3610

GEOLOGICAL AND GEOCHEMICAL REPORT

on the

COL CLAIM GROUP

DUCKLING CREEK AREA

OMINECA MINING DIVISION

55°57'N, 125°26'W

by

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for LUC SYNDICATE

May 1st, 1972.

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INTRODUCTION

The COL claim group described in this report is situated between Duckling and Ha Ha Creeks at 55°57'N 125°26'W. The claim group is centred approximately one mile north of the Lorraine copper deposit and consists of the following located claims:

Claim Name	Record Numbers	Recording Date
Col 1-32	101240-101271	July 12, 1971
Col 51-58	101272-101279	July 12, 1971

Geological mapping was done on air photo enlargements on a scale of 1" = 400'. Data was then transferred to a topographic map prepared by McElhanney Associates at the same scale. The geological portion of this report is a condensed version of a thesis submitted to the University of British Columbia by C.P. Harivel in partial fulfillment of requirements for a B.Sc. degree.

Soil sampling was carried out where practical with respect to soil development and was controlled by a tape and compass grid plotted on 1" = 400' air photo enlargements.

GEOLOGY

1. INTRODUCTION

In central British Columbia, Hogem Batholith extends over an area of about 1200 square miles. Duckling Creek Syenite Complex (Garnett, 1972) which has been variously termed "Duckling Creek Syenite" (Armstrong, 1949) and "Lorraine Syenite" (Koo, 1966 (a), encloses a significant copper mineral deposit which is currently being investigated by The Granby Mining Company Limited. Duckling Creek Syenite Complex lies wholly within Hogem Batholith and occupies about 15 square miles as mapped by Armstrong (op.cit.) but has been extended to cover 60 square miles by Garnett (1972).

This report concerns an area which straddles a small part of the contact between these bodies. The Hogem granitoid rocks outcrop to the north and east in the map-area; rocks of the Complex outcrop to the south and west.

LOCATION AND GENERAL CHARACTER OF THE MAP-AREA

The map-area lies in the centre of the Omineca Mountains of the Central Plateau - Mountain Area of the Interior System of Canadian Cordillera (Bostock, 1940, p. 42-44). The centre of the map-area is approximately at latitude 55°57'N and longitude 125°26'W. The small settlement of Germansen Landing is 25 miles east of the area and access from Germansen Landing is provided by road to within about 12 miles of the area, and this final distance is covered by helicopter.

The relief in the area is a maximum of about 1200' with altitudes ranging from 5500'-6700' above sea level. Two easterly-trending ridges, a north-trending central ridge, and their corresponding valleys, together with an isolated, relatively smooth ridge to the extreme west, characterize the topography of the area. Broad valleys, and a cirque and cirque-lake in the south central part of the map-area, show the effects of recent glaciation. On valley sides rock benches are locally developed. These are believed to result from the control of glaciation by strongly developed sub-horizontal jointing which is generally evident over the area.

North-facing slopes are generally steep and rugged and are commonly mantled with very unstable talus blocks. South-facing slopes are considerably smoother and support modest vegetation in the form of grasses and "shintangle". From the sparse vegetation and abundant rock exposures on the ridges, the slopes lessen giving way to grass-covered alpine meadows in which outcrop is moderate and finally level off in the thickly timbered valley-floors where outcrop is rare.

Streams in the area are fed by numerous emphemeral small streams in the heads of valleys. A major creek in the west of the area flows north to Haha Creek which joins the Osilinka River. The creeks which flow east join other drainage from the north which flows south into Duckling Creek, a tributary of the Omineca River.

PREVIOUS WORK

The area has been mapped by Armstrong (1949) and Roots (1954). In 1968 Koo completed an extensive study of Duckling Creek Syenite Complex (Lorraine Syenite). In 1971 J. Garnett, a geologist with B.C. Department of Mines and Petroleum Resources, mapped the Duckling Creek area of Hogem Batholith and the report of this work was available to the present writer.

2. GEOLOGIC SETTING OF THE MAP-AREA

The following description of the regional geology of the map-area is taken from works by Armstrong (1949), Roots (1954) and Garnett (1972).

Hogem batholith is situated within Omineca Crystalline Belt of Canadian Cordillera (Monger and Hutchison, 1971). It is the largest of the Omineca Intrusions. The eastern border abuts Takla Volcanics of Upper Triassic to Upper Jurassic age; to the west the Pinchi Fault Zone separates the batholithic rocks and strips of rocks of Takla Group from the Paleozoic and older rocks of Cache Creek Group. Clearly intrusive contacts between Hogem Rocks and Takla Volcanics were observed by Armstrong (1949) but he also reported that the contact is gradational in places.

Omineca Intrusions are the most important plutonic rocks of the map-area. They range in composition from granite to pyroxenite and were emplaced in Upper Jurassic or Lower Cretaceous time (Armstrong, 1949).

Hogem batholith extends from Chuchi Lake northwestwards 75 miles and ranges in width from 4 to 25 miles with a total area in excess of 1200 square miles. It is a composite body containing a wide range of rock types and many minor intrusive bodies within the main mass. Satellite stocks, dykes and sills are abundant in the surrounding rocks of Takla Group and late Paleozoic. All are relatively small. Roots (1954) divided rocks of Hogem batholith into two divisions. The older consisted of mainly melanocratic rocks containing little or no

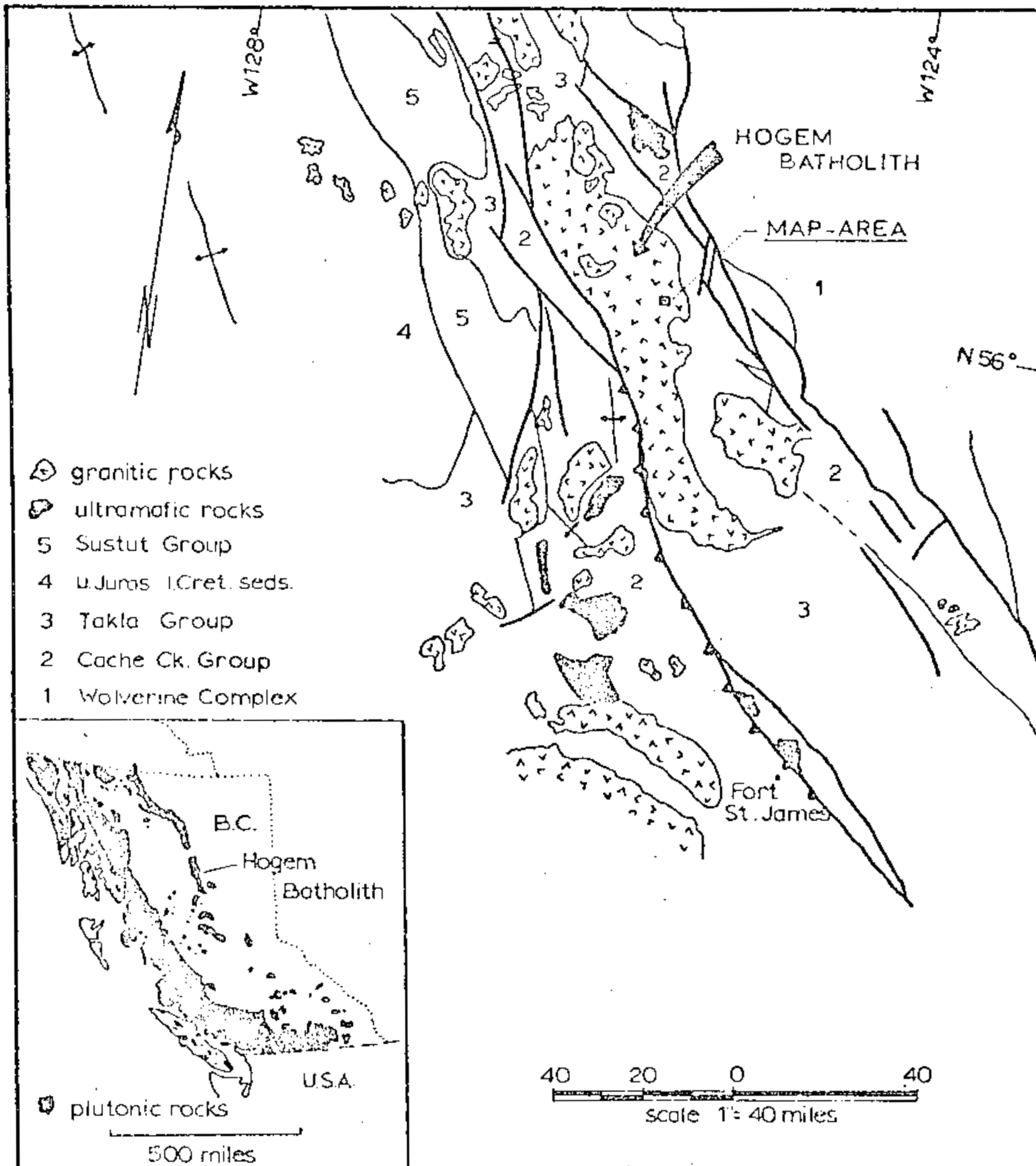

Fig. 1.

Map showing location and geologic setting of map-area.

Department of
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quartz and included pyroxenite, biotite pyroxenite, hornblendite, meladiorite, hornblende diorite, appinite, syenodiorite, and hornblende syenite. The second and younger division included rocks that rarely contain more than 30 per cent ferromagnesian minerals, and thus are predominantly leucocratic, and in which the quartz is a significant and usually conspicuous constituent. The predominant rock types in this division are granodiorite and adamellite-granite; true granite, quartz diorite, and diorite occur in lesser amounts. Associated with these rocks are numerous dykes and small irregular bodies of leucogranite, alaskite, quartz-microperthite, pegmatite and aplite.

