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GEOLOGY OF THE
COLIN LAKE DISTRICT, ALBERTA

by

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GEOLOGY OF THE COLIN LAKE DISTRICT, ALBERTA

Abstract

The geology of a 75 square-mile area in the Precambrian Shield of northeastern Alberta is shown on a colored map of scale 2 inches to 1 mile.

The predominant feature of this map-area is the Colin Lake synclinorium whose folded axis plunges east, and trends northeast, east and southeast in passing from west to east. The 'basement' granite gneiss complex occupies a small area to the northwest of the synclinorium, whereas the principal rock types - porphyroblastic biotite granites - lie in the synclinorium. The typical northerly regional foliation trends are reoriented by the synclinorium to the extent that easterly trends prevail in the southern half of the map-area. Fourteen rock types are differentiated in terms of their field characteristics, and are described in regard to field occurrence, and chemical, and modal analyses. Metasedimentary rocks are present in minor amounts only.

Many local faults are noted and a few large-scale faults are indicated.

INTRODUCTION

General Statement

This report constitutes part of a series dealing with the geology of a portion of the 3,600 square miles of Precambrian Shield in northeastern Alberta, north of Lake Athabasca (Godfrey, 1961, 1963; Godfrey and Peikert, 1963). It deals with the general geology and mineralization of the 75 square miles of the Colin Lake district which adjoins the south side of St. Agnes Lake district (Godfrey and Peikert, 1963).

Location and Access

The Colin Lake district is situated in the northeast part of Alberta and adjoins the Province of Saskatchewan (Fig. 1). It lies between longitudes 110 degrees and 110 degrees 15 minutes west, and between latitudes 59 degrees 30 minutes and 59 degrees 37 minutes 30 seconds north.

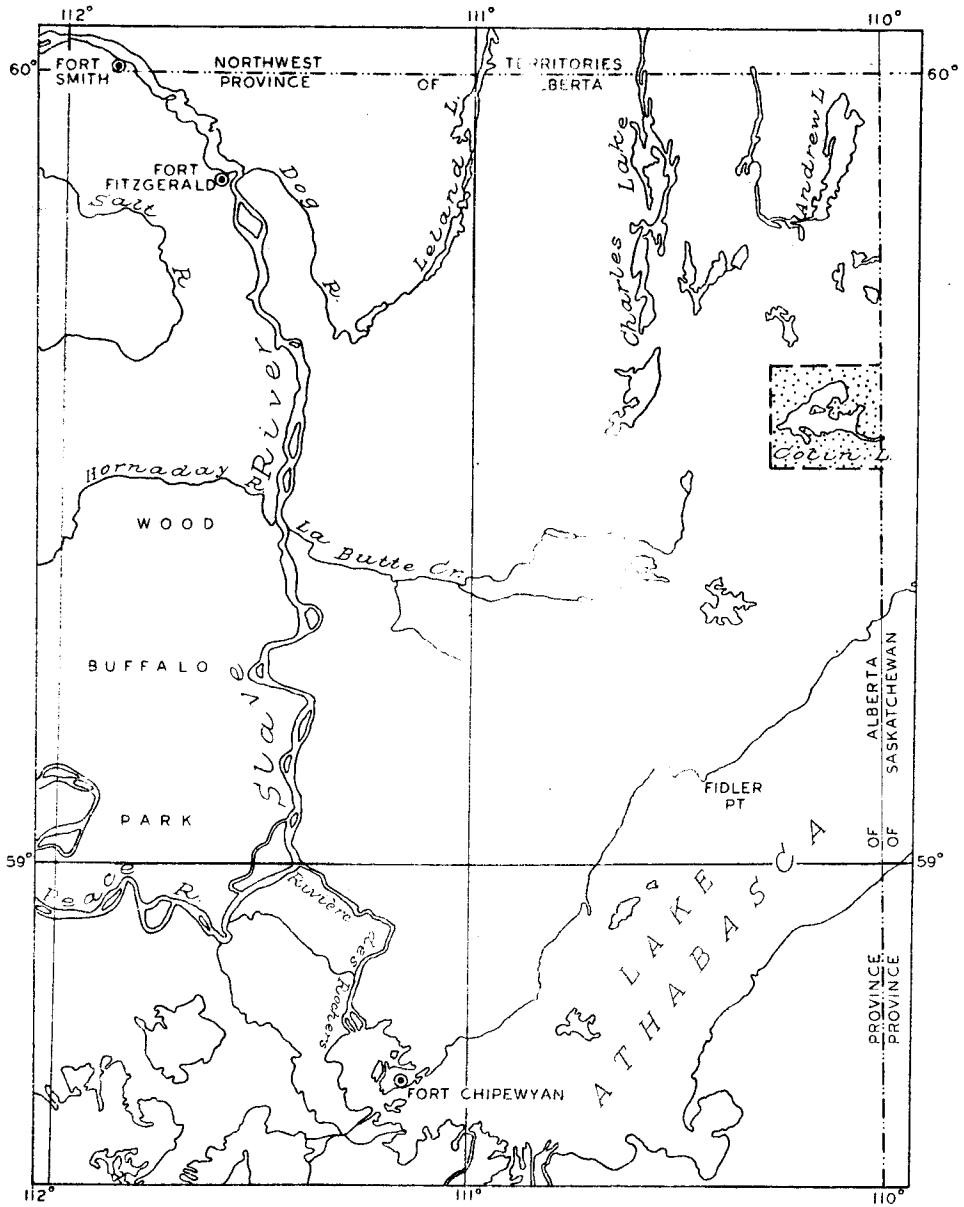


FIGURE 1
LOCATION OF MAP-AREA

SCALE IN MILES
0 10 20 30

Uranium City, Saskatchewan, is situated 45 miles east of Colin Lake and has regularly scheduled commercial airline flights from and to Edmonton, Alberta, via Fort Smith. Pontoon-equipped planes may be chartered from either Uranium City or Fort Smith into the map-area, where many scattered lakes are suitable for landing these aircraft.

Colin Lake is 18 miles north of Lake Athabasca, the nearest commercially utilized water route. Tugs and barges of the Northern Transportation Co. Ltd. operate along this route from Fort McMurray, Alberta, to supply settlements towards the east end of Lake Athabasca, principally Uranium City, Fond du Lac, and Stony Rapids, Saskatchewan.

Physiography

Glacial scouring has left numerous rock-basin lakes, low rounded hills, and a locally rugged surface with a maximum relief of about 300 feet. Striae and giant grooves are the most obvious ice-erosional features seen either on the outcrop scale or on large-scale aerial photographs. The general elevation is from 950 to 1,200 feet above sea-level. About one half of the map-area is bedrock with only a small proportion of muskeg in the covered portion. Glacial sandy plains, such as at the northeast and northwest sides of Colin Lake, have prevented much growth of low bush, and consequently these areas have an open parkland-type vegetation. The lakes are mainly either disconnected or poorly connected, and cross-country canoe travel involves portages. The principal drainage is east via the Colin River to Lake Athabasca.

The distribution and configuration of lakes are controlled by structural and lithological factors and are modified by ice erosion. Many of the narrow elongate bays are related to the erosion of fault zones, and straight shorelines, especially those transecting foliation, suggest fault-line features. Fracture zones or structurally weak rocks have been plucked out by ice erosion, particularly on the west and southwest lake-shores, giving rise to irregular shorelines. Exceptionally clean, fresh bedrock surfaces are found as low, wide aprons bordering some rock-basin lakes. Such water-washed surfaces are particularly suitable for detailed examination of the bedrock geology.

Previous Work

Tyrrell (1896) made the initial traverse along the north shore of Lake Athabasca in 1892 and 1893 and subsequently Alcock (1915, 1917) worked in this general area. In 1929 and 1930 Cameron and Hicks (Cameron, 1930; Cameron and Hicks, 1931; Hicks, 1930, 1932) conducted a reconnaissance survey of the Shield area north of Lake

Athabasca; one of their canoe traverses utilized Colin Lake and the Colin River.

After gold was discovered at Goldfields, Saskatchewan, Alcock (1936) returned to map the Precambrian Shield on a scale of 1 inch to 4 miles in the extreme northwest corner of Saskatchewan adjoining the Colin Lake district to the east. Mapping of the Fort Smith, N.W.T. area, which adjoins Alberta to the north, was completed in 1938 by Wilson (1941) on a scale of 1 inch to 4 miles.

