FINAL REPORT 1971 PROGRAM
SALAL MOLYBDENUM MINES LTD.
SALAL CREEK PROPERTY
N.T.S. 92 J 14/W

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C.B. Campbell November/71

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FINAL REPORT 1971 PROGRAM

SALAL MOLYBDENUM MINES LIMITED

SALAL CREEK PROPERTY

LILLOOET MINING DIVISION, B.C.

LATITUDE 50° 45'N   LONGITUDE 123° 30'W

NTS 92 J 14W

CERRO MINING COMPANY OF CANADA LIMITED

C. B. CAMPBELL

NOVEMBER, 1971

LIST OF ILLUSTRATIONS

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SUMMARY

The Salal Creek Molybdenum Property is underlain by a differentiated granitic stock intruding the Coast Range Plutonic Complex. Much of the stock, which covers an area of approximately 35 square miles, is strongly iron and managanese stained and is intensely fractured.

Molybdenite in quartz veins, quartz + pyrite veins, 'dry' veins, along joints and, rarely, disseminated occurs in an arcuate zone 7 miles long by 1 mile wide. Swarms of acid dykes are concentrated in the central and south portions of this zone.

The best molybdenite occurrences are located along the most complex, irregular contacts between the coarse and fine grained phases of the stock (e.g. at Lost Creek and Float Creek).

Analyses of structures indicate a strong NE-SW preferred orientation within the area of best mineral occurrences (Trail Creek to Lost Creek). Molybdenite bearing quartz veins are dominantly controlled by this structural trend.

Wall rock alteration is more intense, within the same area, than anywhere else in the stock. A possible alteration zoning pattern has been detected which suggests that, between Trail Creek and Cornice Creek, a distance of 8,000 feet, a possible ore zone is being approached.

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Midway between Trail Creek and Cornice Creek, is Float Creek where molybdenite occurs throughout 1,500 vertical feet, and where molybdenite along joints and in minor stockworks becomes abundant at higher elevations.

In this area volcanic flows and ice obscure much of the stock above 6,750 feet. A strong possibility exists that molybdenite of ore grade occurs beneath the volcanic capping.

RECOMMENDATIONS

1. A minimum of 6,000 feet of diamond drilling should be carried out on the property. The target area is that portion of the stock underlying the volcanic and sedimentary sequence between Float Creek and the head of Trail Creek.

   Although this has always been considered the prine target area it has never been drilled, primarily because of the rugged nature of the south face.

   The writer recommends drilling at approximately 160^{o} azimuth, at -40^{o} from the head of Trail Creek for the following reasons:

   a) The orientation should best intersect an expected highly irregular contact and the north dipping vein sets.
   b) Drill set-ups and access should be straight forward.
   c) Water can be pumped either from
      1. Trail Creek - 2,000' SW and 700' below
   or 2. Big Creek - 7,000' NE, at approximately the same elevation.

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The first hole should be drilled until at least 200' of the coarse grained phase has been intersected. Contingent upon the decision to drill, the writer further recommends that:

2. A program of thin section study be carried out to examine the alteration more precisely.

3. The study of structural data collected in 1970-71 can be completed.

4. A legal survey be carried out on the Best, Bat, and Ball claims.

5. Discussions be held with interested parties in the Pemberton area on the possibility of contructing an access road on a shared-cost basis.

6. Depending upon timing of a drilling program the following additional work be carried out on the property:
   a) If snow levels permit, detailed mapping of the cirque area at the head of Trail Creek.
   b) Expansion of the rock geochemical study for trace metals to define zones of enrichment.
   c) Trenching program be conducted over the soil anomalies in the Lost Creek area.
   d) Further detailed mapping and rock geochemistry be carried out in the Red Hill area.

If the above work were carried out additional assessment could be applied and cash-in-lieu payments kept to a minimum.

INTRODUCTION

During 1971 a program of geochemistry, geophysics, and geological mapping on a scale of 1" to 1,000' was carried out on the Salal Creek Molybdenum property. The 1971 program extended detailed mapping, begun in 1970, to cover the entire Salal Stock and included reconnaissance geological mapping of ground acquired in 1970 to the south and southwest of the Salal Stock. In all, an area of approximately 40 square miles was mapped during the season. Geochemistry was limited to a small study of rock geochemistry, completed in May, and routine sampling of soil, silts, talus, and rock. An orientation ground magnetic survey was conducted over a small part of the property. Work in the field ended on September 27th, 1971.

Two crews of two men each were engaged in the mapping program. The number of personnel was increased from time to time as the need arose. (See Appendix 1).

Fly camps were established at a number of localities during the summer to allow access to various parts of the property. The camps were supplied and moved by chartered helicopter.

Rock samples for petrographic examination, grab and continuous chip samples for assay, and bulk samples from the various phases of the stock were collected during the season.

LOCATION AND ACCESS (See Fig. 1)

The Salal Molybdenum Property is located on Salal Creek, a tributary of the Lillooet River, approximately 40 miles by air northwest of Pemberton, B.C. It lies within typically rugged terrain of the Coast Range Mountains. Elevations within the property vary from 3,500' to 8,200'.

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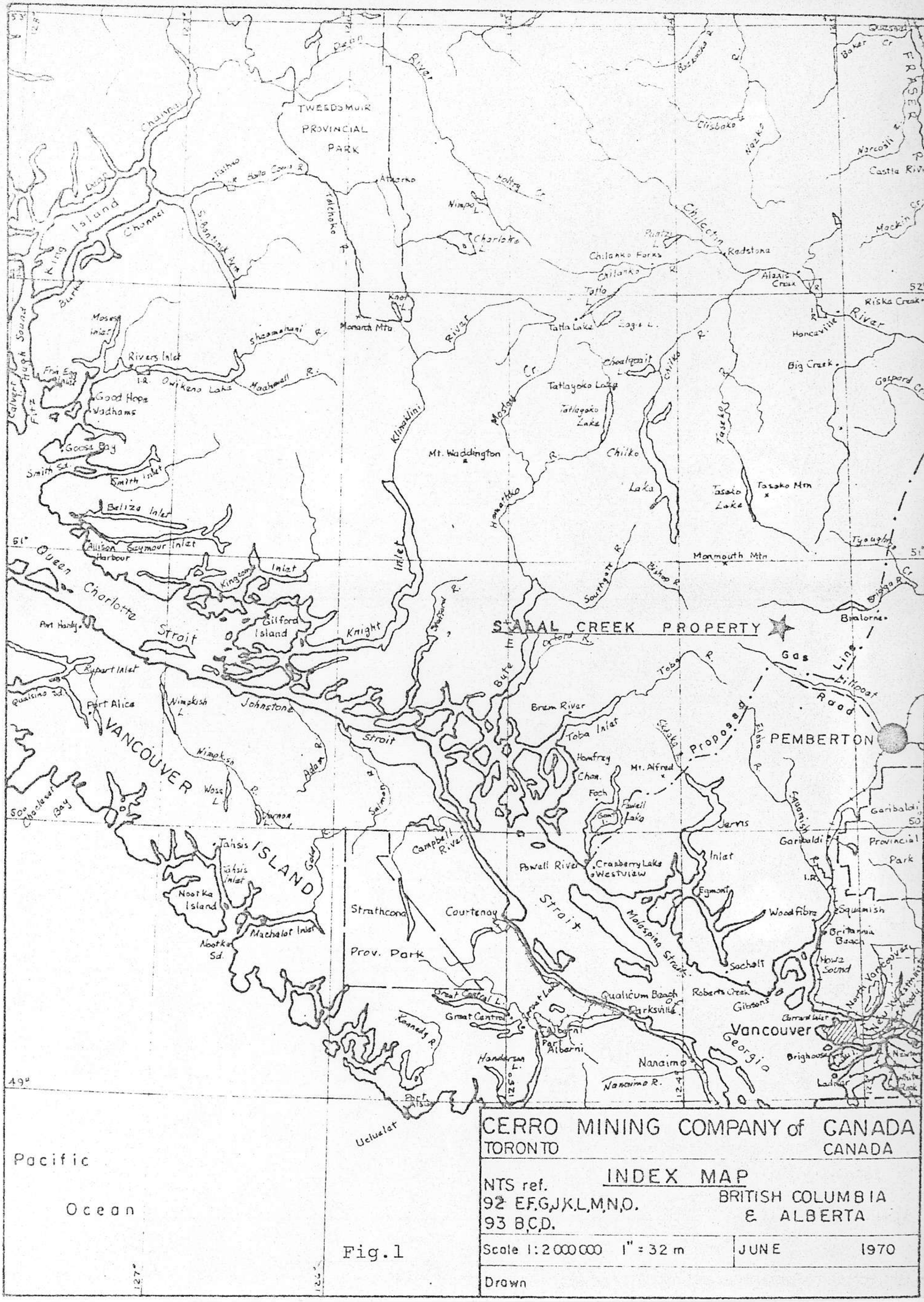
TWEEDSMUIR PROVINCIAL PARK
Dean River
Dean Channel
King Island
Burke Channel
Fitz Hugh Sound
Calvert
Atnarko
Talchako R.
Nimpo L.
Charlotte L.
Chilcotin
Puntzi L.
Chilanko Forks
Chilanko
Redstone
Alexis Creek
Riske Creek
Hanceville
River
Big Creek
Tatla Lake
Eagle L.
Chilko R.
Chaunigan
Tatlayoko Lake
Chilko Lake
Taseko Lake
Taseko Mtn
Taseko R.
Mosley Cr.
Homathko
Mt. Waddington
Klinaklini River
Knot L.
Monarch Mtn
Moses Inlet
Rivers Inlet
Owikeno Lake
Good Hope
Wadhams
Goose Bay
Smith Sd.
Smith Inlet
Belize Inlet
Allison Harbour
Seymour Inlet
Kingcome Inlet
Gilford Island
Knight Inlet
Queen Charlotte Strait
Port Hardy
Rupert Inlet
Port Alice
Quatsino Sd.
Nimpkish L.
Johnstone Strait
VANCOUVER ISLAND
Woss L.
Adam R.
Salmon R.
Tahsis Inlet
Nootka Island
Nootka Sd.
Machalat Inlet
Gold R.
Strathcona Prov. Park
Campbell River
Courtenay
Great Central L.
Great Central
Kennedy R.
Port Alberni
Henderson L.
Ucluelet
Qualicum Beach
Parksville
Nanaimo
Nanaimo R.
Georgia
Strait
Malaspina Strait
Bute Inlet
Southgate R.
Bishop R.
Monmouth Mtn
STAHAL CREEK PROPERTY
Orford R.
Toba R.
Toba Inlet
Brem River
Homfrey Chan.
Mt. Alfred
Powell Lake
Powell River
Cranberry Lake
Westview
Jervis Inlet
Egmont
Sechalt
Roberts Creek
Gibsons
Woodfibre
Squamish R.
Squamish
Britannia Beach
Howe Sound
North Vancouver
New Westminster
Vancouver
Brighouse
Ladner
Garibaldi
Garibaldi Provincial Park
PEMBERTON
Lillooet
Gas Line
Proposed
Road
Bralorne
Bridge R.
Tyaughton Cr.
FRASER R.
Baker Cr.
Castle River
Narcosli
Mackin Cr.
Gaspard Cr.
Chilcotin
Pacific Ocean
52°
51°
50°
49°
CERRO MINING COMPANY of CANADA
TORONTO CANADA
INDEX MAP
NTS ref.
92 E,F,G,J,K,L,M,N,O.
93 B,C,D.
BRITISH COLUMBIA & ALBERTA
Scale 1:2 000 000 1" = 32 m
JUNE 1970
Drawn

Fig.1

The lower parts of the property are heavily timbered to approximately 4,500'. From 4,500' dense bush is present but thins out until at approximately 6,000' only lichen, moss and occasional stretches of alpine grass are present. Above 6,000' much of the ground is covered by glacial debris and moraine. Numerous glaciers and permanent snow-fields exist on the property.

Outcrops are mainly confined to deeply incised creeks, prominent ridges and the steep southern face of the stock from Trail Creek to Cornice Creek.

Movement within the property is generally slow and at times hazardous due to the strong relief and fractured nature of the rock.

Access to the property is by helicopter from Pemberton Meadows 25 miles away. As in the past the Van Loon farm was used as a staging area for operations at Salal Creek. Movement of personnel and supplies was carried out using a Bell Jet Ranger chartered from Okanagan Helicopters.

COMMUNICATIONS

Communication was maintained with the Van Loon farm by means of Spilsbury Tindall SBX 11 single sideband, battery-operated radios. Within the property, walkie-talkie hand sets were used for a limited period. Their usefulness was, however, limited to direct line of sight communication.

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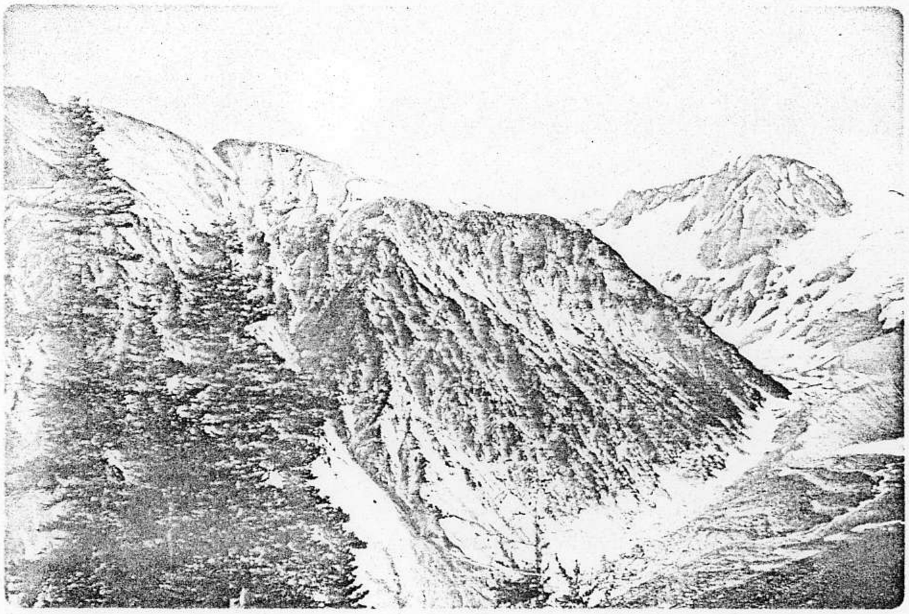
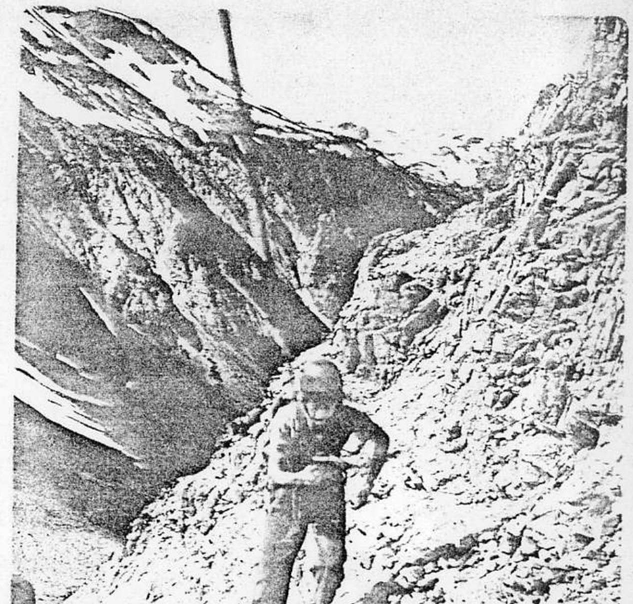


PLATE 1: GENERAL VIEW - FLOAT CREEK TO PINNACLE CREEK



PLATES 2 & 3: TRAVERSING FLOAT CREEK

PREVIOUS WORK

Work prior to 1970 within the Salal Creek Stock has been summarized in earlier reports (Mustard, 1966: Stephens, 1970a). In the past, diamond drilling has been carried out on the property by two companies. In 1964 Norpax Nickel Mines Ltd. drilled two holes. One set-up, within Float Creek, was forced to withdraw because of rock slides, the other set-up, at the base of the mountain, was too far from the target area and was abandonded. No significant results were obtained from either hole.

In 1966 Southwest Potash Corporation (American Metal Climax, Inc) drilled a total of 7,000' in eight holes, mainly for geological information. Drilling was carried out in four widely spaced localities (Glacier Island, Mud Lake, Plug Glacier, Big Creek). MoS_2 values were generally low. The best results were obtained from the Plug Glacier locality, below Red Hill. The Float Creek area was not drilled in 1966 because of adverse weather conditions.

During the winter of 1970 a preliminary petrographic report was prepared from a limited number of rock samples collected from the major rock types encountered during the 1970 mapping program (Stephens, 1970b). In addition, other samples were used in a geochemical program by Barringer Research Ltd. in order to attempt to trace the differentiation history of the Salal Creek pluton and to aid in locating a hidden ore body (Smee, 1971: Bradshaw, 1971). The results of these studies are referred to in a later section of this report.

Also during 1970, a 1" to 1,000' topographic map which includes most of the area of the Salal Creek Stock was prepared for Cerro Mining Company of Canada Limited by Lockwood Surveys Ltd. from aerial photographs and a previous claim survey.

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During the summer of 1970 silt and talus samples were collected from all of the streams draining Salal Creek stock. Subsequent analyses of these samples indicated several areas with anomalously high Mo and Cu concentrations. In October, 1970, claim staking by Cerro Mining Company of Canada Limited was undertaken to gain control of these anomalous areas. A total of 234 full size claims and 3 fractional claims were staked.

PROPERTY

The Salal Creek Molybdenum Property consists of the following 345 full size and 7 fractional Mineral Claims (see Fig. 2) all located in the Lillooet Mining Division.

CLAIM NAME	RECORD NUMBER
R 1-32	24121-24152
EE 1-15	24419-24433
EE 17-30	24435-24448
EE 31-47	24746-24762
EE 48 Fr.	27632
EE 49 Fr.	27633
Plug 9-12	25667-25670
Plug 19-24	25677-25682
Bat 1-6	33454-33459
Bat 7 Fr.	33460
Bat 8-9	33461-33462
Bat10-14	34151-34155
Bat 15 Fr.	34156
Bat 16 Fr.	34157
Ball 1-15	33463-33477
Ball 16 Fr.	33478

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CLAIM NAME	RECORD NUMBER
Best 1-14	34056-34069
Best 15-51	33937-33973
Best 52-68	34070-34086
Best 69-88	33974-33993
Best 89-104	34087-34102
Best 105-116	33944-34005
Beta 1-6	34006-34011
Beta 7-11	34103-34107
Beta 12-27	34012-34027
Beta 28-32	34108-34112
Beta 33-44	34028-34039
Beta 45-46	34113-34114
Beta 47-50	34040-34043
Beta 51-56	39115-34120
Beta 57-68	34044-34055
Beta 69-74	34121-34126
Berg 1 Fr.	34127
Berg 2-16	34128-34142
Berg 17-32	33921-33936
Berg 33-40	34143-34150

REGIONAL GEOLOGY

Little is known about the regional geology in the vicinity of the Salal Creek Stock. Regional mapping of the Pemberton 1:250,000 map sheet (N.T.S. 92 J) is currently underway by the Geological Survey of Canada as part of the Coast Mountain Mapping Project, and is due to be completed in 1973. The Salal Creek area is shown on the Geologic Map of Canada (1968) as undivided Coast Range Intrusives.

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A report by C.E. Cairnes (1924) on the geology of the Pemberton Area describes the Coast Range Intrusives as hornblende-bearing granodiorites, quartz diorites, and diorites. There is evidence that the Lillooet River is located along a large shear zone which is also a zone of earthquake epicenters. In addition, the Bridge River, located to the north of Salal Creek provides another linear element parallel to the Lillooet Lineament.

Recently a paper was presented at the CIMM Annual Western meeting in which the significance of the junctions of thermal zones and major faults was discussed. It was pointed out that the Britannia Beach Mines is located at the south end of the Squamish Thermal Zone, where it is intersected by the Axial Thermal Zone, and that the north end of the Squamish Thermal Zone is crossed by the Lillooet Thermal Line at Bridge Glacier. The Salal Creek Stock is approximately 3 miles S.W. of Bridge Glacier. (Thermal Zones of the Coast Mountains - Their Tectonic and Economic Significance, by Dr. R.R. Guilbert)

A line of Tertiary to Recent volcanic centers which extends 70 miles from Squamish to the north of Salal Creek, passes through the property. A recently published paper states:.."there is an association of most major molybdenum deposits of all ages with Miocene or younger volcanic centers (Adanac, British Columbia Molybdenum, Boss Mountain, Salal Creek)" (Brown, et al 1971).