The preliminary geologic map of the Duckling Creek area (Garnett, 1972) indicates that Hogem granitoid rocks become progressively more quartz-rich southwestwards across the long axis of the batholith. Diorite and monzodiorite outcrop on the east margin where they intrude Takla Volcanics and, progressing southwestwards, monzonite, granodiorite, and quartz monzonite with some granite, are respectively exposed.

Within Duckling Creek map-area a northwesterly-trending syenite complex, Duckling Creek Syenite Complex, is mapped by Garnett. This body extends for approximately 20 miles and ranges in width from 2 to 3 miles. It is characterized by presence of microcline perthite but shows broad textural and mineral-mode diversity (Garnett, 1972).

All the above-mentioned sediments and volcanics have been folded and faulted to varying degrees. General orientation of the formations parallels the northwesterly-trending long axis of Hogem batholith.

The major fault zones also trend northwest. Pinchi Fault Zone is considered to be the most important with an overall length of 150 miles. This fault zone represents the trace of intense eastward thrusting in which Permian sediments were thrust against Mesozoic volcanics and intrusions. All rocks of Pinchi Fault Zone are intensely sheared, crushed and hydrothermally altered. Many steeply-dipping faults occur within and adjacent to this zone and these are presumed to join one thrust zone at depth. Rocks of Cache Creek Group and of Takla Group are generally schistose and altered, with most intense alteration adjacent to Omineca Intrusions.

3. GEOLOGY OF THE MAP-AREA

A. GENERAL STATEMENT

Three main rock types comprise the bulk of outcrop exposed in the map-area. Most abundant of these is leucocratic granitoid rocks of Hogem batholith. Lesser amounts of syenite and pyroxenite are exposed.

Most of the granitoid rocks tend to the composition of an adamellite or, according to Streckeisen's classification (Streckeisen, 1967), a quartz-bearing monzodiorite. This rock type outcrops to the north and east of the map-area and is generally fresh to moderately altered, medium- to coarse-grained and, for the most part, massive. Another variety of granitoid rock is distinguished. It is generally finer-grained than the quartz-bearing monzodiorite and is identified by this feature in combination with the presence of euhedral prismatic pyroxene, the absence of quartz and the presence of strong mineral alignment (particularly of pyroxene). Outcrops of this rock type are generally confined to the south and west of the map-area.

Syenite and pyroxenite are generally spacially related within the map-area but isolated bodies of either may be found. They are exposed as irregular bodies of varying size. A complete mineral composition gradation exists between the foliated holomafic pyroxenite and holofelsic syenite and while the "end members" are in some places identified on the map (Fig. 3) the intermediate varieties ("melanocratic and mesocratic pyroxenite") are not.

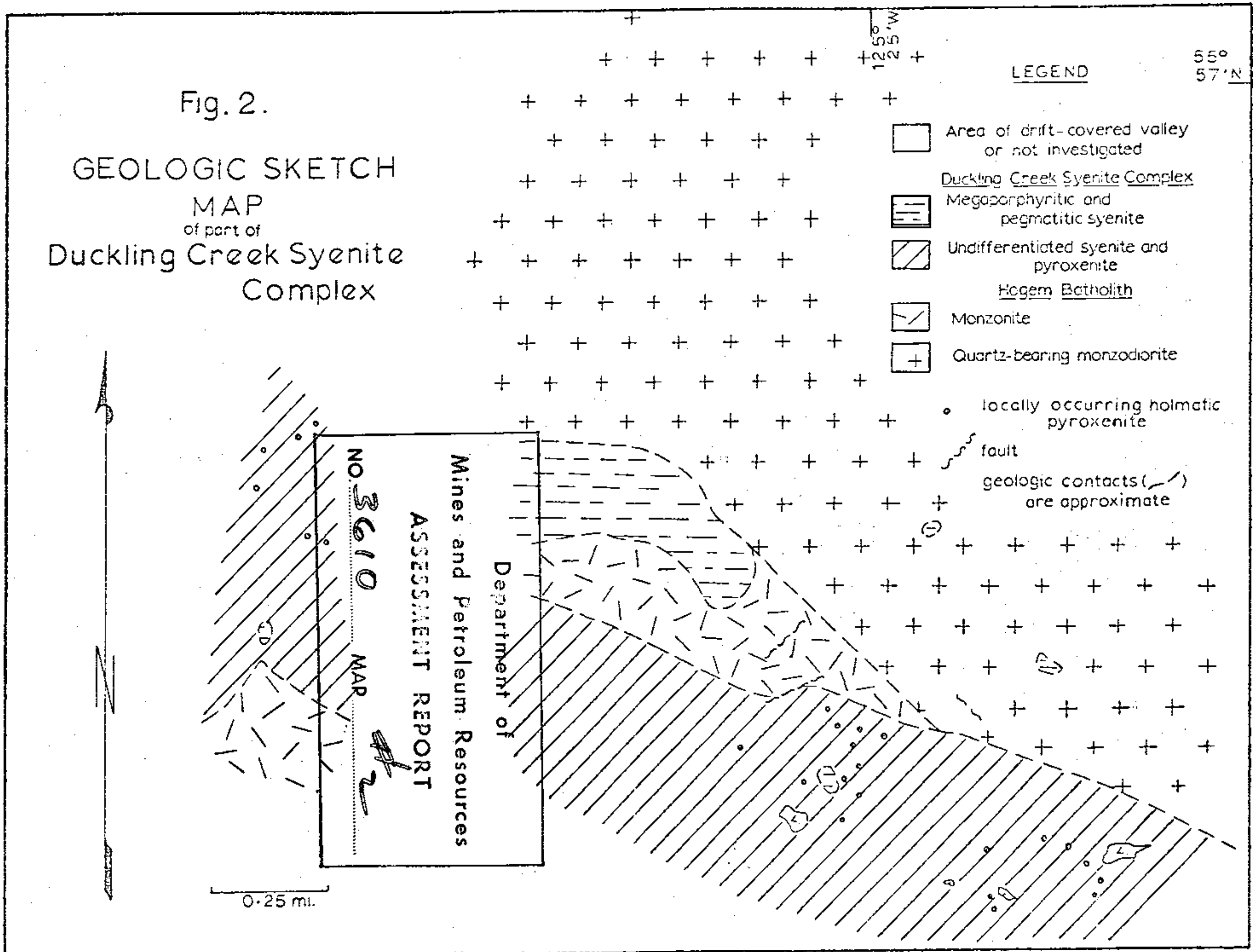


Fig. 2.

GEOLOGIC SKETCH MAP of part of Duckling Creek Syenite Complex

Other rock types include bodies of monzonite and monzodiorite which are variously contorted, layered and gneissose and locally show variations from fine- to coarse-grained textures. These rocks are hereinafter referred to as "flow-form monzonites". They are spacially related to bodies of pyroxenite.

Dykes and stringers of pink to cream-coloured aplite rock of syenitic to granitic composition, which cut all rock types mentioned above in the area, are ubiquitous and are abundant near coarse- and medium-grained syenites. Only sampled exposures of this rock type are indicated on the map.

Fine-grained dykes, commonly porphyritic with plagioclase and/or hornblende phenocrysts are common and cut all rock types in the map-area. These dykes are of variable composition and latites, dacites and rhyolites are included (Garnett, 1972). They are designated collectively on the map as Unit PD.

The map-area is divided into two major mapping units; Hogem granitoid rocks (Unit HG) and Duckling Creek Syenite Complex (Unit SC). The following rock types are included within the map boundaries of the Complex; pyroxenites, variable-textured syenites and monzonites with less common coarse-grained monzodiorites (all of which are locally porphyritic with phenocrysts of alkali feldspar), and flow-form monzonites. Rock types within this unit are gradational into one another in many places.

A description of rock types present in the mapping units follows this section.

Within the map-area, syenites, which cut pyroxenite and Hogem granitoid rocks, are in turn cut by aplite and porphyritic fine-grained dykes. The syenites are cut by quartz, potassium-feldspar veins which in some places exhibit open space grown colonies of singly terminated quartz crystals.

The area exhibits evidence of extensive and locally intense hydrothermal alteration. Veins and stringers of bleached granitoid rock along fractures and minor development of epidote, in stringers, veins and pods, is widely observable. Saussuritization and albitization of granitoid rocks are especially evident in stained slabs. Chloritization of mafic minerals is not complete in the granitoid rocks and leucocratic syenite rocks but is locally prominent. Secondary biotite is a locally obvious feature of most rock types in the map-area.

Figure 2 illustrates the gross features of the geology of the area while in Figure 3 (in pocket) more detail is presented.

B. HOGEM GRANITOID ROCKS (MAP UNIT HG)

(i) Hogem Quartz-Bearing Monzodiorites (Map Sub-unit HG_q)

A large portion of the map-area is underlain by quartz-bearing monzodiorite. This rock type is leucocratic, grey, medium-grained, hypidiomorphic-granular. Generally, it is massive with widely spaced joints. A weak foliation is evident, however, on close inspection. Xenoliths of fine-grained, grey to greenish rock of intermediate (?) composition exhibit varying degrees of roundness and assimilation by the monzodiorite and phenocrysts of feldspar within the xenoliths are commonly evident.

