Formation (unit PDBCv) and the Snow Island Suite (unit ASg) on the southwest side of the Wharton sub-basin and contain fragments of PDBCv as well as Archean basement and vein quartz. The coarsening upward sequence to the northeast suggests that deposition of the upper sequence occurred as the topographic relief increased along the fault system. Beds face up and dip toward the fault system, a geometry that is common in extensional basins formed during syn-depositional faulting (cf. rotational listric normal examples of Wernecke and Burchfiel, 1982). The Kunwak Formation sedimentary sequence is truncated sharply by late, NW- and NS-trending brittle faults, one of which also truncates the younger Thelon sedimentary sliver.

MINERAL SHOWINGS

Mineral showings in this area fall into three metallogenic categories: (1) structurally controlled base metals; (2) structurally controlled uranium with or without base metals; and (3) zones of epithermal alteration prospective for precious metals.

Four base metal showings are distributed along a northeast trend from the north end of Tulemalu Lake to ~15 km southeast of Tebesjuak Lake. They are hosted by Christopher Island Formation volcanic and volcaniclastic rocks. Scant Cu mineralization, described as chalcocite-malachite, was reported following a geophysical survey of the southwest showings on the TUL claim block (Lewis and Bosschart, 1967). LeCheminant et al. (1979a, 1980) describe the mineralization in this area as hosted by minette and volcaniclastic wacke. It consists of discontinuous veins of bornite-chalcopyrite and bornite-digenite(?) partly replaced by covellite in a gangue assemblage of garnet, epidote, calcite, and quartz. The TEB 1-18 Claims were also surveyed geophysically on the basis of reported Cu-Pb showings (Lewis and Bosschart, 1967). The Tebesjuak Lake showing was described by LeCheminant et al. (1979a, 1980) as comprising disseminated Pb-Cu sulphide in a vuggy vein system hosted by trachytic lavas. Galena is the main ore mineral, accompanied by secondary malachite and azurite, in a gangue of quartz, calcite and specularite. This showing is referred to as the Ruby Lake showing by Phelps Dodge (Biczok, 1998).

The most significant of the base metal showings, Spec Lake, is located ~5 km north of the Fish intrusion, and is similarly hosted by the Christopher Island Formation. Spec Lake mineralization and its setting are described in detail by Webb (1981) and LeCheminant et al. (1980). The main mineralized zone comprises 5-6 en echelon lenses up to ~1.5 m wide and 9 m long, striking ~145° containing massive sulphide. Mineralization is controlled by a quartz-veined fault and topographic linear trending 110° with veins up to 5 m wide, and a cross-cutting 070° quartz vein system with veins up to 15 m wide. The massive sulphide is composed of up to 80 vol. % galena, chalcopyrite,

and bornite, with <3 vol. % digenite, enargite, chalcocite, sphalerite, greenockite, tetrahedrite-tennantite, native copper and native silver. Massive mineralization passes outward to disseminated replacement zones, and cm-scale veins containing galena, bornite, and chalcopyrite extend up to 750 m away from the main mineralized zone (Webb, 1981). Carbonate-quartz-fluorite stockworks cut the sulphide-bearing veins south and west of the main mineralization. Fractures in these veins contain uraniferous phases. Pitchblende was also observed by Webb (1981) in microscopic fractures in the massive sulphides. All features suggest the massive sulphide mineralization was epigenetic with respect to its immediate hosts. It was tentatively interpreted to be related to local rapakivi granites or magma related to Pitz felsic volcanics (LeCheminant et al., 1980; Webb, 1981). Biczok (1996) noted that the metals and mineralization style at Spec Lake might represent a deeper, base metal-rich level of the gold-bearing epithermal alteration system affecting the overlying Pitz Formation.

Uranium showings, most of which are minor, are distributed throughout the area hosted by Archean basement gneisses and amphibolite, Christopher Island Formation and age equivalent Martell Syenite, the Kunwak Formation, near the base of Pitz Formation volcanic rocks and near the base of the Thelon Formation.

