DESCRIPTIVE NOTES

The Exeter Lake area (NTS 76D/15) lies in the central part of the Slave Structural Province, 315 km NNE of Yellowknife, Folinsbee (1949) previously mapped the area as part of his 1" to 4 mile map of the Lac de Gras area. The geology of the area surrounding Exeter Lake has recently been mapped to the north by King et al. (1991), to the west by Thompson et al. (1994a, b) and to the south and east by Kjarsgaard et al. (1994a, b). Quaternary geology for the map area is described by Ward et al. (1997) and Dredge et al. (1997).

ARCHEAN INTRUSIVE RELATIONSHIPS AND AGE CORRELATIONS

U-Pb geochronology is presently not available for Archean rocks in the Exeter Lake map sheet. Relative ages based on intrusive relationships and fabric development suggest that the Yellowknife Supergroup metasedimentary rocks (AYSs), containing S_2 , S_3 (and rarely S_1) structures are the oldest map unit. Hornlende biotite tonalite (ATo-h,b) and biotite granodiorite (AGd-b) with variably developed S_2 structures intrude the metasedimentary rocks. Muscovite biotite granite (AGr-m,b) and associated pegmatites (AGr-peg), and the porphyritic biotite granite (AGr-b) intrude all the above mentioned map units and contain rare S_3 structures, hence they are thought to be the youngest Archean magmatic rocks. The relative age of the biotite tonalite (ATo-b) is somewhat problematic. Compared to tonalites associated with the younger granites (ATo-h,b), these rocks have a much lower colour index. The recrystallized nature and development of L and S fabrics (S2 and S3) in the biotite tonalite rocks suggests this unit is older than the (ATo-h,b) and (AGd-b) suite granitoids.

Detrital zircon studies on a Yellowknife Supergroup metasediment sample from the Paul Lake sheet immediatly southeast of the map area indicate a maximum deposition age of 2670 Ma (M.E. Villeneuve, pers. comm., 1994). In the Exeter Lake belt, Yellowknife Supergroup metasedimentary rocks sediments have possible affinities to the iron formation bearing Contwoyto Formation while those in the northern part of the map area lack iron formation and so are more similar to the Itchen Formation, as defined by Bostock (1980). The recrystallized biotite tonalite (ATo-b) along the north shore of Exeter Lake has many similarities to strongly deformed granitoids mapped as 'Older Granitoids' by Thompson (1994a, b) 10 km to the west. However, the exact age of this lithologic unit is unknown, and it is unclear if these rocks

are time correlative with syn-volcanic (syn-D1) granitoids observed in the Contwoyto Lake area to the north which are ca. 2670 - 2650 Ma in age (Bostock, 1980; Davis et al., 1994), or if they are in fact part of an even older lithologic assemblage. The hornblende biotite tonalite (ATo-h,b) and biotite granodiorite (AGd-b) suite rocks in the Exeter Lake map area contain mineral assemblages and structural fabrics similar to the Concession suite granitoids found to the north in the Contwoyto-Nose Lakes sheets (King et al., 1992; Davis et al., 1994). The Concession suite rocks have U-Pb zircon intrusive ages of 2608 +5/-4 Ma (Davis et al., 1994). However, the Exeter Lake tonalite-granodiorite suite rocks also have petrographic similarities to granitoids of the Defeat suite in the Yellowknife area (Henderson, 1985). These latter granitoids are significantly older (2628 ± 3 Ma and 2624 ± 4 Ma) than the Concession suite granitoids (Davis and Bleeker, in press). Thus it is unclear if the Exeter Lake tonalite-granodiorite suite rocks are related to ca. 2608 Ma Concession suite plutonism, to ca. 2626 Ma Defeat suite magmatism, or are temporally

The muscovite-biotite granite (AGr-m,b) and porphyritic biotite granite (AGr-b) plutons in the map area are considered part of the 2580 - 2600 Ma pan-Slave period of granite plutonism (van Bremen et al., 1992; Davis et al., 1994). These granites are similar to the post-deformation Prosperous granite suite in the Yellowknife area (Henderson, 1985) and the late stage Yamba/Contwoyto granite suite of Davis et al. (1994) to the north of Exeter Lake.