The Coast Range Intrusive Complex, into which the Salal Creek Stock was emplaced, is probably Jurassic to Upper Cretaceous in age (Cairnes, C.E., 1924; Roddick, J.O., 1965). Many of the young plutons, which have been determined as Upper Cretaceous to Early Tertiary in age, have been intruded along the east margin of the complex. The Salal Stock, which also lies along the east margin of the complex, is therefore assumed to be Upper Cretaceous to Lower Tertiary in age.

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Most, if not all, of the Salal Creek Stock was covered by ice during the Pleistocene glaciation. Glacial striae have been found at elevations up to 7,900 feet. The area has undergone active erosion since the time of maximum ice coverage and glacial sediments are found at present only along the major valley floors and beneath the volcanic flows at the head of Float Creek.

<u>PROPERTY GEOLOGY</u> (See Figs. 3,4,)

The Salal Creek stock which intrudes the Coast Range Plutonic Complex is a roughly circular body, 35 square miles in area, composed essentially of a coarse grained marginal phase surrounding a fine grained core phase. Other differentiated phases locally occur within the stock.

In places volcanics and glacial sediments form a capping to the stock.

<u>Granitic Rocks - Salal Creek Stock</u>

The granitic rocks of the Salal Creek Stock are divided into four major types. These are:

1) Coarse-Grained Phase
2) Medium-Grained Phase
3) Fine-Grained Phase
4) Fine-Grained Quartz Feldspar Porphyry

For distribution of these types refer to Fig. #3.

<u>Coarse-Grained Phase</u> (Unit 2)

Around the border of the stock is a rim of coarse-grained biotite (and hornblende) bearing quartz monzonite. The average grain size of this coarse-grained phase is 2.0 - 2.5 mm. The rock varies in texture from equigranular to porphyritic. Average phenocryst length in the porphyritic areas is 3.0 - 3.5 mm. The approximate modal composition of the coarse-grained phase is:

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Quartz	33.0%
K-Feldspar	32.0%
Plagioclase	32.0%
Biotite	3.0 - 5.0%

The plagioclase is oligoclase in composition (Ab_{76}). The biotite content is variable and seems to increase slightly toward the contact with the surrounding Coast Range rocks. In addition, minor amounts of hornblende are encountered toward the margin of the stock.

Mafic rich inclusions are locally abundant in the coarse-grained phase. They are sub-rounded, have an average size of 1 ft x 2 ft. and are usually found in the vicinity of the Coast Range contact. Numerous inclusions are, however, found in two areas closer to the core of the stock:

a) at Lost Creek at 6,800 ft. elevation in the Coarse-Grained Phase,
b) in the S.E. corner of Windy Glacier at 7,300 ft. elevation in the Fine-Grained Phase.

Medium-Grained Phase (Unit 3)
A medium-grained equigranular to porphyritic quartz monzonite phase is intermittently present at the contact betweeen the coarse-grained rim facies and the fine-grained core facies of the stock. The medium-grained phase, when present, seems to be transitional between the coarse and fine-grained phases. A large area of medium-grained rock is present in the vicinity of Lost Creek. On the basis of a single thin section, this medium-grained phase seems to be closely related to the coarse-grained quartz monzonite. The average grain size is 1.0mm and the modal composition is:

Quartz	33.0%
K-Feldspar	31.0%
Plagioclase	33.0%
Biotite	2.0%

The plagioclase is oligoclase (Ab_{76}) in composition.

Further thin section study is needed to adequately resolve the relations between the medium-grained phase and the adjacent rock types.

Fine-Grained Phase (Unit 4)

The core of the Salal Creek stock is composed almost entirely of fine-grained equigranular to porphyritic biotite granite. The average grain size of the fine-grained phase is approximately 0.5mm. Rounded quartz phenocrysts with an average grain size of 1.0 to 1.5 mm are present at many localities.

The average modal composition of the fine-grained phase is:

Quartz	42.0%
K-Feldspar	37.0%
Plagioclase	20.0%
Biotite	1.5%

The plagioclase has a composition of Ab_{76} (oligoclase).

Fine-Grained Quartz Feldspar Porphyry (Unit 5)

Irregularly distributed within the stock are lenses and pods of a very fine-grained, light blue to light grey, porphyritic phase which contains plagioclase, orthoclase and quartz phenocrysts. This lithology is especially well exposed near the contact of the stock with the Coast Range Complex northwest of the junction of the East and West Forks of Salal Creek. It has a composition similar to that of the Quartz-Feldspar Porphyry Dykes. These lenses and pods vary in width from less than 1 ft. to tens of feet and are traceable along strike for tens and, rarely, hundreds of feet.

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The groundmass has an average grain size of less than 0.25 mm and the average phenocryst size varies from 2-5 mm. The quartz and feldspar phenocrysts are often perfectly euhedral. The modal composition is:

Quartz		45.0%
K-Feldspar		34.0%
Plagioclase		20.0%
Biotite	Less than	1.0%

<u>Berg Stock</u> (Unit 4a)

In the Berg and Beta ground 2 miles to the south and southwest of the Salal Stock a fine-grained to coarse-grained grey equigranular granite, referred to as the 'Berg Stock', intrudes the Coast Range rocks (see Fig. 4). Its composition is similar to that of the fine-grained phase of the Salal Creek Stock. The contact between the Berg Stock and the Coast Range rocks was observed at several localities west of Salal Creek. It is sharp and transgresses the foliation of the Coast Range rocks. Pods of quartz and potash feldspar pegmatite are abundant within the granite near its contact with the Coast Range rocks. Dykes and pods of granitic material (similar to the quartz-feldspar porphyry phase of the Salal Creek Stock) are exposed in stream valleys within the Coast Range rocks north of the Berg Stock. These dykes have chilled borders and cross-cut foliation of the Coast Range. In the Beta group of claims, pods of fine-grained granitic rock form scattered outcrops in the Coast Range. Their contacts are gradational over 1'-2' and near the contact show crystal lineation parallel to the foliation in surrounding Coast Range rocks.

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COAST RANGE ROCKS (Unit 1)

The Salal Creek Stock is located near the eastern edge of the Coast Range Complex and is intrusive into it. The Coast Range rocks near the contact of the Salal Creek Stock are medium to coarse grained, moderately to well foliated, with a composition which varies from granodiorite to quartz diorite. The mafic minerals present in the Coast Range rocks are biotite and hornblende with biotite comprising approximately 75% of the total mafic content. A small area of gabbro and diorite is located at the contact of the Salal Creek Stock in the north-west corner of the map area. These rocks are unfoliated. Contact relations between these rocks and the foliated quartz diorites are unexposed.

Coast Range rocks in Berg and Beta ground to the south are medium to coarse grained varying in composition from quartz-diorite to amphibolite. They are moderately well foliated.

Foliation in the Coast Range swings from approximately E - W near the contact with Salal Creek Stock to NW - SE at the southern end of the property. Small mafic rich lenses and inclusions occur within the Coast Range rocks, generally aligned parallel to the foliation.

The estimated modal composition of the quartz diorites, which are the most prevalent rock type in the Coast Range Complex, is:

Quartz	25.0%
Plagioclase	45.0%
K-Feldspar	10.0%
Biotite	15.0%
Hornblende	5.0%

These rocks would be classified as 'b-Quartz Diorite' in the classification system developed by Roddick (1965).

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VOLCANICS (Units 8,9)

Overlying the Salal Creek Stock in several areas are lava flows and associated volcanogenic fragmental rocks (agglomerates and tuffs). Two major types of volcanic rocks are present. The dominant type is aphanitic, vesicular to massive, basalt. Two smaller areas of more silicic volcanics (possibly dacites) are exposed on the western edge of the pluton and in a very small area in Trail Creek. In addition, several basalt and dacite (?) plugs are also present within the stock. These plugs vary in size from 25 to 300 feet in diameter.

A small plug exposed in Trail Creek at 5,200 feet has partially melted the surrounding granitic rocks. These granitic rocks show relict unmelted fragments, vesicles, and "columnar jointing" which seems to indicate a vertical movement of the plug through the partially melted granite.

A thick sequence of poorly sorted glacial sediments is present beneath the volcanics at the head of Float Creek. Rounded boulders, up to 3 feet in diameter, of the Coast Range lithology, are interspersed within a silty and sandy matrix. These glacial sediments are poorly indurated and very friable. The basalt volcanics overlying this sequence are clearly post-glacial in age. A thin section from the sedimentary sequence exposed beneath the lava flows northwest of Windy Pass shows that at least some of this material is a vitric tuff rather than a glacial sequence, as formerly believed.

The volcanic sequence exposed above Float Creek consists of two major units. The lower unit is composed of flows and volcanic fragmental rocks and is dark brown in colour. The upper group consists of black, aphanitic, mostly massive, flows with minimum dimensions of 1,000 x 2,000 feet and a thickness of approximately 400 feet. Because of its highly irregular contact with the underlying volcanics, the possibility that this upper sequence is a large intrusive plug has been considered. However, at one poorly exposed locality, flattened vesicles were found which are

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perpendicular to columnar jointing and which dip 40-45° to the horizontal. In addition, the very fine grain size and the lack of phenocrysts seems to indicate that these rocks are extrusive rather than intrusive. Magnetic anomalies over these volcanics are much smaller than the anomalies over other large volcanic areas on the property and this also tends to rule out the possibility of the existence of a very large plug within these volcanic rocks.

A pronounced escarpment occuring in the central portion of the Berg Group of claims is composed of volcanic flows and volcanic agglomerates. These rocks are probably related to and of the same age as the volcanic rocks overlying the Salal Creek Stock.

DYKES

Several varieties of mafic and silicic dykes are represented within the map area. Two varieties of aplite dykes are present. They are particularly abundant in the Float Creek to Big Creek area. These white to light grey and blue-grey aplite dykes typically vary in width from ¼ inch to 12 inches. Rarely, wider aplite dykes are found.

Light grey to blue-grey Quartz-Feldspar Porphyry dykes are also common. The porphyry dykes tend to be wider (6" to 3') than the aplite dykes. A few of the porphyry dykes are tens of feet in width. They typically have chilled border zones which lack phenocrysts and commonly display a planar flow structure parallel to the borders of the dyke. These dykes are thought to be similar in composition to the blue-grey aplite dykes. Some of the aplite and porphyritic dykes have been traced along strike for distances up to 150 feet.

The fourth type of dyke encountered in the area is the younger basalt dykes which are related to the Recent volcanism. These dykes commonly vary from 1 to 8 feet in width, and are dark

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brown to black in colour. They are aphanitic, although at one locality within the Coast Range south of Salal Creek a basalt dyke containing feldspar phenocrysts was observed. The dykes commonly exhibit columnar joints perpendicular to their walls.

To the south of the Salal Stock at two localities basic dykes from 20' to 80' wide were observed. These dykes are fine-grained dark grey phaneritic rocks of apparent dioritic composition. They are unmetamorphosed. These dykes may or may not be related to the Recent volcanism.

In the northwest portion of the Berg Group of claims two pre-metamorphic, foliated, basalt dykes occur. The foliation in these dykes is parallel to the foliation in the surrounding Coast Range rocks.

Specimens of each of the dyke types were collected during the 1971 field season for thin section examination.

AGE RELATIONS WITHIN THE SALAL CREEK PLUTON

Age relations between the various phases of the Salal Creek Stock are difficult to assess. Contacts are typically unexposed or non-diagnostic. However from examination of the map pattern of the entire pluton it seems reasonable that the coarse-grained border phase has been intruded by the fine-grained core phase and that the coarse grained phase is the oldest of the granitic rock types. Preliminary petrographic examination indicates that the medium-grained phase is compositionally very similar to the coarse-grained phase and thus is approximately the same age or slightly younger (Stephens, 1970b). In the Windy Pass - Red Hill area, the medium-grained phase is gradational with the coarse-grained phase and probably formed simultaneously with the coarse-grained phase (Stephens, 1970a).

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The fine-grained phase constitutes the majority of the core of the pluton. Locally it is intruded by lenses and pods of the fine-grained quartz-feldspar porphyry, as is the coarse-grained marginal phase. Therefore the fine-grained porphyry is the youngest of the major plutonic phases.

Cross-cutting relations between the white, and blue-grey aplite dykes and the quartz-feldspar porphyry dykes have been observed in numerous localities and their age relations determined. In general, the following order of dyke emplacement is valid although rare exceptions have been observed.

The white aplite dykes are cut by both the blue-grey aplite and the quartz-feldspar porphyry dykes and therefore are the oldest of the silicic dykes. Cross-cutting relations between the blue-grey aplite dykes and the quartz-feldspar porphyry dykes have not been observed but they are thought to be contemporaneous and to have a common magmatic origin. The porphyry dykes tend to be larger than the blue-grey aplites and are thought to have cooled more slowly. The quartz-feldspar porphyry dykes show chill margins which lack phenocrysts and sometimes show flow banding parallel to the border of the dyke.

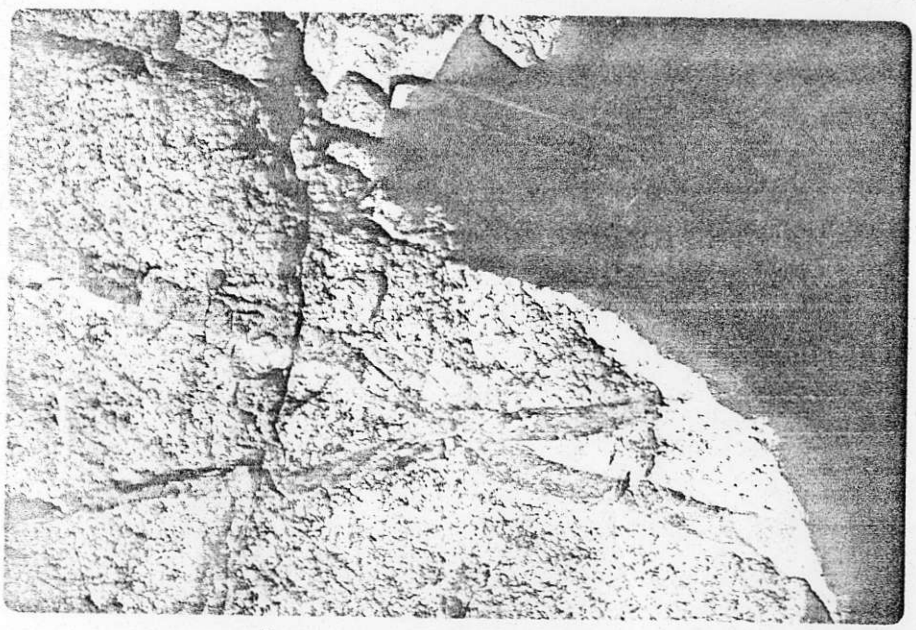

PLATE 4: Q-F PORPHYRY DYKES CUTTING WHITE APLITE DYKES AFTER FAULT MOVEMENT

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As mentioned previously lenses and pod-like masses of quartz-feldspar porphyry occur within the stock - these bodies are not dykes - the percentage of phenocrysts increases from the center of these bodies toward their margin. The borders of these quartz-feldspar porphyry masses are gradational over a few inches with the surrounding country rock.

The basalt dykes cross-cut all of the silicic dyke types and are much younger.

The aplite and quartz-feldspar porphyry dykes are concentrated chiefly in the coarse-grained phase of the pluton and were probably emplaced simultaneously with or slightly later than the fine-grained core phase. They may therefore be petrologically related to the fine-grained core phase. The basalt dykes are directly related to the Tertiary to Recent volcanism

PETROLOGY-DISCUSSION

Based on the field and laboratory investigations to date the following relations between the various rock types within the Salal Creek Stock are proposed.

The coarse-grained marginal phase was the earliest phase to crystallize within the stock. It has the composition of quartz monzonite. The coarse-grained phase becomes more mafic-rich toward the contact with the Coast Range Complex. In addition, hornblende is present in minor amounts along the outer edge of the coarse-grained phase.

As this phase crystallized the remaining melt was depleted in calcium and became relatively more potassium-rich. The fine-grained core phase which crystallized from this alkali-enriched magma has the composition of a biotite granite. The fine-grained phase also contains significantly less biotite than the coarse-grained phase. To date, no differentiation trends have been

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found in the plagioclase of these two phases, rather the percentage of potash feldspar increases at the expense of the plagioclase.

The geochemical study undertaken by Barringer Research Ltd. (Smee, 1971; Bradshaw, 1971) confirms the enrichment of potassium relative to calcium in successively crystallizing magmatic fractions.

The Barringer Study also indicates that the medium-grained phase of the pluton is fractionated more than the coarse-grained phase. This result is at variance with the current field and thin section interpretation of the medium-grained phase. Additional petrologic work is necessary to resolve this problem.

The fact that the aplite and quartz-feldspar porphyry dykes occur chiefly within the coarse-grained phase indicates that they are most likely petrologically related to the fine-grained phase. Only rarely had the core phase crystallized sufficiently for the silicic dykes to invade it and be preserved.

The quartz-feldspar porphyry masses and fine-grained equigranular masses which occur in both the fine and coarse grained phases are believed to originate from very late-stage magmatic fractions which have crystallized slowly at first and then rapidly, due to a release of vapor pressure.

The volcanic rocks and related dykes within the map area are much younger than the plutonic rocks and are unrelated, either to the pluton or to the mineralization (although some minor remobilization of sulphides may have taken place locally near these volcanic rocks).

The "granitic" complex located to the north of Tongue Glacier consists of all textural varieties from fine to coarse-grained, equigranular to porphyritic. In this respect it is similar to the area in the vicinity of Float Creek. Boundaries between the

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various rock types are gradational generally over 3" or less and no consistent pattern of emplacement is evident. These areas are believed to have crystallized slowly giving rise to the coarse-grained varieties and then, again due to a release of the vapor phase, to have cooled more quickly yielding the medium and fine-grained phases. The release of the vapor phase was probably caused by minor tectonic (?) movements which ruptured the outer, semi-solidified shell of the pluton.

The fine-grained granitic complex at Windy Pass possibly had a somewhat similar origin. After nearly complete crystallization of the typical fine-grained phase this semi-consolidated mass was profoundly fractured due to a sudden release in pressure and a silica-rich, highly differentiated, magmatic material was injected along the fractures yielding the "silicified breccia" seen at this locality. The quartz vein stockwork observed here is thought to have formed shortly after the "breccia", with the quartz veins being emplaced along unfilled and incipient fractures within the host rock.

STRUCTURE

As in 1970, considerable emphasis was placed on the study of minor, relatively small, structures. This approach was taken for two reasons: 1) major structures (faults, shear zones, lithologic contacts, etc.) are seldom observed, and 2) a precise chronology of formation can be established for the minor structures. By studying pre-mineralization and post-mineralization features a probable stress field can be established for the time of mineralization. The molybdenite mineralization seems, for the most part, to be very strongly controlled by these stress conditions (since most occurrences are in veins and shear zones). Therefore by studying the orientation of minor structures, possible mineral occurrences and orientations can be established.

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Contact Relations with the Coast Range Complex

A notable feature of the Salal Creek Pluton and of the Berg Stock is the lack of features usually associated with intrusive igneous contacts. No chilled border zone is present at the contact between the Salal Creek Stock and the Coast Range rocks. Likewise no protoclastic border or flow structures are present near the boundary of the stock. The contact is unquestionably discordant, the stock sharply truncating the pre-existing foliation of the Coast Range at numerous localities. In addition, off-shoots from the stock (in the form of numerous silicic dykes) are present in great abundance in the Coast Range rocks surrounding the stock.

The foliation within the Coast Range Complex generally trends within ten degrees of E-W and dips steeply either north or south, although significant deviations from this general trend have been observed in several localities, particularly at the southern end of the property. The foliation is formed by parallel arrangement of biotite flakes (or less commonly hornblende needles). The Coast Range rocks are typically well jointed (fractured?) parallel to the foliation direction.

Faults and Shears

Large faults and shears are seldom seen directly in the Salal Creek Stock because of a lack of suitable "marker horizons" (dykes, etc.). These large features are best recognized by their low linear topographic relief. Where suitable "markers" are available, faults are abundant. Many have apparent displacements measured in inches, but a few show feet or occasionally tens of feet of displacement. Topographic lows are developed on Glacier Island and on Logan Ridge at the contact between the coarse-grained and fine-grained phases of the stock. Exposures along the contact are largely non-existent. Some shearing has, however, probably occurred along the contact at these localities as the fine-grained phase was emplaced.

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Examination of air photos reveals 4 to 6 parallel lineaments in the northwest corner of the stock which trend approximately N 20 W. These lineaments cut the fine and coarse-grained phases of the stock as well as the rocks of the Coast Range. Ground examination showed evidence of shearing and/or faulting along the largest of these lineaments. A heavily iron-stained fracture zone is present to the southeast of these lineaments and is parallel to them.

Likewise, a series of parallel lineaments striking northeast and dipping northwest occurs in the area between Trail Creek and Cornice Creek. These were investigated on the ground and found to be a set of fractures and shears, most of which are mineralized and some of which are heavily iron stained.