Modal compositions of fresh specimens of these rocks derived from rough point counts (200 points) on slabs from 10 hand specimens, etched with hydrofluoric acid and stained with sodium cobaltinitrate are: quartz 8-19%, av. 14.4%; potassium feldspar 15-28%, av. 21.2%; plagioclase 40-55%, av. 48.1%; mafic minerals (including magnetite) 14-19%, av. 16.2%. Accessory minerals include apatite, sparse to locally abundant sphene and ubiquitous magnetite. All granitoid specimens strongly attract a suspended 'pencil' magnet.

In these specimens plagioclase, which is subhedral to euhedral and which measures from less than 1 mm to 5 mm with an average long dimension of 3 mm, forms the framework. Quartz is invariably fine-grained (less than 2 mm), anhedral and interstitial between plagioclase and one of the other essential minerals. Commonly quartz is almost enclosed by grains of plagioclase. Alkali feldspar is evenly distributed as fine- and medium-grained anhedral blebs, interstitial amoung plagioclase and other essential minerals but also occurs, less commonly, as coarse-grained blebs which are hosts to islands of plagioclase.

In thin section, plagioclase commonly exhibits subhedral outlines and universally corroded grain-boundaries. Compositions, determined usually from commonly occurring Carlsbad-Albite twins, range between An_{35} and An_{45} with the majority about An_{38}.

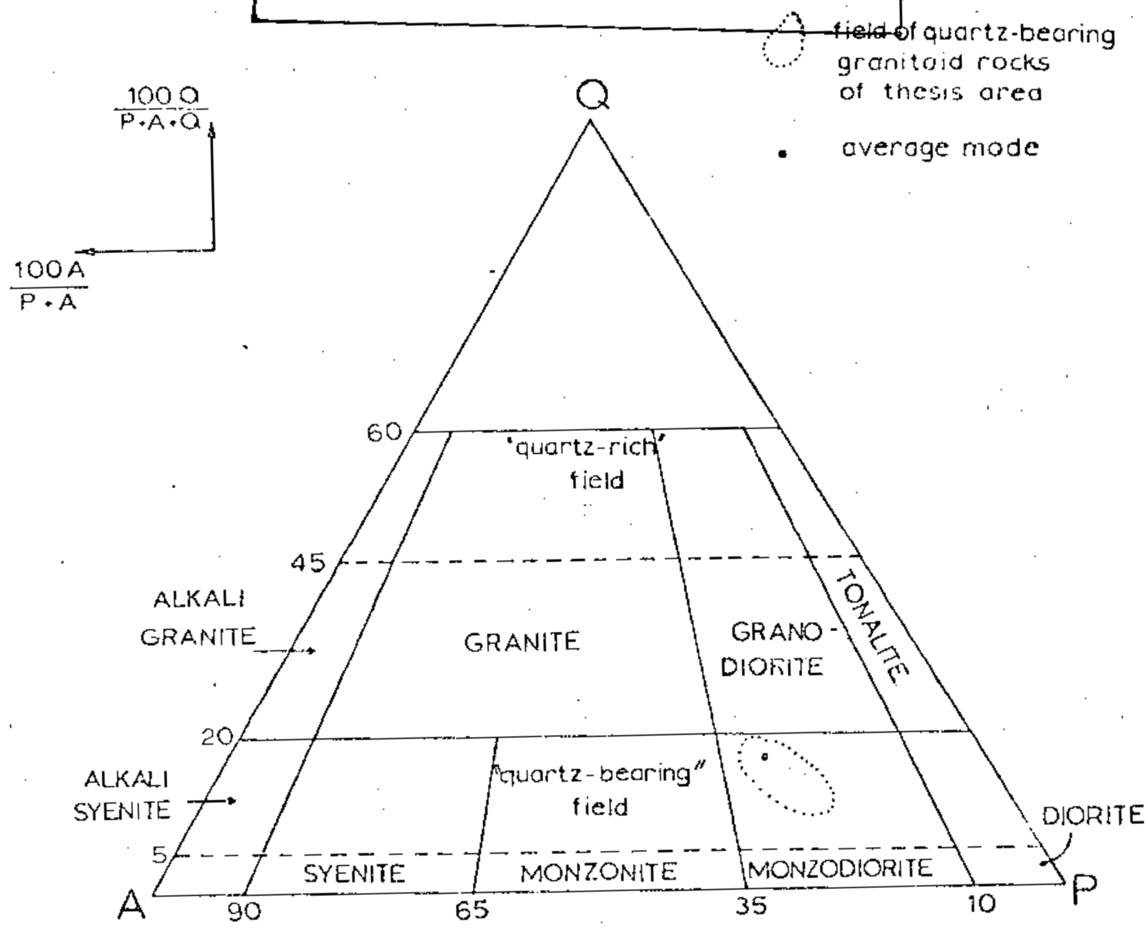


Fig. 3.

Classification of quartz-bearing granitoid rocks of thesis area using modified Streckeisen classification (Streckeisen, 1967).

(a) Hydrothermally altered quartz-bearing monzodiorite

To some extent all quartz-bearing monzodiorite rocks show the effects of hydrothermal alteration. In hand specimen the effects are manifest as white and creamy albite in contrast to the grey more calcic plagioclase and on a cut rock surface the intergranular textural relationships become less clear and often obliterated. Chloritization of mafic minerals is observable but is not obvious in general.

In thin section, saussuritization of plagioclase is obvious with calcic cores being more altered than albitic rims and albite twinning becomes "ghosted" and diffuse. In some grains flakes of sericite are observable in the cores together with abundant very fine-grained sericite and epidote. Within altered plagioclase very fine-grained, commonly euhedral opaques (magnetite) develop either as scattered grains or colonies and in severely albitized rocks this finely granular magnetite appears to be coextensive with fine-grained albite which occurs in "streams" around resistant quartz and less altered alkali feldspar. Brown semi-opaque (clay?) minerals occur as irregular stringers and blebs within the grains of alkali feldspar. Albite occurs more in blebs and rods in microperthite and is commonly exsolved along feldspar grain boundaries. Chlorite partly replaces hornblende, and sphene shows a concomitant increase with increase in chlorite and epidote. Finely granular calcite was observed in a fracture in one section.

In such altered rocks quartz locally becomes polygranular with sub-regular grain size and a quilt-textured extinction pattern.

in some grains extinction progresses from the rim of the original grain to the centre. This feature is noted in rocks proximal to syenite intrusions and near suspected faults.

Potassium feldspathized rocks show replacement of mafic minerals by deep brown clusters of biotite which are partly replaced by chlorite and in stained hand specimen alkali feldspar envelopes grains of quartz. The percentage potassium feldspar content of these rocks is distinctly increased but quartz remains approximately constant.

Such potassium feldspathized rocks seem to occur proximal to later porphyritic dykes in the area.

(ii) Monzonites (Map Sub-unit HG_m)

These rocks are generally finer-grained than the quartz-bearing monzodiorite. Quartz is universally rare but locally may occur up to 1%. The rocks are leucocratic, fine-to-medium grained with lesser volumes of coarse-grained, hypidiomorphic-granular and are comprised principally of plagioclase, alkali feldspar and pyroxene with some hornblende and biotite. The ratio of alkali feldspar to plagioclase ranges from 1:3.0 to 1:1.75 with the average about 1:2.0. Mafic content is generally about 16%. A striking feature of these rocks is the strong alignment of pyroxene.

Albitization and saussuritization are common characteristics of these rocks and the quality of the stain on rock slabs is a good indicator of the intensity of this alteration; stained surfaces show grey, rather than white, altered calcic plagioclase which may have yellow-green centres, and etching with HF accentuates the effects of chloritization of mafic minerals. Albitized rocks locally pass into diorite.

Alkali feldspar generally occurs in "strings", which partially envelope grains of plagioclase, rather than in blebs. Microcline occurs interstitially as fine, anhedral grains but may comprise up to 20% of the thin section. Otherwise, microperthite and cryptoperthite are the alkali feldspars.

Plagioclase determinations were obtained from some thin sections of these rocks and range from An_{35} to An_{42} with the average about An_{37}.

C. DUCKLING CREEK SYENITE COMPLEX (MAP UNIT SC)

Holomafic pyroxenite (Map sub-unit SC_p) and megaporphyritic and pegmatitic syenite (Map sub-unit SC_s) are described in this section. A description of syenites, pyroxenites and flow-form monzonites, not differentiated on the map, is included. All of these rock types comprise the Duckling Creek Syenite Complex map unit.

(i) Holomafic Pyroxenite

Holomafic pyroxenite is exposed on ridge tops near the centre of the map-area and in the valley floors as irregularly-shaped bodies which range up to a few tens of feet in length. Pyroxenite is spacially associated with syenites and flow-form monzonites. Holomafic pyroxenite, a green to greenish-black rock which commonly weathers to a coarse green sand, grades into more leucocratic pyroxenites.

In hand specimen the rock is strongly foliated and alignment of pyroxene grains is obvious. Biotite comprises up to 25% of the rock and some of the biotite lies athwart the plane of foliation. Magnetite is locally so concentrated in these rocks that compass measurement is severly affected.

In thin section the rock has an equigranular texture with grains of pyroxene and biotite from 1 to 2 mm in large dimension. Prismatic pyroxene is pale green to almost colourless, is moderately to weakly pleochroic and comprises 70-75% of the rock. The composition of this clinopyroxene (orthopyroxene is not observed in any pyroxenite thin section) is not determined.

