Natural Resources Canada — Ressources naturelles Canada

GEOLOGICAL SURVEY OF CANADA — COMMISSION GÉOLOGIQUE DU CANADA

DESCRIPTIVE NOTES

INTRODUCTION

The Committee Bay belt is a 600 km long belt of northeast-striking, Archean supracrustal rocks and granitoid plutons that form part of the Rae Province in central Nunavut (Fig. 1). The Archean supracrustal rocks of this belt belong to the Prince Albert group (PAg; Heywood, 1961), and are host to a number of gold and base metal occurrences. This map is a product of the 2000-2003 Targeted Geoscience Initiative that was instigated by the Geological Survey of Canada, in partnership with the Canada – Nunavut Geoscience Office and university researchers, as a stimulus for mineral exploration of this remote area. The project involved an aeromagnetic survey, helicopter-supported, 1:100,000 scale bedrock and surficial mapping of NTS map sheets 56K, 56J (north), 56-O (south) and 56P, supporting geoscience studies and a drift prospecting survey. The aeromagnetic survey covered 85,300 line km and was flown along 400 m spaced, northwest – southeast flight lines (perpendicular to strike) on a pre-calculated drape surface with a mean terrain clearance of 150 m (Kiss et al., 2002a-g). The results of the bedrock mapping and related petrological/structural studies are presented in the following: 1) Laughland Lake area (56K) – Johnstone (2002), Johnstone et al. (2002), MacHattie (2002) and Sandeman et al. (2001a-c); 2) Walker Lake and Arrowsmith River (56J (north) and 56O (south), respectively) – this map, Sanborn-Barrie et al. (2002) and Skulski et al. (2002); and 3) Ellice Hills (56P) – Sanborn-Barrie et al. (2003) and Skulski et al., 2003). Lithogeochemical prospecting results for the study area are presented in Deyell and Sherlock (2003), Hyde et al. (2002) and Sherlock and Deyell (2002; 2003), with the surficial mapping and drift prospecting results in Giangioppi et al. (2003), Little (2001), Little et al. (2002), McMartin et al. (2002; 2003), Ozyer and Hicock (2002) and Utting and Ward (2002).

REGIONAL GEOLOGICAL SETTING

The eastern part of the Rae Province contains a discontinuous, 2000 km long, northeast – trending zone of polydeformed and metamorphosed Archean supracrustal rocks (Fig. 1). These rocks have continental affinities, as reflected in localized evidence for their deposition on an older sialic basement (3.05 Ga, Hartlaub et al., 2001; 2.87 Ga, Zaleski et al., 2001) and the presence of older Meso- to Paleoarchean detrital zircons in widespread quartzite deposits (Ashton, 1988; Davis and Zaleski, 1998; Hartlaub et al., 2001; Skulski et al., 2003). Volcanic rocks within this zone include komatiite, basalt, andesite, and rhyolite, with the latter yielding U/Pb ages in the Woodburn Lake and Committee Bay area between 2.73 and 2.69 Ga (Zaleski et al., 2001; Skulski et al., 2003; T. Skulski, unpublished). Plutonic rocks in the eastern Rae Province are dominated by calc-alkaline granitoid plutons, which were emplaced between 2.64 and 2.58 Ga (LeCheminant and Roddick, 1991; Zaleski et al., 2001; Skulski et al., 2003).

Outliers of platformal to basinal facies Paleoproterozoic meta-sedimentary rocks are found throughout the Rae Province (Fig. 1). These include the >1.85 Ga Amer Group (Tella, 1994) and the c. 1.88 Ga Penrhyn Group (Henderson et al., 1983), Chantrey Group (Frisch, 2000) and Folster Lake Formation (Frisch, 1982). In the Committee Bay area small outliers of Paleoproterozoic metasedimentary rocks include <2.50 Ga quartzite in the Laughland Lake ...