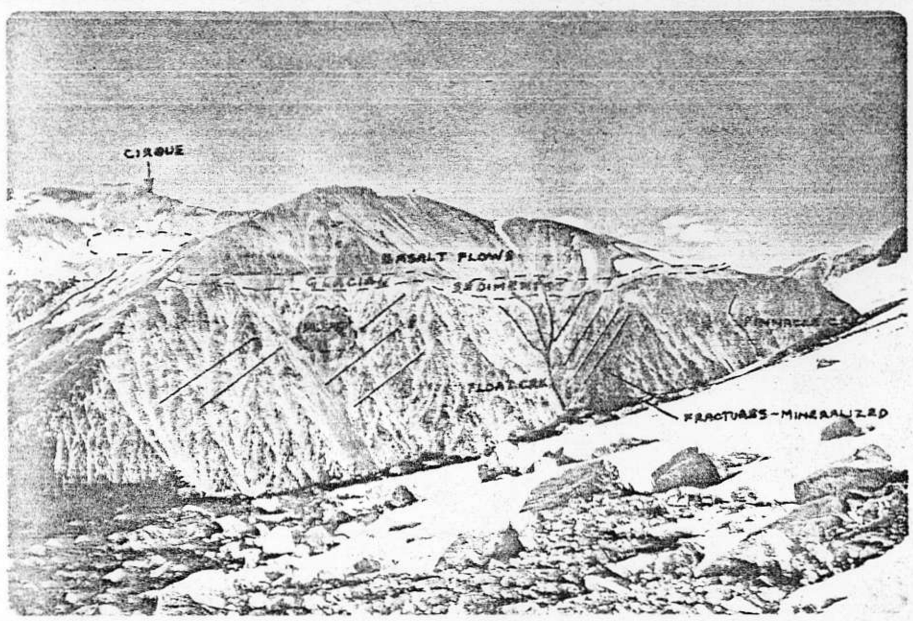

PLATE 5: SOUTH FACE - TRAIL CREEK TO PINNACLE CREEK

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Mineralized Veins (See Fig. 5 & Appendix 2)
The mineralized veins within the stock exhibit a strong preferred orientation. In general they trend N40 - 70E, with those in the southern portion of the stock dipping steeply northwest, and those in the northern portion dipping steeply southeast. The long dimension of the pluton also trends northeast and may reflect a major structural control during both emplacement of the pluton and its subsequent mineralization.

Basalt Dykes

A total of 52 basalt dykes were observed within the Salal Creek Pluton. In general they trend either N15 - 35E and dip 40-60° NW or trend N-S and dip 70-85° E. The NE orientation is the most common.

Aplite Dykes (see Fig. 6 & Appendix 2)
Aplite dykes occur chiefly in the southern portion of the property and are most abundant within the area of extensive molybdenite mineralization. The aplite dykes are not co-planar with the mineralized veins, but are oriented in a more easterly direction. In the area between Waterfall Creek and Cornice Creek the major dyke trend is N 82 E with a dip of 60° NW. In the Cornice Creek-Big Creek area, the dykes have a preferred orientation of N 74 E and dip 65° NW. In the area NE of Big Creek and below Red Hill the dykes are more randomly oriented. Their preferred attitudes are N 74 E dipping vertically and N 42 W dipping vertically.

The co-occurrence of the aplite dykes and molybdenite mineralization is due to a combination of structural and petrologic controls. The aplites and mineralizing solutions are probably genetically related - that is they represent the last, most highly fractionated phases of the original magma. In addition, a well developed fracture system and other favorable structural conditions must have been present within the Waterfall Creek - Lost Creek area, and the emplacement of both the dykes and the later mineralization was very strongly controlled by this structural environment.

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Joints (See Fig. 7 & Appendix 2)

Preliminary analysis of joint orientations indicates that two major joint sets and several minor sets are present within the Salal Creek Stock. The two major sets are radial and concentric to the center of the stock. The minor sets have no systematic orientation pattern. The pluton is highly fractured in most exposures by intersecting joint sets with spacings of six inches or less.

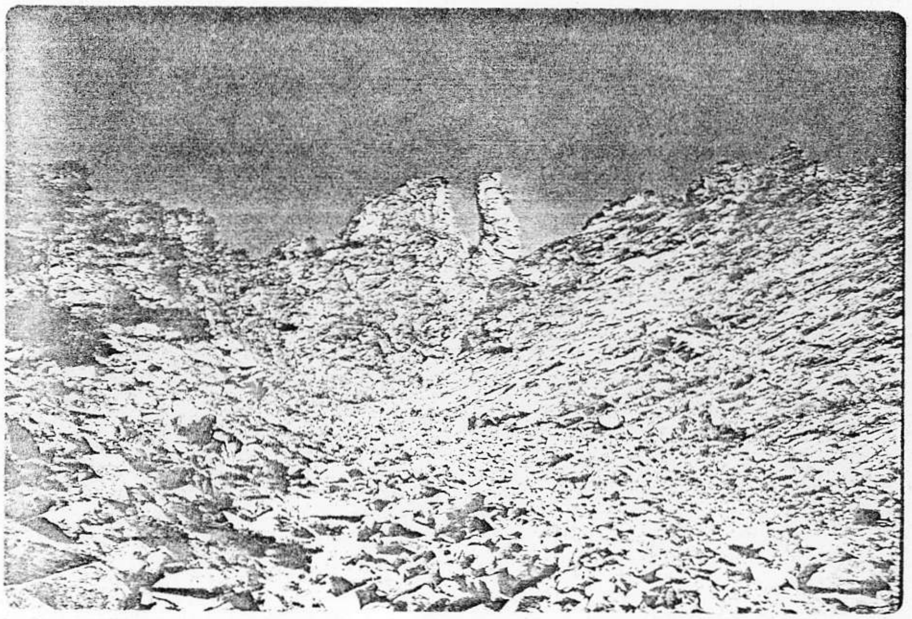

PLATE 6: PINNACLE CREEK - SHOWING INTENSE FRACTURING

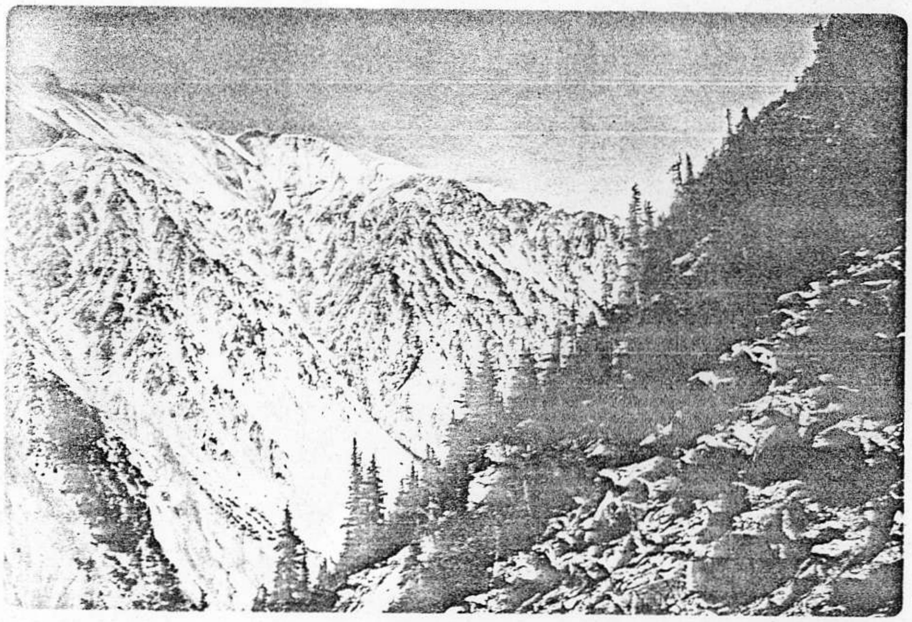

PLATE 7: FLOAT CREEK - SHOWING FRACTURE ORIENTATION AND STRONG GOSSAN

GEOMETRY AND MODE OF EMPLACEMENT OF THE SALAL CREEK PLUTON

The Salal Creek Stock is a small epizonal pluton, which was most likely emplaced at a depth of 5 miles or less below the earth's surface (Buddington, 1959). The geometry of the stock, as deduced from its contact relations with the Coast Range rocks, is that of a vertical body which widens moderately at depth. The vertical extent of the body is, at present, unknown. The presence of 'pendants' of the coarse-grained granitic phase within the fine-grained phase as well as the presence of rounded 'mafic inclusions' (which are presumably recrystallized xenoliths of Coast Range rocks) indicate that the present erosion surface is still relatively close to the top of the pluton.

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On the basis of lithology, alteration and mineralization the Salal Creek molybdenum deposit can be best classified as a 'plutonic porphyry deposit'. This class of deposit is defined as follows:

> "Plutonic porphyry deposits are gradational to complex. They share with all porphyry deposits the common ore and alteration mineralogy and, like complex deposits, are associated with plutons of moderately large size and show a relation between ore distribution and faults. They differ in that they are associated with scarcely-porphyritic or non-porphyritic granitic plutons, and breccia zones and pipes are unknown or unimportant. However, they have associated porphyritic phases or dike swarms. Mineralization is largely confined to a fairly regular vein set and alteration tends to be weakly developed and concentrated as envelopes to the veins. Pyrite halos are generally sparsely mineralized."
> (Brown, et al, 1971).

The lack of certain contact features within the Salal Creek Stock (i.e. the lack of a protoclastic border or a foliation) coupled with the sharp, cross-cutting nature of its contact with the Coast Range rocks indicates that the pluton was emplaced by magmatic stoping while largely in a fluid state.

The lithologic zonation within the Salal Creek Stock is similar to that of other small, zoned, plutons within the western Cordillera. For example, the similarity between the Salal Creek Stock and the Rocky Hill Stock in Tulare County, California (Putnam and Alfors, 1969) is especially striking.

Other small granitic plutons have been discovered within the Bridge River-Lillooet River areas. These stocks seem to be similar in composition to the Salal Creek Stock and at least some of them contain copper and/or molybdenite mineralization. These stocks are thought to be approximately contemporaneous with the Salal Creek Stock and may have originated from the same magmatic source.

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ALTERATION (see Fig. 8)

The most obvious feature of the Salal Creek Property is the strong reddish-brown gossan which can be seen from the air at distances of up to 20 miles. The gossan is developed from breakdown of pyrite and hematite which occur extensively within the property. Much black manganese stain is also present and may be the result of oxidation of secondary manganese minerals.

PLATE 8: SOUTH FACE - SHOWING STRONG GOSSAN

Alteration effects within the exposed rocks at Salal Creek are weak to moderate in intensity. Hydrothermal alteration is most intense in the mineralized area between Lost Creek and Trail Creek. Within this area, the biotite is partially to completely chloritized and the plagioclase is generally weakly to moderately kaolinized. The characteristic pale greenish color of the altered plagioclase is indicative of kaolinization (Drummond and Kimura, 1969).

Within the area from Trail Creek to Big Creek, a bright pink alteration product of plagioclase phenocrysts was occasionally encountered. This pink material has been identified as illite (Mustard and Fox, 1966; Stephens, 1970b). Also present within this same area are sparse, thin, veinlets of pink manganese epidote/K-feldspar. These veinlets, which cross-cut the host rocks, are most probably hydrothermal in origin.

Sericite occurs along joint planes within this southern mineralized area. Sericite also occurs in ½"-1" quartz-sericite veins on Logan Ridge in the vicinity of the coarse-grained-fine-grained contact.

Thin envelopes of secondary potash feldspar were seen surrounding quartz veins in several fine-grained float blocks along the east side of Mud Lake.

In the Mud Lake-Glacier Island locale, biotite shows partial chlorititization and plagioclase phenocrysts have been altered to illite in several outcrops.

Within the Trail Creek-Lost Creek area (approximately 18,000' x 5,000') an alteration zoning pattern is evident. Chlorite is developed widely within the Cornice Creek-Lost Creek area. Kaolinization of the plagioclase is limited to an area of 6,000' x 2,000' and is most intense between Cornice Creek and Big Creek. Within this same area, manganese epidote/K-feldspar

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veinlets, sericite along joint planes, and secondary illite are also present in very restricted areas.

Between Trail Creek and Pinnacle Creek silicification is the major type of alteration in an area of 7,000' x 3,000'. Minor amounts of chlorite, kaolinite, and sericite are also developed.

Preliminary thin section study of a few rock specimens (see Appendix 3 & Fig. 28) show that sericitic alteration is more intense in this area than is apparent in hand speciment. Secondary K-feldspar is also seen, developed along fractures and as crystal overgrowths.

Wallrock alteration effects are very pronounced immediately adjacent to the quartz-pyrite-molybdenite veins within the claims area. Biotite is completely absent within these border zones. The altered rock has been kaolinized and silicified and is generally fine to medium-grained regardless of the original grain size of the parent rock.

No alteration effects were observed in outcrops of the Berg stock to the south.

Lowell and Guilbert (1970) have developed a model for alteration and mineral zoning in porphyry-type mineral deposits. The alteration within the Trail Creek - Lost Creek area corresponds to their phyllic and argillic zones. The occurrence of molybdenite at Salal Creek in veins and veinlets also indicates the same level of exposure as the alteration when compared to their model

According to this model, the Trail Creek-Cornice Creek area is slightly lower in the alteration - mineralization system than the Cornioe Creek - Big Creek area. However, the entire erosion surface at Salal seems to lie moderately close to the top of the pluton.

The major secondary minerals and alteration products within the rocks of the Coast Range Complex are epidote and chlorite. The chlorite typically occurs as an alteration product of the mafic minerals within the rocks, and the epidote occurs as thin (1/16") veinlets which typically cross-cut the foliation of the Coast Range rocks. The Coast Range rocks show only weak alteration effects.

MINERALIZATION (See Fig. 10)

Molybdenite is chiefly located within the coarse-grained phase near the contact with the fine-grained phase. Significant concentrations occur at Glacier Island, Mud Lake, and in the Trail Creek-Lost Creek area. Results of the 1970 geochemical stream sampling program indicate that the most promising area of these is the Trail Creek to Lost Creek area (which is also the most extensively altered of these areas).

Molybdenite mineralization is of three major types: 1) in veins and shears - associated with quartz and/or pyrite; 2) as 'dry' joint and vein fillings, and 3) as disseminated molybdenite within the host rock. By far the most dominant type observed is the vein development. Molybdenite occurring as joint coatings and disseminations is much less abundant than the vein-type mineralization, but locally molybdenite along joints becomes important (as at Float Creek).

The larger molybdenite veins generally exhibit a 'ribbon-type' development. They consist of alternating 1/16" - 1/8" quartz and molybdenite stringers. Pyrite, when present, is often confined to the center of the vein.

Disseminated molybdenite has been observed by the writer at only one locality in the south-central area of Glacier Island.

Other minerals present within the map area are chalcopyrite, galena, specular hematite, pyrite, magnetite, bornite, malachite, and azurite. In addition relatively high concentrations of lead, zinc, and silver have been determined by geochemical analysis in the Glacier Island, Mud Lake and Red Hill areas.

A small occurrence of malachite was noted in the northwest corner of the large volcanic field east of Trail Creek. The malachite occurs as vesicle fillings over a 2-3 foot area.

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No primary copper minerals were observed. Small amounts of malachite and azurite were also observed in a non-foliated 'gabbroic' phase of the Coast Range Complex directly below the volcanics near the northwestern corner of the pluton. Again no primary copper minerals were discernible. Minor malachite was observed in the coarse-grained phase of the Salal Creek Stock in the vicinity of Tongue Glacier and Mud Lake. The malachite occurs as very thin and discontinuous fracture coatings.

In the Coast Range rocks to the south of Salal Creek Stock, mapping of the ground staked in 1970 disclosed little mineralization. In the Berg Group of claims malachite was observed with pyrite in narrow (6"-24") shear zones in Coast Range rocks. The shears trend between N 05° E and N 20° E and dip steeply to the southeast. The mineralized zones are believed to occur irregularly around the perimeter of the Berg stock and to be genetically related to the stock.

Within the Coast Range rocks in the Beta group of claims pyrite occurs disseminated and along planes in narrow (1'-10') shears and fracture zones. Narrow (1/8"-½") veins and fracture fillings of hematite and magnetite were also observed at a few localities. No primary or secondary copper or molybdenum minerals were seen.

Within the Berg Stock no copper or molybdenum minerals were seen. The only metallic mineral observed was magnetite which occurs as an accessory mineral.

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CONTROL OF MINERALIZATION

The molybdenite mineralization within the Salal Creek Stock is both structurally and chemically controlled. The mineralized veins have a strong preferred orientation. In general they strike NE-SW. Veins in the southern portion of the stock (Trail Creek-Lost Creek) dip steeply (60° or more) to the northwest; veins in the northern portion of the stock (Glacier Island-Mud Lake area) dip steeply (60° or more) to the southeast. In addition, the mineralization seems to be at least indirectly controlled by, and localized near, the contact between the fine-grained core phase and the coarse-grained marginal phase of the pluton. The chemical control of the mineral zoning is not yet understood. All observed occurrences of pyrite, magnetite and hematite were recorded and from the data, zones delineated for each mineral. The major mineral zones are generally concentric to the core of the stock and exhibit a high degree of overlap (see Fig. 9). Hematite and magnetite zones are confined to the south and west. The pyrite zone wraps entirely round the stock. The core itself appears to be barren of all zones. Comparison of the molybdenite occurrences shows that in the northern part of the stock they lie within the pyrite, pyrite + magnetite zones. In the south they appear, especially at Float Creek and Lost Creek, to occur where the pyrite, magnetite, and hematite zones overlap. At this stage mineral zoning does not show any consistent pattern related to molybdenite occurrence.

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GEOCHEMISTRY

Geochemical work performed in 1971 is summarized under three main headings. They are:

1) Rock Geochemical Study
2) Routine Geochemical Sampling of Soil, Silt, Talus and Rocks.
3) Assessment of Anomalous Areas Discovered in 1970

1. Rock Geochemical Study (See Appendix 4)

The purpose of the study as outlined in the report was to identify zoning in the bedrock genetically related to the mineralization which would:

a) More closely identify the center of the last phase with which a mineralizing process is believed to be associated.
b) Assist in confirming that fractionation and redistribution of elements has occurred which is consistent with the formation of ore deposits.

A limited number of samples were analysed initially, the intention being to expand the study if the results proved encouraging.

The result of the study was in general consistent with the geology and petrology. A greater degree of fractionation is exhibited by the fine and medium-grained phases than by the coarse-grained phase. Some, possibly significant, exceptions exist as pointed out in the Barringer Report.

With respect to trace metal distribution the Barringer Study concluded that no trends were apparent.

The writer, however, believes that the following observations should be noted.

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TABLE 1

	Cu ppm		Pb ppm		Zn ppm	
	Fract.	Unfract.	Fract.	Unfract.	Fract.	Unfract.
Coarse Grained	7.9	2.4	10.8	4.9	21.2	14.7
Medium Grained	4.4	5.0	6.0	6.0	21.6	11.4
Fine Grained	2.5	7.9	7.0	9.1	19.5	18.4

It can be seen that in the case of fractured rocks there is an increase in metal content from fine-grained to coarse-grained. The medium grained phase behaves somewhat unpredictably.

In the case of the unfractured rocks there is a decrease in metal content from fine-grained to coarse-grained.

Within individual phases similar trends can be seen. Within the coarse-grained phase metal content is greater in fractured than unfractured rock. The fine-grained phase shows, except for Zn, an opposite relationship.

The above trends are consistent with the presently held belief that mineralization was associated with intrusion of the fine-grained phase. Where ground preparation was good (i.e., strong fracturing) movement of metalized fluids from the fine-grained phase to the coarse-grained phase was facilitated. Where ground preparation was poor (unfractured rock) the outer coarse grained phase acted as a dam to metallized fluids which were thus retained in the inner fine grained core.

Table II summarizes the average Cu, Pb, and Zn content of the various phases for combined fractured and unfractured rocks. The results are compared with the results of the Barringer Study undertaken in 1970.

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TABLE II

	Cu ppm		Pb ppm		Zn ppm	
	1970	1971	1970	1971	1970	1971
Coarse Grained	30.0	5.3	11.0	8.0	57.0	18.1
Medium Grained	14.0	4.8	8.0	6.0	128.0	15.0
Fine Grained	41.0	7.1	27.0	9.5	43.0	18.7

With the exception of Zn, trends shown in 1970 are similar in 1971. The lower values exhibited in the 1971 samples may be due to the fact that in 1971 only the salic fraction was analysed.

Frequency histograms were drawn for Cu, Pb and Zn (see Figures 11,12,13). On the basis of the histograms, background, threshold and anomalous values were chosen and plotted on plans (see Figures 14,15,16).