In 1954 uranium-prospecting activities spread to the Precambrian Shield of Alberta, and Collins and Swan (1954) spent several weeks examining mineralization at a number of points in the northeastern corner of the province. Low-grade uranium mineralization was found in the course of this prospecting and exploration activity (e.g. Ferguson, 1953).

In 1959 the Geological Survey of Canada carried out a reconnaissance survey of the Precambrian Shield in Alberta north of Lake Athabasca and published a map on the scale of 1 inch to 4 miles with marginal notes (Riley, 1960).

In 1960, 1961, and 1962 the Saskatchewan Department of Mineral Resources (Koster, 1961) carried out a mapping program on a scale of 1 inch to 1 mile in the northwestern corner of Saskatchewan adjacent to the Alberta boundary and to the published map-areas north of Colin Lake (Godfrey, 1961, 1963; Godfrey and Peikert, 1963).

Present Study

Field work for this report was carried out during 1958 and 1959. The accompanying map (62-2A) is based on parallel pace and compass traverses generally spaced at one-quarter to one-third mile intervals. Anomalous compass readings were obtained in some areas in the vicinity of hornblende granite gneisses and amphibolites. Magnetite was observed at some of these granite gneiss localities, and its presence has since been confirmed in the course of laboratory investigations, thus accounting for some of the magnetic anomalies.

Vertical aerial photographs are of considerable help in prospecting, exploration, and geological mapping, and are available for this area in two sets, both on a scale of 1:40,000. The more recent set of photographs (1955) can be obtained from the National Air Photographic Library, Topographic Survey, Ottawa, Ontario. Another set of photographs (1949) is available from the Technical Division, Department of Lands and Forests, Government of Alberta, Edmonton, Alberta.

Acknowledgments

The field parties were composed of J. M. McLelland, and E. W. Peikert, assistant geologists, D. Clements, R. Jull, J. Steiner, J. G. Tansey and G. Wysocki, field assistants, in 1958; and E. W. Peikert, assistant geologist, G. G. Harrington, P. Hofsteenge, and M. Isaac, field assistants, in 1959.

The assistance of the pilots and staff of McMurray Air Service Ltd., Uranium City, Saskatchewan, is gratefully acknowledged.

GENERAL GEOLOGY

Igneous, sedimentary and metamorphic rocks of Precambrian age¹ underlie the Colin Lake map-area. Over three quarters of the map-area are underlain by rocks of the porphyroblastic biotite granite group, and the remainder is made up essentially of granite gneiss (Table 1). The porphyroblastic biotite granite group is mainly represented by biotite granites D and E with a smaller amount of quartz diorite and a very minor amount of biotite granite C. Massive biotite and leucocratic granites intimately mixed with the porphyroblastic biotite granites together occupy a synclinorium whose east-northeast axis plunges to the east and passes through the central peninsula on Colin Lake. Faults cut across the nose of the synclinorium and are responsible in part for bringing granite gneiss against rocks of the porphyroblastic biotite granite group.

The principal structure is the synclinorium centred in biotite granite D, which has a complex system of longitudinal and transverse faults on the flanks, and transverse faults across the nose.

Geological History

The following approximation of the geological history of the area makes use of geological information gained from the adjoining areas to the north. The biotite- and hornblende-granite gneisses with minor amphibolites and metasedimentary rocks make up a basement complex of para- and orthogneisses representing deep-seated conditions of formation and involving repeated metamorphism (Baadsgaard et al., in press).

A second phase of the history concerns the formation of quartz

¹ Biotite and muscovite from several of the principal rock types in this and adjoining map-areas give potassium-argon dates of 1.8 billion years (Godfrey and Baadsgaard, 1962).

diorite and biotite granites C, D and E by regional metamorphism and re-constitution of sedimentary materials laid down on the older granite gneiss basement. The least-altered parts remain as recognizable metasedimentary rocks. A last phase in the plutonic history includes emplacement of the massive biotite and leucocratic granites, predominantly in the porphyroblastic biotite granite group but also in the granite gneiss terrain.

Glacially smoothed outcrop surfaces, rock basin lakes, sandy outwash planes, striations, and erratics, all attest to a recent ice age.

Rock-Type Classification

Metamorphism, intrusion, and deformation has obscured many original structures and contact zones, and has produced many mixed rock assemblages. Thus, on most parts of the map only the predominant rock type is indicated, and the finer details of the field associations are necessarily omitted.

In order to standardize the rock classification, certain hand specimens were designated as standard reference samples which represent as nearly as possible the typical lithology of each map-unit. The standard samples are listed in table 3 with their modal and chemical analyses, and their locations are shown on the geological map.

MAP - UNITS

Metasedimentary and Associated Rocks

Metasedimentary rocks form a minor portion only of the bedrock in the Colin Lake district (0.2 per cent of the map-area, Table 1) and are confined to the northern part. They occur as bands ranging in width from a few feet up to one quarter of a mile in granite gneiss and quartz diorite.

Each band of metasedimentary rocks is a mixture of rock types, including pure to impure quartzite, biotite schist and phyllite, with minor sericite schist, phyllonite, hornblende schist, and amphibolite. Varied amounts of feldspar megacrysts, pegmatite, granite, microgranite and milky quartz are also present as late-formed constituents.

Banding produced by the interlayering of the metasedimentary rock types is interpreted as relict sedimentary bedding. Typically, alternating layers of quartzite and biotite schist or phyllite are laterally persistent though not of great thickness (commonly from 1/2 to 4 inches).

Table 1. Principal Rock Groups, Constituent Rock Types,
and their Field Associations

| Granite Gneiss (3.9)* | Metasedimentary and Associated Rocks (0.2) | Porphyroblastic Biotite Granite Group (39.7) | Massive Granite and Pegmatite Group (4.1) |
|------------------------------|--|--|--|
| Biotite granite gneiss | Quartzite | Biotite granite C | |
| Hornblende granite gneiss | Biotite schist | Biotite granite D | |
| | | Biotite granite E | |
| | | Quartz diorite | |
| | ← | | Muscovite granite and pegmatite |
| | ← | | Granite pegmatite |
| ← | | | Massive biotite granite, biotite 'p' granite |
| ← | | | Leucocratic granite |
| Amphibolite** | | | → |

* Per cent outcrop of total map-area

** Outcrop area included with each rock group as appropriate

Granitic materials are common in most metasedimentary bands and locally make up not more than 50 per cent of the total rock. Feldspar occurs as individual crystals or augen up to 1/2 inch in diameter, and as feldspathic stringers and pegmatites elongated in the direction of the foliation of the enclosing rock. Quartzo-feldspathic bodies range from a few inches to 100 feet or more in length, and though irregular in outline their contacts are sharp in detail. Minor granitic dykes and stringers, quartz lenses and veins also have sharp contacts in metasedimentary rocks.

Internal structures of the metasedimentary bands include small folds and crenulations from 1 to 2 inches to several feet in amplitude and indicate that plastic deformation has taken place. Some areas exhibit migmatitic structures as a consequence of deformation of intimately mixed granitic and metasedimentary materials.

Contacts of metasedimentary rocks are generally gradational and concordant with foliation structures except at some massive granite contacts.

Many metasedimentary rocks have attained at least the garnet isograd.

Quartzite

The metasedimentary rocks are divided into two map-units; where a quartzose character predominates they are mapped as quartzites, and where a schistose lithology is prevalent the rocks are mapped as biotite schist. The contact between these two map-units is gradational both parallel and normal to the foliation strike.

The pure to impure quartzites are white, grey, green, pink or blue where fresh, with color banding evident in the thicker layers. Weathered surfaces are lighter in color and may have an orange-brown iron stain. Garnet produces pitted surfaces on weathering, and even to uneven fractures tend to parallel the rock foliation.

The typical impure quartzite contains up to 50 per cent combined biotite and feldspar, with minor garnet and amphibole. The quartzites are fine- to medium-grained, sugary textured, with color banding and a foliation produced by partings of biotite schist.

Minor amounts of biotite and hornblende schists are present in the quartzite map-unit, and small amounts of sericite schist and phyllonite characterize sheared areas.

Biotite Schist

Biotite schist, the principal lithology of this composite map-unit,

is dark grey-brown on fresh surfaces with bands and patches of white feldspar and quartz. Many of the weathered outcrop surfaces are characterized by an orange-brown iron stain. A distinctive schistose appearance is obtained with as little as 30 per cent biotite. Small amounts of garnet and pyrite are present locally. Mineralogical banding on a small scale is exemplified by concentrations of quartzo-feldspathic constituents.