(unit Pgr) are fine to medium grained, and were emplaced as metre to decimetre thick sills, dykes and sheets. In comparison to the WLIC, the Hudson suite has a subdued and mottled aeromagnetic signature (total field). Miarolithic cavities and secondary fluorite, common in Hudson monzogranites in the Laughland Lake area (Sandeman et al., 2001a), are absent in the map area. Massive biotitie – magnetite – fluorite monzogranite that cuts foliated 2610 Ma K-feldspar augen granodiorite near Laughland Lake has an U/Pb zircon age of 1821 ± 5 Ma (Skulski et al., 2003). A similar, salmon coloured monzogranite dyke, that cuts S_2 fabric in the Northern subdomain (map sheet 56-O (south)), has a preliminary U/Pb zircon age of 1815 (map number 12; Table 1). Northeast striking, up to 100m wide, MacKenzie diabase dykes (map unit Pmd) cut the map area. The extent and geometry of individual dykes are in part defined by positive linear aeromagnetic anomalies, with individual dykes characterized by overlapping to en echelon dyke tips.

STRUCTURAL GEOLOGY

The Walker Lake – Arrowsmith River area structural geology as presented in Sanborn-Barrie et al. (2002) is summarized below.

D1 STRUCTURES

In the supracrustal rocks, the planar tectonic fabrics that predate the regional northeast-striking foliation are interpreted as S_1 and occur predominantly in komatiitic and plutonic rocks. In komatiite, the northwestward striking, bedding parallel S_1 is defined by aligned to schistose tremolite, serpentine and talc, which dips shallowly northeast or moderately southwest. In plutonic rocks, S_1 is recognizable in the hinge zones of F_2 folds where it is defined by aligned biotite and quartz at a high angle to S_2. In the Northern Migmatite subdomain, S_1 is represented by a migmatite layering defined by millimetre to centimetre scale leucocratic veinlets, and aligned biotite ± garnet layers. F_1 folds, to which S_1 is axial planar, occur at the western end of the NHR and trend north to northwest.

D2 STRUCTURES

The dominant fabric throughout the Committee Bay region is a moderate to strong, northeast-striking foliation. This fabric is axial planar to regional, northeast-trending F_2 folds. In general, this regional foliation appears to represent a composite $S_2 \pm S_1$ fabric, since F_2 hinges commonly display two moderately to weakly developed oblique foliations, S_1 and S_2, whereas F_2 limbs generally contain a single foliation of higher strain.

The $S_2 \pm S_1$ composite foliation typically has a southeastward dip, but shows variations in both dip direction and inclination. Within the supracrustal belts, S_2 planes dip moderately to steeply (65 to 85°) to the southeast. Intervening plutonic panels have planar fabrics with more variable attitudes. In the south, the $S_2 \pm S_1$ fabric varies from steeply southeast to steeply northwest dipping, whereas in the northern part of the Prince Albert group subdomain, the $S_2 \pm S_1$ fabric generally maintains a shallow (14 to 25°) to moderate (55 to 70°) southeastward dip. The $S_2 \pm S_1$ fabric locally contains an elongate quartz lineation that is uniformly characterized by a moderate (15 to 40°) east to northeast ...

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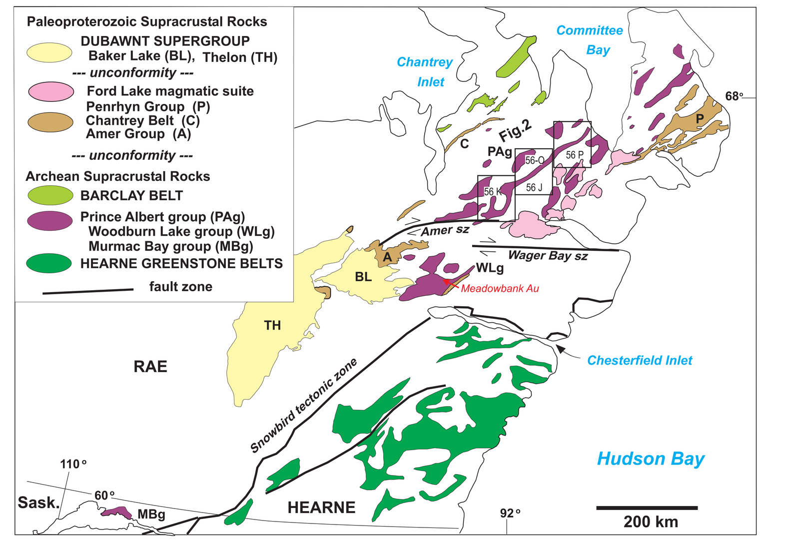


Figure 1. Simplified geological map of the western Churchill Province, showing the location of the Committee Bay project area (Figure 2) and Walker Lake (56 J (North)) and Arrowsmith River (56-O (South)) map sheets.