In the Yellowknife Supergroup metasediments, metamorphic grade is quite variable. Low grade biotite spotted metasediments dominate the southern belt, south and east of Exeter Lake. Cordierite + andalusite grade 'knotted' schist occur both to the north and south of the lower grade rocks east of Exeter Lake. Continuing to the south, however, the metamorphic gradient steeply increases through sillimanite (mm to cm scale acicular sillimanite crystals) to migmatite grade metasediments. The steep metamorphic gradient in this area of the Exeter Lake map sheet is thought to be related to the quartz diorite phase of the Koala batholith (in the adjacent Paul Lake and Koala map sheets to the south). Metamorphosed metasedimentary rocks also occur within the Exeter Lake map area in a northern belt. Here metamorphic grade increases

acicular sillimanite needles plus fibrolite mats plus partial melt. Small Yellowknife Supergroup metasedimentary enclaves associated with tonalite/granodiorite suite granitoids are invariably at migmatite grade. In contrast, metasediments in muscovite-biotite granite exhibit metamorphic mineral assemblages similar to those observed in the nearby metasedimentary belts i.e. the regional metamorphic grade. This is suggested to be due to the tonalite/granodiorite suite granitoids being emplaced at higher temperatures as compared to the muscovite biotite and biotite granites. The metamorphic assemblages observed in the metasediments are similar to those observed in other areas of the Slave Province (Thompson, 1978, 1989) and are consistent with low-P, high-T metamorphism.

northwards, from cordierite + andalusite 'knotted' schist through sillimanite grade 'knotted' schist to migmatite. The higher grade schist contain both

Direct evidence for faulting in the map area is limited to one area in the southwestern part of the map sheet. A wedge of migmatite grade metasedimentary rocks adjacent to biotite spotted mudstones and siltstones is interpreted as a fault-bounded pop-up. Strike trends on steeply dipping, and often haematized joint sets coupled with rare slicken striaes azimuth measurements indicate faulting may be associated with the following trends: ~015°, ~045°, ~080°, ~315°, ~345°. DIABASE DYKES

Four swarms of Proterozoic diabase dykes (<1 to 50 m in width) occurr in the map area. The individual dyke swarms are distinguished on the basis of their orientation, texture, mineralogy and magnetic characteristics (Kjarsgaard and Wyllie, 1993, 1994; LeCheminant, 1994). All the dykes are weakly altered, suggested to be related to deuteric processes. However, the MacKay dykes also appear to have been affected by a very weak prograde metamorphic event (A.N. LeCheminant, pers. comm.). The Mackenzie dykes, intruded at 1.27 Ga (LeCheminant and Heaman, 1989) are the youngest diabase dykes in the map area. The age of the '305' dykes is unknown, however, preliminary studies indicate a paleomagnetic pole position similar to previous determinations on dykes from the Mackenzie swarm (K. Buchan, written comm., 1994), hence they are suggested to be Mesoproterozoic in age. U-Pb baddeleyite studies on Lac de Gras and MacKay dyke samples yielded ages of 2.03 - 2.02 Ga and 2.21 Ga, respectively (LeCheminant and van Breemen, 1994). KIMBERLITES

Limited geological information is available for kimberlites in the Exeter Lake map sheet. St. Pierre et al. (1998), on the basis of paleomagnetic studies suggest an approximate age of ca. 60 Ma for the Beaver pipe. The Beaver kimberlite thus could be distinctly older than the Panda (53.8 ± 3.8; Carlson et al., 1998) and Leslie (53.9 ± 2.0; Berg and Carlson, 1998) kimberlites, both of which lie within the BHP/DiaMet claim block immediatly south of the map area. However, slightly older Cretaceous age (74 \pm 3.0) kimberlites are also reported from the Lac de Gras area, suggesting the occurrence of multiple kimberlite emplacement episodes (e.g. Heaman et al., 1997; Davis and Kjarsgaard, 1997). Kimberlite-derived mudstone and shale clasts containing Lower Cretaceous (Albian) to late Paleocene dinoflagellate, pollen, spores and fossilized leaves, turtle bones and fish parts provide the only evidence to date for deposition of Cretaceous and Tertiary strata in this region of the Slave Province (Nassichuk and Dyck, 1998). FCONOMIC GEOLOGY