Two phases of biotite are evident. The first which is post-pyroxene, is subhedral, strongly pleochroic from pale yellow-brown to medium-brown, and exhibits excellent cleavage traces. It comprises 15 to 20% of the rock. This phase tends to parallel pyroxene alignment. A second phase of biotite, which is greenish-brown, moderately to strongly pleochroic, has a mottled texture and shows poor development of cleavage, comprises up to two thirds of the biotite present in the rock. This biotite commonly replaces phase 1 biotite, to varying degrees, and partially replaces pyroxene, particularly along cleavage planes.

Sphene is a common accessory. Apatite is abundant and is typically poikilitically enclosed by pyroxene and biotite. Magnetite is abundant and comprises up to 5% of the rock.

(ii) Metaporphyritic Ortho- to Normal Syenite and Pegmatic Ortho-syenite (Map sub-unit SC_8)

Alkali-feldspar-rich rocks which range from pegmatitic pink orthosyenite to pinkish-grey megaporphyritic syenite which grades into monzonite, are commonly leucocratic and are in some places holo-felsic. Large areas of relatively homogeneously textured syenite exhibit megacrysts of alkali feldspar up to 10 cm in length, in a matrix of medium- and coarse-grained crystals. Orthosyenite pegmatite was also observed wherein mineral grains were commonly greater than 2 cm in length. A gradational contact between the north boundary of a large body of syenite megaporphyry to the east of the centre of air-photo BC:2063 (shown on Fig. 3) and Hogem granitoid rocks was observed. Mafic content remained approximately constant while phenocrysts and megacrysts of potassium feldspar decreased in amount, as the contact was traversed into exposures of Hogem granitoid rock. Exposure was essentially continuous across this contact zone. Contacts in some places are sharp between orthosyenite and pyroxenite but generally contacts are gradational. Biotite is in some places very conspicuous as the dominant mafic mineral. Flow structures in these rocks, particularly the alignment of alkali feldspar megaphenocrysts were seen.

In thin section, the megacrysts of alkali feldspar are seen to be microperthite and are generally twinned.

In the south-central section of the map-area a small body of pegmatitic orthosyenite is exposed and approximate contacts of this body are indicated on the geologic map (Figs. 2 & 3). An eastern contact of this body is sharp and syenite abuts pyroxenite over a space of less than 3 cm (the exact contact line was not seen). The pyroxenite in this location exhibits spectacular development of glomerphyric microcline.

The pegmatite is extremely well jointed and jointing is closely spaced locally. This feature combined with the large crystal size makes for difficulty in getting a hand specimen. The rock is holofelsic and generally salmon coloured on weathered surfaces.

(iii) Undifferentiated Syenites, Pyroxenites and <u>Flow-form Monzonites</u>

Syenites

These pink to pinkish-grey, (hypidiomorphic-granular) syenites in the Complex range from holofelsic to leucocratic varieties of normal and orthosyenite compositions and grade into one another. They occur in irregularly-shaped bodies and range in size from a few feet to many tens of feet in large dimension. Contacts between these syenites and the pyroxenite rocks (described below) are generally gradational but sharp contacts are observed where dykes and apophyses of syenite intrude pyroxenites.

Alkali-feldspar, plagioclase, biotite and pyroxene are the main mineral constituents of these rocks.

Pyroxenite

Undifferentiated pyroxenite rocks occur in the southern and western parts of the map-area. These green to pink and green rocks outcrop as irregularly-shaped bodies of varying size and grade from mesocratic and melanocratic varieties into leucocratic syenite and holografic pyroxenite. The principal minerals in these rocks are green pyroxene, biotite, and K-feldspar. Generally the textures are medium-grained and there is a regular distribution of K-feldspar through the rock as anhedral blebs. Near a pyroxenite-pegmatitic syenite contact, metacrysts of alkali feldspar in mesocratic pyroxenite give the rock a glomeroporphyritic texture. Phenocrysts of twinned, tabular alkali feldspar are regularly distributed as aligned euhedra from a specimen near the west central boundary of the map-area. Clusters of biotite also impart a glomeroporphyritic texture to some specimens.

In thin section the pyroxene is generally greener than that of the holomafic pyroxenite, though colour distribution is patchy. Some grains are notable for poor cleavage development, and these grains appear somewhat mottled. Many grains exhibit ragged boundaries. Some grains show rims of darker green mineral which has lower extinction angle than the body of the grain. This may indicate presence of aergerine molecule in the rims. All of these features of the pyroxene in these rocks become more marked with increased alkali feldspar content (of the rock).

Alkali-feldspar occurs as microperthite, cryptoperthite and commonly as microcline. The glomeroporphyry mentioned above has clusters of microcline which exhibit quadrille texture. Alkali feldspar occurs as vein-like aggregates of finely granular microperthite and cryptoperthite of less than 0.1 mm to optically continuous grains greater than 5 mm in large dimension which commonly replace pyroxene and both phases of biotite. Alkali feldspar is altered in many grains to a brown semi-opaque mineral distributed as strings and patches.

Two phases of biotite are evident. Phase 2 (as described in the section of holomafic pyroxenite) is generally more abundant than phase 1 and the ratio of abundance increases with increasing content of alkali feldspar in the rock. No thin section of these rocks contained more than 30% biotite and in most sections at least 5% was phase 1.

Small amounts of chlorite and epidote are observed as alteration products.

Plagioclase was observed in only one thin section and contributed less than 5% of the total rock in which alkali feldspar constituted 40%. A reliable optical determination gave the composition as An_{32}. Much of the plagioclase is albitized.

Apatite is more abundant in K-feldspar-rich pyroxenites and occurs as relatively large, often disaggregated ~~(broken-up)~~ grains as well as the commonly observed fine-grained subhedra and euhedra. Sphene likewise increases in amount and comprises up to 0.5% of the rock in some sections. It is generally subhedral.

Flow-form Monzonite

Irregularly layered greissose, and contorted rocks which are believed to have a bulk composition of leucocratic monzonite, are exposed, usually in intimate association with pyroxenite bodies. Locally the rock may be holofelsic monzonite (?) and juxtaposed with melanocratic monzonite (?). Some of the rocks are excellent gneisses. Stained rock slabs reveal high potassium feldspar content. Magnetite is present and generally recorded. In some instances this mineral occurs as veins up to 2 cm in width and traceable for 50 cm.

D. APLITE

Cream to pink to salmon-coloured rock of syenitic and granitic composition is observed in the map-area and is particularly common proximal to syenite bodies. The aplite may be as dykes, veins, or stringers.

Samples of this rock type when stained show anhedral alkali feldspar and quartz in wormy intergrowth. Plagioclase varies in amount to a maximum of about 30 per cent in the samples studied. Mafic minerals are generally less than 10 per cent of the rock and commonly less than 5 per cent. The rock contains appreciable magnetite.

E. PORPHYRITIC FINE-GRAINED DYKES (MAP UNIT PD)

In the map-area, greenish, pink, buff and grey to dark grey fine-grained dykes are generally porphyritic with feldspar and/or hornblende (?) phenocrysts - with the former predominating. The writer's accompanying map (Fig. 3) shows dykes exposed only in granitoid rocks but Koo (1968) indicates numerous such dykes in syenitic rocks.

These rocks are generally brittle and strongly fractured and, where exposed on ridge tops, are preferentially mass-wasted and usually found at the heads of rills in the ridges.

Foliation and, less commonly, incipient flow-layering are in some places evident in these rocks. The general trend of the dykes is NNE.

In the more common rock type, white to cream euhedral plagioclase makes up from 10 to 25 per cent of the rock. It varies in size from 2 mm to 5 mm and is set in a fine-grained matrix of intermediate to acid composition. Magnetite is generally present but varies in amount and is more prominent where hornblende phenocrysts are abundant. These phenocrysts range from 1 mm to 3 mm in size, and are generally subhedral to euhedral, green-black prisms.

Rock types include latite, dacite, and rhyolite (Garnett, 1972).

The rocks are in some places severely saussuritized and are dark coloured, ranging to grey-black with green plagioclase.

F. OTHER FEATURES OF THE GEOLOGY

Quartz veins, commonly with some alkali feldspar, cut syenite and, to a lesser extent, other rock types in the area. Quartz in these veins is commonly drusy with crystals up to 1½" (3.7 cm) in length having been observed. In some localities, quartz veins are densely crystalline quartz which irregularly splay, bifurcate and pinch and swell.

Chalcopyrite and pyrite occur sporadically over the map-area. These minerals are only rarely present, usually as individual grains, in the granitoid rocks. They occur in the syenites to a greater extent but remain patchily distributed and appear commonly as veinlets and stringers and fracture coatings. Individual grains and veinlets of bornite in the syenites and associated potassium feldspar-rich pyroxenites are occasionally observed. Pyrite in potassium feldspar-rich rocks was spectacularly evident in two localities. At the extreme north flank of the north-south trending ridge on the west part of the map area, disseminated pyrite in pyroxene syenite accounted for 10-15 per cent of the total rock. A similar rock type was noted on the ridge immediately above and to the east of the cirque lake in the south central portion of the map-area.

A blue asbestiform mineral, tentatively identified as riebeckite by X-ray diffractoneter analysis, was observed in both southern and western portions of the syenite-pyroxenite areas. It occurred on fracture surfaces and was only noted on talus blocks. Stilbite has been identified by Garnett (personal communication) as a fracture coating and vein mineral present in the area.