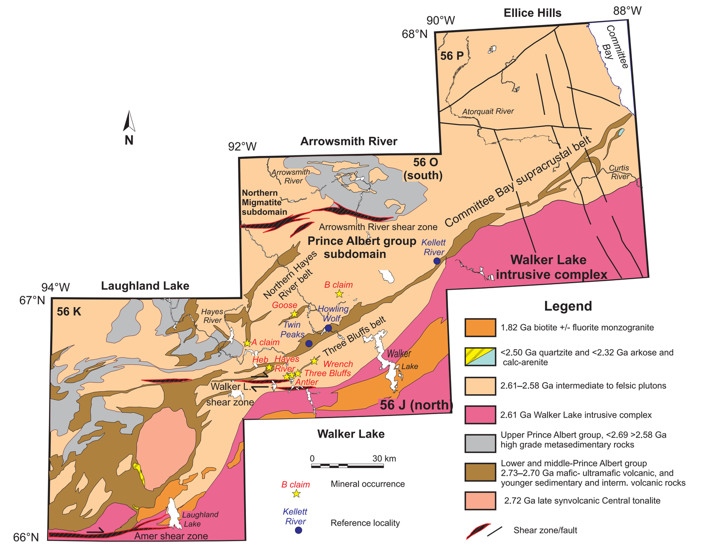
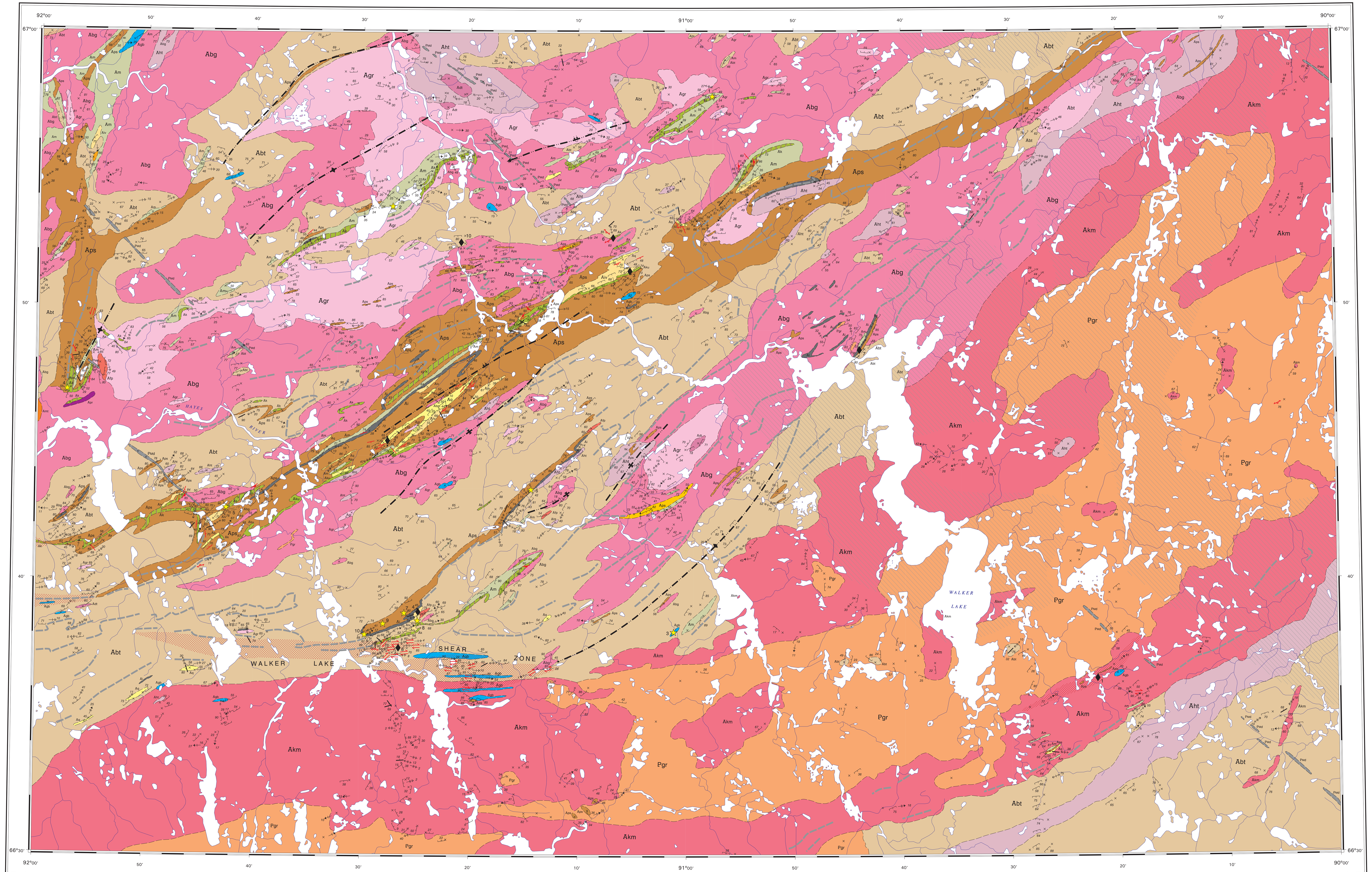
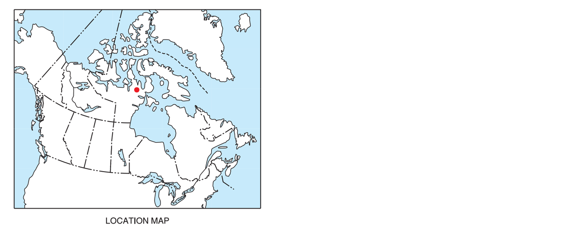


