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Geology of the Myers - Daly Lakes district, Alberta

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ALBERTA RESEARCH COUNCIL
Natural Resources Division
Alberta Geological Survey

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Cover photo: Migmatitic gneissoid phase
of metasedimentary granulite.

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Abstract

The study area comprises essentially two major rock groups—the granite gneisses and the granitoids. Arch Lake and Slave Granitoids form a major pluton and are by far the most abundant group in the map area. The Archean Granite Gneiss belt, situated in the east, consists of biotite and hornblende gneisses with subordinate amounts of high-grade metasediments and very minor amphibolite. Minor granitoid bodies of various sizes are interspersed throughout the Granite Gneiss belt. Most of these granitoids are related to the major granitoid rock units of the pluton either directly or as intermediate lithological phases. Gradational phases are evident both between and within the granitoids, and to some extent between the granitoids and the granite gneisses. The latter are regarded as the protolithic material from which the granitoids were formed in the course of ultrametamorphism and partial melting.

The crystalline rocks have recorded metamorphic conditions ranging from high-pressure granulite to low-pressure amphibolite facies, followed by a ubiquitous regional retrogressive greenschist facies metamorphism.

The metamorphic foliation in the mantling granite gneisses shows complex patterns of ductile flow folds, but overall it has a general regional northerly trend. By contrast, the metamorphic foliation in the granitoids, although deformed, generally shows much more open folds on a local scale. The Hooker Lake synform in Arch Lake Granitoids, almost 40 km across, is the principal structure in the map area.

The bedrock is cut by two regional shear zones. Both major shear zones are characterized by wide mylonitic bands indicative of deep-seated ductile deformation. Both generally parallel the regional foliation, but are locally transgressive. The Allan Fault, in the east, trends northerly and is almost confined to the Granite Gneiss belt. The arcuate Warren Fault, in the west, trends northeasterly and its wide shear zone coincides with a complex, interfingered, ductile deformation contact zone between major bodies of the Slave and Arch Lake Granitoids. Other arcuate faults follow metamorphic foliation within the Arch Lake Granitoids synform. Biotite and hornblende K-Ar age dates show that the region was subjected to an intense thermal event connected with the Hudsonian Orogeny, resetting the K-Ar isotopic ratios at approximately 1900 Ma.

Continental Pleistocene glaciation scoured the region, leaving a Precambrian Shield rocky landscape with abundant evidence of glacial advance and retreat. The major ice advance was from the east, and glacial retreat appears to have been in stages, with ice front positions being delineated by the accumulation of ice-contact outwash deposits. Aeolian reworking of the typically sandy glacial deposits by storm winds has led to the formation of dunes and associated wind polish, facetting and grooves on bedrock outcrop.

Minor mineralization is found in two geological settings. Scattered mineralization consisting of uranium, copper, molybdenite and arsenopyrite is found in high-grade metasedimentary rocks and granite gneisses. In the regolith at the base of Devonian cover rocks seated on the crystalline Precambrian Shield, secondary copper mineralization is found in the highly oxidized Shield rocks. This contact between Devonian cover and the Precambrian Shield is exposed in places along the Slave River. The granitoids are virtually devoid of any signs of mineralization.

Introduction

This report deals with 1429 km² (542 mi²) of exposed Precambrian Shield in northeastern Alberta. The map area is situated between latitudes 59°30′ and 59°45′ N, and longitudes 110°30′ and 111°35′ W (figure 1).

In the study area, the Precambrian Shield surface slopes gently toward the west. Elevations range from 210 m (700 ft) at the Slave River to about 350 m (1150 ft) in the interior. Much of the map area drains westward toward the Slave River and thence north to the Arctic Ocean. The most easterly section, however, drains north to the Thechutheli River and then to Great Slave Lake and the Arctic Ocean. At the Slave River, the basement rocks continue their westward dip beneath the Middle Devonian carbonate rocks, which thicken farther to the west in Wood Buffalo National Park and beyond.

Evidence of the Pleistocene continental glaciation is widespread in the form of polished, scoured, and rounded bedrock surfaces. Glacial deposits are dominantly sandy and occur principally as glaciolacustrine and glaciofluvial outwash. Aeolian reworking of the sandy deposits during deglaciation resulted in the formation of complex, longitudinal dunes. Wind erosion also led to sand polishing of exposed Precambrian Shield bedrock.

Previous reconnaissance geological work in the Alberta portion of the Canadian Shield (herein referred to as the Alberta Shield) was done by Cameron and Hicks (Cameron, 1930; Cameron and Hicks, 1931; Hicks, 1930, 1932). Collins and Swan (1954) spent several weeks examining mineral prospects on the Alberta Shield at a time when uranium exploration was active. In 1959, Riley (1960) of the Geological Survey of Canada conducted a reconnaissance geological survey of the Shield north of Lake Athabasca. Results of this survey were published on a 1:250 000 scale map accompanied by notes. Aeromagnetic surveys conducted by the Geological Survey of Canada over the Shield of northeastern Alberta were originally published on a scale of 1 inch to 1 mile. These maps were later compiled and republished on a scale of 1:250 000 (Geological Survey of Canada, 1964a, 1964b). Bostock (1982) of the Geological Survey of Canada subsequently mapped the NTS 75D map sheet of Fort Smith to the north of the Alberta Shield and published a report and an uncolored map on a scale of 1:125 000.

In 1957, the Alberta Research Council initiated a mapping program of the Shield and has since published several maps and reports in the current series (Godfrey, 1958b, 1961, 1963, 1966, 1980a, 1980b, 1984; Godfrey and Peikert, 1963, 1964; see figure 1). The field work is complete, and the remainder of the maps and reports are in the final stages of publication (Godfrey, in press; Godfrey and Langenberg, 1986). Part of an earlier published map (Godfrey, 1966) has been incorporated into the present map area in order to complete the infor-

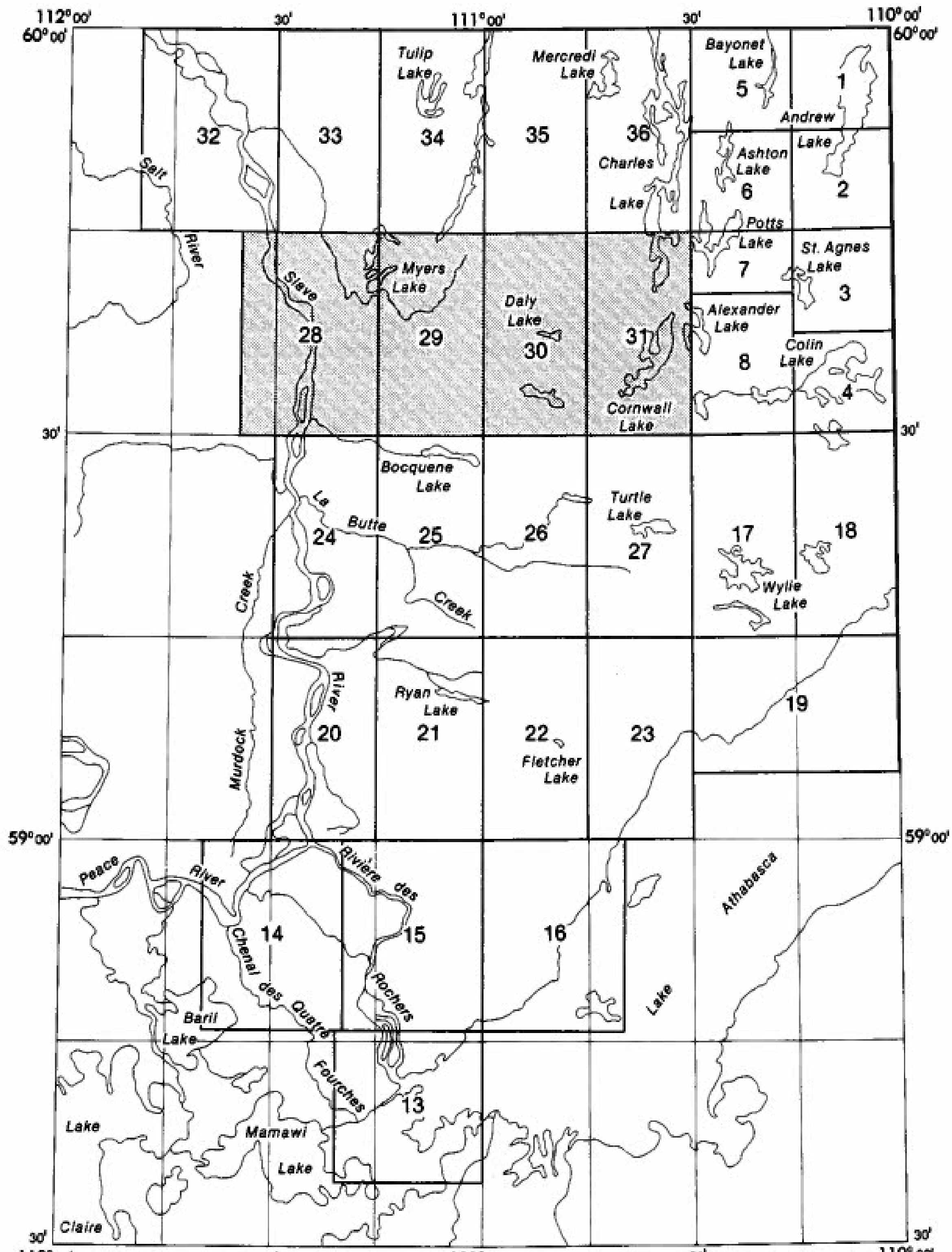


Figure 1. Location of study area, maps 28, 29, 30, 31, the Myers-Daly Lakes district, Alberta, and index to map sheets.

mation on the map area.

Prior to field work by the Alberta Research Council, a structural interpretation based on aerial photographs was undertaken and published (Godfrey, 1958a). Some interpretated aerial photographs of the Shield in Alberta were included in a selection of photographs from throughout Alberta (Gravenor et al., 1960).

Several university theses on various aspects of the bedrock geology have been completed in the course of the Alberta Research Council's mapping program (Peikert, 1961, 1963; Watanabe, 1961, 1965; Klewchuck, 1972; Kuo, 1972; Day, 1975; Sprenke, 1982).

A geochronological program with the University of Alberta, under the direction of H. Baadsgaard, has yielded numerous age dates and allowed identification of significant events in the evolution of the Shield in Alberta (Godfrey and Baadsgaard, 1962; Baadsgaard et al., 1964, 1967; Baadsgaard and Godfrey, 1967, 1972). Microprobe mineral analyses by Nielsen have been instrumental in estimating the petrographic conditions of several metamorphic phases to which this terrain has been subjected (Nielsen et al., 1981; Langenberg and Nielsen, 1982).

General geology

The Shield terrain in this map area is composed principally of a granitoid plutonic complex with a narrow granite gneiss belt at the eastern margin.

The igneous-metamorphic rocks underlying the map area form part of the Churchill Structural Province of the Precambrian Shield (Davidson, 1972). The various terrains are illustrated in a simplified geological sketch map in figure 2, and their rock group constituents are indicated in table 1.

The Slave and Arch Lake Granitoids, in two largely

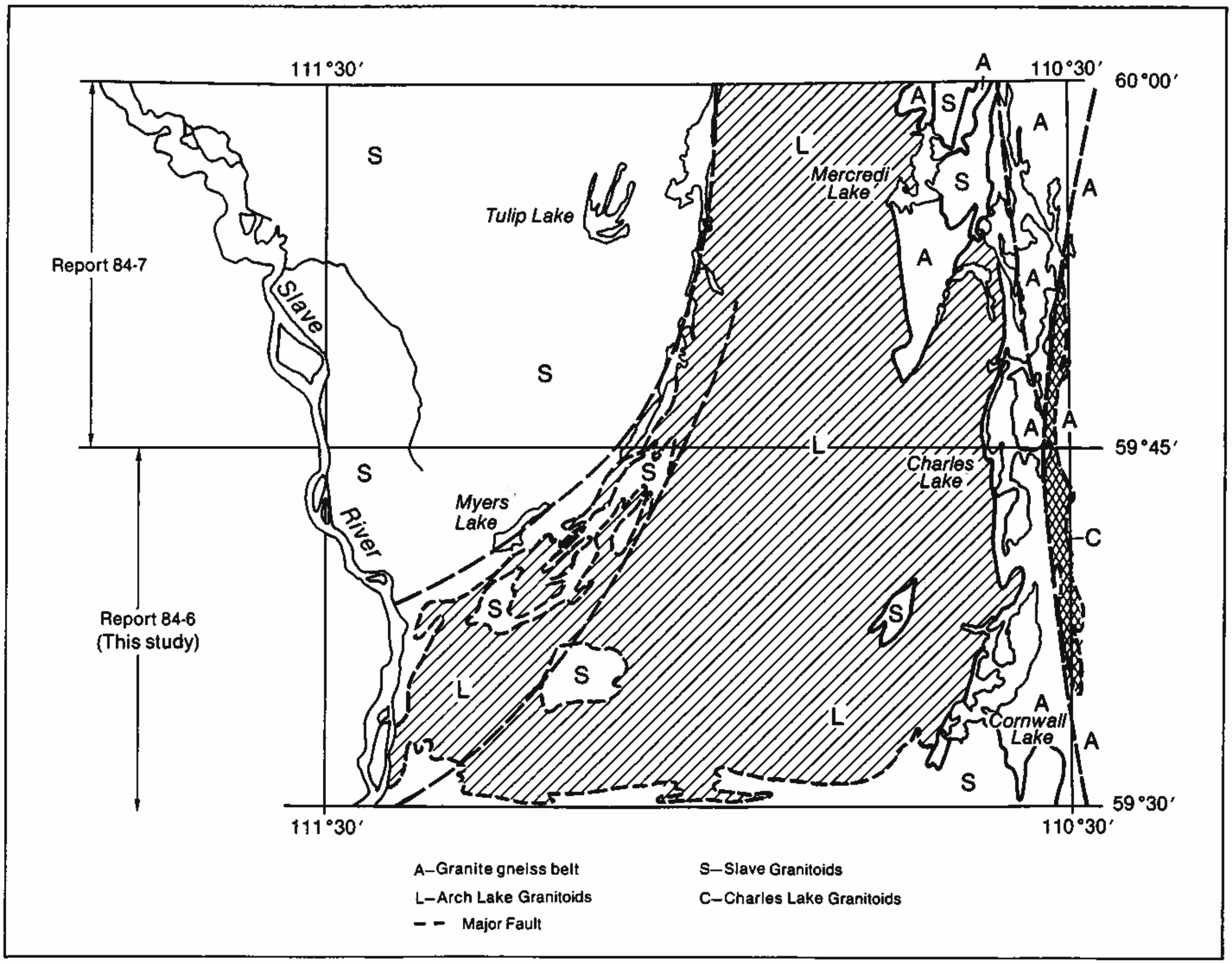


Figure 2. Sketch map of principal geologic terrains.

Table 1. Geological terrains (figure 2) and their constituent rocks for the Myers-Daly Lakes district, Alberta.
Minor component [ ]

Constituent Rocks	Geologic Terrain
granite gneiss mylonitic rocks [high-grade metasediments] [minor granitoids]	A. Granite Gneiss belt partly migmatitic and and mylonitic
Charles Lake Granitoids mylonitic rocks [granite gneiss] [high-grade metasediments]	C. Charles Lake granitoid belt
Arch Lake Granitoids [minor granitoids] [high-grade metasediments]	L. Arch Lake Granitoids
Slave Granitoids [minor granitoids] [high-grade metasediments] [mylonitic rocks]	S. Slave Granitoids

Table 2. Percentage areal composition of the Myers-Daly Lakes district by rock type and rock group.
(For this table, covered ground within the map area is interpreted on the basis of an aeromagnetic survey.)

Granite Gneiss	7.0
Slave Granitoids	29.5
Colin Lake Granitoids	trace
La Butte Granodiorite	0.5
Arch Lake Granitoids	60.5
Charles Lake Granitoids	0.5
High-grade metasediments	1.0
Mylonitic rocks	1.0

distinct plutonic masses, showing considerable internal folding, occupy over 90 percent of the map area (table 2). A belt of older, migmatitic, partly mylonitic gneisses and minor granitoids makes up the eastern section.

The constituent rock units within each group and their possible genetic relationships are presented in table 3.

Geologic history

The geologic history of this part of the Canadian Shield is summarized in table 4. The oldest group of rocks, in the basement granite gneiss terrain, consists of ortho- and minor para-gneisses with subordinate amounts of granitoids, high-grade metasediments, and amphibolites. The formation of these gneisses most likely entailed multi-cycle sedimentation along with polyphase metamorphism and deformation. Primary magmatic material was added in the form of both granitoid masses and basic dykes: again, probably during several phases of intrusion. As a consequence of events in deep-seated environments, major parts of the gneissic belt were subjected to high-grade metamorphism, leading to migmatization, remobilization, plutonism, and subsequent mylonitization.

Metamorphic mineral assemblages in high-grade metasediments of the basement gneiss complex contain: hypersthene, green spinel, corundum and sillimanite. The temperatures and pressures determined from these metamorphic mineral assemblages are estimated to be 900 ± 100°C and 7.5 ± 2 Kbar (M_1 Nielsen et al., 1981). Such peak conditions indicate that moderate- to high-pressure granulite facies metamorphisms were achieved during development of the ortho-para-gneissic complex.