4. STRUCTURE

DISCUSSION

Cross-cutting relationships give the relative ages of some of the rock types in the area. Megaporphyritic syenite cuts monzonite and quartz-bearing monzodiorite as well as pyroxenite. Pegmatite syenite cuts pyroxenite. Aplite cuts all these rock types in the area and all the above rock types are cut by porphyritic volcanic dykes.

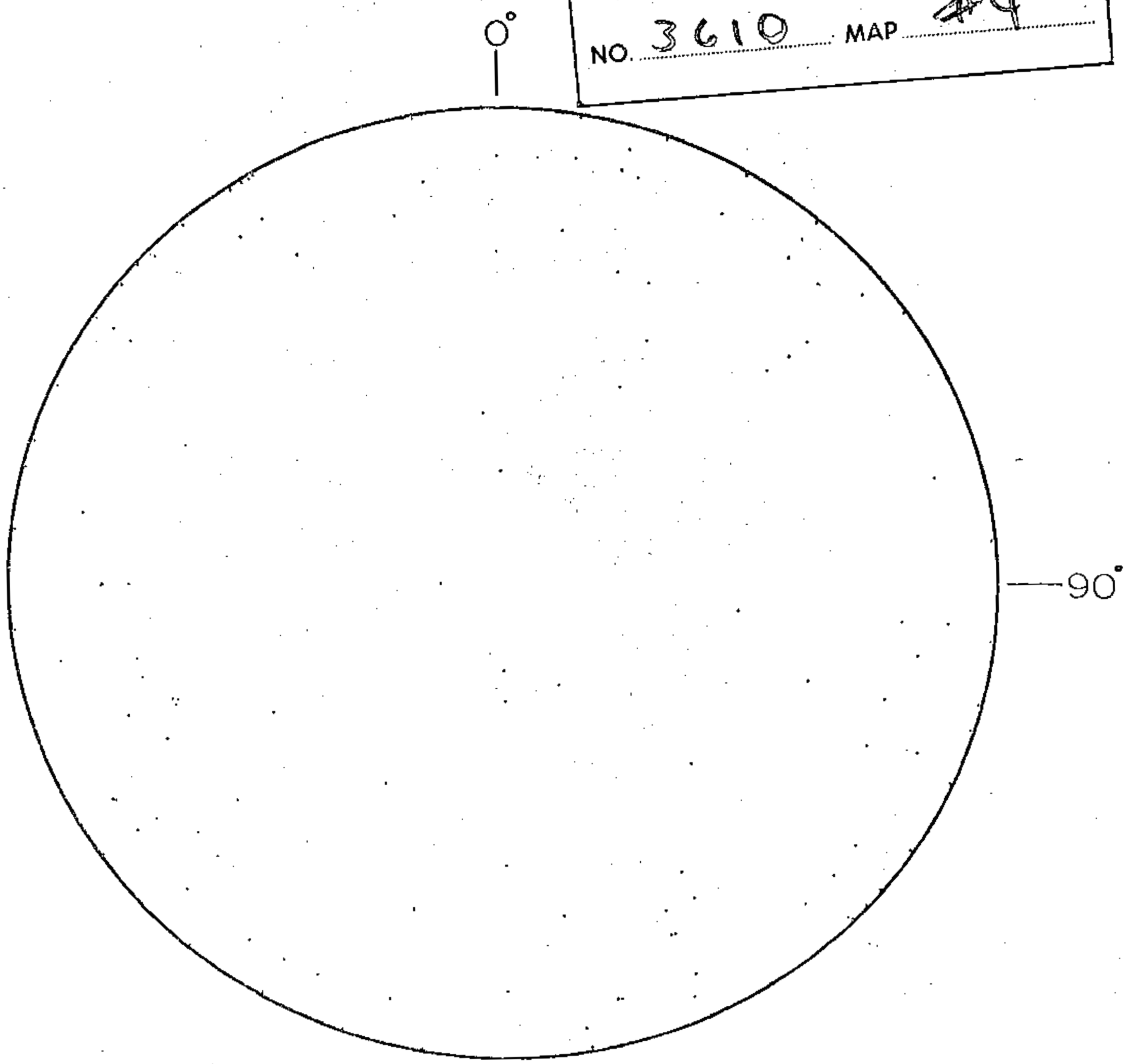
No certain age relation from cross-cutting has been obtained from the contact relation of pyroxenite and quartz-bearing monzodiorite.

Quartz-K-feldspar veins cut syenite rocks, monzonite, and quartz-bearing monzodiorite.

Contacts are sharp in some places but are gradational; a particular case being a part of the contact between megaporphyritic syenite and quartz-bearing monzodiorite. No sharp contacts between fine- to medium-grained monzonite and medium- to coarse-grained quartz-bearing monzodiorite were observed.

Faults in the area were mapped where a local topographic low coincided with observed slickensides or limonitized breccia. Three such fault zones are shown on Fig. 3. The trend of individual faults is inferred from the trend of air-photo linears in the immediate area. Koo (1968) indicated a number of major faults which trend slightly east and west of north and a third set which trends east-west. All are recorded as steeply- dipping.

FIGURE 4



STEREOGRAPHIC PLOT OF POLES TO FRACTURES IN MAP AREA (116 POINTS).

Jointing in the thesis area is indicated by the equal-area stereographic projection of 116 poles to fractures and joints shown in Figure 5. The plot shows weak to moderate maxima for NE-trending very steeply westerly-dipping joints and weak maxima for steeply northerly- and southerly-dipping, NW-trending joint sets. Joints with sub-horizontal attitudes are not represented in the stereographic plot, while they are commonly observed in the field

A very weak maximum of about 11 poles indicates a NNE-trending, steeply, westerly-dipping fracture set.

Foliation in the area as indicated particularly by alignment of mafic minerals was measured by Garnett (1972) and a generally consistent north-west trending, steeply-dipping set of foliation planes was evident over the general area of Duckling Creek. Foliation was only rarely recorded by the writer from observation in the map-area but a north-west trend is discernible. A closely spaced set of shear fractures in monzonitic rock on the extreme west-centre of the map-area was observed, the attitude of which is 135°/85°E.

The writer believes that local foliation trends, and gradational contacts lend credence to the assertion that, at least in some places, Hogem quartz-bearing monzodiorite was intruded while not completely crystalline by the perhaps partly crystallized megaporphyritic syenite.

5. PETROGENESIS OF ROCKS OF THE MAP-AREA

Hogem batholith, according to Armstrong, "apparently differentiated in place with a granodiorite core with syenodiorite or more basic rock forming a border zone from a fraction of a mile to several miles wide. The various rock types grade into one another". (Armstrong, 1949, p. 99). Roots suggested (Roots, 1954, p. 163) that the batholith represents a prolonged period of intrusion of differentiated magma. During investigation of "Lorraine Syenite" Koo derived an absolute age from analysis of biotite from a mafic-rich portion of the syenite. The age date of 170 $\pm$ 8 million years, Koo believed, represented the minimum age of the syenite rocks and the maximum age of the sulphide mineralization at Lorraine Property. He also suggested that this date marked the division of two separate phases of Hogem batholith (Koo, 1968 (b)). In recent work by Garnett this hypothesis is reportedly further confirmed by mapping. Diorite, monzodiorite, and syenite mapped by Garnett are exposed progressively southwestwards away from the batholith contact with rocks of the Takla Group and Garnett suggested that this sequence represents a series of intrusion from a differentiating alkaline magma. The syenites of this sequence are included within Duckling Creek Syenite Complex. The pyroxenite within the boundaries of the Complex could represent a cumulate phase of such an alkaline magma (Garnett, 1972). Koo claimed that the pyroxenite, which he termed "hypermelanic fenite", was formed by intense metasomatism of Hogem granitoid rocks (diorite) (Koo, 1968 (b). The pyroxenite, and its place in the petrogenetic scheme, is of considerable interest and what follows is a discussion on these points.

A number of interpretations on the origin of the pyroxenite are possible. These include consideration of the pyroxenite as:

1. Hypermelanic fenite,
2. Batholithic-margin early intrusive,
3. Cumulate batholith phase.

1. Hypermelanic fenite:

Koo stated (Koo, 1968, (b), p. 37) that "...Essentially all minerals in the diorite country rock were replaced gradually by green soda-pyroxene (aegerine-augite or aegerine) and/or alkali feldspar with minor amounts of accessory minerals such as apatite and sphene. The most intense fenitization created the mafic fenite."

Fenitization is a common phenomenon around alkaline igneous complexes. In a comprehensive study, McKie (1966) showed that in broad terms this metasomatic process involves removal of silica with addition of large amounts of alkalies and lesser amounts of Fe, Ca, Mg. Commonly the increase in alkalies is almost entirely due to Na_2O but examples are known where K_2O increases together with Na_2O.

The production of pyroxenite by intense fenitization of granitoid rocks has been documented by v. Eckermann (1966) in the course of his investigation of the Alnö alkaline complex. Here v. Eckermann showed that there is a metasomatic gradation such that the virtually unaffected granites peripheral to the complex grade into syenite and pyroxenites while the core rock type is carbonatite. The carbonatite, V. Eckermann believed to be intrusive and the source of the metasomatizing fluids. At Alnö the pyroxene of the pyroxenite is aegerine-rich and shows low extinction angles ($x \wedge c$).

An implication of metasomatically formed pyroxenite is that pyroxene would replace plagioclase and quartz of Hogem granitoid rocks (See Deer, Howie and Zussman, 1963, Vol. 2, p. 89). Nowhere in the thin sections examined was this phenomenon observed. In fact, pyroxene was noted to be either: relatively stable (in the pale-green augitic variety of holomafic pyroxenite, being replaced by alkali feldspar or being replaced by moderate amounts of aergerine-augite.