Figure 2. Simplified geological map of the Committee Bay area with principal mineral showings and reference localities for the Walker Lake–Arrowsmith River region.





OPEN FILE 3777

GEOLOGY

WALKER LAKE AND ARROWSMITH RIVER AREA

NUNAVUT

Scale 1:100 000/Échelle 1/100 000

kilometres 2 0 2 4 6 8 kilomètres

Universal Transverse Mercator Projection
North American Datum 1983

Projection transverse universelle de Mercator
Système de référence géodésique nord-américain, 1983

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Geology by T. Skulski, M. Sanborn-Barrie, and H. Sandeman, 2000, with T. MacHattie, S. Johnstone, D. Hyde, D. Byrne, D. Plaza, and D. Panagapko

Geological compilation by T. Skulski, M. Sanborn-Barrie, and H. Sandeman, 2003

Co-ordinated through the auspices of the Committee Bay project (Targeted Geoscience Initiative; TGI)

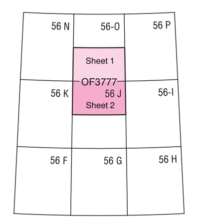
Digital cartography by R.L. Allard, Earth Sciences Sector Information Division (ESS Info)

This map was produced from processes that conform to the ESS Info Publishing Services Subdivision Quality Management System, registered to the ISO 9001: 2000 standard

Any revisions or additional geological information known to the user would be welcomed by the Geological Survey of Canada

Digital base map from data compiled by Geomatics Canada, modified by ESS Info

Proximity to the North Magnetic Pole causes the magnetic compass to be erratic in this area. Mean magnetic declination 2003, 16°00'W, decreasing 13.7' annually. Readings vary from 13°20'W in the SW corner to 18°40'W in the NE corner of the map



LEGEND

Note: This legend is common to sheet 1 and sheet 2 of Open File 3777. Coloured legend blocks indicate map units that appear on this map. Not all symbols shown in the legend necessarily appear on this map.

QUATERNARY

Quaternary cover; predominantly tills and glacio-fluvial sediments.