The Archean age (2.5 Ga) of the basement gneiss

Table 3. Principal Precambrian rock groups, constituent rock units and their field associations, Myers-Daly Lakes district, Alberta

Rock Groups					
Mylonitic Rocks	**Granite Gneisses**		**High-Grade Metasedimentary Rocks**		**Granitoid Rocks**
	Amphibolite ↑		Amphibolite ↑		Amphibolite ↑
Derived from all other rock groups	Granite Gneiss	+	Granitic Metasedimentary Rocks Metasedimentary Rocks	→	Arch Lake Granitoids La Butte Granodiorite Charles Lake Granitoids
	[Granite Gneiss]	+	Granitic Metasedimentary Rocks Metasedimentary Rocks	→	Slave Granitoids

↑ Intrusive relationship
→ Close field, and possible genetic, relationships
[ ] Less significant component

Table 4. Summary of geologic history of the Shield in the Myers-Daly Lakes district, Alberta

Geologic Age	Rock Units/groups	Predominant Rock Type(s)	Process/Event	
Recent	Fluvial, lacustrine deposits	Sand, silt, mud	Sedimentation	
Pleistocene	Glacial/fluvial/lacustrine	Till, sand, silt	Continental glaciation	
Devonian	Elk Point Group and older	Carbonates	Marine and evaporitic sedimentation	
Aphebian			Regional Faults (e.g. Allan Fault) and mylonitization Metamorphism $M_{2.3}$ (greenschist facies)	Hudsonian Event
	La Butte Granodiorite	Granodiorite (quartz diorite)		
	Arch Lake Granitoids	Granite (granodiorite)	Basic dykes Metamorphism $M_{2.1.2}$ (granulite-amph. facies)	
	Slave Granitoids	Granite (granodiorite)	Remobilization Migmatization Plutonic intrusion	
Archean	Charles Lake Granitoids	Granite, granodiorite	Basic dykes Plutonic intrusion	Kenoran Event
	Basement Gneiss Complex	Amphibolite Metasedimentary Rocks Hornblende Gr. Gneiss Biotite Granite Gneiss	Granitization Metamorphism M_1 (granulite facies) Sedimentation	

complex and its involvement in the Kenoran Orogeny is established by the Rb-Sr whole rock isochron on pegmatites from the gneissic belt in the adjacent Charles Lake district (Baadsgaard and Godfrey, 1972). In thin section, cordierite and almandine are seen to typically either enclose or replace the granulite facies mineral assemblages noted above, showing that the rocks were subsequently subjected to lower-grade metamorphic conditions (Godfrey and Langenberg, 1978a). Emplacement of the principal granitoid masses—Slave, Charles Lake and the Arch Lake Granitoids—is coincident with the period of moderate-pressure, granulite facies metamorphic conditions. Emplacement of the major Slave-Arch Lake Granitoids plutonic masses is believed to be diapir-related and is mantled and walled by basement gneisses. All of the diapiric granitoid masses probably originated as remobilized infrastructure crystalline materials. The conditions of emplacement ($M_{2.1}$, Nielsen et al., 1981) are estimated to have been $740 \pm 30°C$ and 5.0 ± 0.7 Kbar (i.e., under moderate-pressure granulite facies conditions). These $M_{2.1}$ conditions are thought to reflect a renewed second phase of metamorphism, rather than being retrograde effects of the first metamorphic phase.

The region was later subjected to pervasive lower-grade metamorphic conditions ($M_{2.2}$), estimated to be $550 \pm 55°C$ and 3.0 ± 0.3 Kbar (i.e. low-pressure amphibolite facies), and greenschist facies ($M_{2.3}$).

The moderate-pressure granulite conditions ($M_{2.1}$) represent the culmination of the Hudsonian Orogeny, and have been dated with Rb-Sr at 1900 Ma (Baadsgaard et al., 1964, 1967; Baadsgaard and Godfrey, 1967, 1972; Nielsen et al., 1981). Formation of the granitoid bodies is linked with intense metamorphism and partial melting of the combined granite gneiss and high-grade metasedimentary rock belt. Large portions of the resulting crystal-liquid granitic product were mobilized and separated from the granite gneiss-metasedimentary belt to form plutons and batholiths. Small amounts of newly segregated granitic material remained within the parent gneissic migmatitic belt, both as minutely dispersed and as larger mappable masses. In outcrop, a close spatial relationship results from an intimate mixture of parent metamorphic and derived granitoid materials.

The lithology of the Arch Lake Granitoids plutonic complex in detail is a mixture of Arch Lake Granitoids with La Butte Granodiorite, and large blocks of Slave Granitoids. Very minor screens of high-grade metasediments and granite gneiss have been mapped within the Arch Lake Granitoids mostly toward the east and west margins. The structure of the core is a complex synform, as defined both by metamorphic foliation and some conformable arcuate faults. The Arch Lake Granitoids pluton is also crossed by other faults: noteworthy is a concentration of easterly trending faults at the southern end. Larger bands of high-grade metasediments, partly fault controlled, are found in the Slave Granitoids to the west.

The contact of the Arch Lake Granitoids with the granite gneisses to the east is partly conformable and partly faulted. The geometry is one of steeply dipping parallel foliations on both sides of the contact, with wedges or tongues of granite gneiss within the granitoids, and vice versa. In places, minor masses of Slave Granitoids complicate this contact zone, although most of the Slave Granitoids really lie within the Granite Gneiss belt.

On the south side of the Arch Lake Granitoids plutonic mass, the contact with Slave Granitoids is one of parallel intertonguing apophyses, with no evidence of a coincident shear zone. On the western contact of the Arch Lake Granitoids, a more complex, wider zone (up to 5 km) lies within the boundaries of the Warren Fault Shear Zone. In the latter instance, the interleaved tongues of Slave Granitoids and Arch Lake Granitoids (with minor La Butte Granodiorite) are unusually elongated as a result of ductile deformation in this contact zone.

Subsequent to the formation of the Archean basement gneissic complex and Aphebian granitoids, there have been several periods of sedimentation in northeastern Alberta. Not all of the periods are represented in outcrop in this map area.

Prolonged uplift and erosion preceded deposition of the largely continental Athabasca Group sediments. The Athabasca Group (Ramaekers, 1980; Wilson, 1985) has not been seen in outcrop in this specific map area. However, as discussed below, it is suggested that outliers of Athabasca Group sandstone may be closely associated with, and in part underlie, the extensive glacial sandy areas. Those linear-shaped sandy areas, related to the northwesterly aligned glacio-fluvial-lacustrine deposits and thin aeolian sand sheets, are excluded from this speculation.

A second extensive period of uplift, leading to erosional stripping of much of the Athabasca Group rocks, preceded a general subsidence and transgression of the Devonian seas. Middle Devonian carbonates rest on a well-developed regolith and unconformably overlie the crystalline basement complex in the extreme westerly portion of the map area. Exposures on the banks and islands of the Slave River show flat to gently warped bedding, with solution collapse breccias. These Devonian strata thicken to the west where they underlie Wood Buffalo National Park.

A third long period of uplift and erosion preceded the Pleistocene continental glaciation. This glaciation is the most significant recent geological event in the region. It has left a generally high proportion of exposed bedrock and scattered minor glacial deposits, with the exception of the lowlands along the Slave River where glacial, post-glacial, and Recent sediments are abundant.

Map units

Rock unit classification

Most of the primary structures and textures of the sedimentary and igneous rocks in the crystalline basement complex have been obscured or even lost entirely in the course of high-grade metamorphism, partial melting, intrusion, and deformation. Mixed rock assemblages, and wide, gradational contact zones, are evident in both outcrop and on a regional scale. This is true in terms of both pluton/pluton and pluton/granite gneiss contacts. The principal map units shown on the accompanying colored geological maps present only the predominant rock unit within a given outcrop area. Of necessity, the smaller-scale variations of minor lithologies are largely not represented.

To permit petrological, geochemical, and geophysical comparisons, and the classification of map units, certain hand specimens were designated as standard (reference) samples. These standard samples represent as nearly as possible the typical lithology of each map unit as observed in the field. Standard samples of granitoid, gneissic, mylonitic and metasedimentary rock are listed in tables 5 to 9 (appendix) along with their modal and major element analyses. Field locations of these standard samples are shown on the accompanying four geological maps (pocket).

Granite Gneisses

The Granite Gneisses are characteristically banded in outcrop. However, the banding ranges widely in quality from distinct to indistinct, and is absent locally. This metamorphic banding can be planar in geometry, or wavy to contorted, as in migmatitically related structures. Individual bands can be fairly continuous, or discontinuous to streaky, and either well or poorly defined (as in the case of mafic-poor, felsic orthogneisses). In appropriate cases, by looking along the outcrop surface at a very low angle of incidence, it is possible to discern the continuity of an individual band from long, attenuated plastic flow folds where the fold limbs are in direct contact. Such limbs can extend for a metre or more in length.

The granite gneiss terrain typically contains subordinate, small-sized granitoid masses. The composition and texture of the latter are in part similar to the principal granitoid rock units of the region (Slave, Arch Lake, and Charles Lake) or intermediate between these granitoids and the granite gneisses.

The Granite Gneisses are typically composed of quartz-feldspar layers alternating with mafic layers or foliae that are biotite rich and locally contain hornblende. The gneisses are typically medium grained overall, with felsic mineral layers being noticeably more abundant and coarser grained than the intervening mafic-rich layers. Chloritization of biotite is usual, and epidote veinlets are present locally. Quartz veins, pods, and pegmatite masses are fairly common. Isolated grains of allanite and concentrations of magnetite in streaks parallel to foliation have been noted.

Amphibolite and metasediments are common as minor components of the granite gneiss terrain. Usually they occur as small lenses or bands parallel to foliation.

A large part of the granite gneiss terrain has been subjected to mylonitization within the wide Allan Fault Shear Zone. These regional mylonite zones show the effects of extensive recrystallization in both outcrop and thin section.

Biotite Granite Gneiss (11)*
Biotite Granite Gneisses are typically composed of quartz-feldspar layers alternating with biotite-rich mafic layers or foliae that locally contain minor amounts of hornblende. Chemical and modal analyses of two typical samples are presented in table 5.

Hornblende Granite Gneiss (12)
In northeastern Alberta, Hornblende Granite Gneisses are much less abundant than their biotite counterparts. These two rock units are similar in petrologic and structural character. Mafic layers in the hornblende-bearing gneisses are rarely without some biotite, although the reverse is not necessarily the case. Magnetite is more common in the hornblende gneisses than in the biotite gneisses. Chemical and modal analyses of one typical sample are given in table 5.

Amphibolite (20)

Amphibolite is present in a variety of host rocks. It is found within each of the major geological terrains and rock groups—granite gneiss, high-grade metasediments, and granitoid rocks. The widespread distribution and variety of rock associations for amphibolites in this igneous-metamorphic terrain suggest that they were emplaced and/or generated under a wide range of geologic conditions and times. Amphibolites show a general regional concentration within the gneissic belt. The larger bodies are also found within the main Granite Gneiss belt. Major bodies of amphibolite have not been found in the map area, and nowhere do they develop a thickness or size indicative of either a volcanic association or a major plutonic mass. Their origins probably involve both metamorphic and igneous processes.

Chilled contacts have not been observed; however, such features could be obliterated through subsequent deformation, metamorphism, and recrystallization. Amphibolite lenses and narrow bands are common in the granite gneisses, ranging typically from 0.7 to 3 m (2 to 10 ft) wide and from 2 to 6 + m (6.5 to 20 + ft) long. They usually trend parallel to the metamorphic foliation and show ductile to plastic deformation. Most amphibolite bodies tend to be discontinuous. They probably represent either boudinage sections of basic dykes and sills, a fragmented restite accumulation, or an agmatitic pegmatite complex within granite gneiss or high-grade metasedimentary rocks. Amphibolites are relatively uncommon in the major granitoid masses.

Massive amphibolites are dark green on a freshly broken surface, weathering to a greenish gray. Gneissic banded varieties weather to alternating green and white to pink layers. Feldspars tend to stand out selectively in high relief on a weathered surface, giving the amphibolite the false appearance of being a relatively felsic rock. Hornblende and feldspar are the principal minerals along with minor amounts of biotite and chlorite. Veinlets of epidote and quartz are locally present. As the proportion of hornblende decreases, amphibolite grades to either Hornblende Granite Gneiss or to high-grade metasedimentary rock. The grain size of amphibolite generally ranges from fine to coarse, and hornblende crystals larger than 5 mm are relatively uncommon. The texture ranges from massive to foliated to banded, the latter two textures being most common. Many of the banded varieties consist of bands from 10 to 25 mm thick, in which alternating layers differ in their hornblende to feldspar ratio.

Many amphibolites, particularly within the granite gneiss and high-grade metasedimentary rocks, have a rusty weathered surface. This phenomenon is probably related in part to the decomposition of small amounts of pyrite.

The less-recrystallized, less-deformed amphibolites (particularly those that have recognizable dyke-like relationships to the granitoid host rocks) are probably the youngest igneous rocks in the map area.

High-Grade metasedimentary rocks (31)

The high-grade metasedimentary rocks are present as relatively minor lenses and bands within both the granite gneiss and the granitoid terrains.

The high-grade metasedimentary rock masses tend to be elongated in plan view. Their long axes are aligned with the local metamorphic-structural trend. In outcrop, the metasedimentary rock structures have small-scale, steeply dipping isoclinal folds, which are locally crenulated and chaotic (due to flow folding) and found particularly in association with migmatitic phases. The enclosing gneisses or granitoids are invariably much less deformed. Such structural relationships indicate greater mobility (plasticity) of the metasedimentary rocks, compared with the host gneisses or granitoids, during deformation.

The high-grade metasedimentary rocks are typically quartzo-feldspathic with subordinate amounts of schist, phyllite, and amphibolite. Almandine is commonly identifiable in outcrop, and hypersthene, green spinel, sillimanite, and cordierite are visible under the microscope. The metasedimentary rocks are usually pyritic, and commonly have a rusty appearance on a weathered outcrop surface. The rust may be sufficiently extensive locally to be termed a rusty zone or in an extreme case a gossan. Chemical and modal analyses of standard samples are presented in table 5.

The outstanding structural feature of high-grade metasedimentary rocks in outcrop is the characteristic regular relict sedimentary banding. However, this banding becomes more disrupted and therefore less continuous as the amount of metamorphic quartz and feldspar increases. At the same time, the rock becomes less sedimentary and more granitoid in appearance. Where the granitic component is not prominent, the metasedimentary rocks are typically well foliated, color banded, or both.

Prograde metamorphism of the metasediments reached granulite facies conditions, as indicated by the presence of hypersthene, green spinel, and sillimanite

*Numbers in parantheses refer to map unit designations used on the accompanying geological maps.

(Godfrey and Langenberg, 1978a, Langenberg and Nielsen, 1982). The development of the metamorphic quartzo-feldspathic component (and possibly some igneous material) is expressed in a variety of ways:

- isolated feldspar porphyroblasts;
- quartzo-feldspathic concentrations as clusters, pods, and irregular patches;
- pegmatites with either conformable or cross-cutting relationships;
- migmatitic to gneissic phases; and
- minor granitoid bodies, with or without schlieren of either biotite concentrations or granitic metasedimentary rock.

The metamorphic end products cover a lithologic gradation from regularly banded metamorphic rocks of obvious sedimentary parentage to rocks that contain a high proportion of metamorphic quartz and feldspar. In outcrop,.these latter rocks may be classified as migmatites or migmatitic-gneisses.

The largest band and concentration of metasediments lies at the granitoid/granite gneiss contacts and in major fault zones. Typically, the bands are structurally complex and contain amphibolite bands from 0.5 to 2 m (1.5 to 6.5 ft) wide that generally parallel the metamorphic foliation.

Sulfide mineralization is common in the high-grade metasedimentary rocks. Pyrite, by far the most abundant sulfide mineral, is associated with rusty zones. Minor chalcopyrite, molybdenite, graphite, and uranium have been noted in adjacent map areas and can be expected here if these metasedimentary rocks are thoroughly prospected. Narrow, milky white quartz veins, and pods occurring either singly or in groups, are usually barren of sulfide mineralization.

The granitoid rocks

This group of crystalline rocks includes all of the granitoid rock units. Collectively, granitoids make up about 91 percent of the map area (table 2). There are essentially two broad groups, based on genetic affinities—the Slave and Arch Lake Granitoids. The individual plutons range in size from more than 40 km to less than 1 km across and probably have a limited range of Hudsonian ages.

Charles Lake Granitoids

The Archean granite gneiss complex at Charles Lake has a unique combination of gneisses with Charles Lake Granitoids (Baadsgaard and Godfrey, 1972) not seen elsewhere in the Alberta Shield. These granitoids include Biotite Granite F, Gray Hornblende Granite, Leucocratic Granite, Charles Lake PQ Granite, and Foliated Hornblende Granite. The latter two units do not appear in the study area but outcrop to the east and north, respectively. Minor bodies of Slave and Arch Lake Granitoids also occur in the general area. Although of diverse character, the Charles Lake Granitoids are grouped together in view of their Archean age. The north-south linear belt of Archean gneisses has a pronounced northerly foliation, which is parallel to, and lies within, the mylonitic Allan Fault Shear Zone. The granitoid bodies themselves tend to be markedly elongate and parallel the metamorphic foliation, which emphasizes the northerly tectonic fabric of this belt.

Biotite Granite F (171)

Biotite Granite F underlies about 0.5 percent of the map area. It is confined to the Granite Gneiss belt of the Charles Lake region.

Biotite Granite F and Recrystallized Mylonitic Rock (223) are texturally gradational, and therefore an arbitrary boundary has been established in order to differentiate these two rock units. The massive to poorly foliated matrix of Biotite Granite F grades to a foliated, finer-grained, crushed matrix that is a mylonitic component of Recrystallized Mylonitic Rock (223).

Biotite Granite F does not generally come in direct contact with granite gneisses in this map area. Usually an envelope of high-grade metasediments separates Biotite Granite F from the granite gneisses.

On both fresh and weathered surfaces, Biotite Granite F appears mottled, with large pink to white and gray feldspar megacrysts enclosed in a gray granular matrix. Both texture and composition tend to be homogeneous in this map unit. The subhedral to euhedral potassium feldspar megacrysts range from 2.5 to 12 cm long, and average about 5 cm. They may be either subparallel or randomly oriented in the coarse-grained massive matrix of quartz, feldspar, and biotite.

Minor quartzo-feldspathic segregations occur as scattered, irregularly shaped aplite and pegmatite masses usually too small to be mapped.

A distinctly or consistently well-oriented texture is largely lacking in Biotite Granite F; the matrix may be either massive or poorly foliated, and the feldspar porphyroblasts are either subparallel or randomly arranged in the matrix. The rock composition is in the granodiorite to quartz diorite fields. Chemical and modal analyses of one sample appear in table 5.

Plastic flowage is evident within both Biotite Granite F and its mylonitic derivative, Recrystallized Mylonitic Rock (223). Folds within Biotite Granite F and its mylonitic counterpart have been delineated, and a highly folded contact of mylonite vs. granite gneiss is found in the southern section of the study area (geology maps in pocket).

Gray Hornblende Granite (173)

This rock unit is of limited distribution, and generally is locally present as small bodies in close association with Recrystallized Mylonitic Rock (224). On both fresh and weathered surfaces, Gray Hornblende Granite is buff to gray with small dark specks of mafic mineral. Hornblende porphyroclasts from 2 to 3 mm in size make up from 1 to 4 percent of the rock. They are enclosed in a typically fine- to medium-grained, quartzo-feldspathic matrix. As a rule the matrix is massive, but a slight foliation can be locally present. Uncommon feldspar porphyroclasts range from 6 to 12 mm in size.