Surely a complete gradation between fenitization and K-feldspathization would exist. It follows then that an arbitrary distinction may be made and, since many features of classical areas of fenite are not present in the map-area and detailed chemical analyses of rocks (generally necessary to prove that fenitization took place) are not available and since later alteration has probably obscured earlier local-equilibrium mineral assemblages, the rocks of the map-area, where severely metasomatized by alkaline fluids, are considered to have been K-feldspathized rather than fenitized.

2. Batholithic-margin, early-phase intrusive:

In discussing the origin of mafic-rich bodies within Hogem batholith in Aiken Lake map-area, Roots (1954, p. 174f) stated that "...the hornblende appinite-hornblende diorite series, together with biotite pyroxenite and related rocks, constitute a distinctive intrusive rock assemblage of wide distribution. Such assemblages, to which the melanocratic, quartz-free rocks of the Omineca intrusions belong, are typically found in orogenic regions, and generally occur marginally to granitic batholiths or as inclusions within acid rocks."

While the similarities between Tutizzi Lake body (Roots, 1954) and Duckling Creek holomafic pyroxenite, as well as textural similarities between an Omineca ultramafite and map-area pyroxenites suggest that the map-area pyroxenites are related to the early phase intrusives of Aiken Lake map-area, the absence of primary plagioclase in pyroxenite of the writer's map-area militates against the likelihood that these rocks were intrusive, in the normal sense of this term, although they are igneous.

Lamprophyric dykes which are characterised, in part, by absence of feldspar are known (see Harker, 1954, p. 126-134). However, the absence of matrix in holomafic pyroxenite of the map-area belies the usefulness of consideration of such an origin.

3. Cumulate batholith phase:

It is possible that the holomafic pyroxenite is a product of Duckling Creek Syenite Complex protomagma (Garnett, 1972). Strong alignment of pyroxene is interpreted as primary flow-texture (see Thayer, 1963) in the pyroxenite and is compatible with this possibility. The absence of plagioclase as a primary mineral implies that the pyroxenite represents a cumulate phase of a magma wherein only clinopyroxene was being deposited. Primary biotite was formed from interstitial fluid, possibly much later than pyroxene. Variably textured monzonites and gneisses (flow-form monzonites) near pyroxenite bodies could then be interpreted as hybrid rocks which represent the progress of assimilation and invasion of pyroxenite by leucocratic phases of Hogem batholith.

The results of Cr analyses of magnetite (tabulated below) are interpreted as supportive evidence that the pyroxenites of the map-area are altered igneous rocks, originally relatively high in Cr content such as would be the case if the rocks formed as early crystal-differentiates of a magma.

Magnetite was concentrated from holomafic pyroxenite (75% pyroxene), from mesocratic pyroxenite (40% pyroxene), and from a composite sample of Hogem quartz-bearing monzodiorite. The table below shows Cr content for the respective samples.

Holomafic pyroxenite	1300 ppm Cr*
Mesocratic pyroxenite	1500 ppm Cr
Quartz-bearing monzodiorite	460 ppm Cr

* Analyst: P. Kempe, Mineral Engineering Dept., Univ. of B.C.

The very fine exsolution lamellae within pyroxene in holomafic pyroxenite of the map-area, together with the zoning of this mineral noted in these rocks, may be interpreted as evidence of relatively rapid cooling at high temperatures (see Deer, Howie and Zussman, 1966, p. 125, and Deer, Howie and Zussman, 1963, Vol. 2, p. 131). Relatively rapid cooling of holomafic pyroxenite might have been possible had a crystal-mush of clinopyroxene cumulate been squeezed into Hogem granitoid rocks. The thermal difference between the two rock masses may have been considerable and this, together with the action of volatiles, could have contributed to plastic deformation of the granitoid rocks in the immediate area of the pyroxenite. This provides another possible origin for the flow-form monzonites spacially related to pyroxenite.

The writer believes that the most acceptable explanation for the origin of holomafic pyroxenite of the map-area is that this rock type represents a cumulate phase of part of Hogem batholith. The age of the pyroxenite relative to Hogem granitoid rocks of the map-area is uncertain. The flow-form monzonites are believed to either; (i) represent the extent of invasion and assimilation of pyroxenite by Hogem granitoid rocks, or (ii) be Hogem granitoid which has been plastically deformed through the combined agencies of temperature and presence of volatiles. In the event that the latter case is true, local fenetization of Hogem granitoid may have resulted (see Currie and Ferguson, 1971, p. 516).

Hogem Granitoid Rocks:

Hogem quartz-bearing monzodiorite and Hogem monzonite have about the same range of plagioclase composition (An_{35}-An_{45}). The plagioclase content of each rock type is comparable (45-50%) and the mafic mineral content of both rock types is about 16%. The dominant mafic mineral in the relatively finer-grained Hogem monzonite is augitic pyroxene while uralite is dominant in Hogem quartz-bearing monzodiorite. Transitional rock types are observable.

To the north of the map-area, Pearse (1971) mapped diorite dykes which are mineralogically similar to Hogem monzonite and contain abundant, aligned, prismatic augite.

It is probable that the uralite resulted from alteration by fluids associated in time with alkali metasomatism and that, therefore, the pyroxene of Hogem monzonite is primary. The even distribution of fine-grained aligned, prismatic pyroxene of Hogem monzonite, in contrast to the medium- to coarse-grained and irregularly distributed blebs of uralite in Hogem quartz-bearing monzodiorite, suggests that these rock types are separate phases of Hogem batholith (with a gradational contact between them). Mapping supports this suggestion since the dykes so mapped are probably related to Hogem monzonite. In the map-area, pyroxenite is spacially associated with Hogem monzonite and the latter may have been a quartz-bearing rock now hybridized as a result of reaction with holomafic pyroxenite.

K-feldspathized Rocks of the Map-area:

Rock types considered in this discussion include all of the rock types named in this section to this point, viz. holomafic pyroxenite, flow-form monzonite and Hogem granitoid rocks (both quartz-bearing monzodiorite and monzonite). As well, K-feldspar-bearing pyroxenites ranging from melanocratic to mesocratic varieties, together with leucocratic, pyroxene-bearing syenites, are discussed. In Hogem quartz-bearing monzodiorite, some samples, which were virtually unaffected by late hydrothermal fluids, exhibit textural features which indicate some alkali-feldspar formed later than quartz. Primary biotite is not present in granitoid rocks of the map-area.

The writer believes that locally, Hogem granitoid rock, originally quartz-bearing diorite (or quartz-bearing monzodiorite with relatively low K-feldspar composition), was relatively permeable and that here the rock was hybridized by K+-rich solutions, which streamed through the crystalline mush, forming late alkali-feldspar. In the rocks where this phenomenon was more intense, quartz was removed and the resulting rock was monzonitic in composition. Garnett (personal communication) suggested that this removed quartz appears as veins in syenite. Sericitization of plagioclase probably accompanied K-feldspathization.

The microcline which formed as a result of potassium metasomatism is tartan-twinned indicating that the mineral formed first as orthoclase and inverted upon cooling to microcline (Barth, p.). The augitic pyroxene of Hogem monzonite was relatively stable during alkali metasomatism.

Clino-pyroxenite and flow-form granitoid rocks were K-feldspathized to produce a wide range of clino-pyroxene-K-feldspar-biotite rocks and flow-form monzonites respectively. With increasing addition of K-feldspar to pyroxenite, the rock becomes pyroxene syenite.

Biotite and pyroxene are stable in these pyroxenites and syenites, although biotite is commonly the only new-formed mafic mineral. The absence of stable amphibole may be attributed to low aAl^{3+} during alkali metasomatism and the modest amounts of aegerine-augite suggests low aNa^{+}.

In the later stages of metasomatism it seems probable that aK^{+} was declining and that, therefore, aNa^{+} was increasing relatively. Locally, where aNa^{+} exceeded aK^{+}, albite was formed and a diorite resulted where otherwise the rock would have been monzonitic. Albitized rocks are more common toward the centre, south and west of the map-area and are commonly sericitized as well. The intensity of this alteration is less farther north and east in the map-area; that is, farther down the presumed temperature gradient.

Magmatic Syenites and Aplite:

Magmatic syenites are more common in the centre of the map-area but pyroxenite-contaminated syenite is present farther south. A pegmatitic variety has sharp contacts with pyroxenite but some parts of the contact between megaporphyritic syenite and Hogem granitoid rock are gradational. There is a gradation between metasomatic syenites and magmatic syenite. Following intense feldspathization of granitoid and pyroxenite rocks, these rocks were intruded by pegmatitic and megaporphyritic syenites producing additional but local K-feldspathization at the contact. Intrusion of aplite dykes, veins and stringers followed emplacement of syenites.

The gradational contact between megaporphyritic syenite and Hogem granitoid rock suggests that the former was emplaced in the latter while both were semi-crystalline or that the thermal difference between the two bodies was not great at the time of emplacement.

Late Alteration:

In the map-area there has been a complete sequence of pre-magmatic, through magmatic and deuteric to late hydrothermal metasomatism. The results of these alterations have overlapped and separation of assemblages which have resulted from alkali metasomatism and antithetic hydrogen metasomatism (see Meyer and Hemley, 1967 and Hemley and Jones, 1964) would be difficult. Overlapping effects of syenite intrusions immediately north and south of the map-area further complicate patterns of alteration.