Considering values obtained from fractured and unfractured rocks together appears to contradict the basis for the conclusions drawn earlier. Closer examination however, shows that whereas averages for fractured and unfractured rocks differ significantly, individual anomalous values are distributed in both fractured and unfractured rocks as shown in Table III.

TABLE III
FREQUENCY OF ANOMALOUS VALUES
IN

ppm	FRACTURED ROCK	UNFRACTURED ROCK
Cu 6+	5	5
10+	2	2
Pb 9+	6	10
15+	4	0
Zn16+	5	11
25+	3	4

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It is therefore considered valid to examine the fractured and unfractured rocks together for the purposes of the study.

Despite the low sample density, two distinct areas of anomalous metal content are apparent. To the north, Cu and Pb zones are centred on Red Hill. A Zn zone lies further to the southwest. These zones are interesting in view of the fact that a boulder of float containing chalcopyrite, bornite, galena and sphalerite is to be found near the west side of Plug Glacier below Red Hill. Further south weaker Cu, Pb and Zn zones occur between Big Creek and Lost Creek. They run approximately parallel to the dominant structural features in the area.

The above observations indicate that rock geochemical analyses for trace metals may prove useful in outlining zones of relative metal enrichment.

2. Routine Geochemical Sampling

a) Soils (see Figs. 19, 19a, 19b)

A limited soil sampling survey was conducted over the granitic complex N.E. of Lost Creek for the following reasons:

1) Molybdenite occurs sporadically in veins and along joints in outcrop in Lost Creek and the creek 3,000' to the N.E.
2) The area is similar to the Float Creek area in that all phases of the stock occur interfingering in a complex pattern.
3) In an area of 3,000' x 2,000', within which a substantial concentration of MoS_2 could occur, there are no outcrops.
4) There is adequate soil development to allow geochemical soil sampling to be effective.

A series of soil and silt samples were collected in this area and analysed for total Mo and Cu. Soil samples were collected

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FREQUENCY HISTOGRAMS - Cu Pb Zn in ROCK

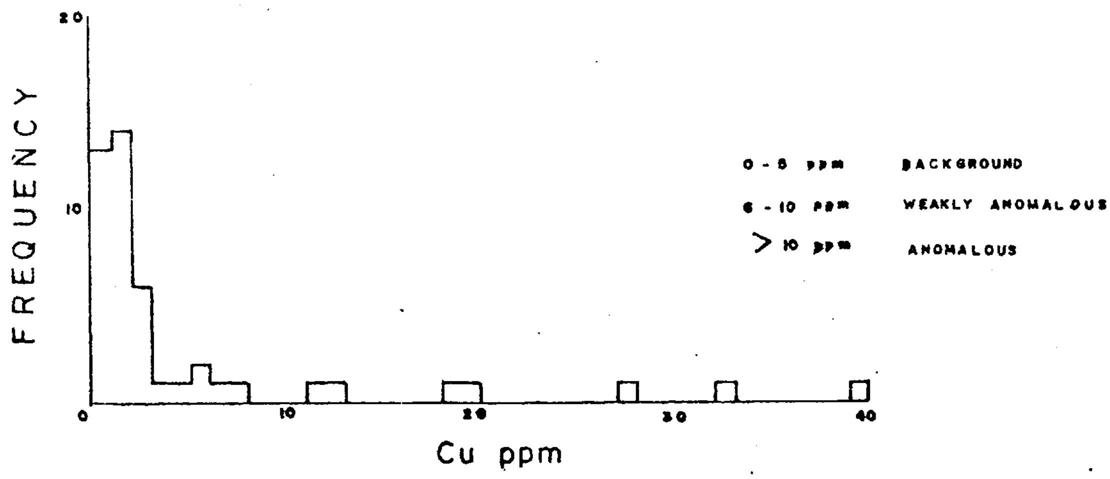

FIG 11

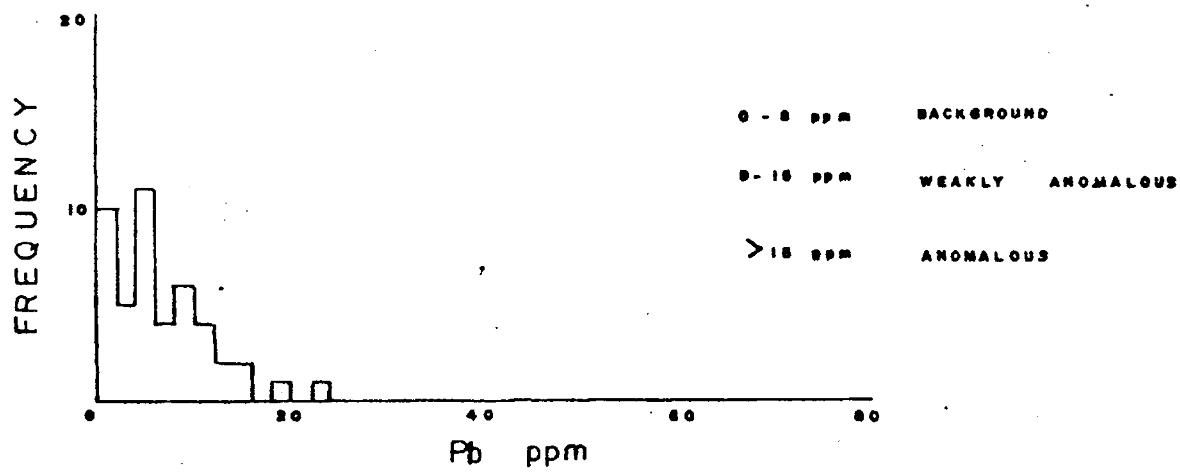

FIG 12

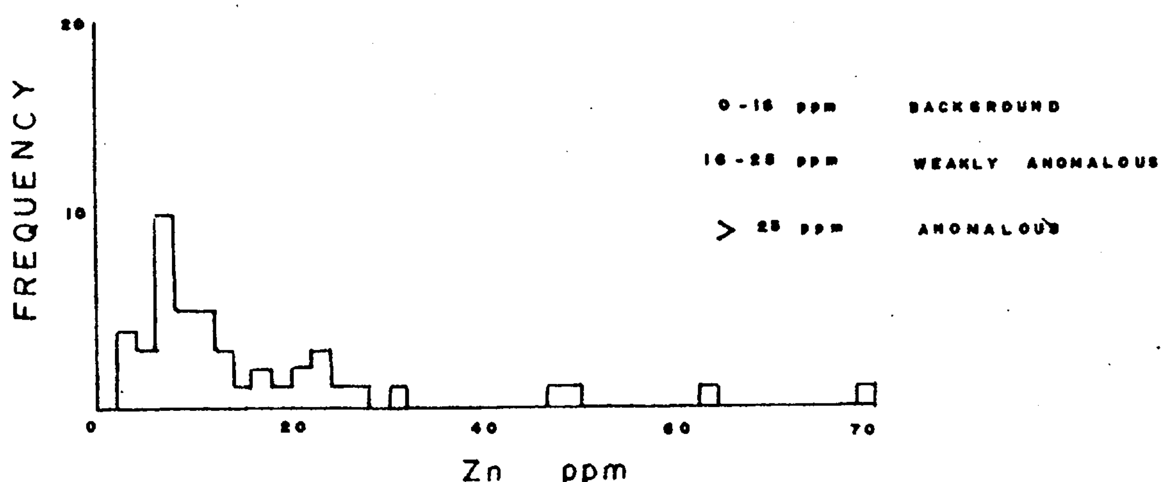

FIG 13

from a weakly developed "B" horizon in accordance with accepted sampling procedures. Background and anomalous values were established by examination of frequence distribution histograms (see Figures 17,18). The anomalies delineated are generally weak and elongate down slope. The Cu anomalies, in the light of previous work and follow-up ground examination, are not considered significant. Of the Mo anomalies, the central one is considered more significant. It shows fairly strong continuity and runs parallel to dominant structures in the area. MoS_2 is known to occur in Lost Creek and the Creek 3,000' to the N.E. Soil in the central anomalous zone is relatively enriched in Mo compared with soil near the two creeks. MoS_2 could confidently be expected to occur in bedrock beneath the anomaly. A small program of trenching is justified in this area to check on the MoS_2 content in the bedrock.

b) Rock Sampling (see Figures 20,21)
Few rock samples were collected. Those taken were for the purposes of giving a general idea of the background copper and molybdenum content to be found in different rock types. Table IV summarizes the results of the sampling.

TABLE IV

Sample No.	Type	Location	Rock Type	Metal Content in ppm Cu	Metal Content in ppm Mo	Remarks
40009-GR-4	Grab	W. Fork	Basalt	43		
CR-4	"	"	"	39		
CR-6	"	"	"	212		
CR-7	"	"	"	54		
CR-9	"	"	"	5		
CR-10	"	"	"	15		
CR-11	"	"	"	19	5	
R-1	Chip	Beta	Qtz Diorite	4	3	/220'
R-2	"	"	"	110	2	/300'
R-3	"	"	"	18	< 2	Mtge vein
R-4	"	Berg	Granite	2	< 2	/150'

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FREQUENCY HISTOGRAM Cu, Mo in SOILS

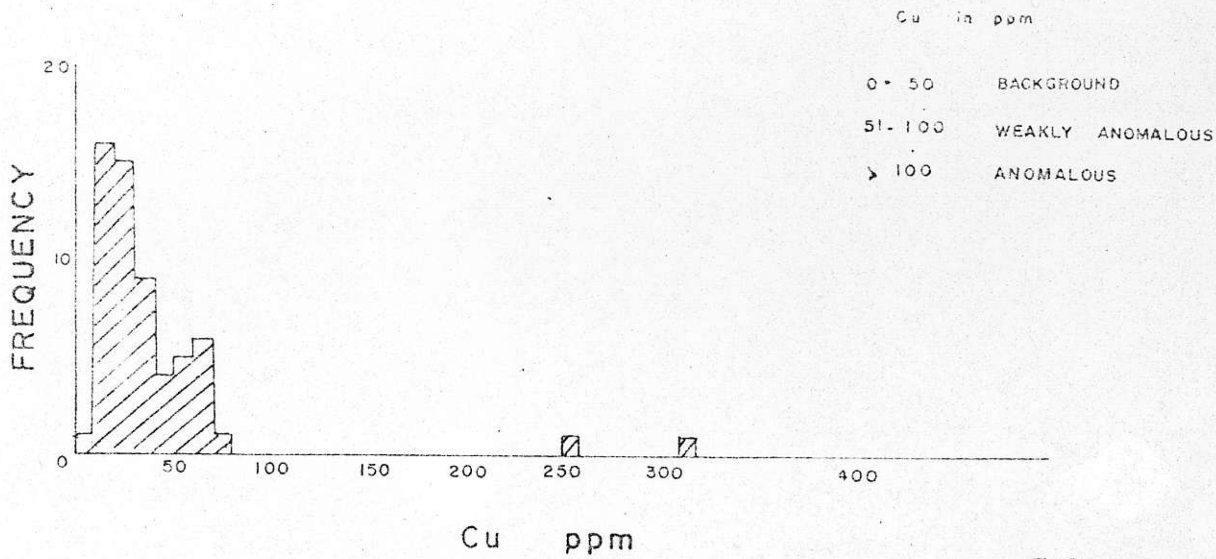


FIG 17

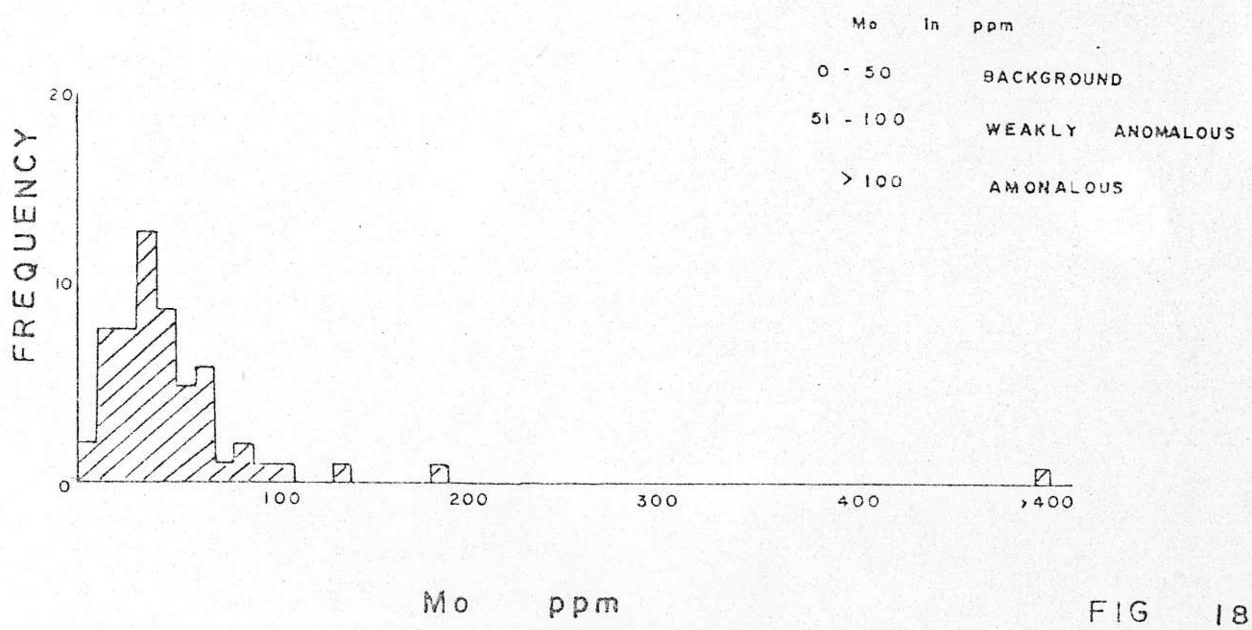
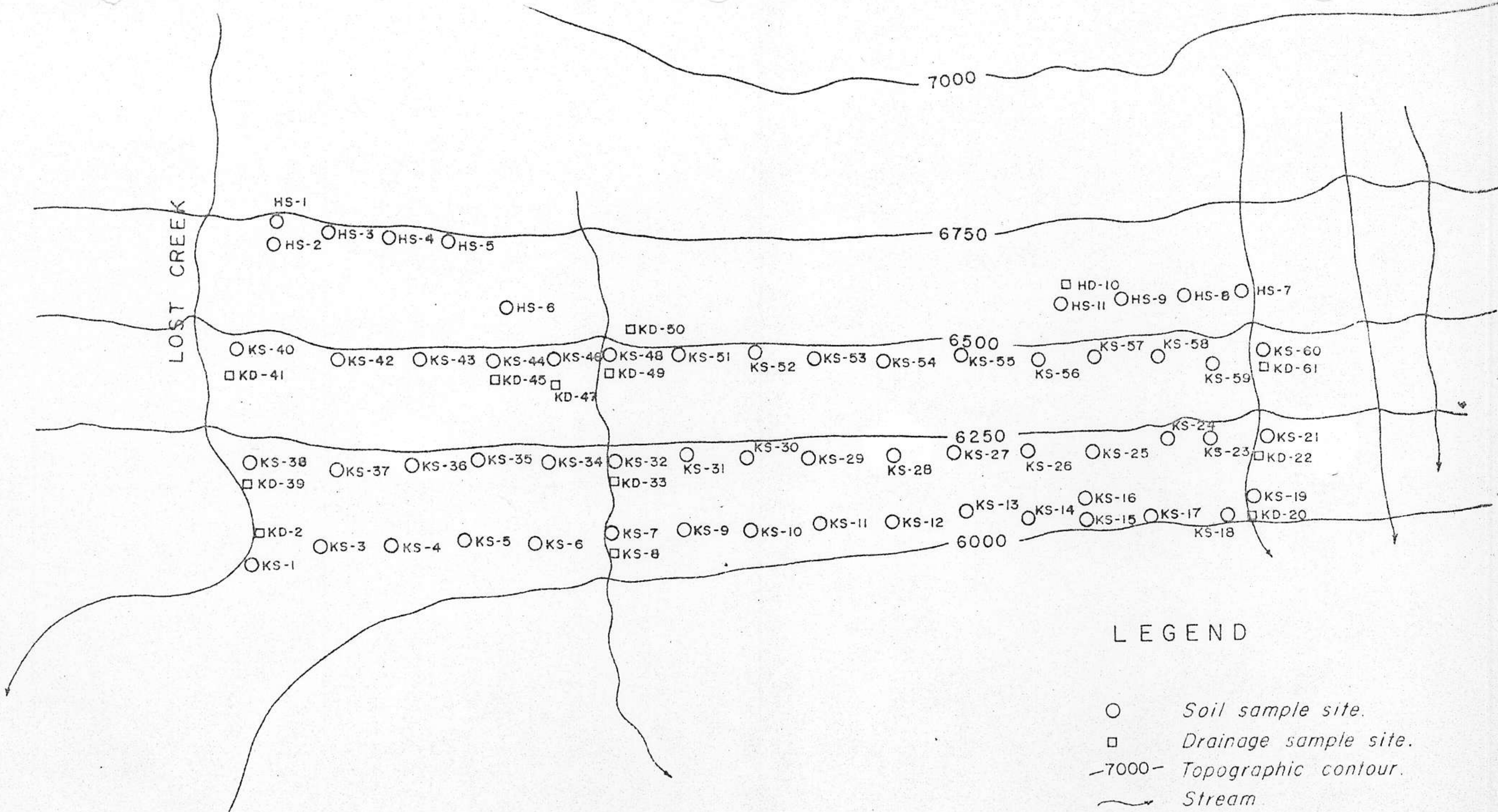


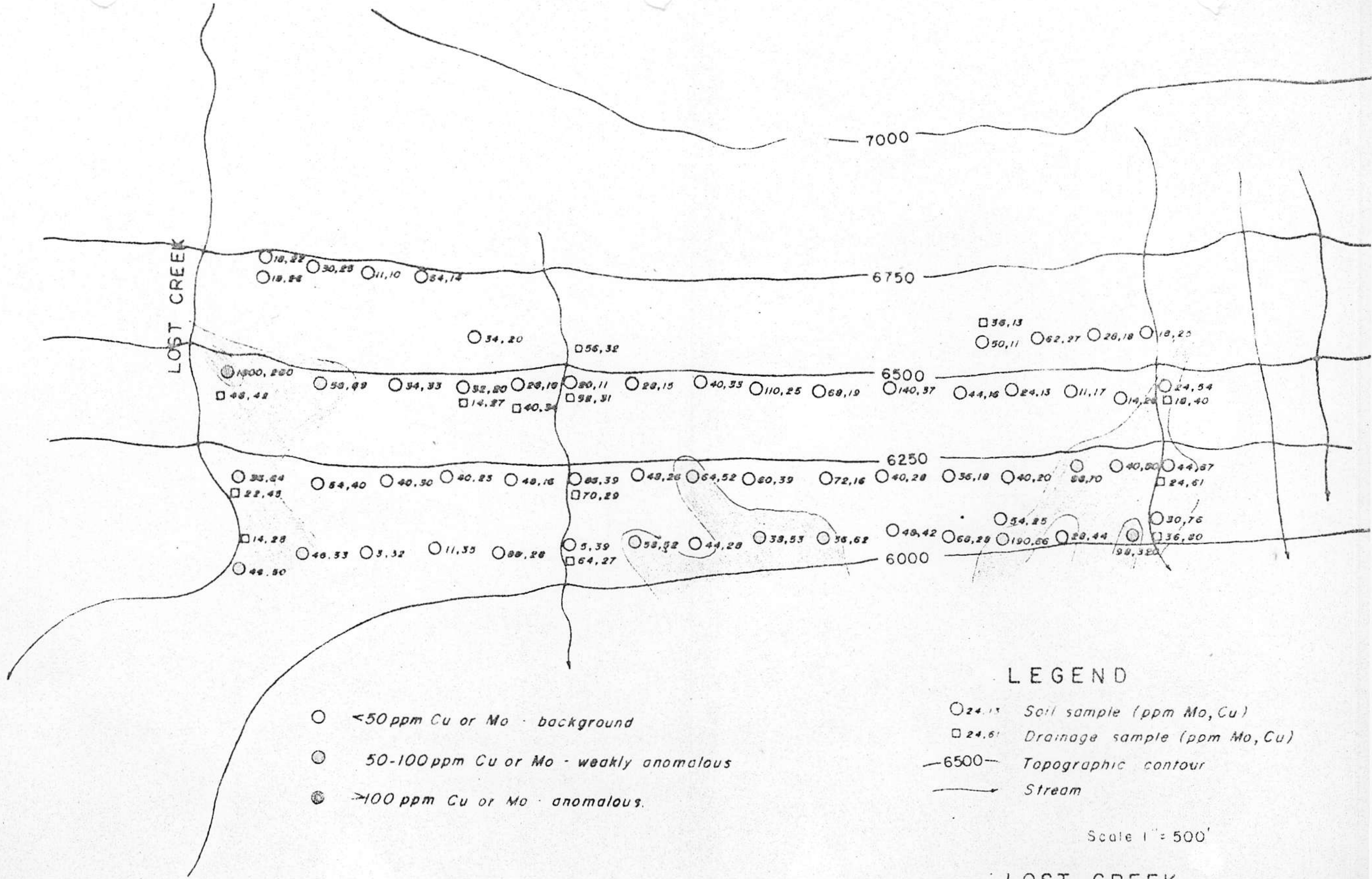
FIG 18



Scale 1" = 500'