Minor amounts of impure quartzite in the biotite schist map-unit contain biotite, feldspar, and locally, garnet and amphibole. Other rock types present in minor amounts in this map-unit include sericite schist, phyllonite, and amphibolite.

Internal structures in the biotite schist are similar to those in the quartzite unit except that folds and crenulations are of smaller dimensions.

Porphyroblastic Biotite Granites and Associated Rocks

Foliated porphyroblastic biotite granites D and E¹ underlie the greater part of this map-area and maintain a high degree of textural and mineralogical homogeneity over large portions of it.

Figure 2 summarizes the genetic relationships between all members of the porphyroblastic biotite granite group recognized in the total area mapped to date. Table 1 shows the rock types of this group present in the Colin Lake map-area, and table 2 gives a summary of their petrographic characters.

The group of biotite granites C, D, and E, are characterized by feldspar megacrysts, though their size differs greatly between rock types. Large megacrysts from 1 1/2 to 3 inches long are confined to biotite granite D, but others from 1/4 to 1/2 inches are present in all three granites and quartz diorite. Although there are serial mineralogical changes between rock types, more abrupt textural differences enable rock-unit boundaries to be firmly fixed in the field. All rocks of the porphyroblastic biotite granite band are foliated, and minor mineralogical layering is confined to small areas which also exhibit structures associated with plastic deformation.

¹ To emphasize the textural characters which are common to the genetically related members of the porphyroblastic biotite granite group, rock types have been included which do not conform to the strict petrographic definition of the term "granite". Precise petrological nomenclature for these rock types is used in the section dealing with chemical and modal analyses.

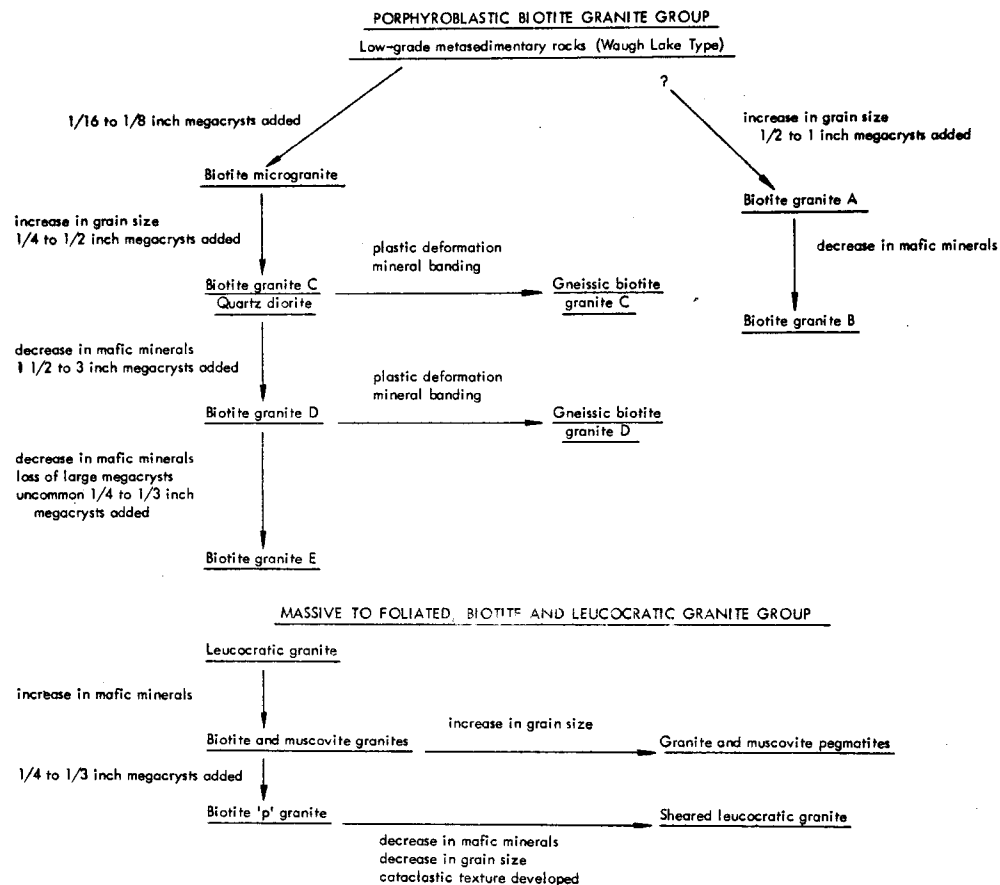


Figure 2: Mineralogical and textural relationships between members of the porphyroblastic biotite granite group, and amongst the massive to foliated, biotite and leucocratic granite group. Map-units from all previously reported adjoining map-areas are included.

Table 2. Systematized Description of Petrographic Properties of the Porphyroblastic Biotite Granite, and Massive Granite and Pegmatite Groups

| Rock-Unit | | Color | Texture | Composition ¹ | |
|---------------------|-------------------------------|--|---|------------------------------------|---|
| | | | | Porphyroblasts ² | Matrix ³ |
| Biotite granite C | | porphyroblasts: white to grey matrix: medium grey | porphyroblastic (1/4 to 1/2"), foliated, fine to medium grained | plagioclase (40 to 65%) | plagioclase, quartz, biotite, minor microcline, hornblende, epidote. |
| Biotite granite D | | porphyroblasts: grey to pink matrix: medium to light grey | porphyroblastic (1 1/2 to 3"), foliated to massive, medium to coarse grained | microcline perthite (15 to 40%) | plagioclase, quartz, biotite, minor hornblende, epidote, microcline. |
| Biotite granite E | | porphyroblasts: pink to red matrix: pink | porphyroblastic (1/4 to 1/3"), foliated to massive, medium grained | microcline perthite (0 to 5%) | plagioclase, quartz, microcline perthite, biotite, minor chlorite, epidote. |
| Quartz diorite | | porphyroblasts: white to pink matrix: medium to green-grey | porphyroblastic (1/4 to 3/4"), foliated, medium grained | plagioclase (30 to 50%) | plagioclase, biotite, quartz, hornblende, minor epidote, chlorite. |
| Massive granite | equigranular biotite phase | pink to reddish | massive, equigranular, medium grained | none | microcline perthite, quartz, plagioclase biotite, minor muscovite, chlorite, locally garnet |
| | biotite 'p' phase | pink to reddish to grey | massive, medium grained, porphyroblastic (1/4 to 1/3") | microcline perthite (25 to 55%) | microcline perthite, plagioclase, quartz, biotite, minor chlorite, muscovite. |
| Pegmatite | equigranular granite phase | pink to red | massive, equigranular, coarse grained | none | microcline perthite, plagioclase, quartz, minor biotite, chlorite. |
| | muscovite phase | white to light grey | massive, equigranular, very coarse grained | none | plagioclase, quartz, microcline, muscovite, locally garnet. |
| Leucocratic granite | | pink | massive, fine to medium grained | none | quartz, microcline perthite, plagioclase minor biotite, chlorite. |

¹ Color is not a reliable guide to the identification of feldspars in the field. Color relations of the two feldspars vary within the area and reporting of a specific feldspar indicates that laboratory studies have been carried out.

² Percentages refer to amount of porphyroblasts in rock.

³ Minerals listed in decreasing order of abundance.

Table 3 shows that rocks of the porphyroblastic biotite granite group are more basic than either the biotite granite gneiss or the leucocratic granite. The mafic mineral content (biotite, hornblende, chlorite) of quartz diorite is over 30 per cent, biotite granite D from 23.9 to 13.7 per cent, and biotite granite E from 11.8 to 8.5 per cent.

Massive granite rocks make up a significant volume within the biotite granites D and E terrain, rocks of undoubted metasedimentary origin are absent, and amphibolites are uncommon, small, and mostly sheared. Scattered small lenses of biotite with feldspar are restricted to the porphyroblastic biotite granites.

The largest bodies of massive granites are located in the central peninsular and adjacent islands of Colin Lake. Elsewhere in the porphyroblastic biotite granite terrain massive granites are present in bodies up to one-half mile in diameter. The contacts of massive granites with the enclosing porphyroblastic biotite granites are typically sharp, there being mineralogical and textural differences between these rock types. Field relations suggest that the massive granite group includes rocks of diverse origins and ages (see massive granite group later in this report).