Stilbite and riebeckite, found on fracture surfaces of Duckling Creek Syenite Complex rocks, probably are representative of the latest alkaline alteration fluids. Propylitic assemblages, characterised by the presence of epidote formed after saussuritization of plagioclase and by chloritization of mafics (including biotite which locally replaces amphibole), are widely evident in granitoid rocks. Much saussuritization accompanied the emplacement of late, fine-grained porphyritic dykes which are locally autometasomatised.

6. SUMMARY AND CONCLUSIONS

Rock samples collected from the map-area in summer 1971 were examined in hand specimen and some in thin section. The map-area was divided into two major mapping units, viz. Hogem granitoid rocks and Duckling Creek Syenite Complex. Within Hogem granitoid rocks, two rock types, quartz-bearing monzodiorite and monzonite, were distinguished. Duckling Creek Syenite Complex consists principally of holomafic pyroxenite, K-feldspathized pyroxenites which grade into metasomatic syenites, and magmatic, commonly porphyritic to pegmatitic syenites. Lesser amounts of flow-form monzonites and monzonite are included in the map-boundaries of the Complex.

Holomafic pyroxenite, a cumulate phase of Hogem batholith, was emplaced in, or included by Hogem granitoid rock and the addition of pyroxenite caused hybridization of Hogem quartz-bearing monzodiorite in the vicinity of pyroxenite; foliated diorite, or monzonite, resulted. Locally, flow-form monzonites were formed at the contact of pyroxenite with Hogem granitoid rock - either as a result of invasion of pyroxenite by granitoid rock or, if holomafic pyroxenite was relatively hot when emplaced, as the product of plastic deformation produced through the combined agencies of temperature and presence of volatiles acting on country rock.

All of the above rock types were, to varying extent, K-feldspathized by fluids which preceded and accompanied emplacement of magmatic syenites. The lack of chilled contacts between rock types mentioned so far implies that relatively high temperatures prevailed. K-feldspathization took place above the temperature of orthoclase-microcline inversion. Late deuteric alkali metasomatism, which caused deposition of riebeckite and stilbite on fracture surfaces, was accompanied by deposition of rare stringers and veins of chalcopyrite and bornite and by dissemination of pyrite. Later hydrothermal alteration, with the waning of alkali metasomatism, became effectively hydrogen metasomatism and propylitic mineral assemblages were produced some distance from syenite contacts. Saussuritization of the country rocks probably accompanied emplacement of relatively rapidly-chilled, late porphyritic fine-grained dykes.

It is suggested that this report forms a basis for more detailed mapping in the area. The rock types described herein would make appropriate mapping units.

GEOCHEMISTRY

PURPOSE

The valley occupied by the northeast portion of the COL claim group drains easterly into the headwaters of the north branch of Duckling Creek. This valley area is practically devoid of outcrop and a geochemical survey was conducted as a practical prospecting tool in spite of the generally poor development of soil horizons.

METHOD

Soil samples were taken with a mattock at 200 foot intervals along tape and compass lines located 400 feet apart.

A brown-coloured, usually loose sandy soil occurs generally at depths of 6 to 10 inches. This was considered to be the 'B' soil horizon and, according to the soil samplers' reports, was the material taken for 95% of the soil samples.

Samples were collected in kraft paper bags, dried and sifted to -40 mesh.

Analysis for total copper and molybdenum content was done by Chemex Labs Ltd., North Vancouver, using hot acid extraction.

RESULTS & INTERPRETATION

The results of this survey are shown on Plate II, "Soil Sample Results".

Several apparently anomalous determinations for copper are accompanied by surprisingly high molybdenum levels. Results are somewhat erratic and have not been contoured.

In spite of the fact that no significant molybdenum mineralization was observed on this property, nor in the immediate district, it was our experience that anomalous molybdenum levels were obtained wherever significant copper showings were encountered.

The copper results above could be attributed to distribution of copper-bearing material from higher ground to the south and west in the Syenite Complex. However, the molybdenum levels, which average 17 ppm over an area 1200' x 2300', are worthy of further investigation.

CONCLUSION

It is suggested rock specimens containing copper mineralization be run geochemically for molybdenum content. Additional research should be done on soil conditions to determine the possibility of unusual concentration of molybdenum by chemical processes.

If the anomalous results appear to be valid, consideration should be given to further exploration of the underlying rock.

TABLE OF EXPENDITURES

Name	Position	Dates	Day Rate	Amount
C.P. Harivel	Geologist	June 27 - July 3) July 20 - Aug. 2) 21	$25	$525
T. James	Geologist	June 27 - July 3) July 22 - 25) 11	20	220
D. Brown	Assistant	July 20 - Aug. 2) 14	15	210
J. Ross	Assistant	June 27 - July 3) July 20 - Aug. 2) 21	15	315
J.C. Stephen	Field Supt.	July 21, 24, 28,) Aug. 2) 4	35	140
W.R. Bacon	Manager	July 24	100	100

Camp costs at $5/man-day for 62 man-days	$310
Geochemical analysis - 377 samples for Cu & Mo @ $1.50	565
Preparation air photo enlargements and 1" = 400' topographic map - McElhanney Associates	460
Proportion of helicopter time - Northern Mountain Helicopters June 24, July 22, 24, 26, 27, Aug. 2 - 4 hrs. @ $155	620
	$3,465

Declared before me at the City of Vancouver, in the Province of British Columbia, this 1st day of May 1972, A.D.

G. Phillips

A Commissioner for taking Affidavits within British Columbia or
A Notary Public in and for the Province of British Columbia.

SUB-MINING RECORDER

W.R. Bacon, Ph.D., P.Eng.

BIBLIOGRAPHY

Armstrong, J.E., 1949, Ft. St. James Map-area, Cassiar and Coast Districts, British Columbia; Geol. Surv. Canada, Mem. 252.

Bostock, H.S., 1940, Physiography of the Canadian Cordillera with Special Reference to the Area North of the Fifty-fourth Parallel, Geol. Sur. Canada, Mem. 247.

Currie, K.L., and Ferguson, J., 1971, A Study of Fenitization around the Alkaline Carbonatite Complex at Callander Bay, Ontario, Canada; in Can. Jour. Earth Sci., Vol. 8, May 1971, pp. 497-517.

Deer, W.A., R.A. Howie, and J. Zussman, 1963, Rock Forming Minerals, five volumes, Longmans, London.

Deer, W.A., R.A. Howie, and J. Zussman, 1966, An Introduction to the Rock Forming Minerals, Longmans, London, 528 pp.

v. Eckermann, H., 1964, The Pyroxenes of the Alno Carbonatites; in Internat. Mineralogical Assoc. Fourth General Meeting, Papers and Proceedings, pp. 126-139.

v. Eckermann, H., 1966, Progress of Research on the Alno Carbonatite; in Carbonatites (Tuttle, O.F., & Gittins, J., editors) Wiley-Interscience, London, 571 pp. (pp. 3-32).

Ferguson J., and I.C. Pulvertaft, 1963, Contrasted Styles of Igneous Layering in the Gardar Province of South Greenland; in Internat. Mineralogical Assoc. Third General Meeting, Papers and Proceedings, pp. 10-21.

Harker, Alfred, 1964, Petrology for Students; An Introduction to the Study of Rocks under the Microscope, 8th Ed., Cambridge, 283 pp.

Hemley, J., and W.R. Jones, 1964, Chemical Aspects of Hydrothermal Alteration with Emphasis on Hydrogen Metasomatism; in Econ. Geol., Vol. 59, 1964, pp. 538-469.

Koo, J.H., 1968 (a), Geology and Mineralization in Lorraine Property Area, Omineca Mining Division, unpublished report of work in progress, Univ. Brit. Columbia.

1968 (b), Geology and Mineralization in Lorraine Property Area, Omineca Mining Division, unpublished M.Sc. thesis, Univ. Brit. Columbia.

McKie, D., 1966, Fenitization; in Carbonatites (Tuttle, O.F., and J. Gittins, editors), Wiley-Interscience, London, 571 pp. (pp. 261-269).

Meyer, C., and Hemley, J.J., 1967, Wall Rock Alteration; in Geochemistry of Hydrothermal Ore Deposits (H.L. Barnes, editor); Holt, Rinehard and Winston, New York, 670 pp. (pp. 166-235).

Monger, J., and Hutchison, W.W., 1971, The Metamorphic Map of the Canadian Cordillera; Geol. Surv. Canada, Paper 70-33.

Roots, E.F., 1954, Geology and Mineral Deposits of Aiken Lake Map-area, British Columbia; Geol. Surv. Canada, Mem. 274.

Streckeisen, Albert L., 1967, Classification and Nomenclature of Igneous Rocks (Final Report of an Inquiry), Neues Jahrb. Mineralogie Abh, 107, 2, pp. 144-214.

Thayer, T.P., 1963, Flow-layering in Alpine Periodotite Gabbro Complexes; in Internat. Mineralogical Assoc., Third General Meeting, Papers and Proceedings, pp. 55-61.