More than 200 kimberlites have been discovered since the autumn of 1991 in the Lac de Gras area of the central Slave Province. A number of these kimberlites are diamond-bearing, and a sub-set of these economically viable. Production of gem quality diamonds from BHP Diamonds/Dia Met Ekati Diamond Mine commenced October 14, 1998. The Sable kimberlite, located in the 76D/15 map sheet, is one of the five kimberlites to be beneficiated during the life of the mine. Bulk sampling results for the Sable and Falcon pipe are as follows (data from BHP/DiaMet press releases):

value(US\$/c) US\$/tonne ore

*higher valuation includes a single 9 carat stone; lower valuation excludes this stone. The diamond grade of a mini-bulk sample taken from the Beaver kimberlite was not reported, other than it was stated to be too low to warrant additional sampling; follow-up mini-bulk sampling on the Flying V kimberlite has not been reported, suggesting that it may not be economically significant (data from

ACKNOWLEDGMENTS:

J. Carlson, R. Ashley, B. Counts and M. Leake of the BHP/DiaMet joint venture are thanked for their assistance in support of this project. Helicopter charter was provided by the Polar Continental Shelf Project along with casual charter from BHP/DiaMet. A field visit by W.J. Davis clarified a number of problems encountered in the course of mapping granites. Craig Nicholson performed wonders expediting out of Yellowknife. Thorough internal review by John Henderson of the GSC, and informal review by staff at BHP Diamonds were greatly appreciated.

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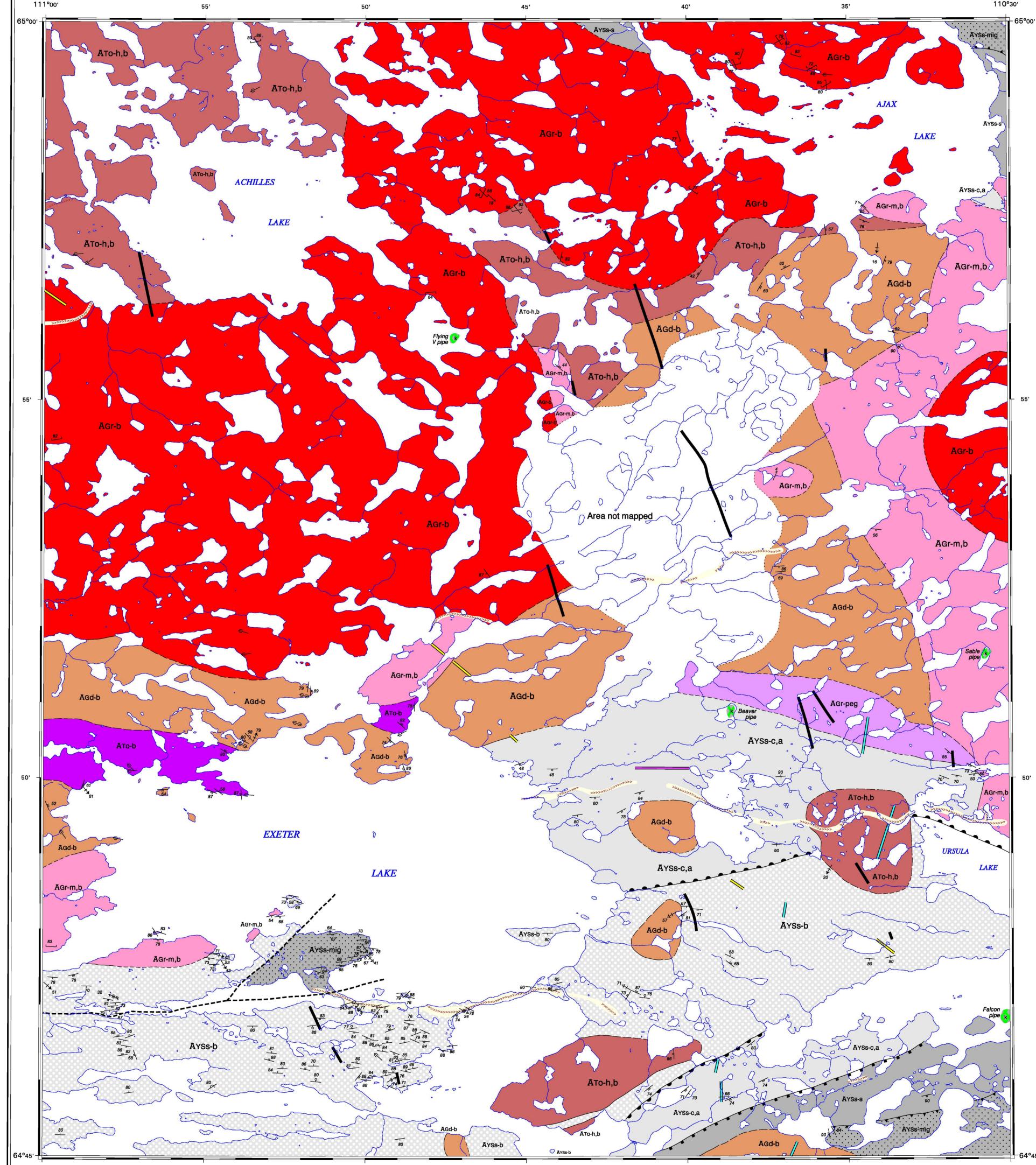
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111°00'

