LEGEND

8		Quartz tonalite, massive to locally weakly foliated, grey, coarse grained, inequigranular, biotite abundant, characterized by abundant coarse masses of quartz.
7		Diorite, foliated to massive, heterogeneous, medium grained, dark grey, equigranular, hornblende and biotite abundant.

YELLOWKNIFE SUPERGROUP

Age relations not implied by order of units

6	AC AS AM (b c s m)	Greywacke, mudstone, siltstone grading to psammitic to pelitic schists to migmatite from northwest to southeast; low grade rocks contain primary sedimentary structures; iron formation, mainly silicate, locally present near volcanic centres. 6b biotite metamorphic zone, 6c cordierite zone, 6s sillimanite zone and 6 m migmatite zone.
5		Rhyolite, some dacite; massive, flow layered, brecciated, sparsely porphyritic; occurs in domes, flows, dykes, and ring fracture intrusions; minor tuff.
3,4,5		Volcanic breccia, conglomerate; clasts of rhyolite, dacite and andesite.
4		Dacite, rhyolite, felsic tuff; breccia and massive units and their metamorphosed and strongly deformed equivalents.
3		Andesite, dacite; massive flows, breccias, tuff and volcaniclastic deposits, includes undifferentiated volcanic units and metamorphosed and strongly deformed equivalents, in vacinity of Tourgis Lake unit is migmatitic.
2		Basalt, andesite; massive and pillowed flows and their metamorphosed equivalents, located mainly at Healey Lake.

PRE-YELLOWKNIFE SUPERGROUP ROCKS (in part)

1		Granitoid gneisses; heterogeneous assemblage of complexly deformed gneisses ranging in composition from diorite to granite gneiss with some massive intrusions. Possibly in part older than Yellowknife Supergroup. Gneisses are complexly deformed in the west as well as in the east, in contrast to the supracrustal and other intrusive units.

SYMBOLS

	Geological contact; defined, approximate, assumed
72 84 79	Bedding, flows; tops known, unknown, overturned, vertical
83	Foliation undifferentiated; dip known, dip not known
→ 46	Lineation undifferentiated
	Fault
	Shear zone, mylonite zone
	Proterozoic metamorphic isograd
PA	Amphibolitization of diabase dykes
	Archean metamorphic isograds
AC	Cordierite isograd
AS	Sillimanite isograd
AM	Migmatite isograd
AO	Orthopyroxene isograd

Geology by:

E. Froese, 1978

J.B. Henderson, 1978, 1979, 1980, 1981

D.T. James, 1981

M.B. Lambert, 1976, 1977, 1978, 1981
(Geology northwest of Back River from Lambert, 1982)

P.H. Thompson, 1979, 1980, 1981

Compiled by:
J.B. Henderson and P.H. Thompson, 1982

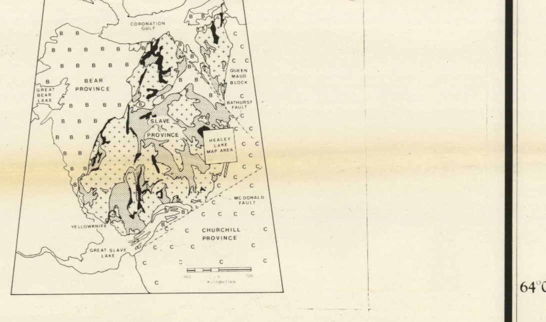

Figure 1 The Healey Lake area is located on the boundary between the Slave Structural Province and the Churchill Structural Province between the Bathurst and McDonald faults.

GEOLOGY
HEALEY LAKE
DISTRICT OF MACKENZIE
NORTHWEST TERRITORIES

Scale 1:125 000 Échelle

Miles 5 0 5 10 15 20 Milles

Kilometres 5 0 5 10 15 20 25 30 Kilomètres

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NOTES

rocks, later metamorphism is expressed as muscovite-rich seams containing chlorite and euhedral staurolite which cut across the leucosome of biotite-garnet migmatite and by chlorite-kyanite-euhedral staurolite and kyanite-chloritoid-staurolite-chlorite assemblages superimposed on an older staurolite-biotite-andalusite-sillimanite assemblage. Mineral assemblages attributed to later metamorphism are typical of intermediate pressure, lower to middle amphibolite facies.

Kyanite occurs in Yellowknife metasedimentary rocks (unit 6m) in a narrow zone east of the shear zone west of Tourgis Lake and in lower grade equivalents (unit 6s) of these rocks at and east of Healey Lake. In several places field observations and petrography indicate that kyanite formed before or during Archean migmatization. Although it can be inferred that early metamorphism temperatures peaked during or after the main phases of deformation, the presence of kyanite in migmatite suggests maximum pressures may have been reached in the highest grade rocks before the temperature maximum (Henderson and Thompson, 1980). If the kyanite can be shown to be a product of a melting reaction rather than inherited from an earlier stage in the metamorphic history, pressure at which melting occurred in the estern part of the area would be 7 kilobars or higher, significantly greater than the pressures (3-5 kbar) normally associated with lower pressure type regional metamorphism as seen in most of the Slave Province. Kyanite in association with chloritoid and staurolite also occurs as small euhedral grains within Archean andalusite porphyroblasts near Healey Lake. Although chloritoid and staurolite are readily attributable to the later metamorphism, textural relations of kyanite are sufficiently ambiguous that nucleation of andalusite on the high pressure polymorph is also a reasonable explanation. On the other hand, textures in a kyanite bearing rock from the straight zone imply that the kyanite is younger than the mylonitization of the Archean migmatites. The available evidence points to a complex P-T history for this eastern terrane with supracrustal rocks being taken down to depths compatable with the formation of kyanite and raised again twice.