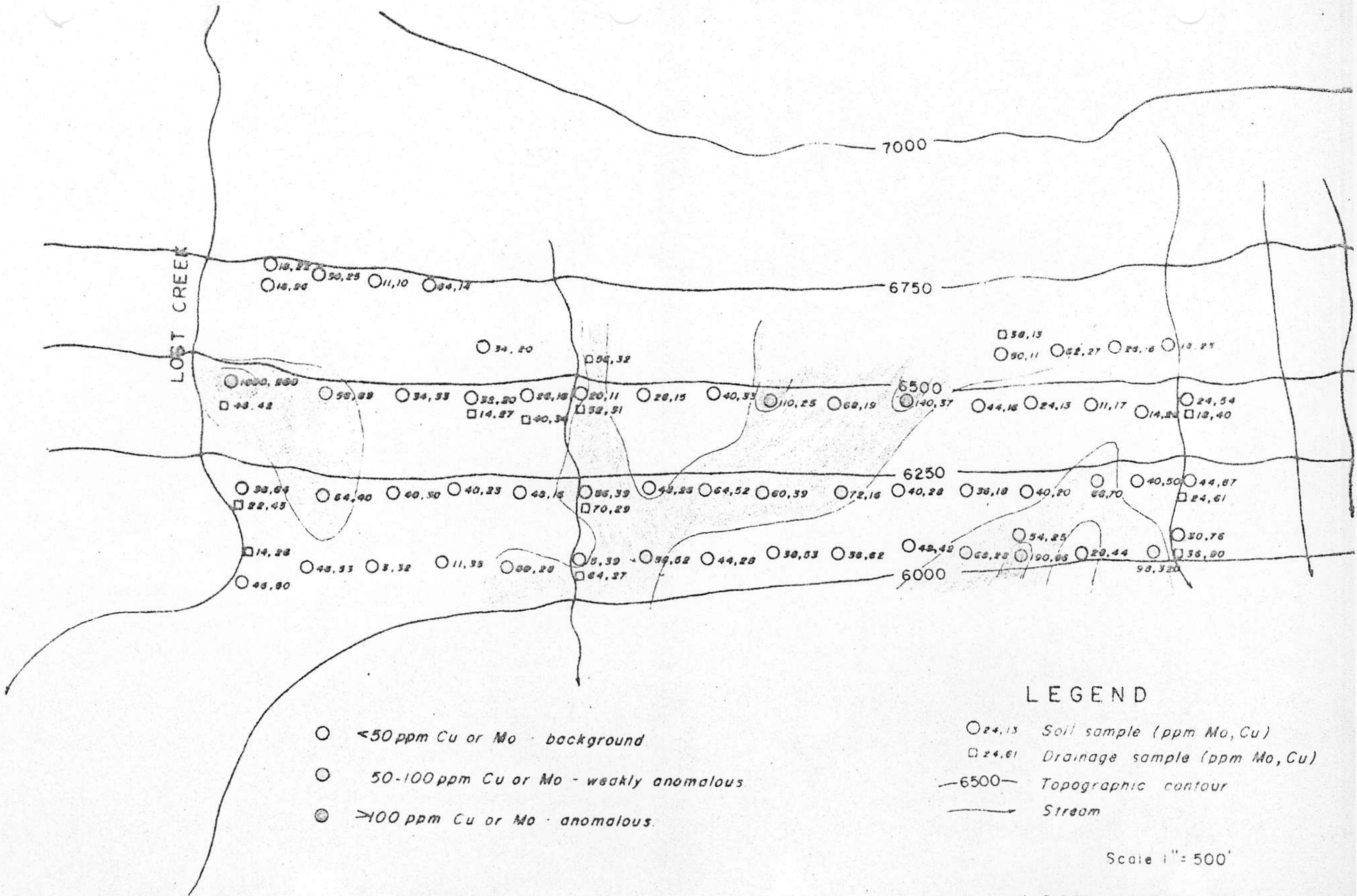
LOST CREEK
SOIL SAMPLING SURVEY
SAMPLE LOCATION

Figure 19



LOST CREEK
SOIL SAMPLING SURVEY
GEOCHEMICAL RESULTS

Figure 19a Cu



LOST CREEK
SOIL SAMPLING SURVEY
GEOCHEMICAL RESULTS

Figure 19b Mo

c) Silt and Talus Sampling (See Figures 20,21)

Silt and talus sampling was carried out in the course of mapping the Berg and Beta ground. Results of samples collected in the Berg ground were generally in agreement with those collected in 1970. The results are interpreted as reflecting the scattered weakly mineralized shear zones round the perimeter of the Berg Stock. In the Beta ground results of sampling did not agree with those of 1970. The writer personally supervised the collection of the samples in 1971. Check analyses of the 1971 samples were run by a second laboratory and the results showed a high degree of agreement. They are therefore considered valid.

In the creek in the central part of the Beta ground silt samples CD-7, CD-8, CD-9 show moderate Cu and Mo values. These may be related to weak mineralized zones occuring below surface and perhaps associated with the granitic patches (apophyses of Berg Stock?) outcropping in the area.

3. <u>Assessment of Anomalous Areas Discovered in 1970</u> (see Fig. 23)

This section is discussed under the following headings:

1) Trail Creek - Float Creek Area
2) Cornice Creek - Big Creek Area
3) Lost Creek Area
4) N.W. Mud Lake Area
5) Berg Group of Claims
6) Beta Group of Claims
7) Best Group of Claims

1) Trail Creek - Float Creek Area: This broad anomalous zone reflects the abundant molybdenite to be found in the area. Copper was found at only two locations, and was confined to:

a) a narrow shear zone within the coarse-grained phase of the stock east of Pinnacle Creek and
b) malachite stained vesicles in the volcanic flows east of the headwaters of Trail Creek.

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The sources of the other copper anomalies were not found but it is possible that small occurrences of a similar nature do exist.

2) Cornice Creek - Big Creek: This smaller area conincides with known MoS_2 occurrences. No copper was seen although in the Rock Geochemical Study discussed above a zone relatively enriched in Cu was seen to run through the Big Creek area.

3) Lost Creek Area: Again MoS_2 occurrences are present which explain the Mo anomalies. Copper was only seen at one location as malachite on fractures in outcrop J 62 near the toe of Tongue Glacier. As in area 2), rock geochemistry suggests a zone of metal enrichment running across the drainage system.

4) Mud Lake Area: This ground is held by Silver Standard Mines Limited. MoS_2 is known to occur quite extensively in the area and one vein with minor amounts of chalcopyrite was seen in the course of the mapping program.

5) Berg Group of Claims: As discussed above the anomalies in the Berg Group of claims are interpreted as being derived from the shear zones which occur around the perimeter of the Berg Stock.

6) Beta Ground: Ground examination did not disclose any occurrences of copper or molybdenum minerals. The pattern exhibited in 1970 would seem to indicate that the molybdenum is concentrated in the area now known to be underlain by the Berg Stock. Silt samples collected in 1971 however, give considerably lower values of molybdenum. This may be due to the following factors:

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a) 1970 reconnaissance samples were collected at the break in slopes whereas 1971 samples were collected approximately 500'-750' higher upslope. There is considerable organic content and finer silt in the lower set of samples which would tend to give higher molybdenum values.

b) Some MoS_2 may, in fact, occur in the underlying rock but be of very limited extent. Examination of the granitic intrusion to the west and east of Salal Creek showed no MoS_2. Two chip samples from the stock average < 2 ppm Mo.

Sources for copper anomalies in Beta ground were not found during the 1971 program. In the N.E. portion of the claims a number of gossaned shear zones in Coast Range rocks were examined but found to contain only pyrite. Further south silt sample KL 648 contains 140 ppm copper. Six silt samples collected on the same creek in 1971 gave much lower values. Again the 1970 sample was collected lower down and may be relatively enriched.

As discussed above the moderately high values contained in samples CD-7, CD-8, CD-9 may be derived from buried, weakly mineralized shear zones, similar to those in Berg Ground, close to the contact of the Berg Stock.

7) Best Group of Claims: A number of highly anomalous Cu and Mo values were obtained from silt samples in the W. Fork of Salal Creek. The Mo anomalies can be explained by a number of quartz + pyrite + MoS_2 veins in the area.

The copper anomalies are more difficult to account for. No copper was found in outcrop and chip sampling of 1,100' of outcrop gave values of 0.01% Cu or less. Samples from 1970 were re-analysed for Cu using a cold 0.5N HCl digestion. The ratio of cold extractable copper to total copper, expressed as a percentage is a measure of the chemical dispersion of the Cu (see Figure 23).

A series of non-anomalous copper stream sediment samples were also analysed in order to judge the variability of background data. The results appear in Table V.

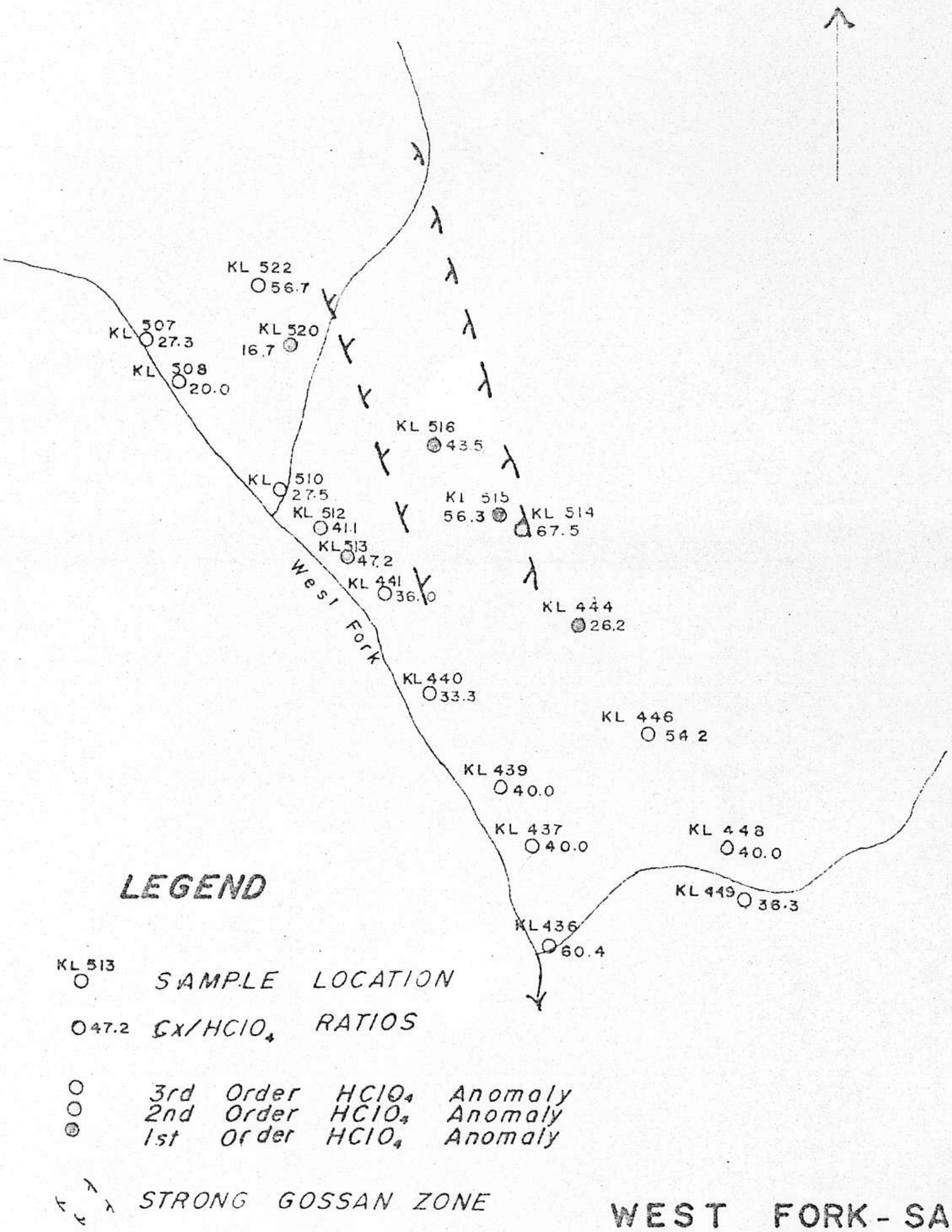
TABLE V

SAMPLE NO.	$Cx/HClO_4$ x 100
KL 359	13.5
360	34.6
361	17.9
362	24.0
364	50.0

From the figures it is evident that the background data is extremely variable and attention to 1st and 2nd order $HClO_4$ anomalous data may be more valid than to the data as a whole. In the West Fork Area the average values of samples upslope is higher than downslope.

Assuming that mineralization is present near or above the top row of samples a working hypothesis can be formulated. Samples KL 444 and KL 515 are both first order anomalies and, upon examination, are found to contain organics. Sample KL 444, although containing organics, has a low ratio compared with KL 515,516. This would imply that much more weathering and mobilization of ions has taken place north of KL 444, which may be caused by a lower pH from the weathering gossan present in the area. Mineralization should be present near or slightly upslope from KL 515, 516 and the mineralization should be associated with the gossan.

...41



WEST FORK - SALAL CREEK

$Cx/HClO_4 \times 100$ RATIOS

SCALE 1" = 1/2 Mile (approx)

FIG 22

As discussed previously no copper was seen in outcrop and chip sampling gave very low values. Quartz + pyrite + hematite veins are numerous in the area. A grab sample of one such vein was found to contain 0.14% Cu. Other grab samples of similar veins contained much lower values. It appears, then, that copper does occur, albeit sporadically, in some of the veins in the area. This may account for the anomalous values in the silts.

GEOPHYSICS

Ground Magnetic Survey (See Appendix 5)

At the end of August a Ground Magnetic Survey was conducted over ground in the Windy Pass - Mud Lake area as an orientation study. The objectives were as follows:

a) To discover if the technique might be of use in defining obscured contacts between various phases of the stock.

b) To discover if a feeder plug existed within the volcanic outcropping in the area.

Depending upon the results of the study, further ground magnetic surveying would be considered on the property, particularly over the volcanics above Float Creek where the existence of a large plug had been suspected.

The results of the survey were rather inconclusive. The 1050 gamma contour line N.W. of Windy Pass may represent the coarse-grained - fine-grained contact. Within the volcanics the picture is complex and, despite the conclusions contained in the assessment report, no major features can be interpreted with any degree of confidence.

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Air Magnetic Survey - Conducted for Silver Standard Mines Limited (See Appendix 6)

Our competitors in the area allowed Cerrocan access to the results of an Air Magnetic Survey flown over the property in 1970.

For complete evaluation of the survey, the map, and preferrably the original data, should be studied by an experience geophysicist.

The following points are, however, worthy of note:

1) There is an increase in magnetic intensity from S.W. to N.E. which may reflect the change in the underlying lithology from a broad area of fine-grained granite in the S.W. to coarse-grained quartz monzonite in the N.E.

2) Most areas of known volcanics show up strongly on the contour map. The volcanics overlying the intrusive in the Trail Creek to Pinnacle Creek area are an exception. They are approximately 1,000' thick and it was expected that they would show up positively. The fact that they do not may be due to the two major flow sequences being reversely polarized. The weak relief also probably precludes the existence of a large plug within this area. Strong magnetic relief is present over, and extends approximately 2,000' S. of, volcanics N.W. of Lost Creek. The southern extension of this area of high relief may reflect the presence of a S. dipping 'feeder' to the volcanics. One would, however, expect some evidence of this in the form of basalt dykes in the area. Their absence tends to detract from the possible existence of a large feeder and the magnetic pattern remains unexplained.

3) A pronounced linear runs NNW-SSE through Logan Ridge. This may reflect a major structural break. The coarse-grained - fine-grained contact on the west side of Logan Ridge changes rather abruptly as one moves east, from E-W to NNW-SSE and back to E-W again.

   This may be evidence of faulting having occurred, with the east downthrown relative to the west.

4) A number of highs and lows occur whose significance is not known. Numerous linears can be drawn whose dominant direction is roughly parallel to the flight lines. This may be due to some bias in contouring. A surprising feature is the lack of linears paralleling the major NE structures mapped on the ground.

5) Although corrections for terrain clearance and a variety of mathematical techniques could be carried out using computers, no such study is recommended by the writer.

ASSAY SAMPLING (See Figs. 20,21)

No extensive sampling was carried out during 1971. Past work, particularly by Southwest Potash Corp., showed conclusively that an ore body is not exposed at surface. The same company also found that because leaching has considerably impoverished the surface outcrops, chip sampling is useful only as an indicator of the presence or absence of molybdenum in the underlying rock. Sampling, therefore, was limited to occasional grab samples and chip sampling of special areas as a check on previous work.

The results of all samples assayed are shown in Table VII.

TABLE VII

SAMPLE NO.	TYPE	LOCATION	RESULTS IN % Mo	MoS_2	Cu	REMARKS
40-009-CR-1	Grab	West Fork Salal	0.010		0.14	Qtz + Pyr + Hematite Vein
CR-2	"		0.135		0.01	Qtz + Hematite + MoS_2 Vein
CR-3	"	"	0.011		Trace	Qtz + Pyr + MoS_2 Vein
GR-1	"	"	0.402		Trace	Qtz + Pyr + MoS_2 Vein
GR-2	"	"	0.085		Trace	Qtz + Pyr + MoS_2? Vein
GR-3	"	"	0.020		Trace	Qtz + Pyr + MoS_2? Vein
CR-8	"	"	0.006			Qtz + Pyr + MoS_2? Vein
GR-5	"	Above Trail Creek			0.30	Malachite in vesicles in basalt
GR-6	"	Coast Range NW Corner			0.03	Malachite along fracture in gabb
GR-7	Chip/9"	Trail Creek		3.20		Qtz + MoS_2 Vein
GR-8	Grab	Outcrop 291-71		0.13		6" Qtz + Pyr + MoS_2 Vein
GR-9	"	Outcrop 291-71		0.83		8" Qtz + Pyr + MoS_2 Vein
GR-10	"	Outcrop 294-71		0.29		8" Qtz + Pyr + MoS_2 Vein
GR-11	"	Outcrop 294-71	Awaiting Results			6" Qtz + MoS_2 Vein
CR-12	Chip	Outcrop C99		0.11		3" Qtz + Pyr + MoS_2 Vein
CR-13	"	Outcrop C104		0.009		9" Qtz + Pyr + MoS_2 Vein
CR-14	Chip/7'	Outcrop 268-71		0.036		Qtz + MoS_2 veinlets
CR-15	Grab	Outcrop 284-71	0.004			Qtz + Pyr in fracture
CR-16	"	Outcrop C119		1.41		1¼" Qtz + MoS_2 Vein
CK-1	Float	Berg Ground		0.001	2.79	Malachite in Coast Range diorite
CK-1a	Grab	" "		0.025	0.03	1' shear zone
CK-1b	"	" "		0.002	0.63	1' shear zone with malachite
CK-2e	Float	" "		0.001	0.10	Malachite along fracture in dior
HR-1	Chip	Float Creek		1.654		6" Qtz + MoS_2 Vein
HR-2	Chip	" "		0.092		2' Qtz + MoS_2 + Pyr Vein
HR-3	"	" "		0.057		5' Qtz + Pyr + MoS_2 Vein
HR-4	"	" "	0.110			10') MoS_2 in joints, veins and
HR-5	"	" "	0.075			10') poorly developed quartz +
HR-6	"	" "	0.045			10') MoS_2 stockworks
HR-7	"	" "	0.050			10')
HR-8	"	" "	0.018			10')
HR-9	"	" "	0.013			10')
HR-10	"	" "	0.010			10')

TABLE VII (Continued)

SAMPLE NO.	TYPE	LOCATION	Mo	Results in % MoS$_2$	Cu	REMARKS
40009-HR-11	Chip	Float Creek	0.021			10') MoS$_2$ in joints, veins
HR-12	"	" "	0.019			10')
HR-13	"	" "	0.053			10') and poorly developed
HR-14	"	" "	0.120			10') quartz + MoS$_2$ stockworks
HR-15	"	E.Trib.Float Crk	0.012			5' Qtz + MoS$_2$, MoS$_2$ veins
HR-16	"	" " " "	0.340			5' shear, Pyr+MoS$_2$+Hem+Mgt.
HR-17	"	Float Creek	0.028			5' shear,Pyr +MoS$_2$ +Hem+Mgt.
HR-18	"	" "	0.035			10' Qtz + MoS$_2$ veins
HR-19	"	" "	0.012			10' Qtz+MoS$_2$, Qtz+MoS$_2$+Pyr vei
HR-20	"	" "	0.017			3' Qtz + Pyr + MoS$_2$ stockwork
HR-21	"	W.Trib.Float Crk	0.036			10') Qtz + MoS$_2$, MoS$_2$ veins,
HR-22	"	" " " "	0.210			10') and MoS$_2$ on joints
HR-23	"	" " " "	0.069			10')
HR-24	"	1000'E PinnacleCrk			0.23	1' Qtz + Pyr + Cp vein in shea
HR-25	"	# 1 Creek		0.004	0.01	50'
HR-26	"	" "		0.002	0.01	50'
HR-27	"	# 3 Creek		0.003	0.01	50'
HR-28	"	# 1 Creek		0.005	< 0.01	50'
HR-29	"	" "		0.001	0.01	50'
HR-30	"	" "		0.001	< 0.01	50'
HR-31	"	" "		0.002	< 0.01	50'
HR-32	"	" "		0.005	< 0.01	50'
HR-33	"	" "		Trace	< 0.01	50'
HR-34	"	# 2 Creek		0.008	< 0.01	50'
HR-35	"	" "		0.001	0.01	50' F R A C T U R E D A N D
HR-36	"	" "		0.007	0.01	50'
HR-37	"	" "		0.009	< 0.01	50' G O S S A N Z O N E
HR-38	"	" "		Trace	< 0.01	50'
HR-39	"	" "		Trace	< 0.01	50'
HR-40	"	" "		0.001	0.01	50'
HR-41	"	" "		0.001	0.01	50'
HR-42	"	# 3 Creek		Trace	< 0.01	50'
HR-43	"	" "		0.002	< 0.01	50'
HR-44	"	" "		0.002	< 0.01	50'
HR-45	"	" "		0.001	0.01	50'
40009- HR-46	"	" "		Trace	< 0.01	50'

Weighted averages for chip samples collected in two distinct parts of the property are shown in Table VIII.