The biotite-feldspar lenses lie in the foliation planes of the porphyroblastic biotite granites and range from 1/2 inch to 3 feet in length. They are fine-grained, and locally contain a few white porphyroblasts from 1/4 to 1/2 inches long.

Field and laboratory data (Peikert, 1961) indicate that the porphyroblastic biotite granites have developed from a mixed assemblage of metasedimentary and metavolcanic rocks such as are found at Waugh Lake, 12 miles north of this map-area. Recrystallization under conditions of medium- to high-grade metamorphism are involved in this transformation.

Biotite Granite C

Only a very small area of this map-unit crops out, at the northern margin of the Colin Lake district, where it is associated with biotite granite D and massive biotite granite. A general petrographic description is given in table 2, and in addition it should be noted that the dispersed feldspar megacrysts protrude on weathered surfaces.

Massive granites, microgranites, aplites, and pegmatites make up an average of about 10 per cent of the biotite granite C area, but may form large percentages of some outcrops. Pink, quartz-feldspar pegmatite is the most abundant of these materials which form tabular bodies from a few inches to 100 feet across and cut the foliation of the host rock at low angles. Pink to white, sugary aplites appears to be a textural variety of the pegmatite with which it is associated.

The foliation in biotite granite C results from deformation prior to recrystallization, as shown by the undeformed grains and by the manner in which some feldspar megacrysts cut the matrix foliation. Locally, late shearing has been superimposed on this structure.

As established in the map-area to the north, biotite granite C is typically interlensed with biotite granite D and quartz diorite.

Biotite Granite D

This map-unit is one of two predominant rock types in the map-area. As in the adjoining area to the north, it appears essentially uniform over much of the map-area, and a limited range of textural and mineralogical varieties extends through a continuous series of intermediate stages.

Euhedral feldspar megacrysts have a sharp contact with the matrix and tend to be oriented in the foliation plane. In general, the blunt ends of the crystals make angular contact with the foliation and have a rim of fine-grained red feldspar, though a few crystals are partly enclosed in a selvage of biotite. Inclusions of biotite (or chlorite) and quartz are commonly irregularly distributed in the megacrysts, but zones of inclusions parallel to the crystal faces are present in some cases. The megacrysts are evenly distributed in most outcrops, but some local concentrations are evident in sheared areas. Petrographic evidence (Peikert, 1961) indicates that the megacrysts are porphyroblasts which have formed at a late stage in the history of the rock. The matrix to the porphyroblasts is similar to that of biotite granite C, but with a little more quartz and less biotite. Biotite granite D contains notable amounts of muscovite in an area of shearing at the nose of the Colin Lake syncline, (Secs. 26, 27, 34, 35, Tp. 121, R. 2), and in the main peninsula on the axis of the Colin Lake syncline, (Secs. 3, 4, 9, 10, Tp. 122, R. 1).

Leucocratic granite and pegmatite are common in biotite granite D, though every type of the younger massive granites and pegmatites is present. There is an apparent concentration of these massive granites in the main peninsula of Colin Lake and in the area south of Colin Lake. Many of the small massive granitic bodies, especially granite pegmatite on the south side of Colin Lake, are moderately radioactive.

The structure in the individual outcrops of biotite granite D is evident as a simple straight foliation, but compilation of the foliation data over the map-area shows the presence of many folds. Small shear zones from 1 to 6 inches wide cross the foliation at small angles and are associated with schistosity and chloritization. The latter is particularly extensive in an area north of the Colin River extending westerly into the central peninsula of Colin Lake, and to the southwest of Colin Lake.

This concentration of chloritization coincides with the axis of the Colin Lake synclorium.

Various types of field relations between biotite granite D and granite gneiss are displayed in this map-area and include contacts that are faulted, conformable and cross-cutting with regard to foliation, and intruded by younger massive granites.

Contacts of both the massive biotite and leucocratic granites and pegmatites with porphyroblastic biotite granites D and E have the same character though a range of composition, texture, and size of these massive granitic bodies is represented. The contacts between these rocks can be accurately and readily placed in view of their contrast in texture, mineralogy, and structure. Many of the leucocratic granite and pegmatite bodies contain remnants of the host porphyroblastic biotite granite in which the foliation is parallel to that of the porphyroblastic biotite granite country rock. The foliation of the country rock may either parallel or be angular to the contacts of the massive leucocratic granite and pegmatite.

The contact between biotite granites D and E is exposed for about eight miles on the south side of Colin Lake and has a general easterly trend, parallel to the foliation. The contact is difficult to place in detail because the large feldspar porphyroblasts of biotite granite D, which provide the obvious textural contrast between these two otherwise similar rocks, tend to be gradational in size and abundance over a few hundred feet near the contact. For example, the porphyroblasts may range up to 1 to 2 inches in length, and may represent 2 to 5 per cent of the rock or may even be virtually absent locally. Interlensing of the two rock types occurs in the contact zone, and masses of biotite granite D are also present for some distance from the main contact within biotite granite E.

Biotite Granite E

This generally foliated rock underlies about 20 square miles on the south side of Colin Lake. It contains slightly megacrystic pink potash feldspar from 1/4 to 1/3 inches in diameter, a little larger than red plagioclase in the matrix, this textural feature of nearly equal sizes of potash feldspar and plagioclase being unique amongst the porphyroblastic biotite granites. Very rarely pink potash feldspar megacrysts from 1/2 to 1 inch in diameter are also present. A close genetic relationship is indicated by the similar modes of biotite granites D and E, the principal difference centering on the K-feldspar:plagioclase ratio and the presence or absence of the 1 1/2 to 3 inch long feldspar porphyroblasts. The generally lower biotite content in biotite granite E results in a less-foliated character than in biotite granite D.

Massive biotite and massive leucocratic granites and pegmatites are common within biotite granite E, and though many varieties are present

the leucocratic granite is by far the most abundant. Field characteristics are similar to those of the leucocratic granite and pegmatites present in biotite granite D. A moderate level of radioactivity is present in many of the small pegmatite bodies.

Though amphibolites are uncommon in both porphyroblastic biotite granites D and E, a slight concentration is evident in biotite granite E in Secs. 22 and 27, Tp. 121, R. 2. These amphibolites are dyke-like bands or lenses which parallel both the foliation and a persistent north-northeast fault system.

Quartz Diorite

This unit forms a band adjoining biotite granite D and is probably partly infolded into the granite gneiss complex.

Quartz diorite resembles biotite granite C in hand specimen, but the foliation is less pronounced due to the presence of hornblende (5 to 15 per cent), and the contrast between feldspar megacryst and matrix is reduced because of interlocking hornblende and feldspar crystals.

The younger massive granitic components make up only a small percentage of this map-unit, granite pegmatite, aplite, and quartz veins being the most abundant. Lenses of biotite-feldspar schist, typical of the porphyroblastic biotite granite group, are common in this rock type. Quartz diorite is more basic than other members of the porphyroblastic biotite granite group, except for biotite microgranite which has a similar mafic content. Quartz diorite has a close field relation to other members of this group and possibly is transitional to biotite granite C, suggesting their common origin.

Granite Gneiss

Biotite and hornblende granite gneiss underlies a portion of the northwestern part of the map-area where it is associated with quartz diorite, biotite granite D, metasedimentary rocks, and the younger massive biotite granites. Rock types mixed on a small scale in the granite gneiss terrain provide great variation in texture and mineralogy and present difficulties in accurately defining areas of a given map-unit. Not only do map-units represent mixed rock assemblages, but various types of gneiss are gradational both in texture and in mineralogy. The granite gneiss includes common structural features such as swirls, pygmatic and drag folds, and other complex contortions which are typical of a plastically deformed terrain. In addition to the granite gneisses, this complex terrain contains amphibolite, metasedimentary rocks, and members of the younger massive granites and pegmatites.

The granite gneiss is characterized by alternating 1/4- to 4-inch wide mafic- and felsic-rich bands which produce a distinct color banding. The bands may be well defined and laterally continuous, or faint and discontinuous, giving way to a general foliation expressed by biotite wisps or by quartz lenses.

Appreciable visible hornblende in hand specimen (greater than about 5 per cent) is used in the distinction of biotite and hornblende granite gneiss map-units. Biotite, however, may remain as a prominent constituent in the hornblende granite gneiss. Biotite-rich and leucocratic varieties of gneiss are recognized, but the distinction is insufficient to justify additional map-units on the present scale of examination.