Gray Hornblende Granite is gradational to Recrystallized Mylonitic Rock (224) on a scale visible in outcrop. Though the main bodies of Gray Hornblende Granite are outlined on the maps, there are other bodies too small to be represented within the Recrystallized Mylonitic Rock (224).

Internal structures outlined by foliation are either absent or poorly developed, and simple in form. External contacts are gradational and mostly interlensed with either Recrystallized Mylonitic Rock or Hornblende Granite Gneiss.

Gray Hornblende Granite is apparently the parent material for Recrystallized Mylonitic Rock (224). However, it is possible that some phases of Gray Hornblende Granite could result from an advanced stage of recrystallization of the mylonite. The character of the contacts with other rocks depends upon the intrusive history of the Gray Hornblende Granite with the adjacent rock, and the subsequent metamorphic-deformational history.

Leucocratic Granite (174)

Leucocratic Granite is present as dispersed small bodies within most of the crystalline rock groups of the map area. Most of the Leucocratic Granite masses lie in a regionally north-trending zone centered on Charles Lake. The larger masses are situated west of Charles Lake.

The Leucocratic Granite is light gray to pink to red on both fresh and weathered surfaces. This medium- to coarse-grained massive granite consists of equigranular feldspar and quartz along with about 3 percent mafic minerals. Although the granite is typically massive, lenticular-rodded quartz provides a local foliation-lineation. Minor microgranite and pegmatite phases are present. Chemical and modal analyses of one sample are given in table 5.

Small patches and bands of granite gneiss, amphibolite and metasedimentary rocks are present in the otherwise uniform Leucocratic Granite. Contacts of the Leucocratic Granite are generally sharp against granite gneiss, although interlensed contact zones are also present. These granitoid/granite gneiss contacts are interpreted as being intrusive.

Although interpretation of the east portion of the map area is based primarily on recent mapping, it also incorporates a small segment of an earlier phase of mapping (Godfrey, 1966). A change in approach to classification and terminology in the interim has led to one discrepancy in the direct reclassification of Leucocratic Granite (174). There is good reason to believe that this older established map unit may in part be a phase of the currently recognized Slave Granitoids.

Slave Granitoids

Apart from forming a portion of the major pluton in the west (figure 2), various members of the Slave Granitoids are also found scattered in the Arch Lake Granitoids plutonic complex and in the Granite Gneiss belt. The Slave Granitoids make up the most abundant rock unit in the entire Alberta Shield. The lithologic and structural characters of the Slave Granitoids are relatively simple compared to those of the Granite Gneiss belt. Nonetheless, the Slave Granitoids contain numerous intermediate lithologic phases and gradations to the Arch Lake Granitoids and granitic metasedimentary rocks. The internal structure of the larger Slave Granitoids masses suggests that they are erosional truncations of small basins and domes, from 1 to 5 km in diameter. These structural features may be an expression of a proximal roofal position of a diapir. The Slave Granitoids mass northwest of Myers Lake is the south-plunging nose of a major fold structure, the Tulip Lake Dome (Langenberg, 1983).

Subordinate masses of Arch Lake Granitoids and high-grade metasedimentary rocks are common in the Slave Granitoids. Derivation of the Slave Granitoids by the partial melting of a granite gneiss/metasediment protolith (possibly dominated by metasediment) followed by segregation of quartzo-feldspathic infrastructure materials seems a most plausible petrogenetic path. This suggestion is based on field relationships and the geochemical studies of Goff et al. (1986).

Slave Granite Phase (101)

The Slave Granite Phase has a relatively limited textural and compositional range. It has a fairly light color in hand specimen, commonly gray to white, but ranging to pink or mauve pink. The characteristically massive, medium-grained texture locally displays fine- and coarse-grained variations. The typically uniform grain size is also locally megacrystic, with 15 to 30 mm-long white feldspars constituting up to 15 percent of the rock. The rock is typically garnetiferous, with chloritic biotite envelopes around garnet cores. These mafic knots (clots) are up to about 5 mm in diameter and are dispersed in the rock (up to 4 percent abundance). Under the microscope, green spinel (along with hypersthene and corundum seen elsewhere in the Slave Granite) place the metamorphic conditions for this rock unit in the granulite facies (Godfrey and Langenberg, 1978a; Langenberg and Nielsen, 1982). Chemical and modal analyses of standard samples are presented in table 6.

Mafic Slave Granite Phase (102)

The Mafic Slave Granite Phase is usually a minor component of major Slave Granitoid bodies. It is petrologically similar and gradational to the Slave Granite Phase (101). Mafic Slave Granite Phase is distinguished by a higher biotite content of up to 10 percent. The chemical and modal analyses of one representative sample are given in table 7.

Red Slave Granite Phase (103)

This rock unit is a minor member of the Slave Granitoids. It is similar to the abundant Slave Granite Phase in both mineralogical and textural features, but has a typically distinct pinkish red appearance. The color is locally gradational to gray, pink, and mauve phases. Red Slave Granite can be mixed on outcrop scale with the Slave Granite Phase, making up a minor component in the range of 10 to 20 percent. Although typically leucocratic, garnets in mafic knots make up from 1 to 5 percent abundance; porphyroblastic feldspar from 20 to 30 mm across makes up 5 to 20 percent abundance. The matrix is medium to coarse grained with a generally poor foliation, though quartz is commonly rodded.

Although chloritic biotite typically forms less than 1 percent of the rock, locally higher concentrations provide a better-defined foliation. Intimate mixtures with minor aplo-pegmatite masses are local. The principal rock composition is granite with minor variations to granodiorite. Chemical and modal analyses of standard samples are presented in table 7.

Red Slave Granite appears to be locally intrusive with a number of other rocks, including granitoids, aplites, high-grade metasedimentary rocks, and granite gneiss. Blocks of both migmatitic metasedimentary rock and granite gneiss have been seen in Red Slave Granite. It appears that Red Slave Granite is a magmatic phase of the Slave Granitoids; it may have injected and intruded earlier-formed Slave Granitoids phases, and, as a minor (about 20%) magmatic component, it may have facilitated massive intrusion. Its intermediate composition between Slave Granite and Arch Lake Granite, looking very similar to Arch Lake Transitional Granite, emphasizes a genetic link between the Slave and Arch Lake Granitoids.

Speckled Slave Granite Phase (104)

This very minor phase of the Slave Granitoids is similar to the Slave Granite Phase (101) in most textural and structural aspects. It differs in having an overall reddish and mottled appearance due to the presence of both red and white feldspars. The matrix of feldspar, quartz, chloritic biotite, and sericite is typically foliated and can be easily crushed. Its composition varies widely, from a quartz-bearing alkali syenite to granodiorite. The chemical and modal analyses for one sample are given in table 7. Speckled Slave Granite Phase bears a generally similar genetic relationship to Slave Granite along with other minor components such as Red Slave Granite Phase and Slave PQ Granite Phase.

Slave PQ Granite Phase (105)

A member of the Slave Granitoids, Slave PQ Granite is noted primarily for its reddish pink to pink color and the presence of red feldspar megacrysts from 6 to 12 mm across. At 3 to 5 percent abundance, biotite contributes to a foliated and even gneissic structure, although there are also locally massive phases. Small lenses and bands of granitic metasediments are typical of this rock unit. The predominant rock composition is granite with gradations to granodiorite. Chemical and modal analyses of this rock unit are presented in table 7. In the field, Slave PQ Granite appears to show (at least locally) intrusive contacts with other granitoid rock units, and it typically also contains blocks and fragments of granitoids such as Arch Lake Granite. Thus, Slave PQ Granite appears to be a Slave Granitoids magmatic phase. It shows a tendency to be gneissic and even migmatitic to the point where it could be mistaken for a felsic or migmatitic granite gneiss in a small outcrop. This latter observation suggests that Slave PQ Granite is a product of partial melting from parent Archean gneisses and locally still shows textural evidence of the protolithic gneiss.

La Butte Granodiorite (140)

This rock unit is characterized by a generally uniform color and texture. The color ranges from light to medium gray through brownish gray to mauve (blue quartz plus pinkish gray feldspar). It is typically medium grained with 8 to 20-mm long feldspar megacrysts, from 0 to 5 percent in abundance. The matrix, consisting principally of feldspar, quartz, and biotite, is typically massive to uncommonly poorly foliated or locally gneissic. The rock composition ranges from granite to granodiorite, quartz diorite, and quartz monzonite, with a mean composition of granodiorite. The chemical and modal analyses of one sample are presented in table 7.

La Butte Granodiorite is intimately associated with both Slave and Arch Lake Granitoids in two places in the map area. At one of those locations, east of Myers Lake, the La Butte Granodiorite band looks as though it could be stratigraphically and structurally controlled. Outcrops of La Butte Granodiorite commonly show the presence of other minor phases of the Slave Granitoids (for example, 10% of Red Slave Granite), which could be minor magmatic phases that facilitated emplacement of La Butte Granodiorite.

In outcrop, La Butte Granodiorite is seen as a potential late intrusive (magmatic) phase. Boudins and fragments of metasedimentary rock are typical within the La Butte Granodiorite. Characteristic hematitic staining along fractures within La Butte Granodiorite is interpreted as a late-stage alteration feature.

Arch Lake Granitoids

Arch Lake Granitoids are the major crystalline rock group in outcrop, underlying 60.5 percent of the map area (table 2) and include the principal crystalline rock structure—the complexly folded Hooker Lake synform, some 40 km across. Apparently disconnected Arch Lake Granitoids masses are common within the Slave Granitoids, and minor bodies are also present within the granite gneiss/metasedimentary rock belt. Isolated Arch Lake Granitoids masses are typically elongated and parallel the metamorphic foliation of the enclosing rock.

Arch Lake Granite Phase (161)

The Arch Lake Granite is overall reddish in outcrop and is distinctly foliated both in outcrop and in hand specimen. This penetrative foliation is usually accompanied by mild mylonitization. The rock texture is fairly homogeneous, and typically medium grained but locally coarse, with up to 25 percent feldspar megacrysts that are from 15 to 30 mm long. The matrix consists of pink to red feldspar, biotite, and typically blue quartz. Chemical and modal analyses of this rock unit are given in table 8. The rock composition is dominantly granite with minor variations to granodiorite and quartz diorite.

Arch Lake Granite Transitional Phase (162)

Arch Lake Granite Transitional Phase is a sub-type of the Arch Lake Granite Phase and it is distinguished by the absence of large 15 to 30 mm-long potassium feldspar megacrysts. However, a smaller size range of potassium feldspar megacrysts, about 15 mm long and forming up to 5 percent of the rock, is usually present. Chemical and modal analyses of standard samples are given in table 9.

The term "transitional" has been introduced in the Arch Lake Transitional Granite Phase in order to convey the gradational lithological quality perceived in viewing the norm (abundant) phases of both the Arch Lake Granite (162) and Slave Granite (101). In a similar way, Mafic Slave Granite (102) is a minor transitional lithological phase between the abundant Slave Granite (101) and the Arch Lake Granite.

Regional Shear Zones

Wide shear zones with mylonitization have affected three regions in the map area. In the east, a belt of granite gneisses and granitoids has been affected in the 8-km wide Allan Fault Zone (Godfrey, 1958a). In the west, Slave and Arch Lake Granitoids, and minor amounts of high-grade metasediments, have been caught up in the Warren Fault Zone, whereas a minor east-west mylonite band within Arch Lake Granitoids passes along the north shore of Cockscomb Lake. Within these shear zones, mylonitization has generated deformational products ranging from ultramylonite to mylonite and less-sheared phases of flaser gneiss. All of these sheared rocks have been affected by recrystallization to some extent, resulting in the formation of blastomylonites and the commonly observed porphyroblastic-augen feldspars in a typically streaked or banded matrix.

Mapping indicates that the parent materials for the mylonitic rocks are dominantly gneisses and granitoids, with lesser amounts of high-grade metasedimentary rocks. The compositional and structural fabric of these mylonitized zones has a planar geometry. The planar form is seen over scales ranging from hand specimens to outcrops, and to belts several km along strike (as viewed on air photographs).

The regional mylonitic shear zones have been studied by Watanabe (1965), Godfrey (1966, 1980b), and Langenberg (1983). It is evident that the structures are associated with deep-seated shear zones and the mylonitic deformation is essentially of a ductile nature. Subsequent to erosional unroofing, further deformation was localized and brittle, involving brecciation and quartz-vein filling. The age of the major period of mylonitization has been fixed by K-Ar dating at 1790 ± 40 Ma. The mylonitic shear zones are characterized by greenschist facies minerals (Langenberg and Nielsen, 1982).

Rocks of the mylonitic group collectively underlie one percent of the map area. Both the Warren and Allan Fault Zones extend beyond the map area in each strike direction.

The color and megascopic texture of the mylonites, together with gradational contacts to less-deformed phases of the rocks, were used to develop a field classification of these mylonitic rocks that is both descriptive and genetically meaningful in terms of their parental relationships. In a few cases, distinctions between the mylonites have not been clear. The parental materials themselves, at least in the gneissic terrain, are already mixtures of rock units on a fairly detailed scale, and further blending is introduced by mylonitization. An overlap or gradation of geologic character among these mylonites in outcrop or hand specimen is inevitable, but the concern is a very minor one.

The mylonitic group of rocks is subdivided on the basis of their protolith equivalents as follows:

- Mylonitic Rock 221 has largely granite gneiss parent material
- Mylonitic Rock 222 has largely high-grade metasediment parent material
- Mylonitic Rock 223 has largely granitoid parent material
- Mylonitic Rock 224 has largely Gray Hornblende Granite parent material

Recrystallized Mylonitic Rock (221)

Recrystallized Mylonitic Rock (221) is pale pink to red or dark greenish on both fresh and weathered surfaces. White to pink feldspar porphyroclasts from 6 to 18 mm long make up to a maximum of about 5 percent of the rock. The augen-shaped porphyroclasts may have trails of smaller feldspar crystals and fragments that are enclosed in a foliated aphanitic, finely banded matrix. Metamorphic foliation has a generally simple geometry in outcrop, but regionally, folds can be clearly demonstrated.

Small amounts of other rock units in the mylonitic group are mixed with this map unit on a scale too fine to be distinguished separately on the present mapping scale. As the bodies become smaller, distinctions among rock types and map units are less evident.

Recrystallized Mylonitic Rock (221) is always enclosed by, and associated with, a rock assemblage typical of the granite gneiss terrain. The contact with these rocks (gneisses, metasedimentary rocks and amphibolite) is commonly gradational. It is obvious that granite gneiss was the predominant parent material from which Recrystallized Mylonitic Rock (221) was developed.

Recrystallized Mylonitic Rock (222)

This mylonitic rock is present in both the Warren and Allan Fault Zones.

Fresh and weathered surfaces are dark green to gray to black, and freshly broken surfaces can be vitreous. Minor porphyroclasts of feldspar, and more rarely of quartz, are enclosed in a siliceous, banded, massive to foliated, aphanitic to schistose or phyllitic matrix, with chlorite, biotite, and sericite.

Geometrically simple metamorphic foliation structures and gradational, crushed and sheared contacts follow the pattern described for other mylonites of granite gneiss and granitoid rock associations. It is apparent that quartzo-feldspathic metasedimentary rocks with minor schistose material and basic rocks were the parent materials for the Recrystallized Mylonitic Rock (222).

Recrystallized Mylonitic Rock (223)

Members of this mylonitic rock unit are to be found in the Warren Fault Zone and Cockscomb Lake mylonite zone to the west, and in the Allan Fault Zone to the east.

Fresh and weathered surfaces are medium to dark gray. White to gray feldspar augen and euhedral porphyroblasts from 1 to 7 cm in size make up from 5 to 15 percent of the rock. The matrix is typically aphanitic and foliated, and locally medium grained and gneissose. Minor aplites and pegmatites are present as small bodies that crudely conform to the main structural trend.

Foliation patterns have a generally simple geometry in outcrop, but on a regional scale they grade from simple forms in the south to distinctly folded and more complex forms in the north. The mylonite contact with quartzo-feldspathic metasedimentary rock is typically interlensed and is gradational both texturally and mineralogically over a short distance. Recrystallized Mylonitic Rock (223) is completely gradational to uncrushed bands, rims, or cores of Biotite Granite F. Granite gneiss in contact with Recrystallized Mylonitic Rock (223) becomes less contorted and more mylonitic, and the size of feldspar porphyroclasts gradually increases from 1 to 7 cm as the mylonite is approached. Bands of granite gneiss from 0.3 to 3 m wide can be recognized in the contact zone, where felsic and mafic layers of the parent gneiss remain distinct in the mylonitic granite gneiss.

Recrystallized Mylonitic Rock (224)

Recrystallized Mylonitic Rock (224) is confined to the Allan Fault mylonitic band. This rock unit is always closely associated with either Gray Hornblende Granite or Hornblende Granite Gneiss.

Recrystallized Mylonitic Rock (224) weathers into distinct, large, flaggy, rectangular slabs from 8 to 15 cm thick. Fresh and weathered surfaces are typically grayish green and may possess a delicate pinkish hue in places. The obvious minerals include epidotized hornblende porphyroclasts up to 3 mm long that make up to 7 percent of the rock, and feldspar porphyroclasts from 12 to 8 mm long, making up 5 percent of the rock. The matrix is fine grained, foliated to poorly banded, and comprises quartz, feldspar, and chloritized biotite. Recrystallized Myonitic Rock (224) is distinguished by its lack of banding and the characteristic presence of hornblende porphyroclasts. The chemical and modal analyses of one sample are given in table 9.

Recrystallized Mylonitic Rock (224) is present as narrow bands oriented in the regional structural trend, proximal to the probable parent hornblende-bearing rocks (Hornblende Granite Gneiss and Gray Hornblende Granite). It is homogeneous in that xenolithic lenses or masses were not noted in outcrop. Uncommon, typically medium-grained, massive phases, generally too small to be represented on the map, are classified as Gray Hornblende Granite. They are coarser grained than the associated mylonite and appear to result from an advanced stage of recrystallization. Metamorphic foliation and lineation have a simple geometry both in outcrop and regionally.

Contacts with Recrystallized Mylonitic Rock (221), Gray Hornblende Granite, and Hornblende Granite Gneiss are fairly well defined in the field, although they can be gradational over a metre or so.