The relation % Mo x 1.6683 = % MoS_2 was used to convert % Mo to equivalent % MoS_2.

TABLE VIII

No. of Samples	Location	Total of Width Sampled	Average Values % MoS_2	Cu
23	Float Creek	185.5 ft.	0.070	
11 (cont.chip)	Float Creek	110.0 ft.	0.048	
22	West Fork	1100.0 ft.	0.003	< 0.01

Sample results in the West Fork region are uniformly low and the ground is not considered to be of economic interest.

The results of the Float Creek sampling are slightly above those obtained by Southwest Potash in 1965. Sampling in 1971 was, however, of the better molybdenite occurrences.

As pointed out in the 1965 report by Southwest Potash Corp., bulk sampling of fresh outcrop gave markedly higher values compared with chip sampling of surface outcrop. Table I from the 1965 Report is shown below.

SOUTHWEST POTASH CORP.. 1965 REPORT - TABLE I

SURFACE CHIP SAMPLES No.	%MoS_2	Interval	BULK SAMPLES FROM EQUIVALENT LINE No.	% MoS_2	Interval
7534	0.01	20'	7679	0.04	50'
7535	0.02	20'			
7536	0.01	20'			
7537	0.01	20'	7680	0.07	50'
7538	0.01	20'			
7539	0.01	20'			
7540	0.01	20'	7681	0.09	50'
7541	0.03	20'			
	0.014	160'		0.067	150'

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This represents a very significant, (almost five-fold) increase in values in fresh rock. If this relationship exists throughout the property then where 110' of chip sampling was obtained from Float Creek, assaying 0.048% MoS_2, one could expect appreciably higher MoS_2 values in the underlying fresh rock.

REVIEW

Work to date has confirmed that the best occurrences of molybdenite are to be found close to the contact between the fine and coarse grained phases of the stock, e.g., Glacier Island, Mud Lake, Float Creek. This being so the most likely locations for molybdenite of ore grade are those areas where there occurs the greatest surface area of contact per unit volume. The only two areas within the property which appear to display this feature are:

1) Granitic Complex near Lost Creek
2) Float Creek Area.

1) Granitic Complex - The fine, medium and coarse grained phases of the stock are all present within the area. Widely spaced veins up to 1' across of quartz + MoS_2 + pyrite occur. As discussed above outcrops are few. There is, however, a soil geochemical anomaly present.

The alteration is, according to the Lowell and Guilbert Model, in the outer argillic zone (see Fig. 8) although there seems to be some telescoping of the phyllic (quartz and pyrite) zone within the argillic. A diagramatic section (Fig. 24) suggests that the different phases may be too compressed to afford a good host for introduced molybdenite.

2) Float Creek Area - Here again fine, medium and coarse grained phases of the stock are present. Molybdenite occurs in fractures and shears at lower elevations and in quartz veins, 'dry' veins and veinlets, along joints, fine fractures and in minor stock-

...48

works at higher elevations. As a section through Float Creek suggests (Fig. 25) the change is actually from shear and fracture control higher in the system to vein and joint control lower in the system.

The alteration pattern (Fig. 9,25) also show a change from argillic to the more favourable phyllic as one moves lower in the system. Diagramatic sections C-D, E-F, G-H (Figs. 25,26, and 27) moreover, suggests that a high degree of interfingering of the fine and coarse grained phases has occurred and the originally suggested condition for ore is met. viz. greatest surface area of contact per unit volume.

The Red Hill - Plug Glacier area, although not considered a target at present, has a number of features which are of interest:

1. The latest phase of the stock outcrops in the area
2. A siliceous breccia and quartz vein stockwork occurs 1,000' west of Red Hill
3. Molybdenite in veins and on fractures, quartz veins, pyrite veins, and minor chalcopyrite veins occur in float below Plug Glacier. The distribution of the float indicates that molybdenite lies beneath Plug Glacier.

The evidence suggests that detailed work in this area could result in a drilling target being defined.

CONCLUSIONS

The geological interpretation, the trend in mode of occurrence of molybdenite, and the alteration zoning all point to the Float Creek area, and particularly the ground overlain by the volcanics, as being the most promising on the property.

C.B. Campbell,
Project Geologist.

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ADDENDUM

Work Requirements

Property Status

Development of Pemberton Area

ADDENDUM

WORK REQUIREMENTS

Under the terms of the agreement Cerro Mining Company of Canada is committed to spending $75,000 by December 31st, 1971. This committment has been met. A further sum of $175,000 must be spent on exploring the property by December 31st, 1976 in order to fulfill our obligations.

PROPERTY STATUS

The property consists of the EE, R, Plug, Bat, Ball, Beta, Best,and Berg Mineral Claims (345 full size, 7 fractions). Of these the Bat, Ball, Beta, Best and Berg have not been legally surveyed. Staking by both Cerro Mining Company of Canada Limited, and Silver Standard Mines Ltd., is thought to have resulted in some ground being overstaked by both parties.

All of the ground originally optioned by Cerrocan is being kept in good standing. In addition the Bat, Ball and certain of the Best and Beta claims are being retained in order to:

1) Retain strategically located ground and unimpeded access to the property.
2) Comply with the terms of the Agreement.

To these ends assessment work has and will be applied to the claims such that the status of the property will be as shown in Table IX.

Based on an evaluation of the data collected in 1971, all Berg claims and the balance of the Best and Beta claims are not being held.

...(2)

TABLE IX

CLAIM NAME	EXPIRY DATE
EE 1-15	May 22, 1973
EE 17-30	May 22, 1973
EE 31-47	Aug. 24, 1973
EE 48-49 Frs.	Oct. 12, 1973
R 1-32	Nov. 19, 1973
Plug 9-12	Sept. 2, 1972
Plug 19-24	Sept. 2, 1972
Bat 1-6	Aug. 4, 1973
Bat 7 Fr.	Aug. 4, 1973
Bat 8-9	Aug. 4, 1973
Bat 10-14	Oct. 20, 1972
Bat 15, 16 Frs.	Oct. 20, 1972
Ball 1-15	Aug. 4, 1973
Ball 16 Fr.	Aug. 4, 1973
Best 1-4	Oct. 14, 1972
Best 16, 18, 20, 22, 24	Oct. 14, 1972
Best 30-34	
Best 50-51	and
Best 94	
Best 115-116	Oct. 20, 1972
Beta 1-6	Oct. 14, 1972
Beta 33-48	Oct. 14, 1972
Beta 53-54	Oct. 14, 1972
Beta 61-62	
Beta 67-68	and
Beta 73-74	Oct. 20, 1972

Prior to May 22nd further assessment work can be recorded, for a fee of $230.00 on Mineral Claims

...(3)

EE 1-15, EE 17-47, which would keep them in good standing until May 22nd and August 24th, 1974.

If the above assessment is applied then the minimum costs incurred in 1972 and 1973 would be as shown in Table X.

TABLE X

1972		1973	
Aug.1	$5,000-Advance Royalties	Aug. 1	$5,000-Advance Royalties
Sept.2	1,000-Plug Claims	Aug. 4	Plug, R, EE
Oct.14	6,300-Best & Beta Claims	to	Best, Beta, Bat
Oct.20	700-Bat 10-16	Nov.14	13,900-& Ball Claims
	400-Recording Fees		695-Recording Fees
	$13,400		$19,595

These costs can be reduced if some of the Best and Beta claims are dropped in the future, after formally giving notice of our intentions to Salal Molybdenum Mines Ltd.

DEVELOPMENT OF PEMBERTON AREA

The nearest roadhead is 22 miles from the property. Indications are that the logging companies and the Forest Department do not intend advancing the existing road for three or four years.

Present plans for construction of a gas pipeline from Williams Lake to Powell River show that the line would run up the Lillooet Valley as far as Meager Creek, approximately 12 miles from the Salal Property (see Fig. 1). Although a dispute over tenders is presently in progress it is expected that by late 1972 a start will be made on the project. This would mean construction of an access and maintenance road along the route of the pipeline.

#

APPENDIX 1

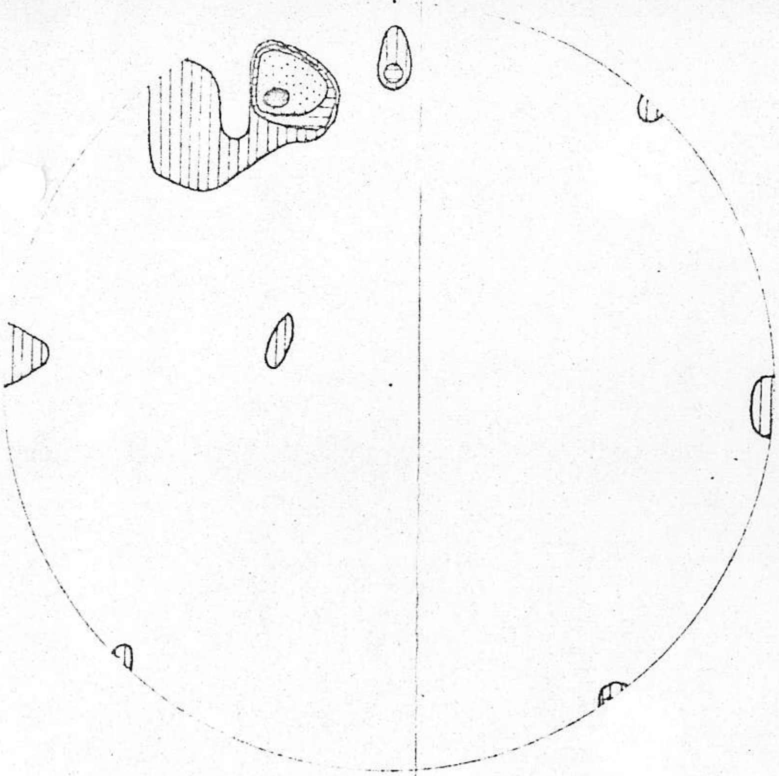
PERSONNEL

PERSONNEL

C. B. CAMPBELL	VANCOUVER, B.C.	PROJECT GEOLOGIST
G. C. STEPHENS	BETHLEHEM, U.S.A.	MAPPING GEOLOGIST
J. S. POMEROY	VANCOUVER, B.C.	ASSISTANT GEOLOGIST
J. WILFERT	HANEY, B.C.	FIELD ASSISTANT
A. R. FINDLAY	OTTAWA, ONTARIO	FIELD GEOLOGIST
K. KIERANS	VANCOUVER, B.C.	GEOCHEMICAL SAMPLER
M. SHAMROCK	VANCOUVER, B.C.	GEOCHEMICAL SAMPLER