Information from adjacent areas suggests that granite gneiss structurally underlies the quartz diorite and biotite granite D in unfaulted areas. Massive granite phases within the granite gneiss partially conform to the structure in the granite gneiss in that the foliation flows around many of the bodies. Blocks and lenses of granite gneiss are common in the massive granitic rocks and have sharp to gradational borders. The complex structure of the gneiss terrain makes it impossible to determine whether the enclosed blocks have been rotated.

Although the quartzo-feldspathic mineral assemblages of the granite gneiss do not permit determination of the conditions of formation of the gneisses, those of the closely associated metasedimentary rocks suggest medium- to high-grade metamorphism. The common association and gradation of mineralogy and structure between these two rock groups suggest that large portions of the granite gneiss terrain are derived from metasedimentary rocks.

Biotite Granite Gneiss

Biotite granite gneiss is by far the most abundant rock type in the granite gneiss terrain.



On fresh and weathered surfaces biotite granite gneiss is generally pink to red, and dark brown, biotite-rich streaks and lenses give the rock its characteristic color banding.

The typical biotite granite gneiss contains less than 10 per cent biotite, approximately 30 per cent quartz, with feldspar comprising the remainder of the rock. Chlorite, amphibole, garnet, epidote (commonly in 1/16 to 1/8 inch thick cross-cutting veins), hematite, magnetite, and allanite are locally present in small amounts. Feldspar-rich varieties are present locally and contain only 2 to 3 per cent of biotite whereas others have abundant, sharply defined, biotite-rich bands. A modal and a chemical analysis of granite gneiss is given in table 3 (56). Most of the granite gneiss is medium grained, but pegmatitic and porphyroblastic

textures with 1/4 to 1/3 inch feldspar augen are locally combined with the layered structure.

Numerous narrow bands and lenses of hornblende granite gneiss, amphibolite, and metasedimentary rocks in the biotite granite gneiss are too small to be shown on the map. The first two of these rock types are most common and generally have gradational contacts with biotite granite gneiss. Rocks lacking a distinct layered structure are termed foliated granites and form small discontinuous bodies. Their penetrative foliation distinguishes them from the younger massive granitic rocks.

In addition to the major bodies of younger massive granitic rocks shown in the map-area, similar rocks are distributed in small amounts throughout the biotite and hornblende granite gneisses. Quartzo-feldspathic pegmatite is the most common of these rock types and is present in almost every outcrop of granite gneiss and comprises the major portion of some. The pegmatite bodies are irregular in size, shape, and texture, although they typically conform to the foliation of the enclosing gneiss. Some bodies of pegmatite appear to be genetically related to the gneiss rather than to be of external origin. Other types of younger massive granitic rocks (biotite granite, leucocratic granite, and porphyroblastic phases) are also present in minor veins and dykes, particularly in the vicinity of the larger massive granite masses.

The banded structure in the granite gneiss is typically swirled and pygmatically folded with the most extreme forms indicated by the symbols  and  on the map.

Hornblende Granite Gneiss

Small patches of hornblende granite gneiss are found throughout the granite gneiss terrain. Two principal types are recognized: in one hornblende is present as disseminated crystals, and in the other amphibolite and quartzo-feldspathic materials alternate in bands from 1/2 to 2 inches thick.

The first type resembles parts of the biotite granite gneiss with hornblende taking the place of some of the biotite. Small hornblende crystals (making up 5 or more per cent of the rock) are oriented in the plane of foliation and commonly form indistinct bands. The remainder of the rock is composed of quartz and pink feldspar.

The second type of hornblende granite gneiss consists of alternating dark green and white or pink bands. In spite of the banding the rock tends to split with an irregular fracture as does the biotite granite gneiss. The dark-colored bands are composed of hornblende and biotite with some feldspar and quartz. The light-colored bands consist of quartz and feldspar with a medium-grained granoblastic texture. The alternation

of bands is regular, and with an increase in the grain size and proportion of mafic layers the rock grades into banded amphibolite.

As in the biotite granite gneiss, hornblende granite gneiss contains amphibolite, metasedimentary rocks, and younger massive granitic materials, and shows features of plastic deformation which are characteristic of the gneissic terrain in general.

Amphibolite

The bodies of amphibolite in the area represent a great variety of textural and mineralogical types present in a number of lithologic associations. Characteristically, they are associated with the granite gneiss, but small bodies are also present in the porphyroblastic biotite granites. The general properties of the group are described first, followed by notes on particular types and associations.

Amphibolites¹ are dark green on fresh surfaces weathering to greenish-grey, with some varieties composed of alternating green and white or pink bands.

The principal minerals are hornblende and feldspar, with quartz, biotite, and epidote present in certain types. As the proportion of hornblende to feldspar + quartz changes, the rock type ranges as a continuous series from hornblendite to amphibolite to hornblende granite gneiss or amphibolitic metasedimentary rocks. These amphibolitic metasedimentary rocks appear to be hornblendic equivalents of the impure biotite quartzites, and gradations between the two are present in the area. The grain size varies from fine to coarse with 1/4-inch and larger hornblende crystals being common in hornblende-rich varieties. The texture ranges from massive to foliated to banded, with regularly alternating 1/2 to 1 inch wide bands of hornblende and white feldspar.

Amphibolite bodies rarely exceed 200 feet in width, most being in the range from 5 to 25 feet. Many of the amphibolites are represented diagrammatically on the map and many others are too small to be shown.

¹ In general reference "amphibolite" is used to include the two petrological terms "amphibolite" and "hornblendite". Shaw's (1957) definition 6A is preferred for amphibolite, i.e. "a metamorphic rock of medium to coarse grain, containing essential amphibole and plagioclase", whereas hornblendite is simply "a rock containing more than 90 per cent hornblende". Both of these rock types are found in the several terrains referred to, but amphibolite is the more common.

All types of amphibolite, particularly those with excessive hornblende, have associated granite pegmatite which is present in veins and discontinuous irregular patches that comprise up to 30 per cent of some outcrops. Contacts of the amphibolite with this pegmatite appear sharp because of the color contrast, but are typically gradational where observed in detail.

The internal structures of the amphibolites conform to those in the surrounding rocks. The banded varieties, in the granite gneiss and meta-sedimentary rocks, show a high degree of contortion, whereas amphibolites with excessive hornblende and those in the porphyroblastic biotite granites have a simple foliation only.

Contacts of the amphibolites with biotite granite gneiss and porphyroblastic biotite granites tend to be sharp, but those with hornblende granite gneiss and metasedimentary rocks are commonly gradational, particularly where the amphibolite is of the layered type.

The principal metasedimentary band at the northern boundary of the map-area contains amphibolite associated with quartzite, biotite schist, and granite pegmatite. Such amphibolites contain abundant quartz in addition to hornblende and feldspar.

The granite gneiss contains both layered and slightly foliated amphibolites with associated granite pegmatite. The layered-type amphibolite is similar to that in the metasedimentary rocks except for a lower quartz percentage, and in many places grades into hornblende granite gneiss. Slightly foliated amphibolite composed of blocky crystals of green amphibole and feldspar have a coarse, varied texture and are accompanied by large amounts of granite pegmatite.

Lenses or bands mapped as amphibolite in porphyroblastic biotite granites D and E south of Colin Lake are hornblende-feldspar-biotite-chlorite rocks which may represent altered basic dykes and sills.

Massive, Biotite and Leucocratic Granites and Pegmatites

Distinct bodies of massive granitic rock of varied size, shape, texture, and composition are present in most parts of the map-area in addition to the dispersed small granitic aggregates associated with other map-units. The largest masses of these rocks are located toward the centre of the north margin of the map-area, and in biotite granite D in the main peninsula of Colin Lake.

Some of these bodies cut the foliation in the surrounding rocks, and as they also generally have a lower percentage of mafic minerals (0 to 8 per cent) they contrast sharply and so appear to be younger than

the surrounding rocks. Many of the granitic rocks are massive, others have a local foliation due to late shearing, and only a few have the penetrative foliation that characterizes the older rocks of this group. These rocks range from fine-grained to pegmatitic and from even-grained to porphyroblastic.

The subdivision of the massive granitic rocks is shown in table 2 along with their petrographic descriptions. Characteristics and associations of each type are discussed under the specific rock types and chemical and modal analyses are given in table 3.