Showings in the southeast corner of NTS 65-O consist mainly of pitchblende deposited in fracture fillings and may include Cu minerals. Occurrences are similar to other epigenetic fracture-controlled prospects within and adjacent to the Baker Lake Basin (Miller, 1980). The Short-eared Owl and Surprise showings are hosted by Archean gneiss southeast of the Tulemalu Fault, and the Boo, Nut Lake, and Snowbound Lake showings are hosted by the Christopher Island Formation on both sides of the fault. Nut Lake is hosted in basal sedimentary rocks, whereas Boo and Snowbound Lake are in volcanic and volcaniclastic rocks. Potassic lamprophyre dykes, mainly minettes, depicted on the map include the reddened, anomalously radioactive microsyenite or bostonite dykes mentioned in descriptions of all the southeast U showings.

Three showings within or next to the margins of Martell syenites (Fox Den, BAK Claims and Stretch) also contain pitchblende with quartz in fractures. Fox Den, reported by LeCheminant et al. (1980), consists of pitchblende and chalcopyrite veinlets in the marginal phase of a fluorite-bearing quartz syenite. The BAK Claims span the contact of a syenite with Christopher Island volcanic and volcaniclastic rocks which overlie basement gneiss, are intruded by small microsyenite bodies, and cut by quartz-feldspar porphyry dykes. U and Th mineralization investigated in two trenched syenite exposures is localized along radioactive fractures and joints (Best et al., 1977). These fracture fillings may have the same origin as those in Archean gneisses and Christopher Island Formation rocks. However, dykes of bostonite (microsyenite) in the southeast part of NTS 65-O and in areas to the east are described by Miller (1979) and LeCheminant et al. (1980) as containing high U and Th associated with accessory thorite, monazite and zircon. Consequently, these showings are interpreted as syngenetic and related to the syenite. The Nutarawit Lake showing, located in Christopher Island Formation rocks northwest of the lake, is described by Prasad (1981) as consisting of “U and Th in alkaline syenite”, which probably refers to cross-cutting bostonite dykes (Miller,1979). Pan Ocean Oil mapped a cluster of red bostonite dykes in the vicinity of this showing, and described them as anomalously radioactive with epigenetic pitchblende segregated along fractures (Mazur, 1981).

Another radioactive showing exposed on the north shore of Nutarawit Lake, referred to as Windy in government databases (Prasad, 1981; NUMIN, 2013) and the Lake zone by Pan Ocean Oil (Mazur, 1981), is locally enriched in Co, Ni, Pb, and Ag. The uranium and base metal mineralization is associated with Archean gneiss proximal to minette to microsyenite (bostonite) intrusions southwest of a cataclastic zone within which remnants of conglomerate (unit PDBCs) are preserved (Mazur, 1981). Both gneiss and intrusions were affected by folding and intense fracturing. The main mineralized trend at 140° is pervasively chloritized and hematized, with U-Co-Ni-Pb-Ag mineralization concentrated at intersections of cross fractures. Native silver was identified locally in chlorite veins along the main trend. Structure was an important primary control, but microsyenite intrusions and proximity to unconformities were important factors in localizing mineralization.

Additional fracture controlled radioactive anomalies, labelled according to Table 14.1 of LeCheminant et al. (1981), are located west and southwest of the Wharton Lake fault system in cataclastically deformed Archean granitoid rocks and microfractured quartz-feldspar porphyry near contacts with the overlying Christopher Island Formation. One anomaly, located in fractured Kunwak arkose near a Nueltin rapakivi granite contact, contains secondary U minerals and pitchblende.

Two radioactive showings in the north half of NTS 65-O are classified as unconformity associated (Prasad, 1981; NUMIN, 2013). The Rhyolite showing in the northeast part of Tebesjuak Lake is hosted by flow-banded rhyolite above the contact with Archean basement (LeCheminant et al., 1981). The Cairn showing consists of anomalous radioactivity due to uraniferous phosphate cement in a thin unit of Thelon Formation west of Tebesjuak Lake.