APPENDIX 2

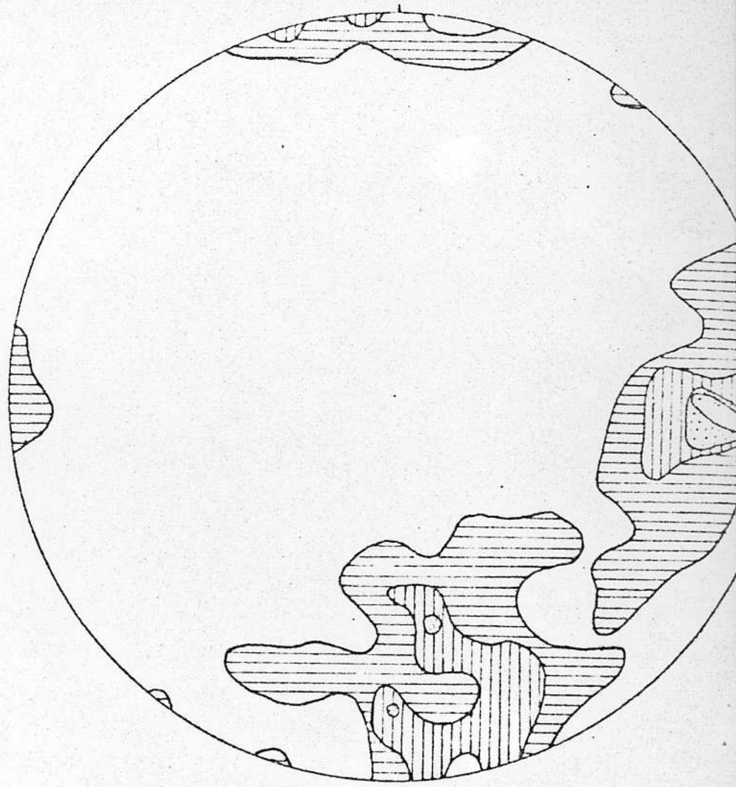
STRUCTURAL STEREOGRAMS



PREFERRED ATTITUDE
088/70SE

MINERALIZED VEINS
AREA 3
35 POINTS

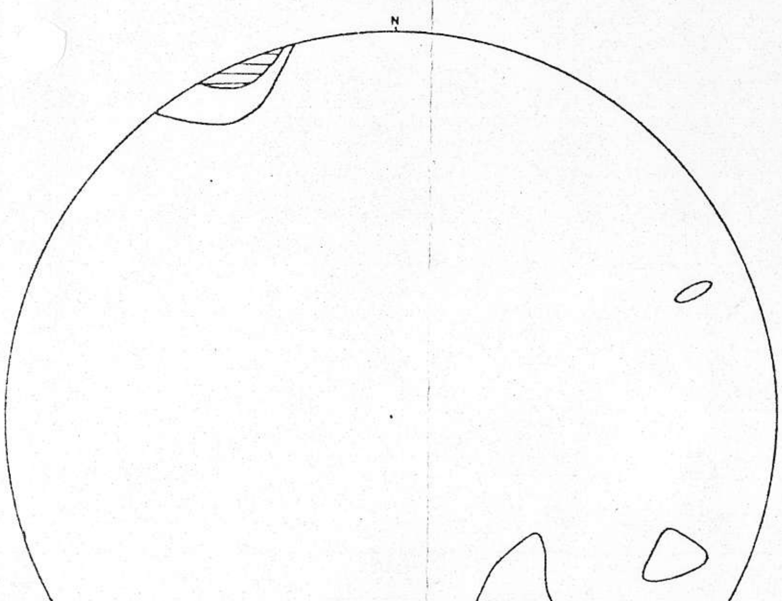
CONTOURS AT
5% 8% 14% 20%



PREFERRED ATTITUDE
002/75W
070/70NW

MINERALIZED VEINS
AREA 4
204 POINTS

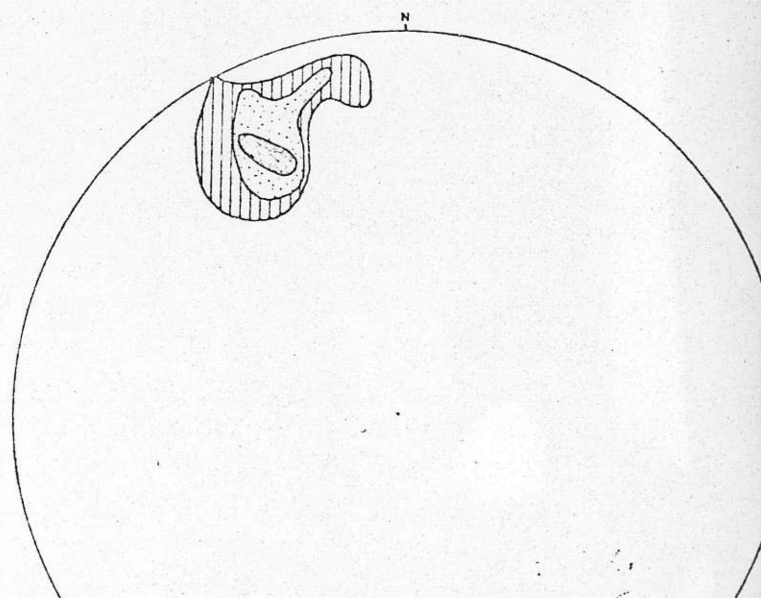
CONTOURS AT
1.75% 3.5%
4.5% 5.5%



PREFERRED ATTITUDE
037/80NW

MINERALIZED VEINS
AREA 8
57 POINTS

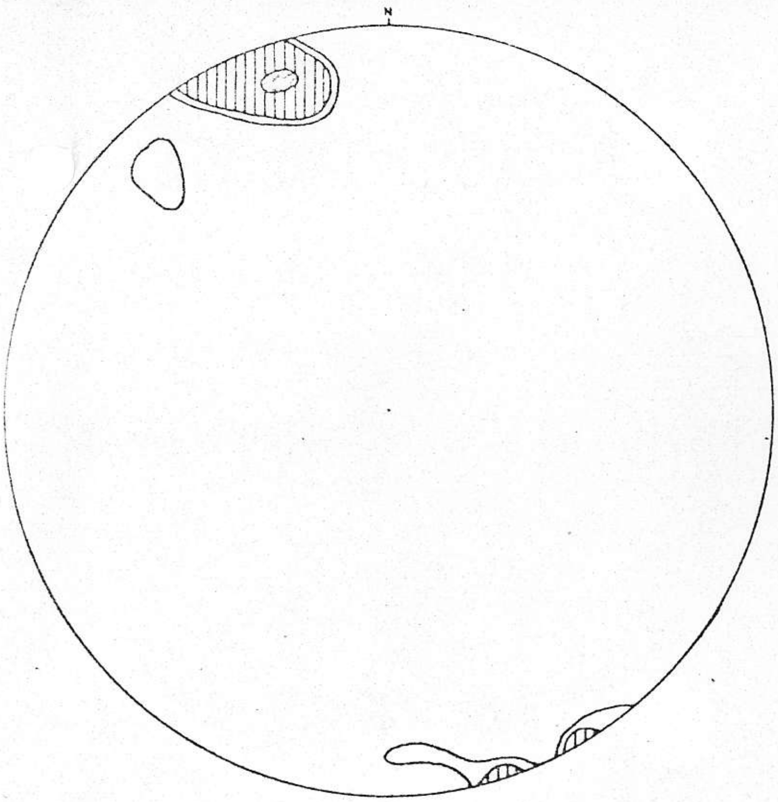
CONTOURS AT
4% 8% 12% 15% 19%



PREFERRED ATTITUDE
062/65S

MINERALIZED VEINS
AREA 10
35 POINTS

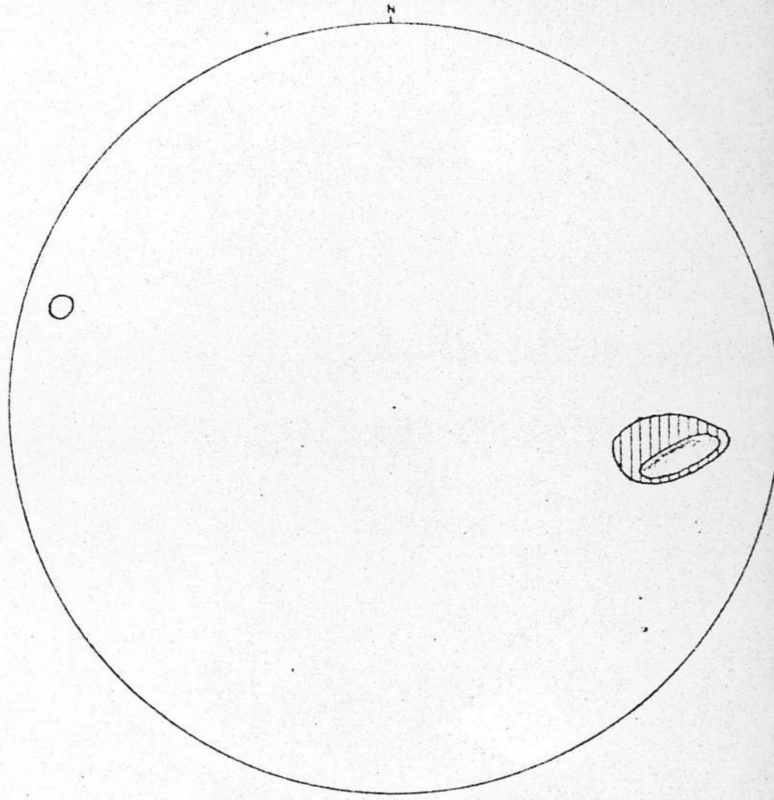
CONTOURS AT
12% 18% 25%



PREFERRED ATTITUDES
072/80SW

MINERALIZED VEINS
AREA 1
23 POINTS

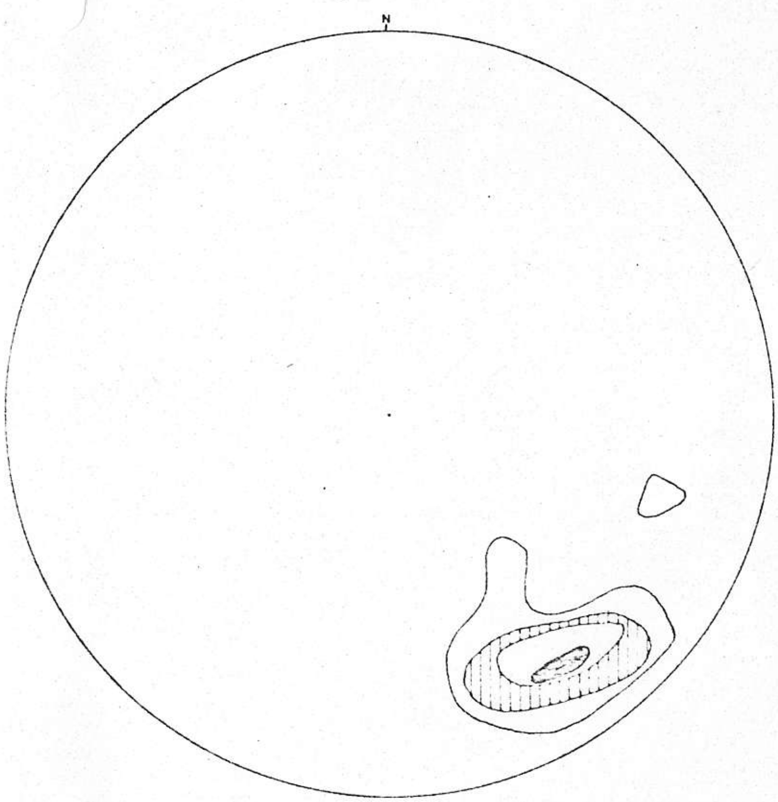
CONTOURS AT
6% 10% 18%



PREFERRED ATTITUDE
010/65W

MINERALIZED VEINS
AREA 2
19 POINTS

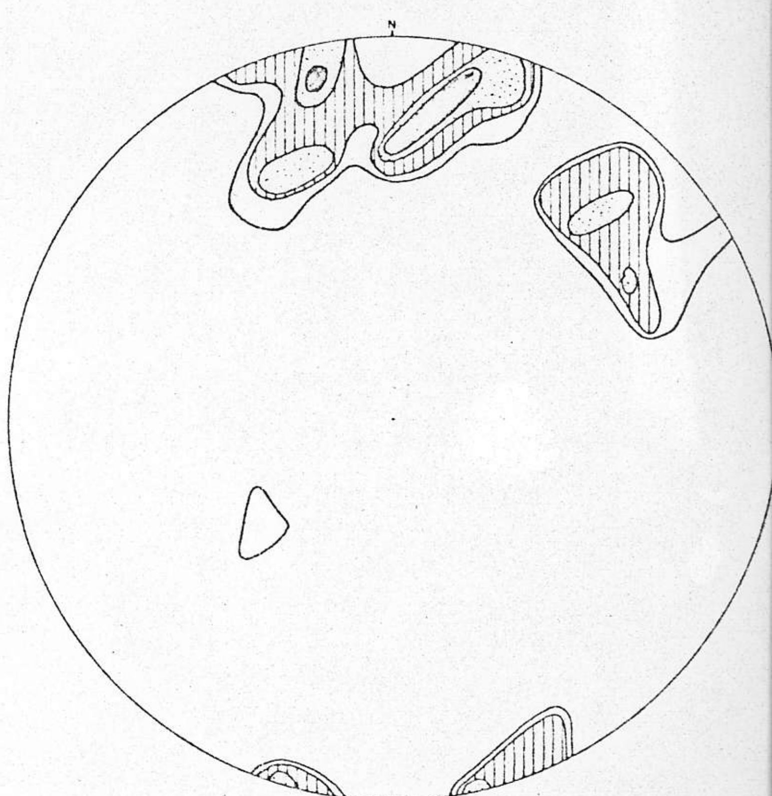
CONTOURS AT
14% 19%



PREFERRED ATTITUDE
057/ 70 NE

MINERALIZED VEINS
AREA 5
87 POINTS

CONTOURS AT
4% 8% 12% 18%



PREFERRED ATTITUDE
078/ 80S
098/ 70S

MINERALIZED VEINS
AREA 7
118 POINTS

CONTOURS AT
25% 35% 55% 65%

Map 002

001-
002

APPENDIX 3

Preliminary Thin Section Alteration Study

PRELIMINARY THIN SECTION ALTERATION STUDY

Twenty-three rocks were selected from the Water Fall Creek - Lost Creek area for thin section section of wall rock alteration. Particular emphasis was placed on attempting to correlate the thin section data with the alteration pattern based on field observations.

It is difficult to identify and distinguish several of the more common alteration minerals in thin section. This is because of the very small grain size of many of the secondary minerals and because several of the alteration products have nearly similar optical properties. Nevertheless it is possible to identify four major alteration products. These are:

1) Chlorite - developed from primary biotite- other minerals which occur with the chlorite are magnetite and epidote.
2) Kaolinite - differentiated from sericite by its white to buff colour, fine grain size, and lower birefringence. Other clay minerals have properties similar to those of kaolinite and could not be distinguished from it optically.
3) Sericite - easily recognized by its higher birefringence, colourless appearance in plane polarized light, and diagnostic cleavage in the larger grains. Illite is indistinguishable from sericite by optical methods and, if present, was grouped with sericitic alteration.
4) Silicification - recognized by an excess of free silica over the normal modal composition. The secondary quartz is generally more inclusion-free than the primary quartz.

The thin sections from Salal Creek show systematic differences in both the type and intensity of the alteration. The reconstructed alteration sequence is as follows:

1) Outer Chlorite Zone - primary biotite is partially altered to chlorite and magnetite (± small epidote blebs). The potash feldspar is unaltered. Plagioclase grains show very mild kaolinization or saussceritization. Quartz is unaltered. (This is the "Propylitic Zone" of Lowell & Guilbert, 1970)
2) Inner Chlorite Zone - biotite is completely altered to chlorite and magnetite (±epidote). The potash feldspar is still relatively fresh; the placioclase is moderately sausseritized ("Argillic Zone" of Lowell & Guilbert, 1970).
3) Outer Sericite Zone - biotite is almost entirely absent. Chlorite grains are partially to completely altered to sericite. All fedspars show moderate to strong development of large grains of sericite and epidote ("Phyllic Zone" of Lowell & Guilbert, 1970).
4) Inner Sericite (± Biotite) Zone - primary biotite and associated chlorite are completely absent. Secondary, fibrous, brown biotite is occasionally present in small quantities. Silicification is present in some thin sections. Secondary sericite is abundant and occurs as large, well-developed flakes. In one thin section (J-58), the orientation of the sericite and secondary quartz imparts a strong foliation to the rock. Minor secondary (?) potash feldspar is sometimes found in this zone. ("Potassic Zone" of Lowell & Guilbert, 1970).

... 3

Wall rock alteration zoning is related directly to ore occurrences in numerous localities throughout North America. The zoning is of two major types:

1) "Vein zoning" - the systematic arrangement of alteration zones adjacent to the individual sulphide-bearing veins. Examples of vein zoning are Butte (Sales and Meyer, 1948), and Endako (Drummond and Kimura, 1969).
2) "Deposit zoning" - the systematic arrangement of the alteration zones relative to the entire ore body. An example of this type of zoning is the San Manuel - Kalamazoo ore body (Lowell & Guilbert, 1970).

At Salal Creek the zoning is not related to any individual veins. It may however be related to the northeast-trending vein system exposed between Trail Creek and Cornice Creek. The thin section density is too low to allow any more than a generalized picture of the alteration zoning. However, several significant facts have been established in this study.

1) Alteration intensity is greatest in the Trail Creek-Cornice Creek area.
2) Alteration types include: I. the propylitic assemblage in which the biotite is chloritized and the plagioclase is slightly kaolinized. II. the argillic assemblage in which the biotite is chloritizied, the plagioclase is kaolinized, and the potash feldspar is flecked with sericite. III. the phyllic assemblage in which sericite and quartz are dominant alteration products. IV. the potassic assemblage in which quartz, sericite, and minor secondary biotite and potash feldspar are present.

...4

These alteration types are zoned around a center located in the Float Creek area; the alteration types are shown on the accompanying map for those localities at which thin sections are available. (See Fig. 28)

3) The most intense alteration is definitely associated with the best molybdenite mineralization.

APPENDIX 4

SECOND BARRINGER RESEARCH STUDY

(AVAILABLE ON REQUEST)

APPENDIX 5

GROUND MAGNETIC SURVEY

GROUND MAGNETOMETER SURVEY

on the

PLUG 9-12, PLUG 19-24, BAT 10-14, BAT 15 Fr., BAT 16 Fr.

MINERAL CLAIMS

SALAL CREEK MOLYBDENUM PROPERTY, SALAL CREEK, B.C.

LILLOOET MINING DIVISION, BRITISH COLUMBIA

N.T.S. 92 J 14

LATITUDE 50° 45' N   LONGITUDE 123° 30' W

BY

CERRO MINING COMPANY OF CANADA LIMITED, ON BEHALF OF

SALAL MOLYBDENUM MINES LTD.

AUGUST 28TH TO SEPTEMBER 2ND, 1971

VANCOUVER OFFICE

September 30th, 1971

D.K. Mustard, P.Eng.

C.B. Campbell

C O N T E N T S

I L L U S T R A T I O N S

INTRODUCTION

From 28th August to 2nd September, 1971, a ground magnetic survey was conducted on the Plug 9-12, Plug 19-24, Bat 10-14, Bat 15 Fr. and Bat 16 Fr. Mineral Claims situated on the Salal Creek Molybdenum Property, approximately 42 miles N.W. of Pemberton, B.C.

The survey was carried out with the following aims:

1. to define contacts, obscured by talus, between various phases of the intrusive
2. to determine if the volcanics in the area are flows, or at least in part, plugs
3. to discover major structures which may exist beneath talus and glacial debris.

LOCATION & ACCESS (See Fig. 1)

The Salal Creek Molybdenum property is situated at the headwaters of Salal Creek, a tributary of the Lillooet River, 42 miles N.W. of Pemberton, B.C.

The property is located in typically rugged Coast Range terrain. Elevations range from 4,500' to a maximum of 8,100'.

The Plug and Bat Mineral Claims lie in the extreme N.W. portion of the property, between Mud Lake and the headwaters of Lost Creek.

Access to the property is by helicopter from Pemberton.

.. 2

GEOLOGY (See Fig. 2)

The property is underlain by a differentiated acid stock intruding the strongly foliated Coast Range Complex. In general a coarse grained quartz monzonite border phase surrounds a fine grained granitic core. A medium grained phase gradational between the other phases locally occurs. Numerous acid and basic dikes intrude the stock. Patches of Tertiary to Recent Volcanics in the form of flows and plugs outcrop on the property.

Molybdenite occurs extensively on the property in veins, as joint coatings and, rarely, disseminated. It is found in all phases of the stock. Recent mapping, however, indicates that the best occurrences are to be found in the coarse grained phase.

The emplacement of the molybdenite is strongly controlled by structural features such as shears and fractures.

Within the area surveyed, coarse, medium, and fine grained phases of the stock are represented. The coarse grained phase is an equigranular, locally porphyritic, grey to pinkish-grey granite. The average grain size is 2.5 to 3.5 mm. Based on a limited number of thin sections studied in 1970 the rock is classified as a quartz monzonite with the following modal composition:

Quartz	35%
Orthoclase	40%
Plagioclase	20%
Biotite	5%

The medium grained phase is similar to the coarse grained phase in all ways except grain size. The average grain size is 1.5 to 2.5 mm. It is classified as quartz monzonite.

The fine grained phase is equigranular, locally porphyritic, grey to pinkish-grey. The average grain size is 0.5 mm to 1.00 mm. It is classified as a biotite granite and has the following modal composition.

Quartz	40%
Orthoclase	45%
Plagioclase	10%
Biotite	3-5%

As can be seen from the above, the fine grained phase is slightly less mafic than the medium and coarse grained phases. The 1971 mapping program indicates that whereas magnetite is present in all three phases of the stock it occurs in lesser quantities in the medium and fine grained phases.

Volcanics outcrop in two distinct localitites. Molybdenite occurs in shears in outcrop in the Mud Lake area and along joints in float.

Much of the ground is obscured by talus and glacial debris and contacts have been defined only approximately by geological mapping.

..4

SURVEY PROCEDURES

The instrument used was a Scintrex Model MF-2 fluxgate magnetometer which measures the vertical component of the earth's magnetic field.

A base station was set up at Windy Pass, a central location. Lines were run along the accessible parts of the survey area. As such they are confined to the ridges above Windy Glacier and to the area between Windy and Plug Glaciers (See Fig. 2).

The instrument was operated in accordance with the manufactures recommendations.

Initially the instrument was adjusted for latitude. Since all possible sensitivity was desired the range switch was set at 1,000 gamma, and the latitude switch was set to the position + 20 to give a reading closest to 0 gamma on the scale. At the beginning of each day the fine control was then adjusted to give a reading of 0 gamma at the base station. At each station the meter reading and time were recorded. A number of closed traverses were made such that additional readings could be taken at the base station approximately every two hours. The difference between the readings at the base station, divided by the number of minutes elapsed between the readings gave the diurnal change in gammas per minute. The reading at intervening stations was corrected using this figure.

..5

RESULTS

The results are plotted as profiles (Figs. 3,4, and 5) along each traverse line and as a contoured plan (Fig. 6). For convenience in contouring an arbitrary value of 1,000 gamma was added to the readings thus eliminating negative values.

In the northern part of the survey a contour interval of 50 gamma was used because of the weak magnetic relief. In the southern part where magnetic relief is stronger a contour interval of 100 gamma was used.

Lines 6 to 11 were run in the area between Windy and Plug Glaciers. Outcrop is mostly obscured by talus and glacial debris. The magnetic relief over most of the survey area is weak. Two features are, however, important:

1. The 50 gamma contour, running in a northeasterly direction is possibly an indicator of the contact between the coarse grained and fine grained phases. This moves the present contact, based on mapping of the few outcrops available, south by approximately 500 feet.
2. Strong magnetic relief in the extreme north of the area lies over known volcanic outcrop. As contacts are obscured, considerable doubt exists as to whether this is a volcanic plug or the remnant of a flow. The strong magnetic relief exhibited over this feature suggests that it is indeed a plug.

..6

In the area to the south a more involved magnetic pattern exists. The picture is fairly typical of that found over Tertiary volcanics. "Highs" and "Lows" occur closely together in a complex pattern. The broad "Low" areas to the east and northwest probably reflect the talus and ice in these localities.

The isolated "High" to the north, as defined by lines 2,3, 4 and 5 may be indicative of a "Feeder" plug to the flows.

From September 3rd to 5th the survey was extended to the south to cover the remainder of the volcanics. This part of the survey was completed quickly as the area is easily accessible and the flat topped volcanic outcrop afforded fast and easy movement between stations. A major structural feature appears to run through Station 5 on Line 13 in an east-south-east direction. This feature is not seen on surface and may be one affecting the intrusive itself.

CONCLUSIONS

Ground magnetic surveys on the Salal Creek Molybdenum Property can be utilized to indicate obscured contacts between different phases of the intrusive and to distinguish volcanic plugs from flows. The limited work to date suggests that obscured structural features may also be detectable by this method.

.. 7

RECOMMENDATIONS

Ground magnetic surveys should be carried out over selected areas of the stock especially where contacts are hidden and where the presence of volcanic plugs may be of significance, e.g., in locating drill holes.

Any structural features suggested by the survey should be carefully investigated on the ground as these are likely to be of great importance in regard to ore localization.

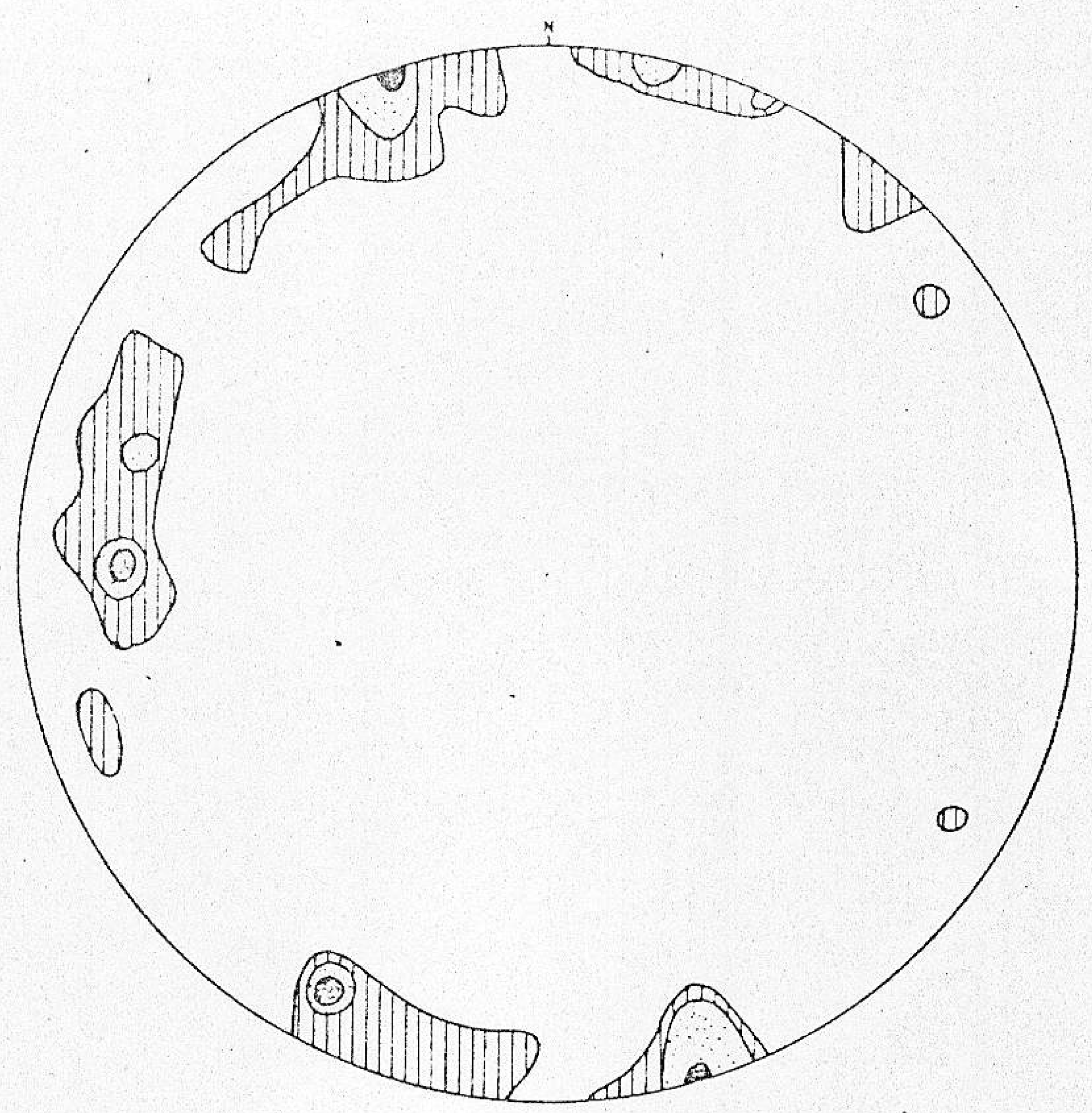
D.K. Mustard, P. Eng.