Devonian carbonate rocks (251, 252, 253, 254)

Middle Devonian and/or older carbonates rest with profound unconformity on the weathered surface of the Precambrian crystalline basement complex. Carbonate rocks that crop out along the Slave River at the extreme western margin of the map area have been described in detail by both Norris (1963) and Richmond (1965). Eight km downstream of the confluence of the Slave and Bocquene Rivers, excellent exposures of the Paleozoic/Precambrian unconformity are seen in three of the Stony Islands in the Slave River. The unconformity reveals a basal regolith that grades upwards through a conglomeratic, sandy granite wash into a sandy dolostone. Rubbly bedding developed in the lower portions of the carbonate section gives way upwards to well-bedded, flat to warped, gently westward dipping strata consisting of sandy and argillaceous dolostone, fine-grained vuggy dolostone and dolomitic limestone, and laminated gypsiferous lithographic dolostone.

Eight km farther downstream, an outlier of Paleozoic limestone was found on a large island in the Slave River, but the unconformity itself was obscured by surficial cover and vegetation.

An additional 6.5 km downstream, relationships between Paleozoic limestone and the Precambrian basement are revealed at Caribou and Lemon Islands and at the east bank. The basement topography has substantial relief in the region of these islands. Part of this relief may be fault related with both pre- and post-Devonian movements along the north/south striking faults. A Slave Granitoids basement is overlain by a granite wash/regolith that is up to 3 m thick locally. It grades upward into a rubbly bedded conglomeratic limestone with Precambrian detritus ranging from 1 m angular blocks to sand-size particles. Primary filling of topographic lows in the Precambrian erosional surface, and drapes on the steep slopes, may account for limestone dips of 27° westward.

Modal and chemical analyses

Mineralogical and chemical data on rock units in the map area are presented in tables 5 to 9 (appendix). Representative specimens were chosen from all of the major rock units in the gneissic, granitoid, mylonitic, and high-grade metasedimentary rock groups. Selection of the standard hand specimens for detailed analyses was based on the representative character of geologic features as seen in outcrop. The gneissic and granitoid standard samples are represented by individual hand specimens. However, because of the typically wide lithological variations encountered within the metasedimentary rock bands, each standard sample for the high-grade metasedimentary rocks is represented by a combined group of 5 to 10 specimens.

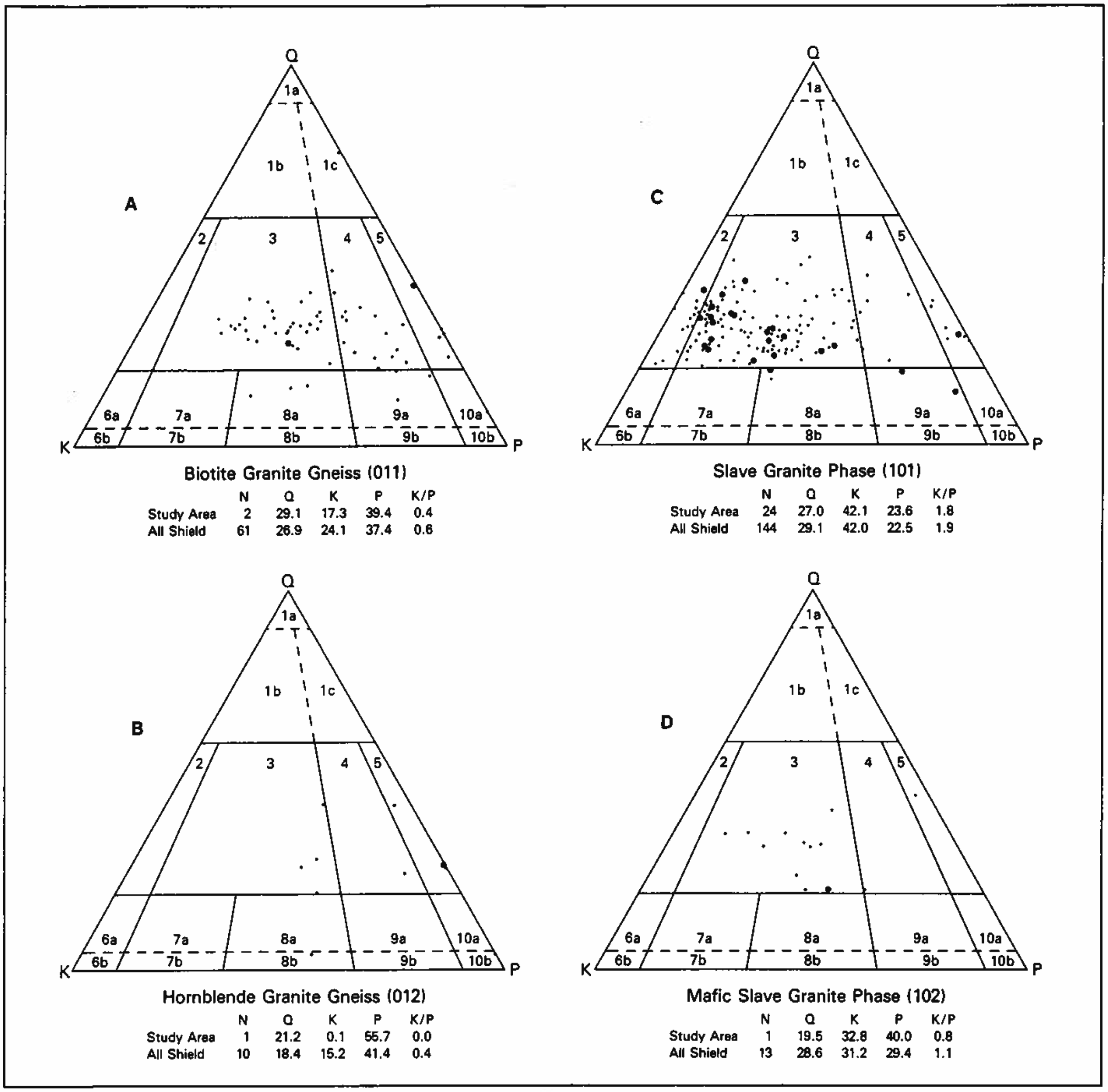


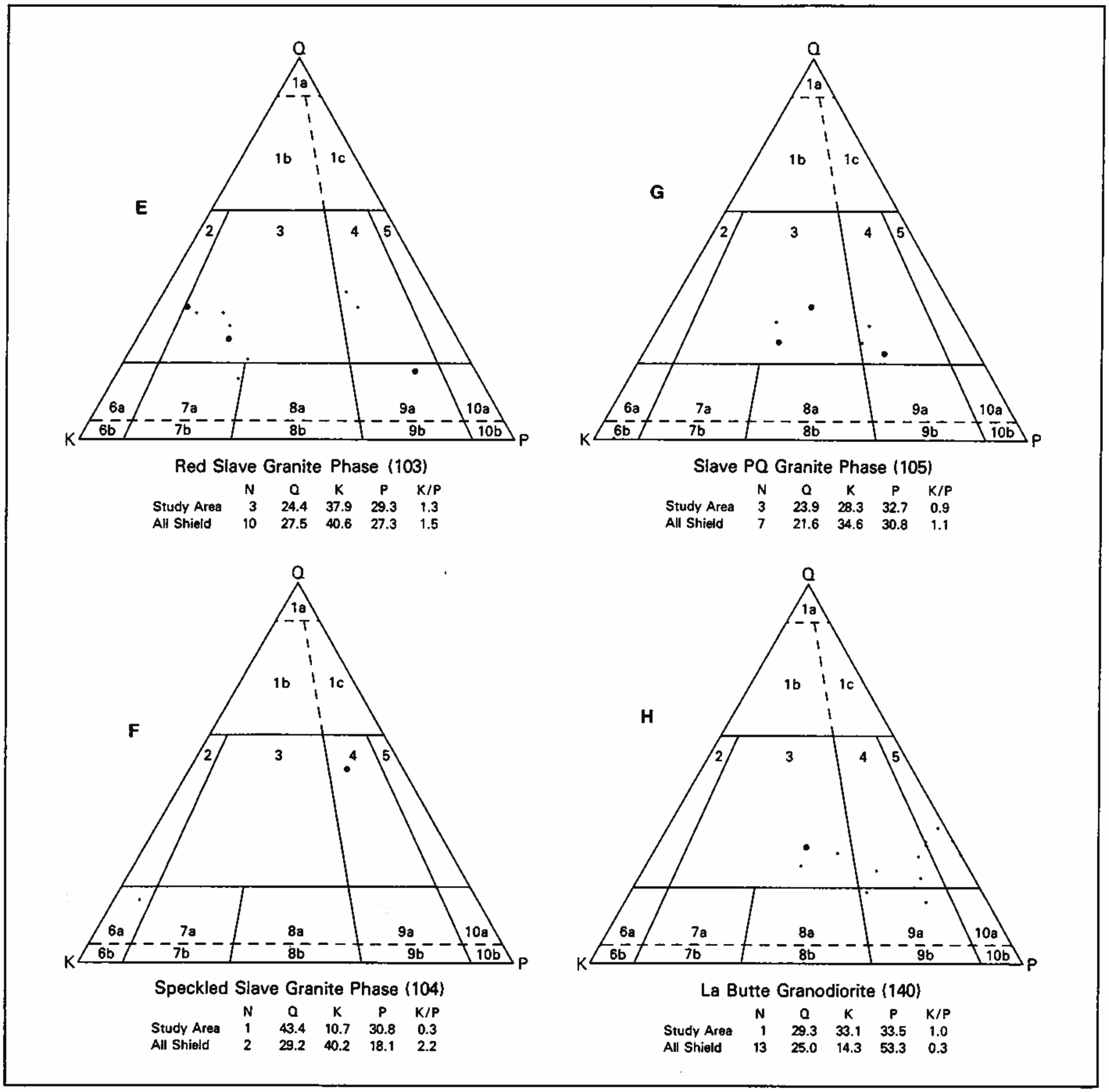
Figure 3. Ternary quartz-alkali feldspar-plagioclase (Q-K-P) plots for granitoids and gneisses in the study area.

Metasedimentary standard rock samples were ideally collected on traverses approximately perpendicular to the regional strike of the compositional banding for the major bands (see locations on geology maps in pocket).

Modal analyses for the gneissic and granitoid rock units are plotted on a series of Q-K-P diagrams (figure 3). Modal data plotted from the present study area are distinguished from those of the same rock unit from other parts of the exposed Alberta Shield. Rock type boundaries in these diagrams are plotted according to the recommendations of Streckeisen (1967).

Field work, and geochemical (Goff et al., 1986) and geochronological studies, strongly suggest that the Archean basement gneiss complex was the source of the protolithic materials from which the younger granitoids were derived. High-grade regional metamorphism of these gneisses led to partial melting, mobilization and segregation of the granitoid constituents. Q-K-P diagrams show that the mean compositions of Slave and Arch Lake Granitoids represent a considerable shift from that of the parent granite gneisses. This shift in composition must be accounted for through the petrogenetic and evolutionary path of granitoid formation and segregation.

In mass-balance calculations, the weighted compositions of all the end products should approximate that of



Red Slave Granite Phase (103)

	N	Q	K	P	K/P
Study Area	3	24.4	37.9	29.3	1.3
All Shield	10	27.5	40.6	27.3	1.5

Slave PQ Granite Phase (105)

	N	Q	K	P	K/P
Study Area	3	23.9	28.3	32.7	0.9
All Shield	7	21.6	34.6	30.8	1.1

Speckled Slave Granite Phase (104)

	N	Q	K	P	K/P
Study Area	1	43.4	10.7	30.8	0.3
All Shield	2	29.2	40.2	18.1	2.2

La Butte Granodiorite (140)

	N	Q	K	P	K/P
Study Area	1	29.3	33.1	33.5	1.0
All Shield	13	25.0	14.3	53.3	0.3

Figure 3. (continued)

the parent materials, if isochemical changes have predominated. Hence, there is a need to identify the mobilizate and restite components of the system. The intimate field relationships of minor granitoid masses and the combined granite gneiss/high-grade metasedimentary belt point to the latter belt as the source of the parent material for the granitoids. The intruded granitoid bodies are likely to contain both the partly magmatic (mobilizate) component and perhaps a portion of the complementary restite. With respect to the Slave Granitoids, the magmatic component could be represented by leucocratic dykes, screens, pods, and irregular bodies, enclosing blocks within Slave Granite, Red Slave Granite, Speckled Slave Granite, and Slave PQ Granite. However, the restite could include mafic blocks and segregations within Slave Granite, Mafic Slave Granite, Red Slave Granite, Speckled Slave Granite, Slave PQ Granite, and La Butte Granodiorite. Other portions of the restite remain within the combined high-grade metasediments and Granite Gneiss belt.

The range in modal composition of the granite gneisses and high-grade metasediments does not include the plagioclase poor-to-absent area corresponding to the alkali feldspar granite members of the Slave Granite (101, figure 3). Hence, direct melting does not appear to be a likely mechanism in the generation of

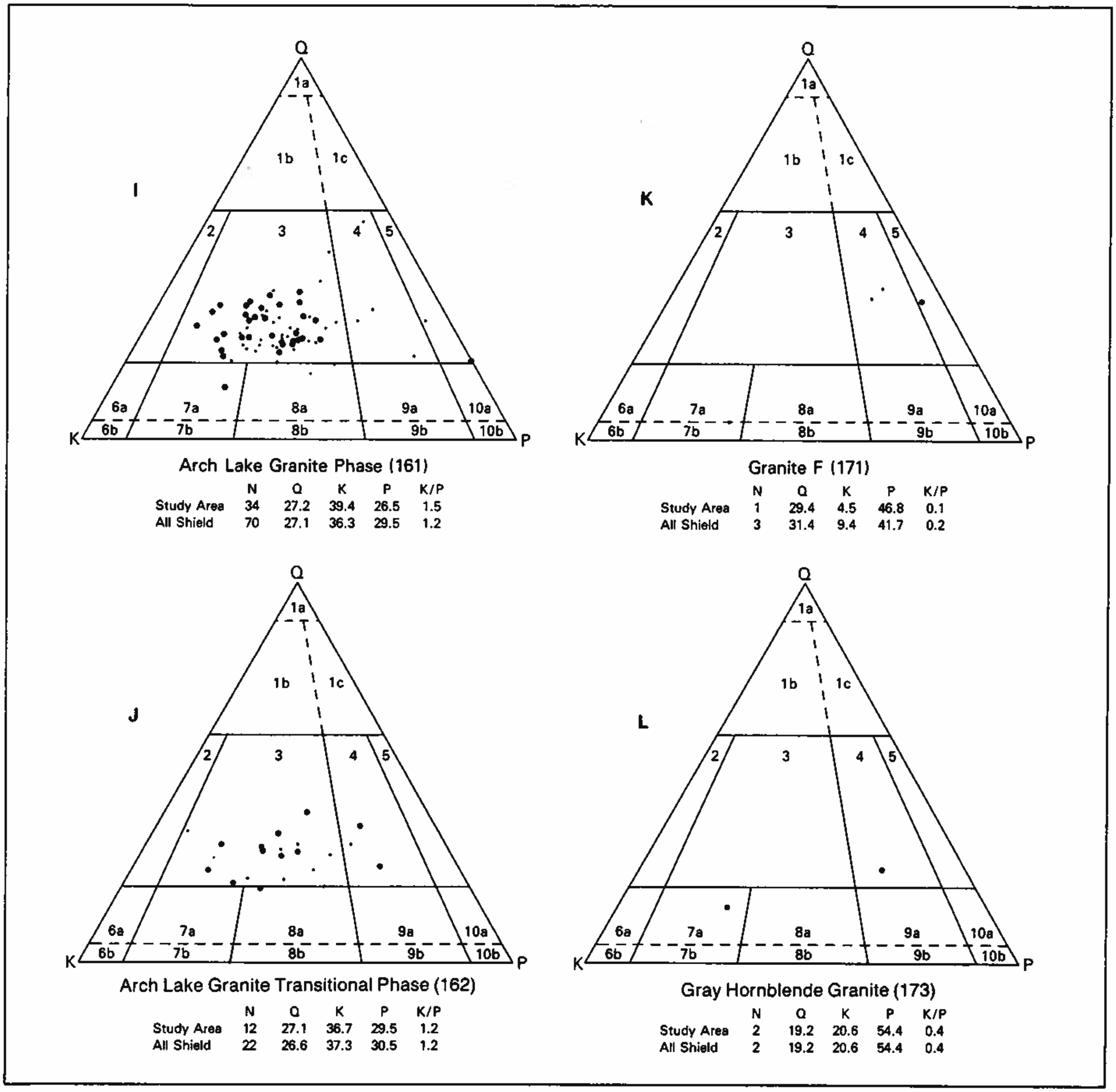


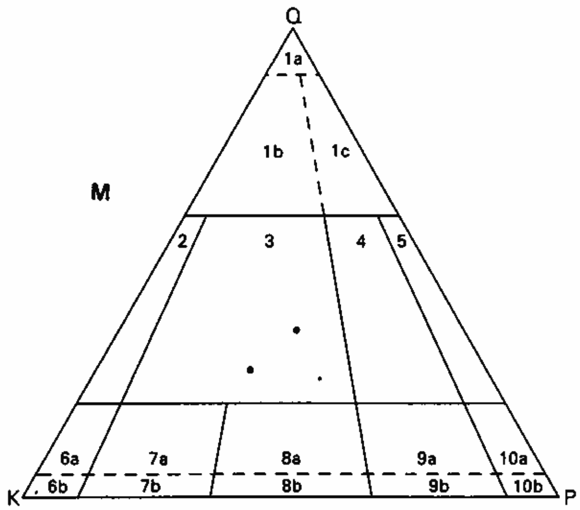
Figure 3. (continued)

these compositions. However, partial melting of the assumed parent materials would be expected to generate granitic end products of potassium-rich composition similar to that of the Slave Granite (Lameyre and Bowden, 1982).

Mafic Slave Granite is part of a continuous compositional gradation from Slave Granite to Arch Lake Granite Transitional Phase and Arch Lake Granite. In terms of our present geochemical view of the petrogenesis of the granitoids, Mafic Slave Granite could represent part of the restite derived from partial melting. In the Arch Lake Granitoids, the melanocratic Francis Granite is likewise a possible restite component.