PROTEROZOIC
POST- TO LATE-TECTONIC PLUTONIC ROCKS

PMd — *MacKenzie diabasic gabbro dykes. Strike continuity is variable and is defined primarily by distinctive, northwest-trending, positive linear aeromagnetic anomalies.*

Pgr — *Salmon-coloured, variably foliated to lineated, medium grained to pegmatitic, Hudson biotite, ± magnetite monzogranite and syenogranite. At locality 12, a Hudson monzogranite dyke cuts S_2, and has a preliminary U/Pb zircon age of 1815 Ma (Table 1). In the Laughland Lake area, a Hudson monzogranite dyke cuts S_2 and has a U/Pb zircon age of 1821 ± 5 Ma.*

ARCHEAN AND/OR PALEOPROTEROZOIC

APgb — *Massive to weakly foliated, coarse grained phlogopite gabbro diorite, and phlogopite ± olivine, ± clinopyroxene lamprophyre dykes.*

ARCHEAN
PRE- TO SYNTECTONIC PLUTONIC ROCKS

Agr — *Pinkish red, variably foliated to lineated biotite monzogranite, syenogranite, medium grained to pegmatitic. In the Laughland Lake area a sample of lineated monzogranite has an age of 2578 ± 11 Ma.*

Amt — *Biotite + magnetite tonalite and pinkish red biotite ± hornblende + magnetite + K-feldspar megacrystic granodiorite. A sample of the latter granodiorite (map location 11) has a zircon U/Pb age of 2580 ± 8 Ma (Table 1). Plutons cut high-grade metasedimentary rocks (unit Adm) and near contacts, pink K-feldspar + magnetite granodiorite is transitional with white K-feldspar augen + garnet monzogranite.*

Ack — *Medium grained, foliated biotite + orthopyroxene + hornblende +magnetite + K-feldspar megacrystic granodiorite. Contains pale green-grey plagioclase. Orthopyroxene is partly retrogressed to biotite. Occurs in the northeast as a small plug cutting high-grade metasedimentary rocks (unit Adm), and is in turn, cut by biotite monzogranite (unit Agr).*

Agg — *White to pale pink weathering, coarse grained to pegmatitic, variably foliated biotite ± muscovite + K-feldspar (white) ± garnet ± sillimanite peraluminous granite. Commonly contains inclusions of inhomogeneous diatexite. Crosscuts high-grade metasedimentary rocks in the Arrowsmith River area. Locally cut by northeast-trending granodiorite dykes.*

Abg — *Equigranular, medium- to coarse-grained biotite ± magnetite ± epidote granodiorite with abundant inclusions of tonalite and supracrustal rocks. A sample of biotite granodiorite at locality 10 (Table 1) has a zircon U/Pb age of 2583 ± 4 Ma.*

Akg — *Pinkish red biotite + K-feldspar megacrystic granodiorite, medium to coarse grained and foliated to lineated. A K-feldspar granodiorite at locality 9 has a zircon U/Pb age of 2604 ± 6 Ma (Table 1).*

Aht — *Medium to coarse grained, foliated hornblende+ biotite tonalite and quartz diorite; occurs as small mafic plugs and larger intermediate massifs that cuts biotite tonalite (unit Abt). A sample of quartz diorite (map locality 7, Table 1) has a zircon U/Pb age of 2609 ± 5 Ma.*

Adt — *Massive to weakly foliated, medium grained hornblende + biotite ± clinopyroxene monzodiorite and diorite; occurs as small plugs.*

Afp — *Feldspar porphyry dykes and thin sills.*

Abt — *Granular, foliated, fine grained biotite, ± epidote, ± magnetite tonalite. Cuts supracrustal rocks of the Prince Albert group. A biotite tonalite at locality 6 (Table 1) has a zircon U/Pb age of 2606 ± 4 Ma. A sample of older tonalite at locality 1 yielded a zircon U/Pb age estimate of 2720 Ma.*

Akm — *Pinkish red biotite + K-feldspar megacrystic + magnetite, ± hornblende granodiorite/monzogranite and associated granite pegmatite of the Walker Lake intrusive complex. In the Laughland Lake area, a sample of granodiorite from the Walker Lake intrusive complex has a U/Pb zircon age of 2610 ± 4 Ma.*

Agb — *Gabbro, (locally anorthositic) may be co-magmatic with mafic volcanic rocks (unit Am).*

Apr — *Serpentinized, peridotite, locally with magmatic layering; may be co-magmatic with komatiite (unit Ak).*

SUPRACRUSTAL ROCKS
PRINCE ALBERT GROUP (units Am - Adm)