Epithermal alteration is associated with local zones of quartz veining, chalcedony, and silicic to sericitic alteration south of Mallery Lake, only two of which have been proven to be gold-bearing. The 1995 discovery by Phelps Dodge of auriferous quartz veins and associated silicified zones led to a two year exploration program focussing on epithermal mineralization within and beneath the Pitz Formation (Biczok, 1996, 1998). Seventeen vein and chalcedonic alteration zones were located during this exploration, one east of the map area. Most are barren of gold at the surface. The Chalcedonic Stockwork is the only zone with Au values substantial enough to be included in the NUMIN database, and is >125 m wide and ~400 m long. The stockwork is characterized by subparallel, NE-trending steeply dipping quartz veins, dominated by a central composite vein up to 20 m wide flanked by a 60 m zone of narrower veins. Turner (2000) found the Au and Ag contents of the veins in this zone were dependent on their nature: (a) cavity filling veins, characterized by crystalline faceted quartz with drusy cavities and commonly including adularia, calcite, and fluorite in veins or breccia matrices, were generally barren; and (b) solid chalcedonic veins characterized by replacement textures of quartz over chalcedony, adularia, and calcite were more likely to contain native gold, silver and electrum. The Pitz Formation in the core zone of the Chalcedonic Stockwork is intensely sericitized and hematized, and this alteration is surrounded by an outer gossanous zone of weak pyritization (Biczok, 1998).

The T-Rex zone is the second of the altered auriferous zones (veins contain ~2–300 ppb Au) and was superimposed on the contact of Pitz Formation, Christopher Island Formation, and Archean granitic gneiss, all of which are veined with quartz (Biczok,

1998). The T-Rex veins are drusy, with cavities lined by quartz cockades and filled with calcite. A prominent hill at the west end of the grid exposes a breccia of Pitz fragments in a matrix of well rounded, sand sized quartz grains, its origin uncertain.

Two other unusual alteration zones in the Pitz Formation were described by Biczok (1996, 1998). Narrow veins at the Agate zone/Stockwork # 3 consist of banded orange-pink-grey agate occupying 20–30% of a 12 m by 300 m zone in spherulitic rhyolite. Aphyric to mafic porphyritic and felsic to intermediate dykes cut this rhyolite. This is the only Pitz locality where this was observed during 1996–1997 exploration, suggesting to Biczok (1996) proximity to a volcanic centre. At the zone nicknamed the “Fumarole”, vuggy red rhyolite with silicified spots is cut by crystalline to chalcedonic quartz veins up to 25 cm wide. The rhyolite overlies fine grained red quartzite and is overlain by feldspar-phyric dacite. Vugs filled with chalcedony and pervasive chalcedony replacement observed in thin section led Biczok (1996) to interpret the zone as a possible volcanic vent area.

In addition to metallic mineral showings, several notable non-metallic mineral occurrences are in the area. Wollastonite and wollastonite-adularia has been observed near contacts of the Nueltin rapakivi granite and are the products of high temperature contact metamorphism. Prominent occurrences of topaz in Pitz rhyolites (unit PDWPf) and Nueltin rapakivi granite (unit PKNg) have been noted above. One 014°-trending topaz- bearing greisenized felsic dyke consisting of quartz, plagioclase, K-feldspar, lepidolite (zinnwaldite), and topaz (10 vol.. %) with trace muscovite, fluorite, opaques and a metamict mineral cuts Christopher Island Formation for 140 m south of a PKNg contact. This dyke is unique and its age and affiliation are not known.

Topaz rhyolites have been reported in the Great Basin, southwest USA and in Finland, where they have been correlated with rapakivi granites emplaced during tectonic extension (Christiansen et al., 2007). Occurrences of topaz in rhyolites of the Pitz Formation and in Nueltin rapakivi granite of the Kivalliq igneous suite reinforce the interpretation that the Wharton Group and its age-related Kivalliq igneous suite were emplaced in an extensional tectonic setting (Rainbird et al., 2003).

FOLLOW-UP

This preliminary map, its geodatabase, and these notes are based on a legacy map, legacy field observations and university theses. It is supplemented by recent age determinations, field work, and petrography which ultimately may result in revised interpretations for the final map. Whereas the units in the Tebesjuak Lake map area reflect the stratigraphy and magmatic activity of the region as a whole, the area displays several unique features that are targeted for follow-up investigation.

The sequences interpreted tentatively by LeCheminant et al. (1981) as Kunwak Formation that lack upper alluvial beds, fine upward toward the base of the Pitz Formation, contain a local volcanic horizon, and show lacustrine influences, may represent an early, previously unrecognized member of the Wharton Group. In addition, the age and stratigraphic position of the basalts of the Pitz Formation that prompted re-investigation of this area under Geo-mapping for Energy and Minerals remain unclear. Topaz rhyolites, as yet undated, may prove to be younger than Nueltin granites and rhyolite porphyries, and may extend the time span of Kivalliq igneous suite activity.