In summary, it is apparent that the basement gneiss complex has been partially molten, mobilized, segregated, and then recrystallized during formation of the Slave and Mafic Slave Granites. Granite gneisses of intermediate and plagioclase-rich compositions were recrystallized, mobilized, and segregated to give rise to the complementary suite of Arch Lake and Arch Lake Transitional Granitoids.

The intimate field relationships of minor leucocratic components present as irregular dykes and patches within the main granitoid masses (for example, Slave Granite, Mafic Slave Granite, Arch Lake Granite and Arch Lake Granite Transitional Phase) suggest that the



Leucocratic Granite (174)

	N	Q	K	P	K/P
Study Area	2	30.6	36.4	29.9	1.2
All Shield	3	28.7	34.5	33.4	1.0

1a Quartz rocks
1b Quartz granite
1c Quartz granodiorite
2 Alkali granite
3 Granite
4 Granodiorite
5 Quartz-diorite
6a Quartz-bearing alkali syenite
6b Alakali syenite
7a Quartz-bearing syenite
7b Syenite
8a Quartz-bearing monzonite
8b Monzonite
9a Quartz-bearing monzodiorite
9b Monzogabbro
10a Quartz-bearing (diorite, gabbro)
10b Diorite, gabbro, norite, anorthosite

• Samples from study area
· Samples from remainder of shield in Alberta
N Number of Samples

Figure 3. (continued)

leucocratic phases are products of late-stage leucosome (magmatic) segregation and mobilization. The widespread occurrence of a leucosome phase in each of the granitoid complexes points to a common petrogenetic history for the granitoids.

Minor amounts of scattered, small bodies of amphibolite are believed to be derived by metamorphism, structural extension, and dislocation of diabase dykes and metamorphic basic segregations. The high-grade metasedimentary rocks (table 5) are retrograde quartzitic granulites that correspond to initial compositions of arkosic graywackes.

The chemical composition of the metasedimentary rocks tends to be low in CaO, MgO and Na_2O, and high in K_2O, relative to worldwide averages for graywackes. These compositional differences may be carried over and revealed in the locally high K_2O content of the derived granitoid bodies of Slave and Arch Lake affinity in the Shield of northeastern Alberta.

Metamorphism

The regional metamorphic history is summarized in Godfrey and Langenberg (1978), Nielsen et al. (1981), and Langenberg and Nielsen (1982).

Metamorphic events in the Shield of northeastern Alberta have been identified and dated by geochronology using a variety of radioactive systems and isotopes (Godfrey and Baadsgaard, 1962; Baadsgaard et al., 1964; Baadsgaard and Godfrey, 1967, 1972). Two principal metamorphic events have been defined (Langenberg and Nielsen, 1982):

1. An Archean high-pressure granulite facies metamorphism, M_1, is indicated by relict hypersthene, sillimanite, green spinel, and corundum in Slave Granitoids and high-grade metasediments.
2. An Aphebian moderate-pressure granulite facies metamorphism, M_2, affected all the granitoid and gneissoid rocks in the Alberta Shield.

The Aphebian M_2 Event is associated with an assemblage of almandine, hornblende, cordierite, and andalusite. The moderate-pressure granulite maxima of the M_2 Event has been traced by electron microprobe mineral analysis to retrogress through the amphibolite facies and ultimately to the greenschist facies. The latter is represented by a fairly ubiquitous assemblage of chlorite, muscovite, and epidote. Chlorite is usually seen as an alteration product of biotite, hornblende, or garnet, whereas epidote typically occurs as veinlets.

Moderate-pressure granulite facies are the maximum Aphebian metamorphic conditions (M_2) attained by the principal Slave Granitoids mass. By extrapolation, the same conditions must apply to the associated granitoid masses. These conditions are thought to have been achieved during the Hudsonian Orogeny and coincided with the time of emplacement of most of the granitoids in the Shield of northeastern Alberta.

Development of the regional mylonitic shear zones—the Allan and Warren Fault Zones—is related to greenschist facies conditions, presumably a late stage of the Hudsonian Orogeny.

Structural geology

An overview of the structural geology of the Shield in northeastern Alberta has been published by the Alberta Research Council (Langenberg, 1983).

A metamorphic foliation is developed in the granitoids, granite gneisses, and high-grade metasediments. Thin sections show that this foliation is formed by elongated lenses of platy quartz, flattened feldspars, and micas, indicative of a dynamo-metamorphic origin. Large-scale structures, such as the Tulip Lake Dome, are defined by this foliation. The southern tip of the dome is situated in the Myers Lake area (Langenberg and Ramsden, 1980). The diapiric doming is dated by the age of the Slave Granitoids at about 1900 Ma (Nielsen, et al., 1981). Co-existing metamorphic minerals in metasediments indicate that the doming occurred under moderate-pressure granulite facies conditions ($P = 5 \pm 0.7$ kbar and $T = 750° \pm 30°C$).

The Arch Lake Granitoids basin in the Hooker Lake area is also related to the Aphebian remobilization and doming. The core of the basin encloses a crescent-shaped domal structure (Langenberg, 1983, pg. 12). Doming is the end result of Aphebian reactivation of the Archean basement as a consequence of regional heating. The heating also led to anatexis and the separation of the S-type Slave, Arch Lake, and La Butte Granitoids. These granitoids were emplaced into higher crustal levels by the process of diapiric doming. Tight to isoclinal megascopic folds occur in the migmatitic granite gneisses and are not found in the granitoids. These folds are transected by the granitoids, which intrude the granite gneisses. The folds are assigned to the Archean, because dating shows the Archean to have the age of the basement gneiss complex (Nielsen et al., 1981).

Several regional mylonitic shear zones are evident in the area. In the extreme eastern part of the Daly Lake map area, part of the Allan Fault Zone passes through Charles Lake. In the Myers Lake map area, multiple shear zones delineate the Warren Fault Zone (Godfrey, 1958a). In this map area, the southern end of the more poorly defined Rutherford Fault is also seen (Godfrey, 1958a).

Fault movement along the regional shear zones is younger than the domal structures, because the shear zones transect or truncate some of the granitoid domes and basins. The regional shear zones are characterized by mylonites and greenschist facies minerals (Langenberg and Nielsen, 1982). K-Ar dating of these minerals shows that the mylonites formed at 1790 ± 40 Ma. In outcrop, the deformation in the mylonite rocks is seen as a ductile shear phenomenon of varied intensity rather than as brittle fracture. Mylonitization is expressed within both the granite gneisses and granitoids. Recrystallization has affected all rocks in the region, including the mylonitic zones. This combination of events in the mylonitic zones has produced a range of comminuted rocks—mylonites, ultramylonites, blastomylonites and less-sheared phases such as flaser gneisses. Minor local megabrecciation of the mylonites has produced quartz-filled fractures and quartz-lined vugs.

Transverse faults in the map area strike easterly, northwesterly, and northeasterly. Some of these faults may have originated at the same time as the regional shear zones (for example, those that are parallel and lie close to the shear zones). Other faults cut the shear zones and, therefore, are younger. All of the transverse faults are of a brittle nature.

A fairly representative selection of joints is given on the accompanying geological maps. The dominant strike directions are northerly and easterly, although some minor northwest and northeast directions also occur (Langenberg, 1983). The north- and east-striking joints are parallel to faults and therefore could have formed in the same stress system in either Precambrian or Recent times. Joints formed in Recent times could still be further related to a strain release of Precambrian origin. The northwest- and northeast-striking joints, although parallel to some older faults, are thought to have originated in a recent regional stress field having large, unequal, horizontal principal stresses. This stress field (the Rocky Mountain Front) is active today, as indicated by fracture breakouts in oil wells. These breakouts have effectively elongated the drill holes in cross-section, with the longer axis aligned northwesterly, parallel with the Rocky Mountain Front (Gough and Bell, 1981).

Economic geology

Overall, high-grade metasedimentary rocks have proven to be among some of the most interesting and prospective rocks for metallic mineralization in the Shield of northeastern Alberta. For example, scattered graphite was noted in a band of high-grade metasedimentary rocks close to the Dog River at the intersection of the Warren and Rutherford Fault Zones (Godfrey, 1958a, 1960). However, there are very few such rocks in this map area, as they underlie only 1 percent of this part of the Shield (table 2).

Small areas of yellow mineral stains (unconfirmed uraniferous stains) were noted on Slave Granite outcrops in Wood Buffalo National Park, about 1.5 km west of the Caribou Islands.

Many quartz veins are parallel and closely associated with the Allan Fault Shear Zone in the southeast part of the map area. An unusual amount of allanite was noted in both Biotite and Hornblende Granite Gneisses in this part of the Granite Gneiss belt.

Minor amounts of molybdenite, chalcopyrite, and arsenopyrite are dispersed in Hornblende Granite Gneiss near the partly faulted contact of the Arch Lake Granitoids with the Granite Gneiss belt. These mineral occurrences are situated in a zone of faults that parallel and lie close to the west side of the Allan Fault, just west and south of the southern tip of Charles Lake. Arsenopyrite-bearing grab samples assayed from the south end of Potts Lake (Godfrey, 1966) revealed an absence of both gold and silver mineralization.

Copper (chalcopyrite) mineralization has been found in the Paleozoic sedimentary rocks immediately overlying the regolith developed in the Precambrian Shield crystalline rocks (Godfrey, 1973). At a group of four islands, known as Stony Islands, 8 km north and downstream from Hay Camp on the Slave River, the regolith and sections with granite wash and carbonates are well exposed. Fresh Slave Granite grades upwards through regolithic basement materials to a granite wash, rubbly bedded dolomite, to a thin bedded dolomite, shale, and flaggy limestone. Section thicknesses range up to approximately 8 m.

Secondary and primary copper mineralization are present, although not all chalcopyrite is accompanied by secondary staining. Marcasite nodules up to 15 mm in diameter are locally associated with the copper mineralization. The mineralization is stratiform and largely restricted to a 30 cm thick dolomitic bed beneath the upper flaggy limestone and close to the thin shale.

Copper mineralization is low grade and dispersed. It probably averages less than 0.3 percent even over a selected bed thickness of 10 cm. However, the mineralization could be widespread; therefore, all of the sedimentary rocks, granite wash, and regolith should be checked wherever feasible.

The various types of glacial deposits in this region have a dominant sandy lithology. The well-defined ice-contact fluvial channel deposits, trending northwesterly, should contain gravel, and offer the best possibility for providing granular construction materials in the map area.

A keyworded index to assessment reports that describe the results of metallic minerals exploration programs has been compiled and is available from the Alberta Research Council (Poruks and Hamilton, 1976).

Glacial history

A variety of glacial deposits, scattered throughout the map area, together with polished, scoured, fluted, rounded, and striated bedrock surfaces, attest to a recent continental glaciation. The direction of the major ice advance was from the east. The glacial sediments are dominantly sandy and occur as glaciolacustrine, glaciofluvial, and crevasse-fill deposits. The classification, distribution, size, and shape of the glacial deposits are largely interpreted from air photographs.

Ice-contact deposits are associated with phases of stability (equilibrium), hence the accumulation of recessional moraine deposits. Parts of three such ice-contact deposits can be identified in the study area. They have a relatively smooth trend as seen in plan view, are aligned northwesterly, and appear to gently converge to the northwest. Their projected junction is well beyond the northern boundary of the regional map area. The spacing between the ice-contact deposits in the center of the map area is uniform at about 13 km. They are located: (1) just north of the mouth of Bocquene River; (2) on the west side of Cockscomb Lake; and (3) on the west side of Hooker Lake.

Ice-contact fluvial channels preceded the glaciolacustrine stage, because the former are higher in elevation and therefore they required higher (thicker) ice walls in order to confine the meltwater flow. Gradually, the ice thinned, wasted, and the meltwater ice-contact channels broadened out locally into lakes at the stagnating ice front. The fluvial channels became less well defined and ultimately became unconfined to the point that channel flow was essentially non-existent. Storm-wave action on the pro-glacial lakes built beaches and probably destroyed some of the higher-elevation, earlier-stage, meltwater channel sediments. However, evidence of the former higher ice-contact channels remains in places (for example, the ridge with abandoned beaches to the southwest of Hooker Lake).

At the time of ice-contact meltwater flow, the stagnant ice was thick enough to confine and channel the meltwaters. With time the ice sheets melted down, the water level was lowered, and ponding of meltwater took place at lower elevations on both sides of the fluvial channel, as shown by abandoned beaches developed to both the east and west sides of the fluvial channel deposits. Evidence of the abandoned beaches is confined to the higher elevation glaciofluvial deposits. It is speculated that the abandoned beaches on the west side of the ice-contact deposits were due to wave action on Glacial Lake McConnell, a large body of meltwater ponded in the Slave River valley lowlands (Craig, 1965).

Erosion by meltwater sheetwash has left only patches of glaciolacustrine and glaciofluvial deposits from what appears to have been fairly continuous ice-contact fluvial meltwater systems. The loose surficial sediments were washed away, exposing the underlying Precambrian bedrock. Segments of one fluvial meltwater channel system can be readily connected across the map sheet, from west of McClelland Lake to Myers Lake, Cockscomb Lake, and still farther south, for a total length of at least 27 km.

It is noteworthy that many of the existing lakes in the map area are situated on the east side of the ice-contact meltwater channels. This situation arises from a combination of several geological conditions:

1. a series of three ice-contact, recessional moraines, oriented northwesterly, were left by a receding ice-sheet;
2. the general ground slope is westward towards the Slave River, and therefore the northwest-trending ice-contact glacial deposits now act as a dam on the natural surface drainage to the west; and,
3. ice meltout debris was deposited in the ice-free con-

tact zone adjacent and on the west side of the stagnant ice front. Many lakes (for example, Myers Lake) now occupy depressions and low ground on the upslope side of the dams formed by the recessional ice-contact moraines.

The major sandy outwash plain in the southeast of the map area was built, at least in part, over stagnant ice blocks, as witnessed by the presence of kettle holes. Distribution of these kettle holes is not random. Their location and elongation are directly related to ice-scoured fault zones in the underlying bedrock. The kettle holes, in turn, have controlled development of the local post-glacial valleys.

Exposure to the atmosphere and drying of the higher-level sandy glacial deposits led to erosion by storm winds from the southeast, forming sand sheets, and more especially, longitudinal dunes. Some of these dunes probably moved after ice melt. Others, earlier in the phase of deglaciation, may have been blown across isolated stagnant ice blocks and were subsequently lowered onto the relatively clean, sheet-washed bedrock during further ice melting. Shifting winds appear to have subsequently modified the initial longitudinal dunes. One set of dunes just east of Cockscomb Lake appears to have no immediate source of sand. The closest sand source upwind, according to the distribution of sand mapped today, would be 3 to 5 km to the southeast. This is an acceptable distance for dune migration. However, it is further speculated that any related (that is, formerly connecting) thin sand sheets would have been subject to late-glacial meltwater sheet-wash and therefore could be effectively destroyed.

Aeolian erosion and transport of surficial sand must be accompanied by abrasion of bedrock on the appropriate slope faces. Abrasion of granitic outcrop is seen to be particularly effective on the half metre or so just above the general ground level; that is, on steep southeast-facing slopes. Here, the outcrop surface may be facetted (planed flat in contrast to rounding by glacial erosion) with a surface of parallel, smooth, overlapping grooves (a few millimetres both deep and across the groove). Glacial polish and striations were accordingly erased by wind polish. Wind-polished bedrock surfaces are found nearby, downwind, and within the major deposits of sand.

Glacial deposits are essentially confined to the generally scattered sandy ice-contact and outwash deposits. The glacially smooth rocky uplands are generally clear of glacial deposits. It is apparent that in the latter stages of deglaciation, glacial meltwaters sheet-washed the landscape, transporting minor fine glacial sediments from the uplands and leaving the latter essentially clear of surficial debris. This meltwater sheet-wash was obviously extensive regionally. However, the presence of rounded boulders commonly from 0.6 to 1.0 m in diameter, and typically lying directly on bedrock scattered around the top of a bedrock high, marks the particle-size transport limitations of the glacial meltwaters. These glacial boulders are interpreted as having been glacially and then fluvially transported, in order to account for rounding by abrasion. They were deposited off-ice onto bedrock by meltwaters and/or let down from melting stagnant ice. Meltwater flow was inadequate to transport these boulders farther downslope, but meltwaters were instrumental in removing other finer-sized glacial debris.

Glacially scoured and smoothed bedrock surfaces at lakeshore level, which are actively water washed, provide excellent surfaces for the detailed study of bedrock lithologies and structures.

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Appendix
Modal and chemical analyses of standard samples

Table 5. Modal and chemical analyses of standard samples for Biotite Granite Gneiss (11), Hornblende Granite Gneiss (12), Amphibolite (20), Metasedimentary Rock Bands (31), Granite F (171), Gray Hornblende Granite (173), and Charles Lake Leucocratic Granite (174) in percent.