The general type of contact of these bodies with the surrounding rocks consists of a zone from a few feet up to hundreds of feet in width composed of dykes and irregularly shaped bodies of massive granitic rock that enclose remnants of country rock oriented in the regional trend. Local foliation in these young massive granitic rocks is generally best developed parallel and near to the contacts.

The diversity of texture, mineralogy, field association, and contact relationships displayed by this rock group suggests that the constituent rock types may not be of a common origin, and even those rocks of similar petrographic characteristics, such as biotite granites, appear likely to include rocks of different origins and ages.

Biotite Granite

The two phases of massive biotite granite differentiated on the map include an equigranular biotite granite and a megacrystic phase referred to as biotite 'p' granite.

Equigranular massive biotite granite with up to 5 per cent biotite locally contains muscovite (Sec. 10, Tp. 122, R. 1) or hornblende (Sec. 29, Tp. 122, R. 1). This granite is present mainly in small, scattered bodies except in the granite gneiss areas in the northwest part of the map-area.

The rock is characterized by a high degree of variability in texture which ranges to pegmatitic in patches of some areas. On the one hand these rocks are transitional to biotite 'p' granite and on the other they grade into leucocratic granite.

Though a slight foliation is present in some areas, it is either confined to discrete shear planes or is near contacts. Crushed and granulated parts, chloritization of biotite, and the development of sericite in foliated areas suggest that the foliation is produced by post-crystalline deformation.

The hornblende granite (Sec. 29, Tp. 122, R. 1) is similar to

biotite granite but with 2 to 3 per cent of disseminated hornblende.

Biotite 'p' Granite

This rock is restricted to the north-central region of the map-area, and contains from 5 to 10 per cent biotite, thus making it more mafic than the equigranular biotite granite.

The rock is mostly massive, but has a foliated texture near some of its contacts. Foliation is produced by the preferred orientation of undeformed grains and it is therefore pre- rather than post-recrystallization in origin. Within a single mass the massive biotite 'p' granite is uniform, but the size and abundance of the large feldspars, the biotite content, and the grain size may differ among major bodies.

Although some field relations in adjoining map-areas suggest that massive biotite 'p' granite is derived in part from the replacement of biotite granite C (Godfrey and Peikert, 1963, p. 23), most of the massive biotite 'p' granite bodies are not so related, but are surrounded by granite gneiss and enclose blocks and lenses of gneiss. This lithological unit appears to include similar rocks which have formed by diverse lines of development.

Granite Pegmatite

Although individual bodies of granite pegmatite are of insufficient size to be indicated on the map, the rock type forms a minor component in all map-units and is particularly abundant in the central and southern parts of the map-area.

Pegmatite bodies are of varied size and shape and commonly cut the foliation in the surrounding rocks; pegmatite contacts range from gradational to extremely sharp. Examples were noted of an older pegmatite displaced by a younger one as though by dilation.

Muscovite Pegmatite

This rock is similar to granite pegmatite except that it contains 1/4 to 1/2 inch diameter flakes and books of muscovite rather than biotite or chlorite (Table 2). This pegmatite outcrops in the porphyroblastic biotite granite area and is associated with either the porphyroblastic biotite granites or the leucocratic granites.

Leucocratic Granite

This granite is the most abundant member of the massive granites in the Colin Lake area, with a concentration of large masses in the main peninsula of Colin Lake. Massive leucocratic granites contain less than

3 per cent mafic minerals, and two subdivisions are recognized, one which contains small amounts of biotite, chlorite, or both, and a second variety which is mafic-free. Both types of leucocratic granites are associated with the porphyroblastic biotite granites D and E.

Leucocratic granite is essentially the same as the massive equigranular biotite granite, except for an absence or lower percentage of mafic minerals. Though commonly massive, a local foliation may be indicated by lenticular quartz grains and patches. Leucocratic granite forms dykes and irregularly shaped bodies that range from a few inches to two miles in width. These bodies include many oriented blocks of country rock, and their contacts vary from sharp to gradational, typical of the younger massive granite rocks.

CHEMICAL AND MODAL ANALYSES

The eleven chemical and modal analyses given in table 3 were determined from the standard reference samples representing the major rock types mapped.

In the porphyroblastic biotite granite group, quartz diorite (54) and the hornblende-bearing biotite granite D (55) are notably low in silica compared to all other samples, and fall in the intermediate range. Those two rocks are also high in CaO , MgO , and Fe_2O_3 , as might be expected from their hornblende content. The remaining three samples of biotite granite D (58, 59, 60) are in the high silica range and in the moderate range for $(\text{CaO} + \text{MgO})$ and Fe_2O_3 . Modal analyses of all these rocks place them in the granodiorite to quartz diorite fields (Moorhouse, 1959, p. 154). Though sample 55 is the only true quartz diorite, samples 54 and 58 approach the field boundary very closely.

The biotite granite E samples (62, 63 and 64) are in the high-silica range with moderate $(\text{CaO} + \text{MgO})$ and Fe_2O_3 values which are similar to samples in the more acidic range of biotite granite D. Modal analyses place this rock type in the quartz monzonite field, but bordering on granodiorite.

The single biotite granite gneiss (56) is very high in silica and low in $(\text{CaO} + \text{MgO})$ and Fe_2O_3 . This very acidic gneiss falls in the quartz monzonite field but towards the granite boundary.

The two leucocratic granites (57 and 61) are also very high in silica, and correspondingly very low in $(\text{CaO} + \text{MgO})$ and Fe_2O_3 . These samples are placed in the quartz monzonite field with sample 57 tending toward the granite field boundary.

Table 3. Chemical and Modal Analyses of Standard Rock-Type Samples (Chemical Analyses by H.A. Wagenbauer)

| Sample | 54 | 55 | 58 | 59 | 60 | 62 | 63 | 64 | 56 | 57 | 61 |
|--------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SiO ₂ | 62.66 | 61.41 | 70.69 | 64.86 | 66.63 | 68.68 | 67.04 | 70.27 | 74.34 | 73.98 | 75.31 |
| TiO ₂ | 0.64 | 0.82 | 0.52 | 0.47 | 0.51 | 0.40 | 0.48 | 0.37 | 0.13 | 0.10 | 0.15 |
| Al ₂ O ₃ | 15.63 | 15.77 | 13.67 | 15.48 | 15.49 | 14.65 | 14.35 | 14.07 | 13.02 | 13.58 | 13.23 |
| Fe ₂ O ₃ | 5.65 | 6.47 | 3.91 | 3.42 | 3.70 | 3.05 | 3.81 | 3.16 | 1.74 | 0.70 | 1.45 |
| MgO | 3.41 | 3.07 | 1.43 | 3.43 | 2.37 | 1.67 | 1.81 | 1.61 | 0.96 | 0.43 | 0.43 |
| CaO | 4.23 | 4.58 | 2.55 | 1.15 | 1.92 | 1.92 | 2.16 | 1.01 | 0.67 | 0.76 | 0.92 |
| Na ₂ O | 2.94 | 3.35 | 2.77 | 1.32 | 3.51 | 3.10 | 2.73 | 2.36 | 2.30 | 2.99 | 4.05 |
| K ₂ O | 2.64 | 2.11 | 2.95 | 6.42 | 3.40 | 4.11 | 4.53 | 4.52 | 5.41 | 6.13 | 3.51 |
| L.O.I. | 0.52 | 0.83 | 0.54 | 2.35 | 1.20 | 1.11 | 1.14 | 1.52 | 0.59 | 0.84 | 0.27 |
| P ₂ O ₅ | 0.20 | 0.29 | 0.19 | 0.17 | 0.25 | 0.23 | 0.30 | 0.14 | 0.06 | 0.03 | 0.05 |
| MnO | 0.07 | 0.07 | 0.05 | 0.06 | 0.06 | 0.05 | 0.05 | 0.05 | 0.03 | 0.01 | 0.00 |
| Total | 98.59 | 98.77 | 99.27 | 99.13 | 99.04 | 98.97 | 98.40 | 99.08 | 99.25 | 99.55 | 99.37 |
| Quartz | 23.3 | 16.6 | 33.6 | 25.0 | 27.5 | 21.4 | 33.3 | 24.2 | 39.5 | 36.8 | 33.6 |
| Potash feldspar | 2.5 | 0.0 | 2.9 | 11.3 | 13.1 | 23.1 | 17.9 | 27.4 | 32.8 | 35.0 | 26.9 |
| Plagioclase | 38.0 | 57.7 | 45.4 | 47.3 | 41.4 | 42.9 | 35.0 | 38.5 | 21.1 | 24.0 | 35.7 |
| Biotite | 24.6 | 20.6 | 17.3 | 9.4 | 17.3 | 11.6 | 11.5 | 0.0 | 5.2 | 0.0 | 2.4 |
| Chlorite | 0.2 | 0.0 | 0.0 | 4.3 | 0.0 | 0.0 | 0.3 | 8.5 | 0.9 | 3.0 | 1.3 |
| Hornblende | 7.8 | 3.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Epidote | 2.2 | 0.6 | 0.5 | 1.9 | 0.0 | 0.3 | 1.2 | 1.0 | 0.3 | 0.0 | 0.1 |
| Muscovite | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.05 | 0.8 | 0.0 |
| Garnet | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Calcite | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Accessories | 1.4 | 1.2 | 0.3 | 0.8 | 0.7 | 0.7 | 0.8 | 0.4 | 0.15 | 0.4 | 0.0 |
| No. of Points | 2,000 | 3,000 | 7,500 | 2,000 | 3,500 | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 |