Cu-Pb mineralization which was tentatively attributed to rapakivi granite or Pitz magma (LeCheminant et al., 1980; Webb, 1981) or to deeper level of the auriferous epithermal alteration and mineralization (Biczok, 1996), may instead be proximal to mafic intrusive members of the Kivalliq igneous suite (Peterson et al., submitted).

Finally, the Wharton Lake fault system's mylonitic to cataclastic shear zone component that was imposed on basement rocks around the northeast and east sides of the Wharton sub-basin should be re-examined for evidence, such as kinematic indicators and cooling ages, to test the early detachment hypothesis proposed here.

Data Sources

This geological map is derived from GSC Open File 728 (LeCheminant, 1981) and is based on 1:250,000 scale mapping (LeCheminant et al., 1979a, 1980, 1981), university theses (Booth, 1983; Burton, 1981; Roberts, 1981; Tambosso, 1981; Webb, 1981; Turner, 2000) and unpublished legacy notes and data tables. The reports and theses are the principal sources for the contents of the Descriptive Notes. The first two authors re-examined the Tebesjuak Lake map area in 2010 and 2012 because the earlier mapping indicated the presence of mafic volcanic rocks that may be key components of the 1.75 Ga Pitz Formation and mafic plutonic rocks associated with a plug-like intrusion of Nueltin Granite at Mallery Lake. Interpretation of this map area benefitted from subsequent mapping to the north in the Aberdeen Lake (NTS 66-B) and Beverly Lake (NTS 66-C) map areas by LeCheminant et al. (1983, 1984), and detailed investigations around Mallery Lake (T.D. Peterson and J.M.J. Scott, 2010–2012 field notes).

In addition to geology from Open File 728, this map includes geochronology, mineral occurrences, and alteration zones. Published U-Pb ages extracted from the Canadian Geochronology Knowledgebase (2013) and new U-Pb ages for ca. 1.75 Ga granites, the McRae Lake Dyke, and the Mallery Lake gabbro (Peterson et al., in prep.) are included. Data for historical mineral showings in this area were downloaded from NUMIN (2013), and updated from Best et al. (1977), LeCheminant et al. (1980), Lewis and Bosschart (1967), Mazur (1980), and Prasad (1981). The epithermal alteration zones shown on the map were derived from Biczok (1996, 1998).

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Coordinate System

Projection: Universal Transverse Mercator
Units: metres
Zone: 14
Horizontal Datum: NAD83

Bounding Coordinates

Western longitude: 100°00’00” W
Eastern longitude: 98°00’00” W
Northern latitude: 64°00’00” N
Southern latitude: 63°00’00” N

Data Model Information

Surface bedrock data are organized into feature classes and themes consistent with logical groupings of geological features. All field observation point data are related

through the Station_ID property of the Station theme. These feature attribute names and definitions are identical in the shapefiles and the XML files.

Consult PDFs in Data folder for complete description of the feature classes, feature attributes, and attribute domains.

The Bedrock Data Model and the Bedrock Domains documents are intended to describe all bedrock features which may be compiled at the 1:250 000 scale. Therefore, some of the feature classes and feature attributes described in these documents may not be present.

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III. **AND WHEREAS** Canada represents that it has full authority to grant the rights desired by the Licensee on the terms and conditions herein contained;

IV. **AND WHEREAS** the parties hereto are desirous of entering into a licence agreement on the basis herein set forth.

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5. The Licensee's liability to indemnify Canada under this Agreement shall not affect or prejudice Canada from exercising any other rights under law.

5.1 TERM

1. This Agreement is effective as of the date and time of acceptance (Eastern Time) and shall remain in effect for a period of one (1) year, subject to subsection 5.2 and section 6.0 below.

2. At the end of the first term, this Agreement shall automatically be extended for successive one (1) year terms, subject to section 6.0 below.

6.1 TERMINATION

1. Notwithstanding section 5.0, this Agreement shall terminate:

i automatically and without notice, if the Licensee commits or permits a breach of any of its covenants or obligations under this Agreement;

ii upon written notice of termination by the Licensee at any time, and such termination shall take effect thirty (30) days after the receipt by Canada of such notice; or

iii upon mutual agreement of the parties.