Standard sample number	(11)		(12)	(20)			Metasedimentary rock bands (31)				(171)	(173)		(174)
	151	461	152	147	450	498	63	64	65	68	146	150	156	154
Quartz	24.6	33.6	21.2	0.1	0.0	0.0	54.1	10.4	47.9	48.1	29.4	13.9	24.4	25.0
K-feldspar	34.1	0.4	0.1	0.0	0.0	5.2	5.1	14.9	11.5	14.6	4.5	23.1	18.0	30.8
Plagioclase	33.3	45.6	55.7	27.6	41.7	52.3	10.8	34.1	19.5	14.2	46.8	54.9	54.0	40.5
Biotite	2.7	13.0	8.5	0.1	4.2	1.8	15.1	9.1	2.0	5.3	16.8	1.4	1.6	0.0
Chlorite	2.7	0.4	2.1	0.1	0.0	0.1	0.6	0.0	1.1	0.0	0.2	0.0	trace	1.1
Hornblende	0.5	0.0	7.8	70.6	51.2	39.6	0.0	6.8	0.0	0.0	0.0	3.9	0.0	0.0
Epidote	1.1	3.6	0.7	1.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	1.5	0.8	1.4
Muscovite	0.0	1.8	0.0	0.0	0.0	0.0	5.0	14.9	2.5	4.3	0.0	0.0	0.5	1.0
Spinel	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.7	0.0	0.0	0.0	0.0
Garnet	0.0	0.0	0.0	0.0	0.0	0.0	4.5	0.0	0.5	4.2	2.2	0.0	0.0	0.0
Pyroxene	0.0	0.0	0.0	0.0	0.3	0.0	trace	4.0	2.7	1.5	0.0	0.0	0.0	0.0
Cordierite	0.0	0.0	0.0	0.0	0.0	0.0	1.9	0.0	9.1	4.0	0.0	0.0	0.0	0.0
Andalusite	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sillimanite	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.5	0.0	0.0	0.0	0.0
Accessories	1.0	1.6	3.9	0.5	2.6	0.3	2.4	5.6	2.2	2.6	0.0	1.3	0.7	0.2
Number of points	2000	1000	2000	2000	1000	1000	2000	2000	1625	2100	2500	2500	2500	2500
SiO_2	71.55	71.12	63.31	46.50	49.52	54.06	64.28	47.79	63.61	65.02	65.21	66.16	70.32	71.62
TiO_2	0.28	0.48	0.56	1.00	1.06	0.58	0.84	0.93	0.73	0.70	0.76	0.23	0.13	0.09
Al_2O_3	14.74	12.94	16.01	14.81	14.15	17.87	14.97	13.85	17.81	19.84	16.13	17.14	15.44	15.24
Fe_2O_3	1.57	5.10	5.45	15.09	11.18	6.88	8.67	12.76	6.48	3.83	4.99	2.26	1.16	0.73
MgO	0.60	0.84	2.76	6.63	9.24	4.15	3.57	6.47	2.42	1.58	2.48	1.06	0.48	0.46
CaO	1.57	3.17	5.92	12.04	7.03	7.42	0.93	9.90	2.19	2.31	3.22	3.60	2.64	2.16
Na_2O	3.27	3.86	4.17	1.40	2.26	4.08	0.83	2.80	1.43	1.25	2.81	5.29	4.96	3.72
K_2O	4.95	1.70	1.00	1.06	2.14	2.71	3.42	1.57	3.15	4.38	3.20	2.53	3.12	4.03
MnO	0.06	0.06	0.10	0.25	0.03	0.13	0.10	0.16	0.10	0.07	0.06	0.09	0.04	0.06
P_2O_5	0.07	0.03	0.09	0.06	0.32	0.07	0.04	0.10	0.12	0.05	0.17	0.11	0.05	0.12
L.O.I.	0.66	0.79	0.59	1.28	1.52	1.20	1.69	2.39	1.01	1.27	0.76	0.37	0.25	0.34
H_2O	0.00	0.03	0.00	0.00	0.19	0.13	0.07	0.39	0.17	0.04	0.08	0.00	0.00	0.00
Total	99.32	100.12	99.96	100.12	98.56	99.28	99.41	99.11	99.22	100.34	99.87	98.84	98.60	98.57

Chemical analyses by J.R. Nelson, Alberta Research Council Chemistry Laboratory.

Appendix (continued)

Table 6. Modal and chemical analyses of standard samples for Slave Granite Phase (101) in percent.

Standard sample number	Slave Granite Phase (101)											
	321	443	444	445	446	447	448	449	457	458	459	460
Quartz	32.0	30.2	26.7	31.7	37.7	24.1	27.3	23.7	27.4	41.1	25.3	29.8
K-Feldspar	38.9	51.0	47.7	47.7	50.9	57.6	1.8	57.5	38.3	42.1	55.0	53.2
Plagioclase	23.5	8.3	8.8	13.1	4.1	11.3	65.5	12.1	31.6	12.4	11.8	6.2
Biotite	3.6	2.5	2.1	1.0	2.4	1.5	0.6	0.3	1.3	1.9	0.6	7.7
Chlorite	0.9	0.0	0.5	4.4	0.0	0.4	0.6	0.0	0.3	0.9	0.0	0.0
Hornblende	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Epidote	0.1	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Muscovite	0.6	5.1	4.4	1.8	3.5	2.3	4.2	5.2	1.1	0.9	2.7	2.4
Spinel	0.0	0.7	0.5	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.2	0.0
Garnet	0.4	0.0	4.9	0.0	0.0	1.2	0.0	1.2	0.0	0.0	3.8	0.0
Pyroxene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cordierite	0.0	0.5	2.5	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.2	0.0
Andalusite	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sillimanite	0.0	1.1	0.8	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.1	0.0
Accessories	0.0	0.5	0.9	0.6	1.4	0.1	0.0	trace	0.1	0.7	0.3	0.9
Number of points	1000	2000	2000	2000	1994	1002	1000	1000	1000	2000	2109	2008
SiO_2	72.84	72.35	71.91	72.30	72.44	74.25	73.30	73.55	73.57	73.65	74.65	73.21
TiO_2	0.16	0.14	0.26	0.14	0.14	0.14	0.16	0.08	0.18	0.10	0.14	0.22
Al_2O_3	14.22	14.86	15.12	14.24	15.30	14.52	14.87	14.95	14.34	15.02	14.17	14.19
Fe_2O_3	1.15	1.28	1.38	1.12	0.71	1.31	0.97	0.75	1.03	0.74	1.09	1.03
MgO	0.37	0.25	0.40	0.33	0.22	0.26	0.42	0.23	0.39	0.22	0.23	0.45
CaO	0.83	0.57	0.60	0.33	0.71	0.59	0.58	0.61	0.79	1.24	0.96	1.02
Na_2O	3.45	2.58	2.40	2.17	3.69	2.95	4.79	3.29	3.29	4.57	3.51	3.83
K_2O	5.21	6.55	6.58	7.24	6.09	4.96	3.41	5.41	5.03	3.74	4.49	4.25
MnO	0.04	0.00	0.02	0.01	0.01	0.00	0.01	0.04	0.00	0.01	0.03	0.01
P_2O_5	0.11	0.14	0.20	0.11	0.11	0.20	0.13	0.25	0.09	0.06	0.04	0.10
L.O.I.	0.25	0.62	0.75	0.87	0.53	0.20	0.88	0.37	0.57	0.16	0.13	0.15
H_2O	0.00	0.15	0.27	0.26	0.11	0.20	0.08	0.13	0.01	0.71	0.14	0.11
Total	98.63	99.49	99.89	99.12	100.06	99.58	99.60	99.66	99.29	100.22	99.58	99.46

Chemical analyses by J.R. Nelson, Alberta Research Council Chemistry Laboratory.

Appendix (continued)

Table 6. (continued)

Standard sample number	477	483	484	486	497	508	515	521	522	524	528	529	608
	Slave Granite Phase (101)												
Quartz	28.9	33.7	26.0	36.5	12.1	23.4	21.7	31.3	24.2	23.2	17.9	28.9	19.0
K-Feldspar	42.3	52.2	38.8	47.7	9.1	39.9	51.2	47.0	44.4	45.2	18.4	44.0	46.6
Plagioclase	24.4	7.9	26.4	8.3	67.5	22.2	24.9	13.5	28.8	28.4	56.4	24.2	28.5
Biotite	2.0	3.0	3.0	4.4	0.8	2.7	0.2	4.1	0.0	2.1	1.2	1.0	2.8
Chlorite	0.0	2.0	4.0	0.0	0.0	0.4	0.3	0.5	0.5	0.5	0.8	1.0	0.0
Hornblende	0.0	0.0	0.0	0.0	7.8	0.0	0.0	0.1	0.0	0.0	3.2	0.0	0.0
Epidote	0.0	0.0	0.0	0.0	1.8	0.0	0.0	0.0	0.0	0.0	1.3	0.1	0.0
Muscovite	0.0	1.0	1.2	1.5	0.0	6.8	1.0	2.1	0.0	0.1	0.0	0.3	2.8
Spinel	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Garnet	2.4	0.0	0.0	0.0	0.0	4.2	0.3	0.0	2.2	0.0	0.0	0.0	0.3
Pyroxene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cordierite	0.0	0.0	0.0	0.2	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
Andalusite	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sillimanite	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Acessories	0.1	0.3	0.6	1.2	1.0	0.5	0.0	1.2	0.0	0.6	1.0	0.4	trace
Number of points	1002	2000	2001	2000	1000	2000	1000	2000	1000	1000	1000	2000	1000
SiO_2	72.03	73.26	71.99	72.98	65.98	70.47	72.70	73.35	72.67	72.85	68.22	74.75	71.36
TiO_2	0.22	0.11	0.35	0.16	0.28	0.24	0.14	0.12	0.14	0.20	0.22	0.10	0.15
Al_2O_3	15.46	14.81	14.22	14.87	18.30	15.30	14.92	14.69	15.00	14.37	15.70	13.84	16.12
Fe_2O_3	1.91	0.41	1.88	1.11	2.45	1.30	1.23	0.99	1.79	1.58	2.95	0.81	0.86
MgO	0.44	0.20	0.45	0.27	0.63	0.47	0.32	0.25	0.49	0.34	0.87	0.14	0.33
CaO	0.94	0.83	0.82	0.86	3.51	0.60	0.81	1.13	0.68	0.76	2.36	0.60	0.75
Na_2O	3.36	3.70	2.82	3.75	5.26	2.77	3.74	3.70	2.95	3.17	3.86	0.01	3.31
K_2O	5.16	5.92	6.52	5.59	2.40	7.30	5.91	4.77	5.02	5.70	3.84	3.00	5.69
MnO	0.02	0.01	0.03	0.02	0.09	0.02	0.01	0.04	0.06	0.04	0.04	0.02	0.01
P_2O_5	0.14	0.06	0.14	0.09	0.22	0.10	0.13	0.07	0.08	0.17	0.10	0.02	0.08
L.O.I.	0.09	0.21	0.52	0.28	0.39	0.69	0.23	0.28	0.64	0.40	0.73	0.32	0.59
H_2O	0.08	0.13	0.15	0.12	0.10	0.19	0.12	0.09	0.11	0.04	0.06	0.01	0.14
Total	99.85	99.07	99.89	100.10	99.61	99.45	100.26	99.48	99.63	99.62	98.95	99.51	99.39

Chemical analyses by J.R. Nelson, Alberta Research Council Chemistry Laboratory.

Appendix (continued)

Table 7. Modal and chemical analyses of standard samples for Mafic Slave Granite Phase (102), Red Slave Granite Phase (103), Speckled Slave Granite Phase (104), Slave PQ Granite Phase (105), and La Butte Granodiorite (140) in percent.

Standard sample number	(102)	Red Slave Granite (103)			(104)	Slave PQ Granite (105)			(140)
	530	470	488	526	482	520	525	527	472
Quartz	19.5	33.5	23.2	16.6	43.2	24.6	17.9	29.3	29.3
K-Feldspar	32.8	55.1	46.2	12.5	10.6	42.6	16.8	27.1	33.1
Plagioclase	40.0	6.9	18.7	62.2	30.7	28.2	42.8	26.9	33.5
Biotite	5.0	1.2	6.2	0.3	7.6	3.3	13.1	9.1	2.2
Chlorite	0.0	0.7	1.6	2.2	1.9	0.0	1.2	0.6	1.3
Hornblende	0.1	0.0	1.5	1.8	0.0	0.0	1.7	0.0	0.9
Epidote	0.5	0.2	0.1	2.7	0.2	0.0	1.8	0.0	0.0
Muscovite	0.0	0.5	0.8	0.1	3.8	0.5	1.9	5.2	0.0
Spinel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Garnet	0.0	0.2	0.2	0.0	0.0	0.1	0.0	0.0	0.0
Pyroxene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cordierite	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Andalusite	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sillimanite	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Accessories	2.1	1.7	1.6	1.6	1.6	0.7	2.6	1.7	1.2
Number of points	1000	2000	2000	1000	2000	2000	2000	2000	2000
SiO_2	69.37	72.79	71.82	67.89	72.85	73.27	58.13	69.72	70.62
TiO_2	0.58	0.18	0.21	0.36	0.26	0.21	0.91	0.46	0.38
Al_2O_3	13.53	13.76	14.73	15.56	13.18	14.77	19.26	15.10	14.45
Fe_2O_3	5.46	1.66	1.14	3.14	1.71	1.21	6.35	2.28	2.57
MgO	0.44	0.24	0.46	1.08	0.54	0.41	2.29	0.68	0.82
CaO	1.22	0.49	0.90	2.29	0.45	0.95	5.04	1.09	1.80
Na_2O	2.81	3.34	3.57	3.90	1.77	3.52	4.43	3.22	4.08
K_2O	5.49	6.62	5.86	3.82	8.09	4.94	1.50	5.52	4.44
MnO	0.09	0.04	0.00	0.05	0.02	0.03	0.09	0.04	0.05
P_2O_5	0.09	0.04	0.10	0.17	0.19	0.09	0.20	0.26	0.15
L.O.I.	0.37	0.33	0.64	1.06	0.49	0.27	1.23	0.95	0.31
H_2O	0.02	0.15	0.19	0.00	0.00	0.09	0.11	0.10	0.19
Total	99.47	99.64	99.62	99.32	99.55	99.76	99.54	99.42	99.86

Chemical analyses by J.R. Nelson, Alberta Research Council Chemistry Laboratory.

Appendix (continued)

Table 8. Modal and chemical analyses of standard samples for Arch Lake Granite Phase (161) in percent.

Standard sample number	**Arch Lake Granite Phase (161)**											
	148	**155**	**451**	**452**	**453**	**454**	**455**	**456**	**471**	**475**	**478**	**479**
Quartz	22.8	33.5	22.0	24.9	35.0	24.1	34.1	29.4	35.6	33.5	25.0	34.3
K-Feldspar	37.3	26.4	40.2	46.4	42.1	29.3	42.6	43.4	35.4	47.9	44.9	30.3
Plagioclase	30.7	26.5	31.1	31.7	20.3	38.2	19.6	21.6	22.9	13.8	23.3	30.7
Biotite	5.0	6.9	6.5	4.2	2.9	7.4	1.7	1.4	2.6	1.2	3.4	0.7
Chlorite	1.0	0.6	0.0	0.1	0.1	0.1	0.3	0.0	0.0	1.3	3.0	0.1
Hornblende	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Epidote	0.6	0.0	0.1	trace	0.0	0.1	0.0	0.0	0.4	0.3	0.0	trace
Muscovite	1.7	5.9	0.1	2.4	0.6	0.8	0.1	2.5	1.1	1.7	0.1	0.0
Spinel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Garnet	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8	0.8	0.0	0.0	3.8
Pyroxene	0.0	0.0	0.0	trace	0.0	0.0	1.4	0.0	0.0	0.0	0.0	0.0
Cordierite	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Andalusite	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sillimanite	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Accessories	0.9	0.2	0.1	0.2	0.0	0.4	0.1	0.0	1.1	0.3	0.3	0.1
Number of points	2500	2500	1000	1000	1000	1004	1000	1000	2000	1965	1000	1000
SiO_2	67.80	70.87	70.47	70.80	74.73	70.87	74.07	74.23	72.33	70.96	71.81	71.58
TiO_2	0.48	0.10	0.27	0.38	0.22	0.38	0.19	0.16	0.22	0.23	0.32	0.24
Al_2O_3	15.26	14.63	15.38	14.69	13.96	14.99	14.61	14.46	14.82	14.86	14.82	15.48
Fe_2O_3	3.18	1.60	1.83	2.47	1.25	2.58	0.94	1.16	1.00	1.56	2.13	1.86
MgO	1.28	0.58	0.60	0.75	0.34	0.57	0.32	0.33	0.35	0.61	0.55	0.43
CaO	1.77	1.15	0.98	0.94	0.74	0.96	0.79	0.70	0.75	0.54	0.84	0.87
Na_2O	3.26	2.86	2.84	2.63	2.65	2.72	2.93	3.00	2.95	2.92	2.70	3.35
K_2O	5.61	5.72	6.05	5.90	5.22	5.53	5.34	4.91	5.90	6.61	5.89	5.34
MnO	0.04	0.02	0.03	0.01	0.02	0.02	0.02	0.01	0.01	0.01	0.03	0.03
P_2O_5	0.29	0.10	0.10	0.20	0.09	0.15	0.08	0.11	0.05	0.10	0.13	0.13
L.O.I.	0.78	0.70	0.16	0.58	0.35	0.53	0.23	0.41	0.23	0.77	0.28	0.25
H_2O	0.00	0.00	0.13	0.06	0.08	0.00	0.10	0.10	0.16	0.16	0.13	0.04
Total	99.75	98.33	98.84	99.41	99.65	99.30	99.62	99.58	98.77	99.33	99.63	99.60

Chemical analyses by J.R. Nelson, Alberta Research Council Chemistry Laboratory.

Appendix (continued)

Table 8. (continued)

Standard sample number	Arch Lake Granite Phase (161)										
	481	485	487	489	491	492	493	495	500	501	502
Quartz	23.7	22.3	32.9	33.4	22.9	28.8	24.6	12.5	28.9	29.2	20.1
K-Feldspar	38.8	53.2	51.2	34.1	33.6	56.3	34.9	54.9	40.1	28.5	52.1
Plagioclase	31.4	19.5	13.1	25.5	31.8	11.4	34.4	23.7	19.0	35.4	20.1
Biotite	4.2	1.2	1.4	2.4	8.0	2.9	3.0	4.1	1.4	5.0	1.4
Chlorite	0.6	2.2	0.0	0.0	0.9	0.0	2.4	1.7	4.5	0.6	2.7
Hornblende	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Epidote	trace	0.0	0.0	0.0	0.2	0.2	0.0	trace	0.0	trace	0.0
Muscovite	1.3	1.1	0.6	0.2	2.2	0.4	0.4	2.9	4.6	0.0	0.8
Spinel	0.0	0.0	0.1	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0
Garnet	0.0	0.0	0.4	4.5	0.0	0.0	0.0	0.0	0.0	0.3	2.1
Pyroxene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cordierite	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Andalusite	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sillimanite	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Accesories	0.0	0.5	0.3	0.0	0.0	trace	0.3	trace	1.5	1.0	0.7
Number of points	1000	2000	2000	1000	2000	1000	1000	1000	1698	1000	2000
SiO_2	74.77	73.65	71.58	72.23	72.78	72.87	69.85	72.06	71.45	71.47	73.14
TiO_2	0.22	0.19	0.23	0.49	0.33	0.26	0.32	0.39	0.30	0.34	0.16
Al_2O_3	13.74	13.86	14.76	14.72	13.72	15.00	16.04	13.93	14.16	14.92	13.81
Fe_2O_3	1.37	0.86	1.38	1.55	2.00	1.59	1.52	2.32	1.72	2.00	1.38
MgO	0.50	0.32	0.40	0.54	0.41	0.38	0.56	0.80	0.76	0.48	0.29
CaO	0.64	0.51	0.82	1.05	0.95	0.79	0.77	0.71	0.61	0.84	0.67
Na_2O	2.44	2.51	2.89	3.16	2.80	3.44	4.69	2.44	2.92	3.30	2.94
K_2O	5.14	6.84	6.52	5.74	5.15	5.00	4.58	5.05	6.60	4.90	6.27
MnO	0.02	0.00	0.01	0.02	0.03	0.03	0.03	0.02	0.01	0.02	0.02
P_2O_5	0.13	0.08	0.15	0.11	0.12	0.26	0.16	0.19	0.10	0.11	0.11
L.O.I.	0.65	0.42	0.34	0.23	0.39	0.31	0.73	1.40	0.69	0.63	0.38
H_2O	0.08	0.18	0.14	0.12	0.21	0.08	0.16	0.08	0.11	0.08	0.14
Total	99.70	99.42	99.22	99.96	98.94	99.88	99.41	99.39	99.43	99.09	99.31

Chemical analyses by J.R. Nelson, Alberta Research Council Chemistry Laboratory.