Adm — *Metatexite, diatexite (biotite ± garnet ± sillimanite ± K-feldspar ± cordierite ± melt). Inhomogeneous diatexite contains 70-95% medium grained to pegmatitic mobilizate, typically garnet-bearing, commonly contains inclusions and rafts of metatexite. Metatexite differs by containing 10-40% interbanded granitoid mobilizate. A sample of metawacke protolith from locality 5 (Table 1) has a maximum U/Pb age (detrital zircon) of 2691 ± 16 Ma. A minimum age of deposition is provided by 2580 ± 8 Ma biotite + magnetite granodiorite (locality 11, Table 1) that cuts diatexite.*

Aku — *Upper komatiite unit comprises 0.5 to 2 m flows with green and brown layering. Overlies 2711 Ma intermediate lapilli tuff, and is overlain by semipelite and locally thin mafic volcanic rocks.*

Aiv — *Andesite tuff and lapilli tuff (dominant) and massive dacite (minor) mainly overlying quartzite (unit Aq). Occurs as aphyric or plagioclase (± quartz) phyric volcanic rocks. A sample of lapilli tuff (map location 3, Table 1) has a zircon U/Pb age of 2711 ± 3 Ma, and dacite (map location 4, Table 1) has a zircon U/Pb age of 2706 +5/-3 Ma.*

Aq — *Quartzite, massive to weakly bedded, locally with planar cross-bedding (foresets >50 cm), and normal grading. Occurs as an up to 80 m wide, ridge-forming unit. A sample of quartzite from locality 2 (Table 1) yields a maximum U/Pb age of deposition of 2722 ± 11 Ma (detrital zircon). A minimum age of quartzite deposition is provided by an overlying dacite lapilli tuff at locality 3 (Table 1) with a U/Pb zircon age of 2711 ± 3 Ma.*

Aps — *Pelite, semipelite and psammite, rusty red and brown, rare grading in psammite, medium to coarse bedded. Mineralogy is variable but includes biotite ± garnet ± sillimanite ± cordierite ± muscovite.*

Ai — *Banded iron-formation, includes oxide facies magnetite-recrystallized chert (quartz) iron-formation and silicate facies iron-formation (garnet, ± grunerite, ferroactinolite). Commonly associated with rusty weathering gossan zones.*

Ak — *Komatiite, komatiitic basalt and undifferentiated ultramafic schists Komatiite flows have dark green and brown layers corresponding to spinifex (rare, up to 10 cm long) and cumulate zones, respectively. Individual flows are <1 m to 10 m thick. Occurs primarily in the lower sequence, and rarely, in the upper sequence of the Prince Albert group (e.g, northeastern part of the Arrowsmith River area 56-O(S)).*

Am — *Tholeiitic mafic volcanic rocks; typically amphibolitic (rare clinopyroxene) with rare massive and pillowed basalt flows. Pillows are variably flattened, up to 1 m wide, with 5 cm dark chill margins. In the Laughland Lake area, basalt in the lower sequence of the Prince Albert group is locally associated with 2732 Ma rhyolite lapilli tuff. Northeast of the Arrowsmith River mafic gneiss and metabasalt occur in the upper sequence of the Prince Albert group.*

Lithological contact (approximate)
Bedding, with tops (northwest), and overturned (northwest younging)
Lava flow, (top, overturned)
Igneous layering
First foliation (S_1) or sole foliation where only one planar fabric observed, and gneissic mineral banding
Second foliation and gneissosity S_2
Third foliation S_3
Cleavage (1st generation, 2nd generation, 3rd generation)
Outcrop-scale ductile shear zone
Ductile shear zone (apparent dextral displacement)
Ductile shear zone (apparent extensional displacement)
Ductile shear zone (apparent sinistral displacement)
Mineral Lineation (unknown, 1st generation, 1st generation stretching, 2nd generation, 2nd generation stretching, 3rd generation)
M fold hinge (unknown, 1st generation, 2nd generation, 3rd generation)
S fold hinge (unknown, 1st generation, 2nd generation)
Z fold hinge (unknown, 1st generation, 2nd generation, 3rd generation)
Axial plane
Axial trace of second generation antiform (F_2)
Axial trace of second generation synform (F_2)
Axial trace of second generation synform (F_2) (overturned, north vergent)
Dyke
Regional-scale shear zone undefined, strike-slip and normal-slip (circle side down) components
Outcrop where observations were made
Positive linear aeromagnetic anomaly
U/Pb geochronology sample site (Table 1)
Mineralized sample site (Table 2)