COL 31
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COL 2
COL 1
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COL 52
COL 51
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COL 3
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5678 M
COL 12
GK 12
5919 G
5672 M
5673 M
5674 M
GK 11
5676 M
GK 10
N
Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
NO 3610 MAP #7
To Accompany Geological Geochemical Report
on the
COL CLAIM GROUP
Omineca Mining Division
by W.R. Bacon Ph.D. P.Eng
May 1 1972
LUC SYNDICATE
COL CLAIM GROUP
PRELIMINARY RECONNAISSANCE TYPE MAPPING
Compiled by
McELHANNEY SURVEYING & ENGINEERING LTD.
Vancouver, B.C.
SCALE 1" = 400'
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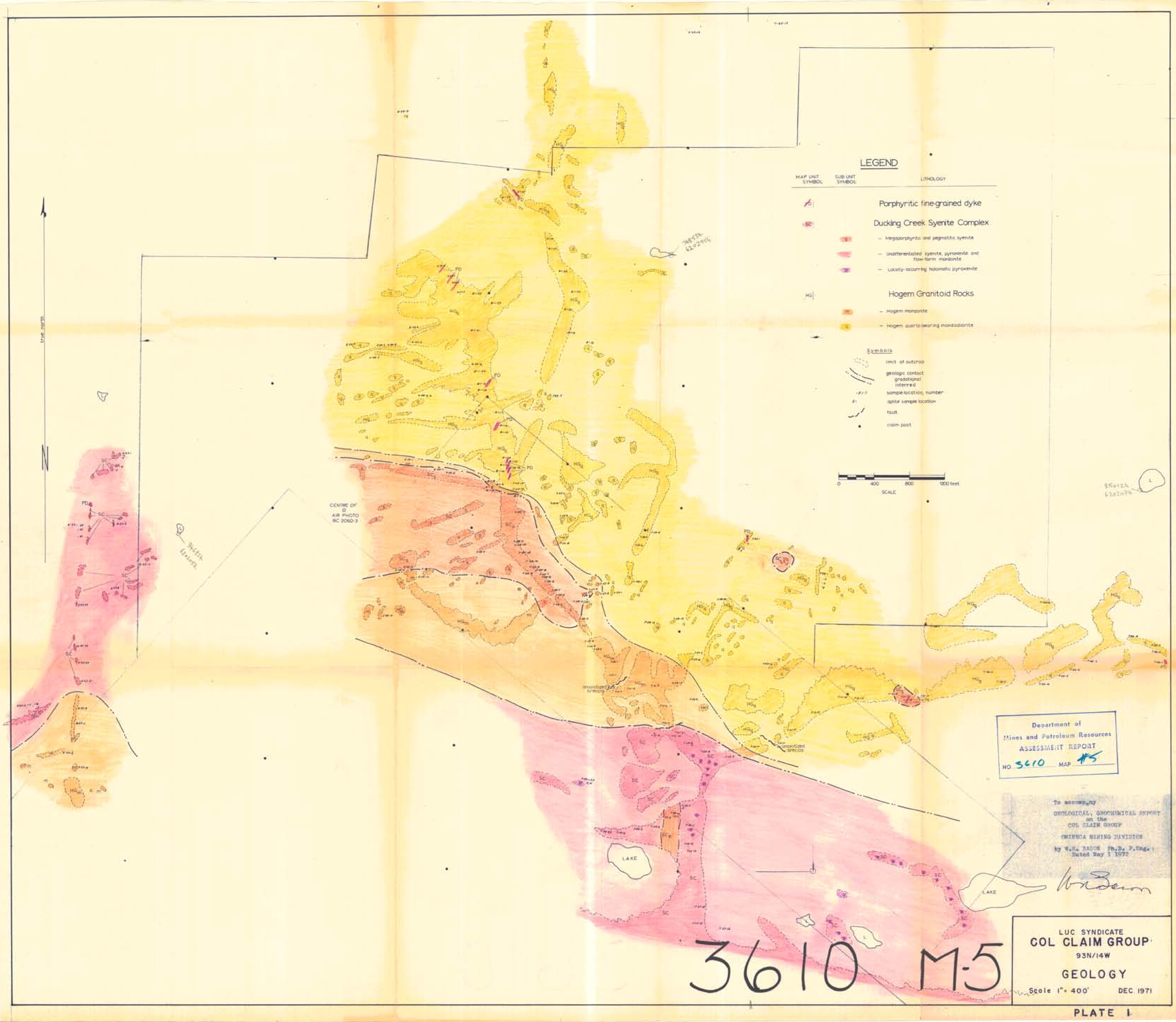
DATE July 3/1971
JOB NO. 05636-0
PLATE III



LEGEND
MAP UNIT SYMBOL
SUB UNIT SYMBOL
LITHOLOGY
Porphyritic fine-grained dyke
Duckling Creek Syenite Complex
– Megaporphyritic and pegmatitic syenite
– Undifferentiated syenite, pyroxenite and flow-form monzonite
– Locally-occurring holomafic pyroxenite
Hogem Granitoid Rocks
– Hogem monzonite
– Hogem quartz-bearing monzodiorite
Symbols
limit of outcrop
geologic contact
gradational
inferred
sample location, number
aplite sample location
fault
claim post
0
400
800
1200 feet
SCALE
true north
N
CENTRE OF AIR PHOTO BC 2060-3
LAKE
Department of Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 3610 MAP #5
To accompany
GEOLOGICAL, GEOCHEMICAL REPORT on the COL CLAIM GROUP
OMINECA MINING DIVISION
3610 M-5
LUC SYNDICATE
COL CLAIM GROUP
93N/14W
GEOLOGY
Scale 1" = 400'
DEC. 1971
PLATE 1

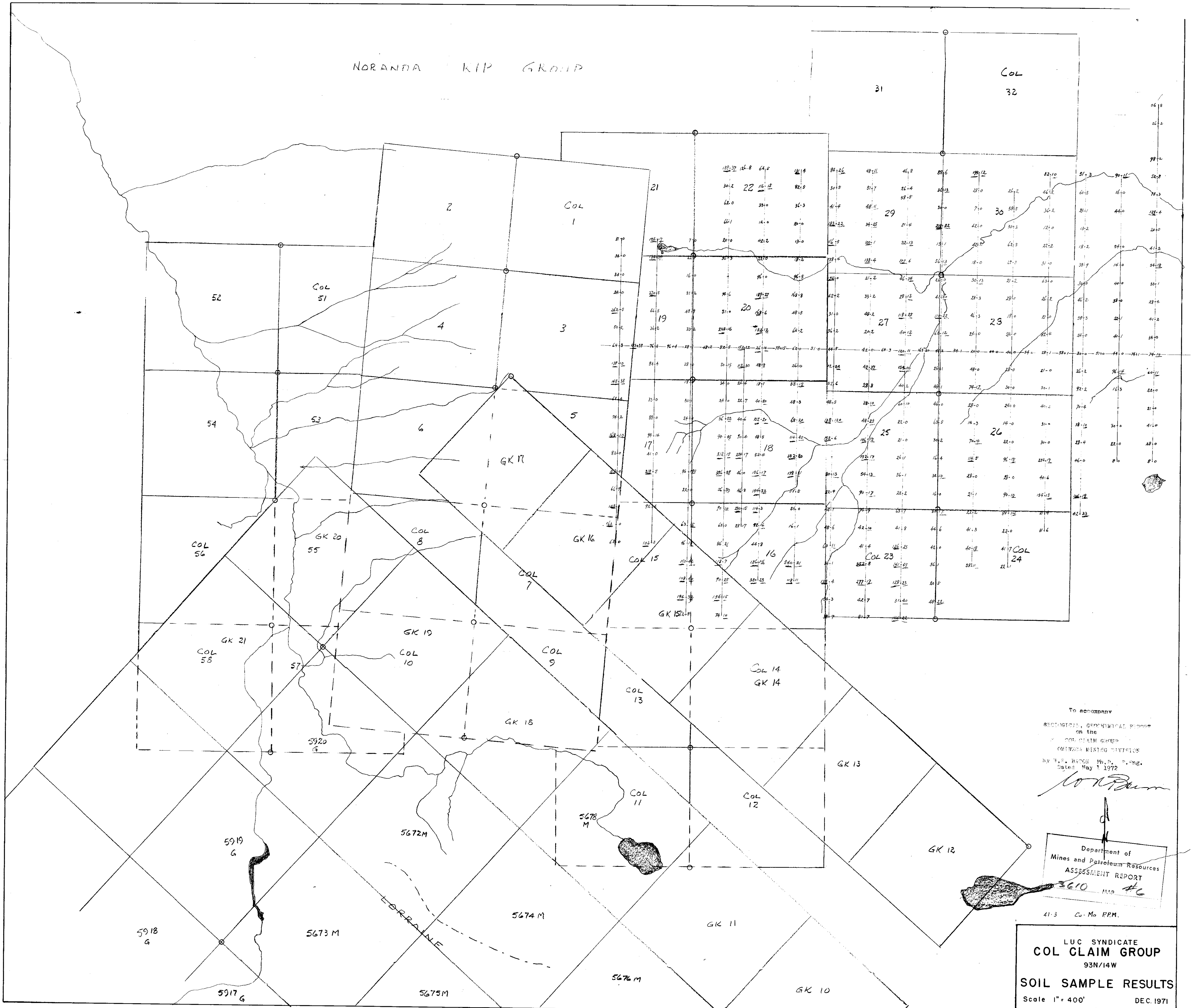

NORANDA KIP GROUP
To accompany
GEOLOGICAL, GEOCHEMICAL REPORT
on the
COL CLAIM GROUP
OMINECA MINING DIVISION
Dated May 1 1972
Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
3610 MAP #6
41·3 Cu-Mo P.P.M.
LUC SYNDICATE
COL CLAIM GROUP
93N/14W
SOIL SAMPLE RESULTS
Scale 1" = 400'
DEC. 1971
LORRAINE

PLATE II