Appendix (continued)

Table 8. (continued)

Standard sample number	Arch Lake Granite Phase (161) 503	504	505	506	507	510	512	514	516	518	523
Quartz	29.8	25.3	24.9	23.4	30.1	26.5	32.9	26.2	18.4	29.6	25.9
K-Feldspar	40.4	52.9	33.4	35.3	30.7	51.9	39.0	40.3	0.3	38.7	33.4
Plagioclase	21.9	17.2	35.0	32.9	32.6	18.1	23.1	28.7	69.5	24.2	32.4
Biotite	6.1	3.0	6.1	3.8	3.9	1.9	2.6	2.7	0.0	3.5	0.3
Chlorite	0.9	1.3	0.1	1.1	0.0	0.3	1.5	0.8	7.3	3.1	2.7
Hornblende	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Epidote	0.1	trace	0.1	trace	0.0	0.0	0.1	0.1	0.3	0.0	0.3
Muscovite	0.1	0.3	0.3	3.0	2.6	0.0	0.0	0.1	3.8	0.4	5.1
Spinel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Garnet	0.0	0.0	0.0	0.3	0.0	0.0	0.0	1.2	0.0	0.0	0.0
Pyroxene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Cordierite	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Andalusite	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sillimanite	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Accessories	0.6	0.1	0.1	0.2	0.0	0.9	0.7	0.4	0.3	0.4	0.0
Number of points	1000	1000	1000	1000	1000	1970	2000	1005	1000	2000	1000
SiO_2	70.93	73.84	70.19	73.50	74.83	74.02	72.38	72.03	70.46	72.75	71.93
TiO_2	0.44	0.22	0.47	0.28	0.22	0.14	0.30	0.28	0.38	0.22	0.36
Al_2O_3	15.32	13.71	15.19	13.93	13.55	14.02	14.37	14.35	14.80	14.56	14.75
Fe_2O_3	2.35	1.64	2.29	1.86	1.40	1.17	1.63	2.14	2.45	1.41	1.88
MgO	0.59	0.45	0.79	0.63	0.36	0.27	0.53	0.59	0.97	0.48	0.66
CaO	1.15	0.77	0.93	0.49	0.80	0.88	0.66	1.15	0.93	0.88	0.53
Na_2O	3.04	2.99	2.74	2.23	2.83	3.94	3.21	3.04	5.08	3.51	2.39
K_2O	5.09	5.29	5.79	5.61	4.84	5.15	5.63	5.56	1.94	4.58	6.18
MnO	0.02	0.01	0.04	0.01	0.01	0.00	0.02	0.02	0.02	0.02	0.02
P_2O_5	0.12	0.09	0.22	0.19	0.09	0.04	0.09	0.13	0.14	0.11	0.17
L.O.I.	0.60	0.56	0.66	0.89	0.51	0.29	0.66	0.27	1.14	0.46	0.99
H_2O	0.07	0.01	0.07	0.00	0.01	0.11	0.21	0.05	0.13	0.25	0.00
Total	99.72	99.58	99.38	99.62	99.45	100.03	99.69	99.62	98.44	99.23	99.86

Chemical analyses by J.R. Nelson, Alberta Research Council Chemistry Laboratory.

Appendix (continued)

Table 9. Modal and chemical analyses of standard samples for Arch Lake Transitional Granite Phase (162) and Recrystallized Mylonitic Rock (221, 223, 224) in percent.

Standard sample number	Arch Lake Transitional Granite Phase (162)							
	473	474	476	490	494	499	509	511
Quartz	23.3	28.1	29.6	19.7	28.9	33.4	28.6	33.9
K-Feldspar	55.0	33.4	49.0	50.3	41.7	16.1	39.5	23.3
Plagioclase	16.9	34.1	16.2	23.8	27.1	43.1	25.1	27.6
Biotite	3.8	2.5	1.9	3.6	2.0	5.8	1.4	7.8
Chlorite	0.0	0.1	1.9	0.0	0.2	0.5	1.4	0.0
Hornblende	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Epidote	0.2	0.0	0.3	0.0	0.0	0.0	0.0	2.8
Muscovite	0.1	0.3	0.8	0.7	0.1	0.6	3.7	2.9
Spinel	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
Garnet	0.0	0.3	0.0	1.7	0.0	0.0	0.0	0.0
Pyroxene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cordierite	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Andalusite	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sillimanite	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Accessories	0.8	1.0	0.3	0.4	0.0	0.6	0.4	1.4
Number of points	1000	1000	2000	1000	1000	2000	2000	2000
SiO_2	72.07	74.47	72.84	74.04	73.52	71.27	70.37	68.23
TiO_2	0.23	0.20	0.22	0.22	0.36	0.32	0.30	0.32
Al_2O_3	14.40	14.20	14.15	14.37	13.84	15.34	15.30	15.37
Fe_2O_3	1.46	1.39	1.49	1.13	1.08	1.82	1.89	2.86
MgO	0.30	0.32	0.43	0.36	0.39	0.87	0.66	0.93
CaO	0.68	0.73	0.83	0.86	0.82	0.82	0.99	2.07
Na_2O	3.59	3.19	3.20	3.10	2.79	5.11	3.58	4.38
K_2O	6.81	5.01	5.96	5.09	5.40	2.27	5.34	4.06
MnO	0.02	0.03	0.01	0.02	0.01	0.01	0.00	0.04
P_2O_5	0.11	0.13	0.09	0.12	0.59	0.09	0.09	0.16
L.O.I.	0.22	0.20	0.26	0.21	0.43	0.96	0.53	0.48
H_2O	0.15	0.14	0.17	0.20	0.11	0.16	0.17	0.14
Total	99.99	100.01	99.65	99.72	99.34	99.04	99.22	99.04

Chemical analyses by J.R. Nelson, Alberta Research Council Chemistry Laboratory.

Appendix (continued)

Table 9. (continued)

Standard sample number	Transitional Granite Phase 517	519	(162) 560	599	614	Recrystallized Mylonitic Rock (221) 149	(223) 145	(223) 153	(224) 144
Quartz	18.5	29.7	21.0	29.0	23.7	15.0		22.9	25.7
K-Feldspar	45.6	31.9	40.4	38.1	17.0	14.0		8.6	10.4
Plagioclase	30.3	25.0	35.0	30.6	52.7	64.8		46.5	58.4
Biotite	3.3	3.4	1.8	1.0	2.9	0.0		6.5	1.4
Chlorite	1.1	6.2	1.3	1.2	2.7	2.0		6.9	1.5
Hornblende	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Epidote	0.0	0.9	trace	trace	0.0	3.0		0.4	1.6
Muscovite	0.2	1.9	0.2	0.9	0.0	1.0		7.2	0.2
Spinel	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Garnet	0.4	0.4	0.0	0.0	0.0	0.0		0.0	0.0
Pyroxene	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Cordierite	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Andalusite	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Sillimanite	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Accessories	0.2	0.6	0.2	0.0	1.0	0.2		1.0	0.8
Number of points	2000	2000	1000	1008	1000	estim.	N.D.	2500	2500
SiO_2	73.06	70.40	71.11	75.32	72.99	74.93	71.50	64.37	69.16
TiO_2	0.17	0.26	0.30	0.23	0.24	0.16	0.28	0.65	0.16
Al_2O_3	14.68	15.92	15.27	13.72	14.44	13.08	13.27	16.36	16.38
Fe_2O_3	0.94	1.57	1.82	1.47	1.39	1.48	2.43	5.26	1.61
MgO	0.38	0.59	0.61	0.43	0.43	0.78	1.66	1.64	0.98
CaO	0.78	1.59	1.28	0.75	0.85	1.54	1.40	3.22	2.38
Na_2O	3.16	3.90	2.98	3.08	2.87	3.22	2.11	3.14	4.55
K_2O	5.00	4.08	4.74	4.88	5.44	3.71	4.88	3.46	3.49
MnO	0.02	0.06	0.02	0.00	0.00	0.03	0.07	0.08	0.06
P_2O_5	0.07	0.18	0.10	0.08	0.11	0.02	0.05	0.20	0.06
L.O.I.	0.36	0.55	0.67	0.64	0.43	1.69	1.50	1.21	0.53
H_2O	0.14	0.09	0.07	0.04	0.30	0.00	0.00	0.00	0.00
Total	98.76	99.19	98.97	100.64	99.51	100.64	99.15	99.59	99.36

Chemical analyses by J.R. Nelson, Alberta Research Council Chemistry Laboratory.
N.D. - not done, too fine grained.

Geology of Myers Lake District, Alberta

Sheet No. 28

John D. Godfrey, C. Willem Langenberg, Thomas J. Donaghy, and Mervyn N. Rogan, 1974, 1975.

Published 1984
Map to accompany Earth Sciences Report No. 84-6

NOTE: West of Slave River Precambrian bedrock only indicated. For surficial geology see Bayrock, L.A. (1972): Surficial geology, Peace Point and Fitzgerald (part), scale 1:250000.

Any revisions or additional geological information would be welcomed by the Alberta Research Council.

Base maps compiled from planimetric sheets published by Alberta Energy and Natural Resources, Edmonton.
Aerial photographs covering this area are obtainable from the Alberta Energy and Natural Resources, Edmonton; or the Mapping and Surveys Branch of Energy, Mines and Resources, Ottawa.
Cartography by Alberta Research Council, Graphic Services, R.D. Hite.

ALBERTA RESEARCH COUNCIL
Natural Resources Division
Alberta Geological Survey

For interpretation of information on this map please refer to legend on Myers Lake Sheet No. 29

Adjoining Sheet No. 34

Adjoining Sheet No. 28

Adjoining Sheet No. 30

Adjoining Sheet No. 25

MYERS LAKE LEGEND

DEVONIAN

254 — LA BUTTE FORMATION: light to medium, brownish gray, thin- to thick-bedded to massive, fossiliferous, bioclastic argillaceous fine-grained limestone, with laminations of brownish gray shale.

253 — HAY CAMP FORMATION: light brown to orange brown, generally (collapse brecciated limestones and dolomitic limestones, containing laminated, lithographic dolostone, partly gypsiferous, and light gray fossiliferous, argillaceous limestone, with light gray, calcareous shale laminations.

252 — FITZGERALD FORMATION: pale brown, weathering light orange brown, thin to rubbly bedded to massive, fine grained, vuggy, dolostone and dolomitic limestone. Carbonaceous dolostone locally; transitional through sandy and argillaceous dolostone to underlying La Loche Formation. Locally bitumen impregnated.

251 — LA LOCHE FORMATION: basal regolith developed on crystalline shield rocks, grades upwards through poorly sorted, poorly consolidated, conglomerate, arkosic and pebbly sandstone, to sandy dolostone. The finer-grained matrix includes clay, iron oxide, and secondary copper mineralization.

(Subdivision based on Norris, A.W. (1963), G.S.C., Bulletin 313)

PRECAMBRIAN**

REGIONAL SHEAR ZONES

Zones of regional shearing and recrystallization have principally affected granite gneisses and metasedimentary rocks to produce: ultramylonite, mylonite, cataclasite, blastomylonite, and flaser gneiss; megastructure is typically streaky; may contain rounded or augen rock clasts or feldspar porphyroclasts (0).

223 / 223 — RECRYSTALLIZED MYLONITIC ROCK: dark colored, with white to gray anhedral feldspar porphyroclasts and euhedral feldspar porphyroblasts 10 to 50 mm long; foliated, locally gneissose; aphanitic matrix, locally medium-grained; minor aplite and pegmatite. Parent material largely Slave Granitoids and Arch Lake Granitoids.

222 — RECRYSTALLIZED MYLONITIC ROCK: green to black; granulose (siliceous) to schistose, with biotite, chlorite, sericite; feldspar and minor quartz porphyroclasts in a massive to foliated, finely banded, aphanitic matrix. Parent material largely metasedimentary rock.

GRANITOID ROCKS

ARCH LAKE GRANITOIDS

161 — ARCH LAKE GRANITE PHASE: typically reddish overall; 20 to 40 percent red, subhedral, elongate to tabular feldspar megacrysts, from 15 to 30 mm long, aligned subparallel in a medium-grained (locally coarse-grained) usually well-foliated matrix of feldspar, blue quartz and biotite. Locally reduced amounts of feldspar megacrysts. Mafic mineral content 6 to 14 percent. Commonly mildly mylonitic, with crushed matrix and augen megacrysts.

162 — ARCH LAKE TRANSITIONAL GRANITE PHASE: (transitional to Slave Granitoids); typically reddish overall; up to 10 percent white to pink subhedral, elongate to tabular feldspar megacrysts, from 10 to 15 mm long, aligned subparallel in a medium-grained (locally coarse-grained) usually well-foliated matrix of feldspar, blue quartz, and biotite. Quartz content locally reduced from 25 to 10 percent. Commonly mildly mylonitic.

LA BUTTE GRANODIORITE

140 — Generally light gray to brownish gray to mauve (bluish quartz combined with pink-gray feldspar), of uniform color and texture; in hand specimen specks and aggregates of dark mafic mineral in a lighter gray background. Medium grained but ranging to fine- and coarse-grained, with 8 to 20 mm long feldspar megacrysts from rare to 5 percent abundance in a quartz, feldspar, biotite matrix. Typically massive to uncommonly poorly foliated or locally gneissic. Rock types range from granite to granodiorite, quartz diorite, and quartz monzodiorite, with a mean composition of granodiorite.

SLAVE GRANITOIDS

101 — SLAVE GRANITE PHASE: typically whitish gray (locally white to greenish gray to pink feldspar mottled on a darker background); medium- to coarse-grained (locally fine-grained); up to 5 percent white feldspar megacrysts, 7 to 15 mm long, in a matrix of white feldspars, quartz and biotite (< 1 to 5 percent); massive to more commonly foliated (increase in biotite content tends to better define foliation); typically garnetiferous, in knots 5± mm across with a biotite envelope; may be locally gneissic; includes minor small-scale mafelsic lenses of metasedimentary appearance; minor gray white, fine- to medium-grained felsic dykes and quartz veins.

102 — MAFIC SLAVE GRANITE PHASE: similar to Slave Granite but with a notably higher biotite content (up to 10 percent); distinctly foliated.

MEGACRYSTIC COMPONENT: up to 15 percent white feldspar megacrysts 15 to 50 mm long, either randomly oriented or aligned with the foliation of map units 101 and 102 ( ).

103 — RED SLAVE GRANITE PHASE: similar to Slave Granite Phase but with a distinct pinkish red color.

104 — SPECKLED SLAVE GRANITE PHASE: similar to Slave Granite Phase, but reddish to mottled overall; red and white feldspars in a medium-grained matrix of feldspar, quartz, chloritic biotite, and sericite; midly crushed and foliated matrix.

METASEDIMENTARY ROCKS

31 — METASEDIMENTARY ROCKS: the high-grade metasedimentary rock types included in this map unit are lithologically and texturally gradational, and in part intermixed on outcrop scale. Typically impure quartzite; dark greenish (bluish) gray (fresh surface); fine-grained; layered, with ferruginous and garnetiferous zones, locally scattered pyrite, gossans, and milky to bluish gray quartz pods and veins. Minor amphibolite may be present. Common local lithologic gradational variations to: (1) fine- to medium-grained, metamorphic quartzo-feldspathic (granitic and minor pegmatitic) phase ranging from individual white feldspar porphyroblasts 5 to 15 mm long, to nebulous or distinct aggregations and masses; commonly foliated to locally gneissic ( ); (2) fine-grained, retrograde phyllite and schist (biotite, chlorite, sericite, and uncommonly hornblende), and phyllonite.

AMPHIBOLITE

20 — Dark brownish green (fresh surface) to grayish green; typically medium grained; biotite may be common; composition ranges from essentially amphibole pure or amphibole rich to a feldspathic biotite amphibolite; commonly foliated but may be banded where feldspar rich; minor pyrite common.

**NOTE: Rock groups are arranged in approximate chronological sequence. Nomenclature follows Strekeisen (1967): Classification and nomenclature of igneous rocks; Neues Jahrbuch für Mineralogie, Abhandlungen, 107, No. 2, p. 144-240.

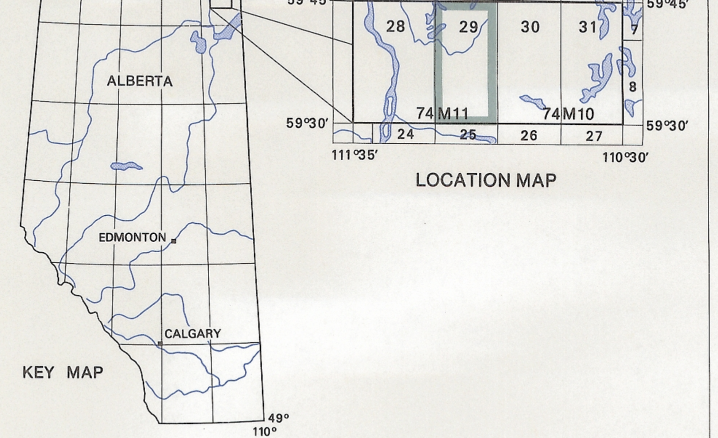
Geological boundary (defined, approximate)
Foliation (defined: dip known, dip vertical; foliation assumed) — 69
Foliation trend*
Lineation (combined with foliation) — 76 73
Extreme contortion (structural trend shown)
Tight folds (structural trend shown)
Local gneissosity in generally massive to foliated rock
Joint (dip-known, vertical, unknown) — 76
Fault (defined: dip known; fault assumed) — 79
Shear (dip known) — 79
Breccia — ▽△▽
Mylonite (local)
Crystalline standard sample — o455
Metasedimentary rock band standard sample — ⊙62
Mineral occurrence — copper — ×Cu
Yellow mineral stain — Y
Garnet — G
Epidote — E
Isotopic age (million years); biotite (b); K-Ar (k); University of Alberta — △bk 1789
Glacial stria (direction of ice movement shown)
Drumlin* (outline to scale)
Esker* (flow direction known, unknown) — <<<< ><><
Kettle*
Dune
Raised beach* (downslope indicated)
Wind-cut groove (wind direction shown)
Sand-covered area*
Small outcrop (map unit shown) — ×31
Muskeg
Drainage (permanent, intermittent)
Township boundary
National Park boundary
Road
Trail

*Aerial photographic interpretation

Approximate magnetic declination 26°12′ East in 1984 decreasing approximately 4.4′ annually for the Myers Lake map area.