Geology by B.A. Kjarsgaard, Z.J. Jakop, R.S. Spark and R.J.S. Wyllie Digital cartography by P.M. O'Regan, Geoscience Information Division

Electrostatic plot produced by the Geoscience Information Division Part of the Canada - N.W.T. Mineral Iniative Agreement and NATMAP

Slave Province Project

50'

OPEN FILE 3702 PRELIMINARY GEOLOGY

EXETER LAKE DISTRICT OF MACKENZIE NORTHWEST TERRITORIES

Scale 1:50 000 - Échelle 1/50 000 Universal Transverse Mercator Projection Projection transverse universelle de Mercator © Her Majesty the Queen in Right of Canada, 1999 © Sa Majestié la Reine du chef du Canada. 1999 Any revisions or additional geological information known to the user would be welcomed by the Geological Survey of Canada

Base map digitized from topographic map published at 1:50 000 scale

40'

from Geomatics Canada Magnetic declination 1999, 24°35'E, decreasing 20.6' annually

76 D/14 76 D/15 76 D/16 OF 3702 OF 2967 76 D/11 76 D/10 OF 2966 OF 2739 NATIONAL TOPOGRAPHIC SYSTEM REFERENCE AND INDEX TO ADJOINING GEOLOGICAL SURVEY OF CANADA MAPS

110°30'

76 E/2

QUATERNARY

Kimberlite; suggested Cretaceous or Eocene in age, four kimberlites lie under small lakes and/or are buried by surficial materials, and are only known from diamond exploration drilling. The kimberlite boundaries on the map sheet are schematic and do not indicate the actual size or shape of these bodies

MESOPROTEROZOIC Mackenzie dykes

> Diabase; medium to coarse grained, sub-ophitic, well developed chill margins; typically 20 -50 m wide; not metamorphosed; strongly magnetic, 320° to 340° trend

Diabase; fine to medium grained, well developed chill margins; typically 10 - 20 m wide; unmetamorphosed; moderately magnetic, 300° to 310° trend

PALEOPROTEROZOIC

Lac de Gras dykes Diabase; medium to coarse grained, ophitic, well developed chill margins; typically 30 -40 m wide, very weak deuteric alteration; strongly magnetic, 000° to 020° (typically

Diabase; medium to coarse grained, plagioclase phyric, olivine absent, well developed chill margins; typically 30-50 m wide; weak deuteric or low grade metamorphic alteration/overprint; weakly magnetic, 080° - 100° (typically 80°) trend

Older granitoids

Pegmatite; white weathering, very coarse grained, massive, microcline-rich; dykes typically metres to tens of metres wide; consist of microcline, quartz, albite, biotite and muscovite, and accessory tourmaline, apatite, silliminite and garnet; close spatial association with muscovite biotite granite (unit AGr-m,b). Mapped pegmatite unit

consists of greater than 50% pegmatite, intrusive into metagreywacke and granitoid