54 Quartz diorite
55 Biotite granite D
58 Biotite granite D
59 Biotite granite D
60 Biotite granite D

62 Biotite granite E
63 Biotite granite E
64 Biotite granite E
56 Biotite granite gneiss
57 Leucocratic granite
61 Leucocratic granite

These modal analyses confirm the predominance of rocks in the quartz monzonite and granodiorite fields amongst the crystalline plutonic map-units of the Precambrian Shield in northeastern Alberta.

STRUCTURAL GEOLOGY

Colin Lake appears to be centred on a folded synclinal axis which plunges eastward. The axis of this fold extends from the southwest margin of Colin Lake and arcs to the northeast, east, and finally southeast, through the main peninsula of the lake and the mainland beyond. The two large arms of Colin Lake occupy the limbs of this regional fold, and the core has been preserved apparently as a result of the emplacement of relatively erosion-resistant leucocratic granite. It seems likely that faults may be present parallel to the limbs of this fold, especially on the northern limb where local shearing and chloritization are evident in the islands and nearby mainland, and at the extreme western end of Colin Lake. A synclorium is readily conceived from the isoclinal folding mapped on the south side of Colin Lake in biotite granites D and E. The general northerly trend of the regional foliation, noted in areas mapped to the north, is disturbed in the area of the synclorium and exhibits an easterly alignment south of Colin Lake.

Northeasterly trending faults parallel to the north limb of the Colin Lake synclorium are evident to the north, whereas in the main peninsula and in the mainland to the east, faults arc and parallel the trend of the fold axis. On the western margin of the map-area a regional fault arcs from northwest to south-southwest and forms an important contact between several major map-units.

A complex group of faults of varied orientations dissects the area south of Colin Lake which is underlain by biotite granites D and E. Some of these faults are responsible for the termination of bodies of leucocratic granite and also locally form boundaries between biotite granites D and E. Hydrothermal alteration, brecciation, sheeting, and quartz stockwork are small-scale features connected with parts of these fault zones.

As in adjoining areas, many faults are mapped on the basis of marked topographic linears connecting isolated occurrences of small-scale fault features. Evaluation of displacements along these faults is a difficult problem in view of the lack of markers, the generally flat terrain, and the sparse outcrop in the fault zones.

The pattern of magnetic anomalies and contours outlined on an aeromagnetic survey by the Department of Mines and Technical Surveys (1958) can be clearly correlated with regional structures and the

distribution of the principal rock groups as indicated on the map 62-2A.

A planar structure can be measured in most rock types of the map-area, and two types of foliation are recognized (though a distinction is not made on the accompanying map):- (1) penetrative foliation, which affects all the major mineral components throughout the body of the rock to some extent, such as in the biotite granites D and E; and - (2) restrictive foliation, which appears as parallel shear surfaces and which have not resulted in an apparent preferred orientation of the major mineral components, such as in the massive biotite granites.

An examination of the foliation patterns on map 62-2A reveals structures indicative of continuous deformation in the granite gneiss, which correspond to small-scale features of plastic deformation observed in outcrop.

In outcrop, biotite granites C, D, E, and quartz diorite display a penetrative foliation of simple straight planes, and compilation of this structural data over the map-area shows the presence of folds.

Metasedimentary rocks are highly plastically deformed on both large and small scales and form part of the complicated structural picture both in the granite gneiss terrain and in association with quartz diorite.

The massive biotite and leucocratic granites in both the granite gneiss and the porphyroblastic biotite granites conform to the contortions of the foliation in the host rocks and many are positioned in the cores of folds. Their emplacement is largely post-deformational in that they generally lack a readily recognizable foliation.

The lack of three-dimensional exposures, the smooth-surfaced outcrops, and the sparsity of acicular minerals makes the measurement of lineations difficult though possible in a few places. The long axes of the large feldspars in the porphyroblastic biotite granites are arranged in a vertical or near-vertical direction in the plane of foliation. Since the feldspars are tabular in habit, lineation is difficult to observe, although lineations may not have a general distribution. In hornblende-bearing rocks, where lineation should be best expressed, lineation is rarely measured because of the small size of the hornblende crystals.

A number of small-scale megascopic structural features representing both plastic and cataclastic phenomena may be summarized here. Mullion and rod structures are rare and are found mostly in the metasedimentary rocks. Joints and sheeting are common to all rocks. Other cataclastic structures observed include crushed augen, mortar structure, flaser structure, and mylonite. Slaty and fracture cleavage are commonly found in the fine-grained metasedimentary rocks, especially the phyllonites and biotite-sericite schists. Breccias are commonly a

well-cemented stockwork of quartz veins enclosing and cutting hematized, chloritized, and epidotized, country rock fragments.

Migmatite structures found in the basic granite gneisses, at granite gneiss-metasedimentary rock contacts, and in highly feldspathized metasedimentary rocks include tight isoclinal or chevron folds, and drag folds. These and other more complicated forms illustrative of plastic flowage are indicated by the symbol (N) on map 62-2A, and more open folds and swirls are indicated by the symbol (S). These symbols are oriented parallel to structural trends in the outcrop. Boudinage structures were observed in amphibolite bodies within the granite gneiss.

A brief history of deformation and alteration in this map-area involves: - the metamorphic transition of pre-existing rocks to form the granite gneiss basement complex and the associated high-grade metasedimentary rocks; a second phase of metamorphism producing biotite granites C, D, E, and quartz diorite from sediments which overlay the granite gneiss; emplacement of massive biotite and leucocratic granites in all of these rocks; and finally, intrusion of basic dykes, mainly in biotite granites D and E.

In short, deformational features of both a plastic and cataclastic nature have shaped many of the dominant textural and structural characters of the rocks in this map-area. All major rock types show some degree of deformation, most have evidence of shear, and many contain zones of mylonitization.

MINERAL OCCURRENCES

Since previous detailed mapping in northeastern Alberta has shown that the most favorable association for sulfide mineralization is in metasedimentary rocks, and these rocks occupy some 0.2 per cent of the map-area, there can be little possibility of finding sulfide mineralization in the Colin Lake area. A great number of moderately radioactive pegmatites and coarse-grained granites with yellow stains are present in biotite granites D and E throughout the area south of Colin Lake.

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LEGEND

PRECAMBRIAN*

- Quartzite, pure and impure, white, grey, green, pink and blue; including biotite sericite schist, minor milky quartz pods, feldspar augen, granite and pegmatite lenses, ferruginous and garnetiferous zones.
- Biotite schist, with abundant quartz, some sericite; including phyllite, phyllonite, quartzite, minor milky quartz pods, feldspar augen, granite and pegmatite lenses, ferruginous, and garnetiferous zones.
- Biotite granite C, with white to grey subhedral to anhedral feldspar megacrysts, one-quarter to one-half inch in size, in a foliated matrix; including minor aplite, microgranite and pegmatite.
- Biotite granite D, with grey to pink to red euhedral feldspar megacrysts, one and one-half to three inches in size, in a foliated to massive matrix; including minor aplite, microgranite and pegmatite.
- Biotite granite E, with pink to red subhedral feldspar megacrysts, one-quarter to one-half inch in size, in a foliated to massive matrix; including minor aplite and microgranite.
- Quartz diorite, with white to pink feldspar megacrysts, one-quarter to three-quarters inch in size, in a foliated matrix containing hornblende, minor biotite, (locally biotite rich and hornblende poor); including minor aplite, microgranite.
- Biotite granite gneiss, with some hornblende, chlorite; including minor massive granite, porphyritic granite, granodiorite, alaskite; lenses of biotite, quartzite, amphibolite; garnetiferous zones.
- Hornblende granite gneiss, with some biotite, chlorite; including minor massive granite, porphyritic granite, granodiorite and amphibolite.
- Amphibolite, including biotite amphibolite, hornblendite; banded to massive.
- Biotite granite, with white to pink to red feldspars, minor sericite; including leucocratic phases; massive. Phases with abundant feldspar megacrysts (p), one-quarter to one-third inch in size.
- Granite pegmatite, with white to pink to red feldspars, sparse biotite and/or chlorite; massive. Muscovite pegmatite (m), with abundant white to pink feldspars, quartz; massive.
- Leucocratic granite, with pink to red anhedral feldspar, equigranular; massive, locally foliated; including minor microgranite and pegmatite.