SCALE 1:31,680

Miles 1 — 0 — 1 Miles
Kilometres 1 — 0 — 1 Kilometres



KEY MAP

LOCATION MAP

Geology of Myers Lake District, Alberta

Sheet No. 29

John D. Godfrey, C. Willem Langenberg, Thomas J. Donaghy, and Mervyn N. Rogan, 1974, 1975.

Published 1984
Map to accompany Earth Sciences Report No. 84-6

Any revisions or additional geological information would be welcomed by the Alberta Research Council.

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Cartography by Alberta Research Council, Graphic Services, R.D. Hite.

ALBERTA RESEARCH COUNCIL
Natural Resources Division
Alberta Geological Survey

DALY LAKE LEGEND

PRECAMBRIAN**

REGIONAL SHEAR ZONES

Zones of regional shearing and recrystallization have principally affected granite gneisses and metasedimentary rocks to produce: ultramylonite, mylonite, cataclasite, blastomylonite, and flaser gneiss; megastructure is typically streaky; may contain rounded or augen rock clasts or feldspar porphyroclasts (0).

224 — RECRYSTALLIZED MYLONITIC ROCK: light grayish-green overall, with dark specks of hornblende porphyroclasts up to 3 mm long, and locally feldspar porphyroclasts from 10 to 15 mm long; in a sheared, foliated, fine-grained matrix, some indistinct banding. Locally mixed with and gradational to parent material Grey Hornblende Granite.

223 — RECRYSTALLIZED MYLONITIC ROCK: dark colored, with white to gray anhedral feldspar porphyroclasts and euhedral feldspar porphyroblasts 10 to 50 mm long; foliated, locally gneissose; aphanitic matrix, locally medium-grained; minor aplite and pegmatite. Parent material largely Slave Granitoids and Arch Lake Granitoids.

222 — RECRYSTALLIZED MYLONITIC ROCK: green to black; granulose (siliceous) to schistose, with biotite, chlorite, sericite; feldspar and minor quartz porphyroclasts in a massive to foliated, finely banded, aphanitic matrix. Parent material largely metasedimentary rock.

221 — RECRYSTALLIZED MYLONITIC ROCK: mostly light colored, with white to pink feldspar porphyroclasts 5 to 20 mm long making up 2 to 5 percent of the rock, in a foliated, finely banded, aphanitic matrix. Parent material largely granite gneiss.

GRANITOID ROCKS

ARCH LAKE GRANITOIDS

161 — ARCH LAKE GRANITE PHASE: typically reddish overall; 20 to 40 percent red, subhedral, elongate to tabular feldspar megacrysts, from 15 to 30 mm long, aligned subparallel in a medium-grained (locally coarse-grained) usually well-foliated matrix of feldspar, blue quartz and biotite. Locally reduced amounts of feldspar megacrysts. Mafic mineral content 6 to 14 percent. Commonly mildly mylonitic, with crushed matrix and augen megacrysts.

162 — ARCH LAKE TRANSITIONAL GRANITE PHASE: (transitional to Slave Granitoids); typically reddish overall; up to 10 percent white to pink subhedral, elongate to tabular feldspar megacrysts, from 10 to 15 mm long, aligned subparallel in a medium-grained (locally coarse-grained) usually well-foliated matrix of feldspar, blue quartz, and biotite. Quartz content locally reduced from 25 to 10 percent. Commonly mildly mylonitic.

LA BUTTE GRANODIORITE

140 — Generally light gray to brownish gray to mauve (bluish quartz combined with pink-gray feldspar), of uniform color and texture; in hand specimen specks and aggregates of dark mafic mineral in a lighter gray background. Medium grained but ranging to fine- and coarse-grained, with 8 to 20 mm long feldspar megacrysts from rare to 5 percent abundance in a quartz, feldspar, biotite matrix. Typically massive to uncommonly poorly foliated or locally gneissic. Rock types range from granite to granodiorite, quartz diorite, and quartz monzodiorite, with a mean composition of granodiorite.

SLAVE GRANITOIDS

101 — SLAVE GRANITE PHASE: typically whitish gray (locally white to greenish gray to pink feldspar mottled on a darker background); medium- to coarse-grained (locally fine-grained); up to 5 percent white feldspar megacrysts, 7 to 15 mm long, in a matrix of white feldspars, quartz and biotite (<1 to 5 percent); massive to more commonly foliated (increase in biotite content tends to better define foliation); typically garnetiferous, in knots 5± mm across with a biotite envelope; may be locally gneissic; includes minor small-scale mafelsic lenses of metasedimentary appearance; minor gray white, fine- to medium-grained felsic dykes and quartz veins.

102 — MAFIC SLAVE GRANITE PHASE: similar to Slave Granite but with a notably higher biotite content (up to 10 percent); distinctly foliated.

MEGACRYSTIC COMPONENT: up to 15 percent white feldspar megacrysts 15 to 50 mm long, either randomly oriented or aligned with the foliation of map units 101 and 102 ( ).

103 — RED SLAVE GRANITE PHASE: similar to Slave Granite Phase but with a distinct pinkish red color.

105 — SLAVE PQ GRANITE PHASE: typically redish pink to pink; commonly medium-grained ; abundant white to pink to red feldspar megacrysts 6 to 12 mm across in a medium-grained matrix of feldspar, quartz, biotite (4 to 5 percent) and minor sericite; massive to foliated matrix, locally gneissic. The predominant rock type is granite with a gradation towards granodiorite; includes minor small-scale mafelsic lenses of metasedimentary appearance, minor fine- to medium-grained felsic dykes and quartz veins.

CHARLES LAKE GRANITOIDS

174 — LEUCOCRATIC GRANITE: light gray to pink to red on both fresh and weathered surfaces. The medium- to coarse-grained equigranular texture is composed of pink to red anhedral feldspars, quartz and up to about 3 percent mafic minerals. Massive texture is locally foliated. Minor microgranite and pegmatite accompany the dominant granite composition.

173 — GREY HORNBLENDE GRANITE: buff to gray, with dark specks of hornblende and locally feldspar porphyroclasts from 5 to 12 mm in size within a quartz-feldspar matrix; texture is fine-to medium-grained, massive to slightly foliated. Locally mylonitc.

171 — GRANITE F: mottled, with large white to pink and gray feldspar megacrysts in a gray matrix; subhedral feldspar megacrysts from 25 to 100 mm long are enclosed in a coarse-grained, massive to poorly foliated matrix of feldspar, and biotite. Minor local bodies of aplite and pegmatite are included. The predominant rock type is granodiorite.

METASEDIMENTARY ROCKS

31 — METASEDIMENTARY ROCKS: the high-grade metasedimentary rock types included in this map unit are lithologically and texturally gradational, and in part intermixed on outcrop scale. Typically impure quartzite; dark greenish (bluish) gray (fresh surface); fine-grained; layered, with ferruginous and garnetiferous zones, locally scattered pyrite, gossans, and milky to bluish gray quartz pods and veins. Minor amphibolite may be present. Common local lithologic gradational variations to: (1) fine- to medium-grained, metamorphic quartzo-feldspathic (granitic and minor pegmatitic) phase ranging from individual white feldspar porphyroblasts 5 to 15 mm long, to nebulous or distinct aggregations and masses; commonly foliated to locally gneissic ( ); (2) fine-grained, retrograde phyllite and schist (biotite, chlorite, sericite, and uncommonly hornblende), and phyllonite.

AMPHIBOLITE

20 — Dark brownish green (fresh surface) to grayish green; typically medium grained; biotite may be common; composition ranges from essentially amphibole pure or amphibole rich to a feldspathic biotite amphibolite; commonly foliated but may be banded where feldspar rich; minor pyrite common.

GRANITE GNEISSS

12 — HORNBLENDE GRANITE GNEISS: typically pink to reddish with dark green bands; quartz-feldspar bands interlayered with mafic-rich bands (hornblende, with biotite; generally chloritic) on hand specimen scale; fine- to medium-grained, typically equigranular, uncommonly megacrystic; typically well banded, uncommonly poorly banded, and rarely foliated. Composition is predominantly granite, with minor granodiorite, and quartz diorite. Large areas are migmatitic, particularly where intimately associated with minor lenses, pods, or bands of metasedimentary rocks, pegmatite, or amphibolite.

11 — BIOTITE GRANITE GNEISS: typically pink to reddish; quartz-feldspar bands interlayered with mafic-rich bands (biotite, possibly with subordinate hornblende; generally chloritic) on hand-specimen scale; fine- to medium-grained, generally equigranular, rarely megacrystic; commonly well banded but may be locally poorly banded to foliated, and leucocratic phases may be nearly massive. Composition is predominantly granite, with minor granodiorite, quartz diorite, and quartz monzodiorite. Large areas are migmatitic, particularly where intimately associated with minor lenses, pods, and bands of metasedimentary rocks, pegmatite, or amphibolite. Minor hornblende granite gneiss.

**NOTE: Rock groups are arranged in approximate chronological sequence. Nomenclature follows Strekeisen (1967): Classification and nomenclature of igneous rocks; Neues Jahrbuch für Mineralogie, Abhandlungen, 107, No. 2, p. 144-240.

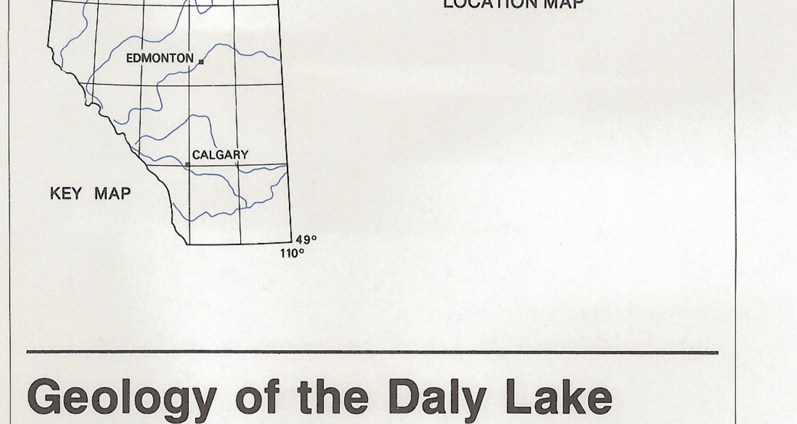
- Geological boundary (defined, approximate)
- Foliation (defined: dip known, dip vertical; foliation assumed) — 69
- Foliation trend*
- Lineation (combined with foliation) — 76, 73
- Extreme contortion (structural trend shown)
- Tight folds (structural trend shown)
- Local gneissosity in generally massive to foliated rock
- Joint (dip known, vertical, unknown) — 76
- Fault (defined: dip known, fault assumed) — 79
- Shear (dip known) — 79
- Breccia
- Mylonite (local)
- Quartz vein
- Crystalline standard sample — o312
- Mineral Occurrence — copper — x Cu
- — molybdenite — x mol
- — arsenopyrite — x asp
- Rock alteration — A
- Allanite — Al
- Chlorite — C
- Epidote — E
- Garnet — G
- Hornblende — H
- Isotopic age (million years); biotite (b); K-Ar (k); University of Alberta — △bk 1789
- Glacial stria (direction of ice movement shown)
- Dune*
- Kettle
- Raised beach* (downslope indicated)
- Wind-cut groove (wind direction shown)
- Sand-covered area*
- Small outcrop (map unit shown) — x 31
- Muskeg
- Drainage (permanent, intermittent)
- Township boundary

*Aerial photographic interpretation

Approximate magnetic declination 25°39′ East in 1984 decreasing approximately 4.4′ annually for the Daly Lake map area.

SCALE 1:31,680

Miles 1 — 0 — 1 Miles
Kilometres 1 — 0 — 1 Kilometres



Geology of the Daly Lake District, Alberta

Sheet No. 30

John D. Godfrey, C. Willem Langenberg, Thomas J. Donaghy, and Mervyn N. Rogan, 1974, 1975.

Published 1984
Map to accompany Earth Sciences Report No. 84-6

Any revisions or additional geological information would be welcomed by the Alberta Research Council.

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Cartography by Alberta Research Council, Graphic Services, R.D. Hite.

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Natural Resources Division
Alberta Geological Survey

Adjoining Sheet No. 36

Adjoining Sheet No. 30

Adjoining Sheet No. 27

DALY LAKE LEGEND

PRECAMBRIAN**

REGIONAL SHEAR ZONES

Zones of regional shearing and recrystallization have principally affected granite gneisses and metasedimentary rocks to produce: ultramylonite, mylonite, cataclasite, blastomylonite, and flaser gneiss; megastructure is typically streaky; may contain rounded or augen rock clasts or feldspar porphyroclasts (0).

224 — RECRYSTALLIZED MYLONITIC ROCK: light grayish-green overall, with dark specks of hornblende porphyroclasts up to 3 mm long, and locally feldspar porphyroclasts from 10 to 15 mm long; in a sheared, foliated, fine-grained matrix, some indistinct banding. Locally mixed with and gradational to parent material Grey Hornblende Granite.

223 / 223 — RECRYSTALLIZED MYLONITIC ROCK: dark colored, with white to gray anhedral feldspar porphyroclasts and euhedral feldspar porphyroblasts 10 to 50 mm long; foliated, locally gneissose; aphanitic matrix, locally medium-grained; minor aplite and pegmatite. Parent material largely Slave Granitoids and Arch Lake Granitoids.

222 — RECRYSTALLIZED MYLONITIC ROCK: green to black; granulose (siliceous) to schistose, with biotite, chlorite, sericite; feldspar and minor quartz porphyroclasts in a massive to foliated, finely banded, aphanitic matrix. Parent material largely metasedimentary rock.

221 / 221 — RECRYSTALLIZED MYLONITIC ROCK: mostly light colored, with white to pink feldspar porphyroclasts 5 to 20 mm long making up 2 to 5 percent of the rock, in a foliated, finely banded, aphanitic matrix. Parent material largely granite gneiss.

GRANITOID ROCKS

ARCH LAKE GRANITOIDS

161 — ARCH LAKE GRANITE PHASE: typically reddish overall; 20 to 40 percent red, subhedral, elongate to tabular feldspar megacrysts, from 15 to 30 mm long, aligned subparallel in a medium-grained (locally coarse-grained) usually well-foliated matrix of feldspar, blue quartz and biotite. Locally reduced amounts of feldspar megacrysts. Mafic mineral content 6 to 14 percent. Commonly mildly mylonitic, with crushed matrix and augen megacrysts.

162 — ARCH LAKE TRANSITIONAL GRANITE PHASE: (transitional to Slave Granitoids); typically reddish overall; up to 10 percent white to pink subhedral, elongate to tabular feldspar megacrysts, from 10 to 15 mm long, aligned subparallel in a medium-grained (locally coarse-grained) usually well-foliated matrix of feldspar, blue quartz, and biotite. Quartz content locally reduced from 25 to 10 percent. Commonly mildly mylonitic.

LA BUTTE GRANODIORITE

140 — Generally light gray to brownish gray to mauve (bluish quartz combined with pink-gray feldspar), of uniform color and texture; in hand specimen specks and aggregates of dark mafic mineral in a lighter gray background. Medium grained but ranging to fine- and coarse-grained, with 8 to 20 mm long feldspar megacrysts from rare to 5 percent abundance in a quartz, feldspar, biotite matrix. Typically massive to uncommonly poorly foliated or locally gneissic. Rock types range from granite to granodiorite, quartz diorite, and quartz monzodiorite, with a mean composition of granodiorite.

SLAVE GRANITOIDS

101 — SLAVE GRANITE PHASE: typically whitish gray (locally white to greenish gray to pink feldspar mottled on a darker background); medium- to coarse-grained (locally fine-grained); up to 5 percent white feldspar megacrysts, 7 to 15 mm long, in a matrix of white feldspars, quartz and biotite (<1 to 5 percent); massive to more commonly foliated (increase in biotite content tends to better define foliation); typically garnetiferous, in knots 5± mm across with a biotite envelope; may be locally gneissic; includes minor small-scale mafelsic lenses of metasedimentary appearance; minor gray white, fine- to medium-grained felsic dykes and quartz veins.

102 — MAFIC SLAVE GRANITE PHASE: similar to Slave Granite but with a notably higher biotite content (up to 10 percent); distinctly foliated.

MEGACRYSTIC COMPONENT: up to 15 percent white feldspar megacrysts 15 to 50 mm long, either randomly oriented or aligned with the foliation of map units 101 and 102 ( ).

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CHARLES LAKE GRANITOIDS

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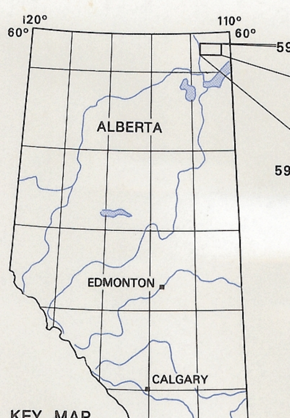
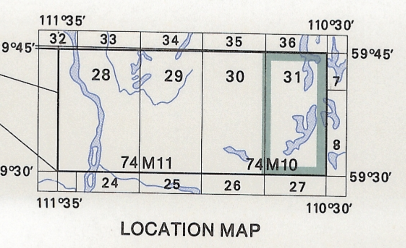


KEY MAP



LOCATION MAP

Geology of the Daly Lake District, Alberta

Sheet No. 31

John D. Godfrey, C. Willem Langenberg, Thomas J. Donaghy, and Mervyn N. Rogan, 1974, 1975.

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Map to accompany Earth Sciences Report No. 84-6

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