2. Upon the termination for whatever reason of this Agreement, the Licensee's obligations under section 4.0 shall survive; and the Licensee's rights under section 2.0 shall immediately cease.

3. Upon the termination for whatever reason of this Agreement, the Licensee shall delete or destroy all Data acquired under this Agreement immediately or within a reasonable timeframe where the Data is required to complete orders of Derivative Products made before the termination date of this Agreement.

7.1 GENERAL

1. **Applicable Law**
   This Agreement shall be construed and enforced in accordance with, and the rights of the parties shall be governed by, the laws of Ontario and Canada as applicable. The parties hereto attorn to the jurisdiction of the Superior Court of the Province of Ontario.

2. **Entire Agreement**
   This Agreement constitutes the entire agreement between the parties with respect to its subject matter. This Agreement may only be amended in writing, signed by both parties, which expressly states the intention to amend this Agreement.

3. **Dispute Resolution**
   If a dispute arises concerning this Agreement, the parties shall attempt to resolve the matter by negotiation.

ACCORD DE LICENCE

ACCORD DE LICENCE D'UTILISATION SANS RESTRICTION DE DONNÉES NUMÉRIQUES DE GÉOGRATIS

CE DOCUMENT constitue une entente légale entre vous (ci-après le " Détenteur de licence ") et SA MAJESTÉ LA REINE DU CHEF DU CANADA (ci-après le " Canada "), représentée par le Ministre des Ressources naturelles du Canada. **EN ATTEIGNANT, TÉLÉCHARGEANT, IMPRIMANT OU UTILISANT LES DONNÉES, L'INFORMATION OU LE MATÉRIEL FOURNIS OU ACCESSIBLES SELON CETTE ENTENTE, VOUS VOUS ENGAGEZ À RESPECTER LES MODALITÉS DE CET ACCORD.** SI VOUS ÊTES EN DÉSACCORD AVEC CES MODALITÉS, VOUS DEVEZ IMMÉDIATEMENT ÉLIMINER TOUTE COPIE DE CES DONNÉES, INFORMATION, MATÉRIEL ET PRODUITS DÉRIVÉS.

I. **ATTENDU QUE** le Canada détient les droits de propriété sur les données (les " Données ") accessibles aux termes des modalités de cet Accord;

II. **ATTENDU QUE** le Détenteur de licence désire obtenir certains droits sur les Données, sous réserve des modalités énoncées ci-après;

III. **ATTENDU QUE** le Canada déclare avoir la pleine autorité pour accorder les droits demandés par le Détenteur de licence, sous réserve des modalités énoncées ci-après;

IV. **ET ATTENDU QUE** les parties veulent en venir à une entente d'utilisation à partir de ce qui suit.

V. **À CES CAUSES**, en considérant les conventions contenues dans cet Accord, les parties conviennent de ce qui suit :

1.1 DÉFINITIONS

1. Données du Canada signifie toute Donnée dont le Canada détient le droit de propriété.

2. Données signifie toute donnée numérique, métadonnée ou documentation visée par les modalités de cet Accord.

3. Produits dérivés signifie tout produit, système, sous-système, appareil, composant, matériel ou logiciel qui comprend ou utilise toute partie des Données.

4. Droits de propriété intellectuelle signifie tout droit de propriété intellectuelle reconnu par la loi, y compris tout droit de propriété intellectuelle protégé par une législation telle que celle qui régit, sans être limitée à, les droits d'auteur et les brevets.

2.1 CESSION D'UNE LICENCE

1. 2.1 Sous réserve des modalités du présent Accord, le Canada octroie au Détenteur de licence une licence non exclusive, sans frais ni redevances exigibles, et le droit d'exercer tous les Droits de propriété intellectuelle sur les Données. Ceci comprend le droit d'utiliser, incorporer, accorder des licences d'utilisation (avec droit subséquent d'accorder des licences d'utilisation), modifier, améliorer, développer et distribuer les Données; et de fabriquer ou distribuer des Produits dérivés.

2. Les Droits de propriété intellectuelle découlant de toute modification, amélioration, développement ou traduction des Données, ou de la fabrication de Produits dérivés, effectués par ou pour le Détenteur de licence seront détenus par le Détenteur de licence ou tout substitut identifié par le Détenteur de licence.