Biotite granite; sub-porphyritic to porphyritic K-feldspar-rich monzogranite; light red to pinkish-white weathering, medium- to coarse-grained, rarely equigranular; massive; typically 10% biotite, muscovite absent (or <1%), some secondary muscovite. Microcline-rich pegmatite dykes are generally not a common association of these granites and where observed, they contain only biotite

Muscovite biotite granite; white to light grey-green weathering, massive, equigranular AGr-m,b monzogranite; sub-equal quartz, plagioclase and K-feldspar, 5 - 10% of muscovite and biotite; aquamarine apatite and tourmaline common accessories, with zircon and monazite; garnet, cordierite and sillimanite present in granite close to metasedimentary inclusions; weak (S_3) foliation observed near pluton margins. Pegmatite dykes similar to those seen in unit AGr-peg are common both within and adjacent to the muscovite biotite granite plutons

Biotite granodiorite; equigranular, medium grained, light brown-grey weathering; subhedral to anhedral plagioclase and biotite, interstitial microcline and quartz; accessory magnetite and hornblende, with apatite, zircon and pyrite; weakly to moderately foliated (S2); hornblende-rich micro-diorite enclaves rare to absent; contains minor phases of hornblende biotitite tonalite (unit ATo-h,b)

Hornblende biotite tonalite; brown-grey weathering, equigranular and medium grained; euhedral to subhedral plagioclase, with subhedral quartz, biotite and hornblende, minor K feldspar, accessory magnetite, pyrite, epidote and zircon; hornblende-rich microdiorite enclaves common; moderately to strongly foliated (S2); thin (10 cm - 10 m scale) metasedimentary septae of variable length (10's - 100's of

Biotite tonalite; light brown to white weathering, medium grained, strongly recrystallized, well developed foliation, strong plagioclase and quartz mineral lineation; abundant plagioclase plus quartz, minor K feldspar and biotite, hornblende rare or absent; contains Yellownkife Supergroup metasedimentary inclusions Yellowknife Supergroup

Metamudstone and metagreywacke, interlayered; centimeter to meter thick paired units; thicker metagreywacke dominated beds beds massive, metagreywacke grades AYSS-b into mudstone characteristic of turbidity current deposits; metamorphic grade varies from lower greenschist through upper amphibolite: AYSs-b, biotite zone, spotted AYSS-c,a schists, typically grey-green weathering; AYSS-c,a, cordierite ± andalusite zone, knotted schists, typically brown-green weathering; AYSS-s, silliminite zone, 'knotted' schists, typically rusty brown-brown weathering; AYSs-mig, migmatite zone, AYSs-s leucosome and restite schlieren, typically brown-white weathering. Yellowknife Supergroup sediments in the Exeter Lake metasedimentary belt are at variable metamorphic grade and dominantly thin bedded, with very thin bedding- parallel quartz veins. Rare, thin beds of graphite-bearing metasediments and silicate iron

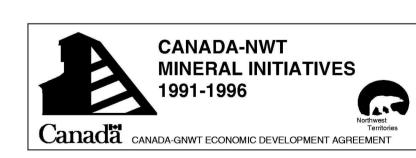
graphite-rich beds nor banded iron formation were observed.

formation are locally present. In contrast, in the northern belt, metasedimentary rocks

are all at higher grade (cordierite + andalusite zone to migmatite zone) and neither

SYMBOLS

Bedding, facing unknown (inclined, vertical) Bedding, facing known (inclined, overturned) Foliation (S₂), main or principal (inclined, vertical) Foliation (S₃) or crenulation cleavage (inclined) . ntersection lineation (S2 and S3) Fold hinge axis (second, third deformation) Metamorphic mineral zone boundaries (ornament on high-grade side) Cordierite + andalusite isograd (ornaments on high temperature side) Silliminite isograd (ornaments on high temperature side)



Contribution to the Canada-Northwest Territories Minerals Initiations 1991-1996, a subsidiary agreement under the Canada-Northwest Territories Economic Development Agreement. Project funded by the Geological Survey of Canada

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Recommended citation: Kjarsgaard, B.A., Jakop, Z.J., and Spark, R.S. 1999: Preliminary geology, Exeter Lake, Northwest Territories; Geological Survey of Canada, Open File 3702, scale 1:50 000.

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