With the exception of the southwest quadrant and the plutons of unit 16, the granitoid rocks in the area show varying degrees of metamorphic crystallization and deformation. For example, the granodioritic to quartz/dioritic plutons known to intrude the Yellowknife Supergroup east of the Back River exhibit textures and mineral assemblages compatable with the regional metamorphic grade of the adjacent metasediments suggesting they are older than the metamorphism. In the central part of the map area, leucocratic, muscovite-biotite granite-granodiorites have intruded regionally metamorphosed rocks and are themselves foliated and recrystallized. The basement granitoid gneiss unit is in part composed of isoclinally folded partially migmatized granitoid rocks that predate deposition of the Yellowknife Supergroup.

THE THELON FRONT

On the basis of 1:1 000 000 scale geological reconnaissance across the northwestern Precambrian Shield (Wright, 1957, Fraser, 1964) Wright (1967) described the Thelon Front as a feature which marked changes in lithology, metamorphic grade and structural style that reflected the farthest westward extent of the 'Hudsonian orogeny' and was thus the boundary between the Slave and Churchill Structural Provinces. He described the 700 km long boundary as "...gradational, probably over several miles..." but pointed out that "...on the present regional scale it appears as an abrupt, clearly defined feature...".

In the area between the Bathurst and McDonald faults, which includes the Healey Lake area (Fig. 1), the term Thelon Front was applied to a transition eastward from a terrane where undeformed granitoid plutons intrude medium grade metasedimentary and metavolcanic rocks of the Yellowknife Supergroup to a gneissic terrane with abundant foliated granitoid rocks. The sinuous nature of the transition line as originally defined within the Healey Lake area (Fig. 2) appears to be related to variations in foliation trend which on the basis of scattered K-Ar mica ages were interpreted as Hudsonian features. Gibb and Thomas (1977) noting the proximity of the geological change with the steep gravity gradient suggested the feature is a suture formed during a Proterozoic collision between the Slave craton and the rocks of the Churchill Province. In Figure 2 various metamorphic, structural and geophysical boundaries are compared with the location of the Thelon Front as originally defined in the Healey Lake area. A complex scenario is indicated. None of the prominent geological or geophysical features of Archean age coincide with the front as presently defined. For example the Yellowknife Supergroup rocks extend completely across the area to the eastern boundary and the striking structural change across the area appears to be either Archean or early Proterozoic but almost certainly pre-Hudsonian (1.75 Ga). There is, however, the later cataclastic to mylonitic structures that predate or are synchronous with a younger Proterozoic event. The Proterozoic K-Ar ages (in the Healey Lake area 1630 ± 90 Ma K-Ar muscovite 10 km southeast of Healey Lake) may represent cooling ages related to this event.

The straight zone in the southeast corner of the area is perhaps the best condidate for a single boundary feature if such a line must be selected. It would appear to be the most prominent of a series of mylonitic zones with similar trend that continue beyond the map area to the east. It is a feature that corresponds at least in part to two geophysical features. On the basis of its magnetic and geomorphological expression it would appear to be a mappable structure beyond the Healey Lake area to at least the Bathurst fault 75 km to the northeast and to the McDonald fault 100 km to the southwest.

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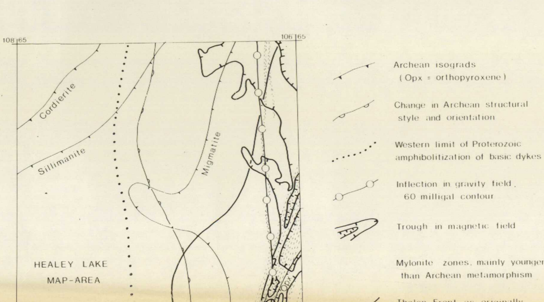

Figure 2 Distribution of various geological and geophysical features with respect to the position of the Thelon Front as originally defined by Wright (1967). The predominant metamorphic gradient is Archean and the regional change in structural style and orientation from west to east is also Archean or early Proterozoic. Following the intrusion of Proterozoic diabase dykes, a later phase of metamorphism and some reactivation of the pre-dyke structure occurred. Deformation in major mylonite zones is younger than Archean metamorphism but the same age or older than the later metamorphism. Both a large part of the inflection of the gravity field between major positive and negative gravity anomalies and a prominent linear negative magnetic anomaly are coincident with a major cataclastic straight zone. This feature is considered a good candidate for a revised position of the Thelon Front.