3.1 PROTECTION ET IDENTIFICATION DE LA SOURCE

1. L'utilisation des Données ne constitue en aucune façon une reconnaissance par le Canada d'un Produit dérivé. Le Détenteur doit identifier la source de données, de la façon suivante, lorsque toute partie des Données est redistribuée ou comprise dans un Produit dérivé :
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4.1 GARANTIE, EXCLUSION ET INDEMNISATION

1. Le Canada ne fait aucune représentation ou garantie, expresse ou tacite, découlant de la loi ou d'autres sources, en ce qui concerne entre autres l'exactitude, l'utilité, la nouveauté, la validité, l'étendue, l'intégralité ou l'actualité des Données et rejette expressément toute garantie implicite de qualité loyale et marchande ou l'à propos à une fin particulière des Données. Le Canada n'assure ni ne garantit la compatibilité du site qui contient les Données avec les versions antérieures, actuelles et futures de n'importe quel fureteur.

2. Le Canada ne peut être tenu responsable par le Détenteur de licence en ce qui a trait à toute réclamation, revendication ou action en justice, quelle qu'en soit la cause, concernant toute perte ou tout préjudice ou dommage ou frais, direct ou indirect, qui pourrait résulter de la possession ou de l'utilisation des Données par le Détenteur de licence.

3. Le Détenteur de licence tiendra le Canada et ses représentants, employés, agents et exécutants, indemnes et à couvert à l'égard de toute réclamation, revendication ou action en justice, quelle qu'en soit la cause, alléguant toute perte, tout frais, toute dépense, tout dommage ou toute blessure (y compris toute blessure mortelle) qui pourrait résulter de la possession ou de l'utilisation des Données par le Détenteur de licence.

4. Le Détenteur de licence devra accorder des licences d'utilisation à toute personne ou partie qui obtient les Données ou des Produits dérivés au moyen d'un accord de licence, et cet accord devra imposer à ces personnes ou parties les mêmes modalités que celles qui sont énoncées dans la section 4.0 de cet Accord.

5. L'obligation du Détenteur de licence d'indemniser le Canada selon cet Accord ne peut affecter ni empêcher le Canada d'exercer tout autre droit selon la loi.

5.1 DURÉE

1. Cet Accord entre en vigueur à partir de la date et de l'heure d'acceptation des modalités de l'Accord (Heure de l'Est) et restera en vigueur pour une période d'un (1) an, en vertu de la sous-section 5.2 et de la section 6.0 qui suivent.

2. À la fin du premier terme, cet Accord sera automatiquement renouvelé pour des termes successifs d'un (1) an, en vertu de la section 6.0 qui suit.

6.1 RÉSILIATION

1. 6.1 Nonobstant la section 5.0, cet Accord peut être résilié :

   i. automatiquement et sans préavis, si le Détenteur de licence manque à ses engagements ou obligations selon cet Accord;

   ii. par un préavis écrit de résiliation émis par le Détenteur de licence, en tout temps, et cette résiliation prendra effet trente (30) jours suivant la réception d'un tel préavis par le Canada; ou

   iii. par consentement mutuel des parties.

2. Lors de la résiliation de cet Accord, pour quelque raison que ce soit, les obligations qui incombent au Détenteur de licence en vertu de la section 4.0 continueront de s'appliquer et les droits du Détenteur de licence en vertu de la section 2.0 cesseront immédiatement.

3. Lors de la résiliation de cet Accord, pour quelque raison que ce soit, le Détenteur de licence devra immédiatement effacer ou détruire toutes les Données obtenues en vertu de cet Accord, ou à l'intérieur d'un délai raisonnable lorsque les Données sont nécessaires pour terminer la livraison de Produits dérivés commandés avant la résiliation de cet Accord.

7.1 GÉNÉRAL

1. **Lois d'application**
   Le présent Accord est régi et interprété en vertu des lois en vigueur dans la province de l'Ontario. Les parties acceptent de tomber sous la juridiction de la Cour supérieure de la Province de l'Ontario.

2. **Totalité de l'Accord**
   Le présent Accord constitue l'intégralité de l'entente conclue entre les parties relativement à l'objet du présent Accord. Toute modification à cet Accord ne peut être que par écrit, doit porter la signature de chaque partie et exprimer clairement l'intention de modifier cet Accord.

3. **Solution des litiges**
   Si un litige survient à propos de cet Accord, les parties tenteront de le résoudre par des négociations de bonne foi.