*Note: Rock units are not arranged chronologically.

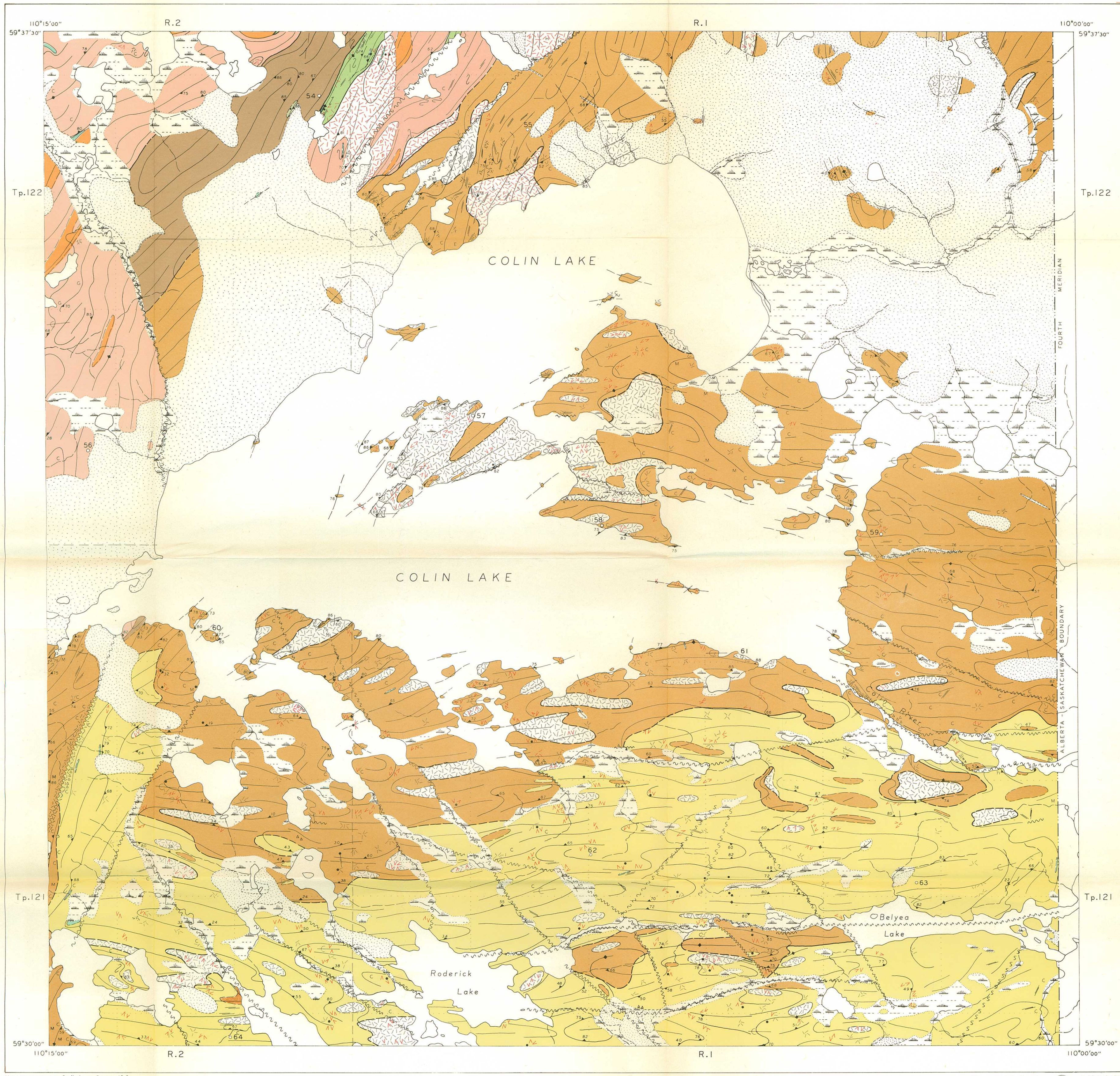
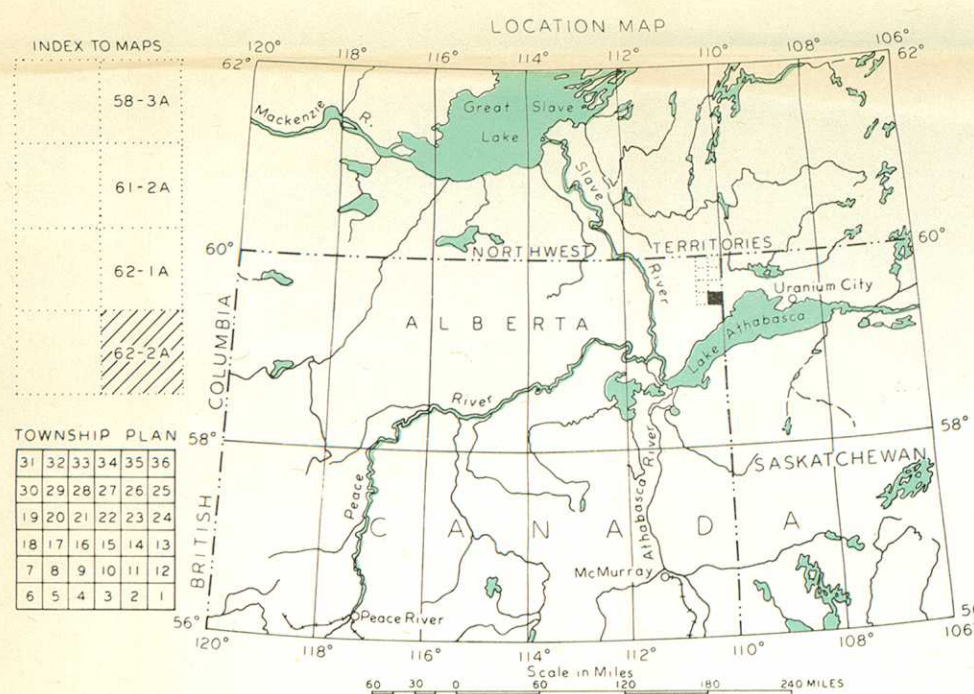
- Geological boundary (defined, approximate)
- Schistosity, gneissosity, foliation (defined, dip known, dip vertical; assumed)
- Extreme contortion (structural trend)
- Tight folds (structural trend)
- Fault (defined, inclined; approximate, assumed)
- Shear zone
- Breccia
- Mylonite
- Joint
- Sample location
- Glacial striae (direction of ice movement known)
- Radioactivity
- Garnet
- Muscovite
- Chlorite, abundant

Geology by John D. Godfrey and E. W. Peikert, 1958, 1959

- Drainage (permanent, intermittent)
- Muskeg
- Sand-covered area
- Provincial boundary
- Township boundary
- Section line
- Base map compiled from planimetric sheet 74 SE, quarter, published by Government of Alberta, Department of Lands and Forests, Edmonton.

Air photographs covering this area are obtainable from the Technical Division, Department of Lands and Forests, Government of Alberta, Edmonton, and the National Air Photographic Library, Topographical Survey, Ottawa.

Approximate magnetic declination 25° 58' East in 1962, decreasing 6' annually.



Map to accompany Preliminary Report 62-2

MAP 62-2A

COLIN LAKE

WEST OF FOURTH MERIDIAN

Scale: Two Inches to One Mile = 1/31,680



Lithographed in Canada Published 1962