Locality	Rock type	Method (1)	Age (Ma)	Interp. (2)	Reference (3)	Easting (4)	Northing
1	tonalite	SHRIMP z	2720	crystal. est.	4	616376	7389978
2	quartzite	SHRIMP dz	<2722 ±11	detrital	1	567493	7404486
3	dacite lapilli tuff	TIMS z	2711 ±3	crystal.	2	583904	7416512
4	dacite	TIMS z	2706 +5/-4	crystal.	2	570250	7392959
5	metawacke	SHRIMP dz	<2691 ±16	detrital	1	584507	7473845
6	tonalite	SHRIMP z	2606 ±4	crystal.	1	582698	7418741
		SHRIMP z	2566 ±9	metam.	1		
7	quartz diorite	SHRIMP z	2609 ±5	crystal.	1	599646	7411671
		SHRIMP z	2580 ±13	metam.	1		
8	leuco granodiorite	SHRIMP z	2608	crystal. est.	4	568734	7390452
9	K-spar granodiorite	SHRIMP z	2604 ±6	crystal.	1	595399	7446297
		SHRIMP z	2575 ±5	metam.	1		
10	Bt granodiorite	SHRIMP z	2583 ±4	crystal.	1	572435	7418014
11	Bt-Mt granodiorite	SHRIMP z	2580 ±8	crystal.	3	599033	7478084
12	Bt-monzogranite	TIMS z	1815	crystal. est.	2	550162	7471104
		TIMS m	1790	metam.			

Notes:
(1) Method: U/Pb analyses obtained in the Geochronology section of the Geological Survey of Canada using the GSC SHRIMP II or TIMS thermal ionisation mass spectrometer instrumentation (with R. Stern, N. Rayner and W. Davis) and at the Royal Ontario Museum (with J. Ketchum); *z* zircon, *dz* detrital zircon, and *m* monazite.
(2) Interpretation: *detrital* maximum age of sedimentation from age of youngest detrital zircon; *crystal*. age of crystallization; *crystal. est*. estimated age of crystallization; *metam.* age of metamorphic zircon overgrowth or recrystallization.
(3) Reference: 1 Skulski et al., unpublished; 2 Sanborn-Barrie and Davis, unpublished; 3 Carson et al., unpublished; 4 Johnstone, 2002.
(4) UTM coordinates, zone 15, NAD 1983.

Table 1. U/Pb geochronology of the Walker Lake and Arrowsmith River area, Nunavut, samples shown on map as black diamond with locality number.

Locality	Showing	Easting (1)	Northing	Sample#	Au (ppb)	Cu (ppm)	Description	Reference (2)
1	B Claim	589106	7428538	20864	7950	827	massive Po, Py, Cp	1
2	Goose	567689	7420409	5AKP149	1620			2
3		587648	7392109	20784	12	10000	sulphide Qz vein	1
4	A Claim	545968	740742			800000		3
5	Heb	556995	7399670	37		3700000		4
6	North Wrench	577651	7401473	20792	9730		sulph./Qz in oxide IF	1
7	Ledge	569300	7392850	ADBP054	21430			5
8	Three Bluffs	570220	7392360	3SHP028	85820			6
9	Antler	567885	7392090	3MFP018	120820			6
10	Hayes River	566650	7391325	3MFP064	23380			6

Notes:
(1) UTM zone 15, NAD 1983.
(2) All data are from Sherlock and Deyell (2002; Geological Survey of Canada, Open File 4257) including new assays (samples 20864, 20784 and 20792) and data compiled from Assessment Reports (see reference list); references are 1: OF4257; 2: assessment report #83609; 3: assessment report #060783; 4: assessment report #082146; 5: assessment report #083406; 6: assessment report #083201.

Table 2. Selection of mineralized samples, Walker Lake and Arrowsmith River area, samples shown on map as yellow star with locality number.

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COMMISSION GÉOLOGIQUE DU CANADA
2003
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Sheet 2 of 2, Geology

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