C.B. Campbell

APPENDIX 6

AIR MAGNETIC SURVEY - PLAN ONLY

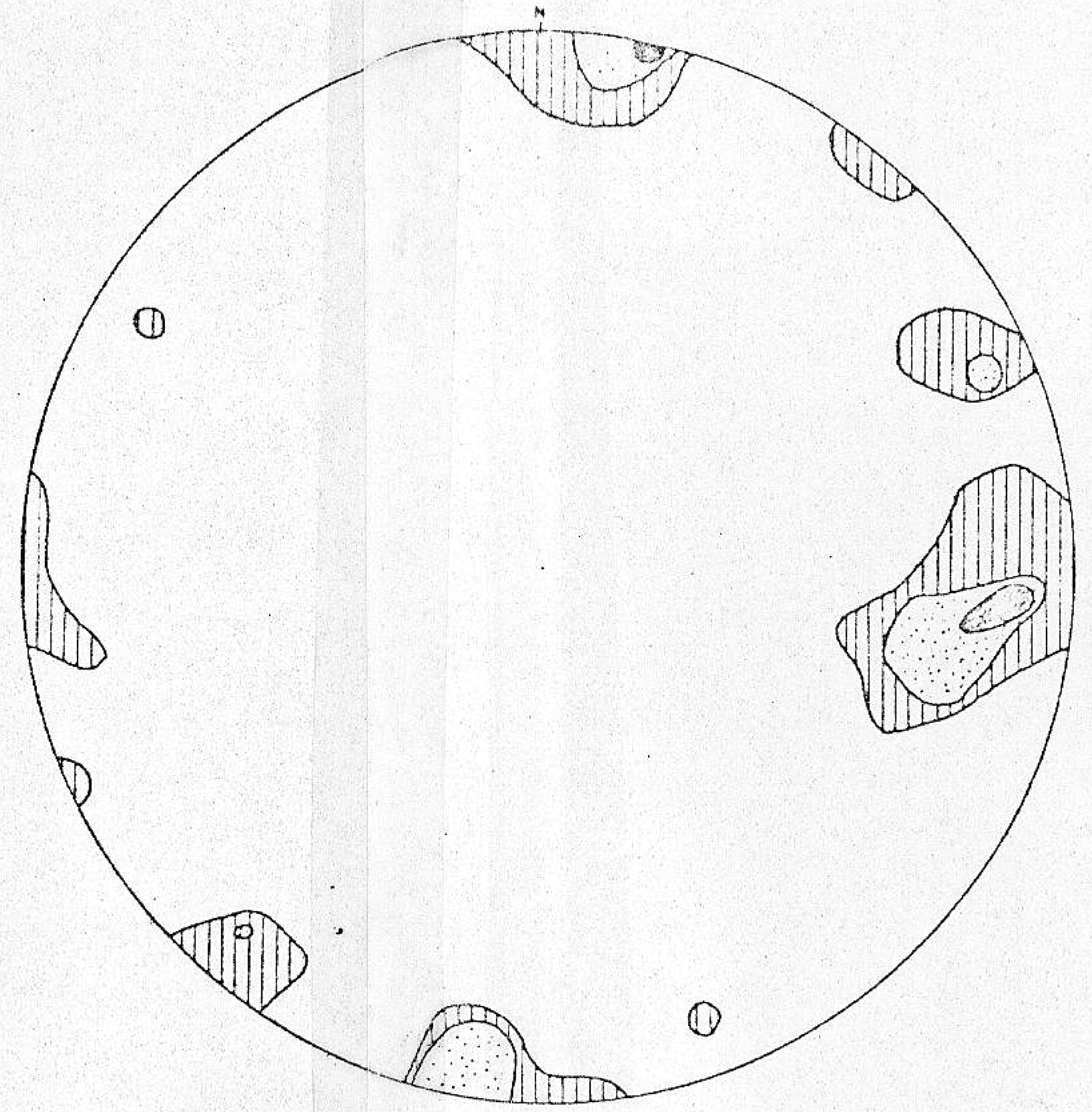
(SEE POCKET 6)



PREFERRED ATTITUDE
000/68E
073/V
118/78NE

HIGH ANGLE JOINTS
AREA 1
204 POINTS

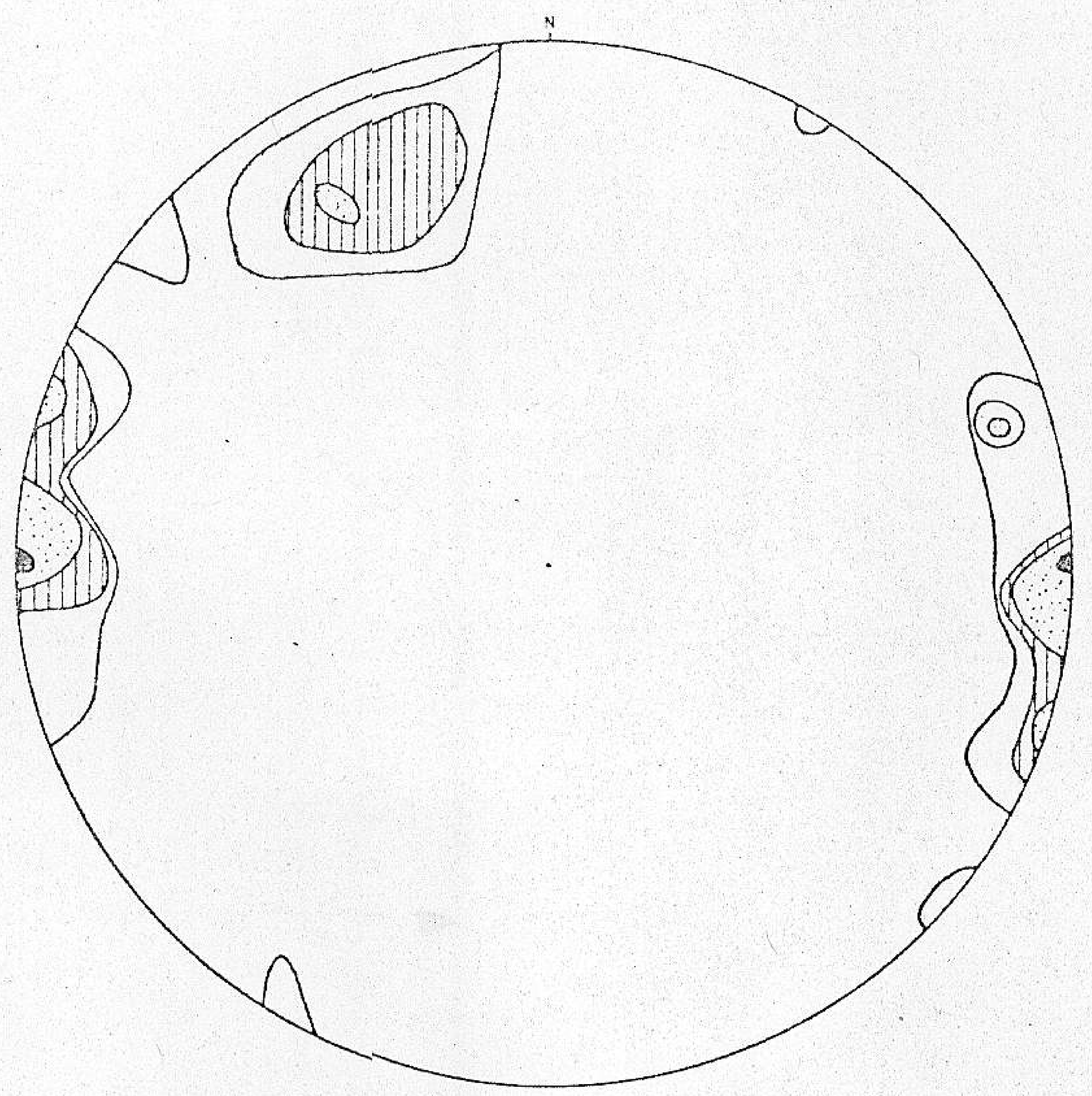
CONTOURS AT
2.5% 4% 4.75%



PREFERRED, ATTITUDE
005/75W
102/V

HIGH ANGLE JOINTS
AREA 2
105 POINTS

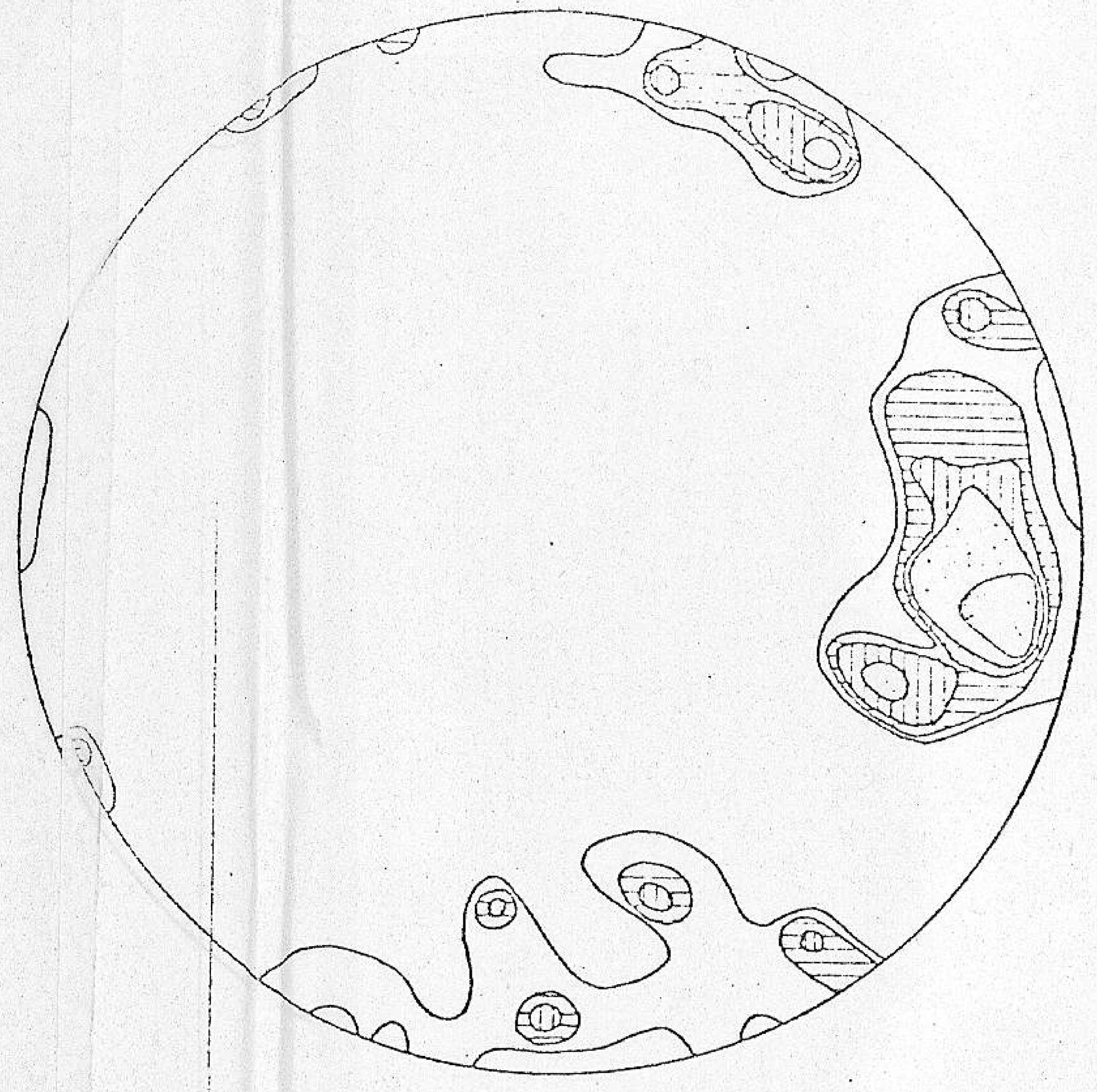
CONTOURS AT
2.5% 5% 7%



PREFERRED ATTITUDE
000/V
060/68SE

HIGH ANGLE JOINTS
AREA 3
224 POINTS

CONTOURS AT
2% 3.2% 3.75% 4.5%



PREFERRED ATTITUDE
018/75W
020/60SW
124/80SW

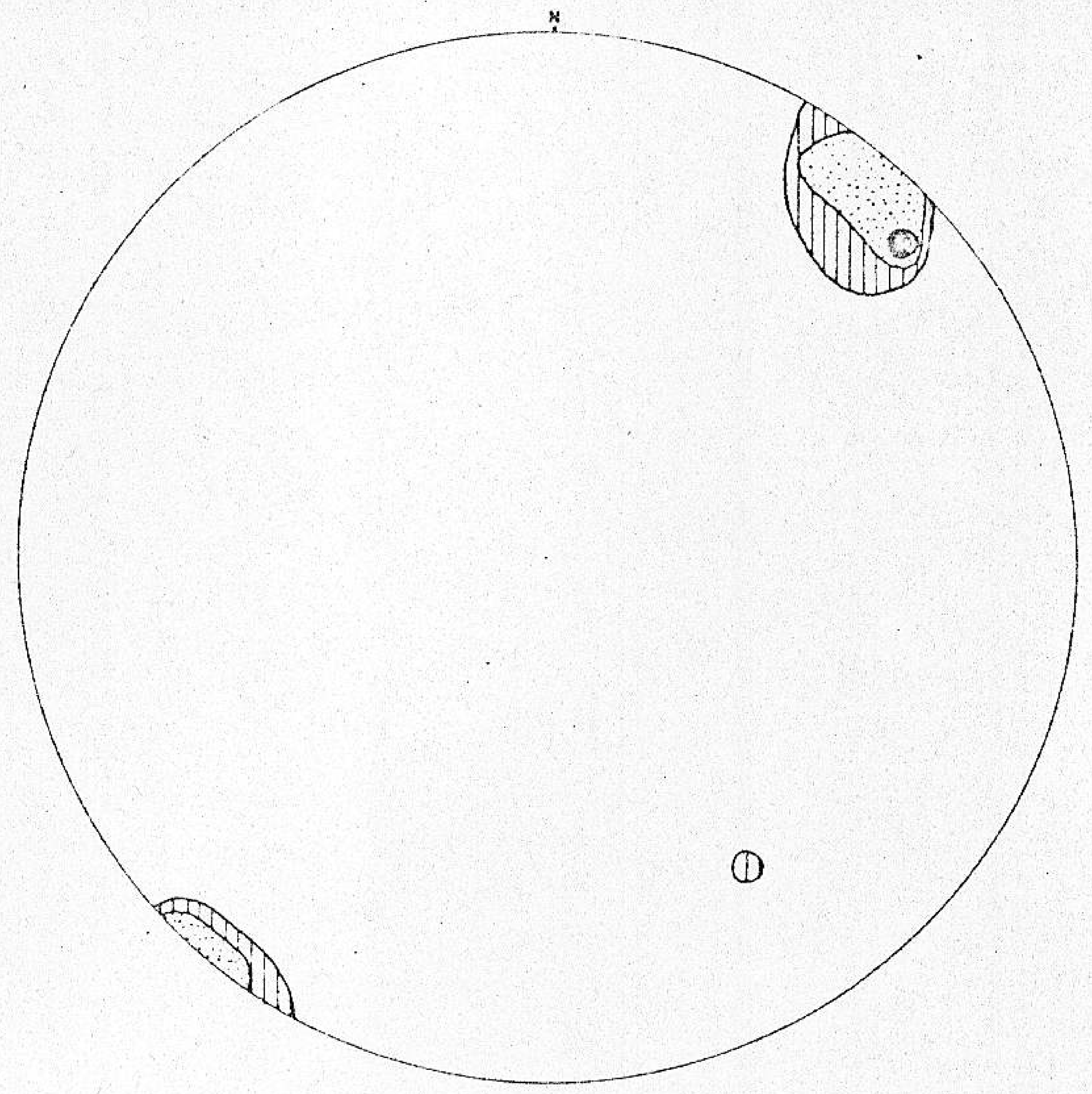
HIGH ANGLE JOINTS
AREA 4
367 POINTS

CONTOURS AT
2% 3% 3.5% 4%

PREFERRED ATTITUDE
058/65NW
152/85SW

HIGH ANGLE JOINTS
AREA 5
245 POINTS

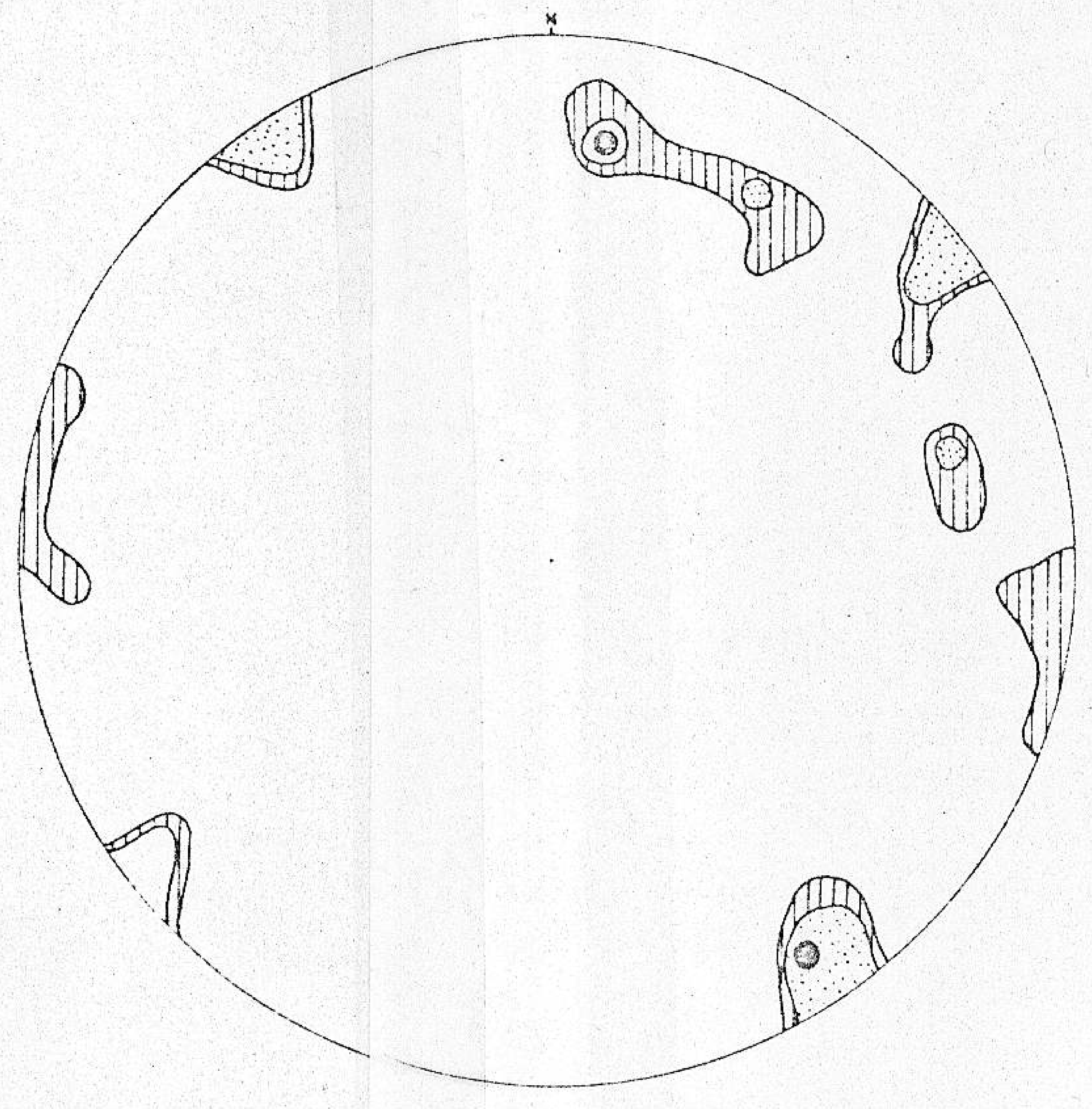
CONTOURS AT
2% 3% 4%
8% 9%



PREFERRED ATTITUDE
138/80SW

HIGH ANGLE JOINTS
AREA 6
13 POINTS

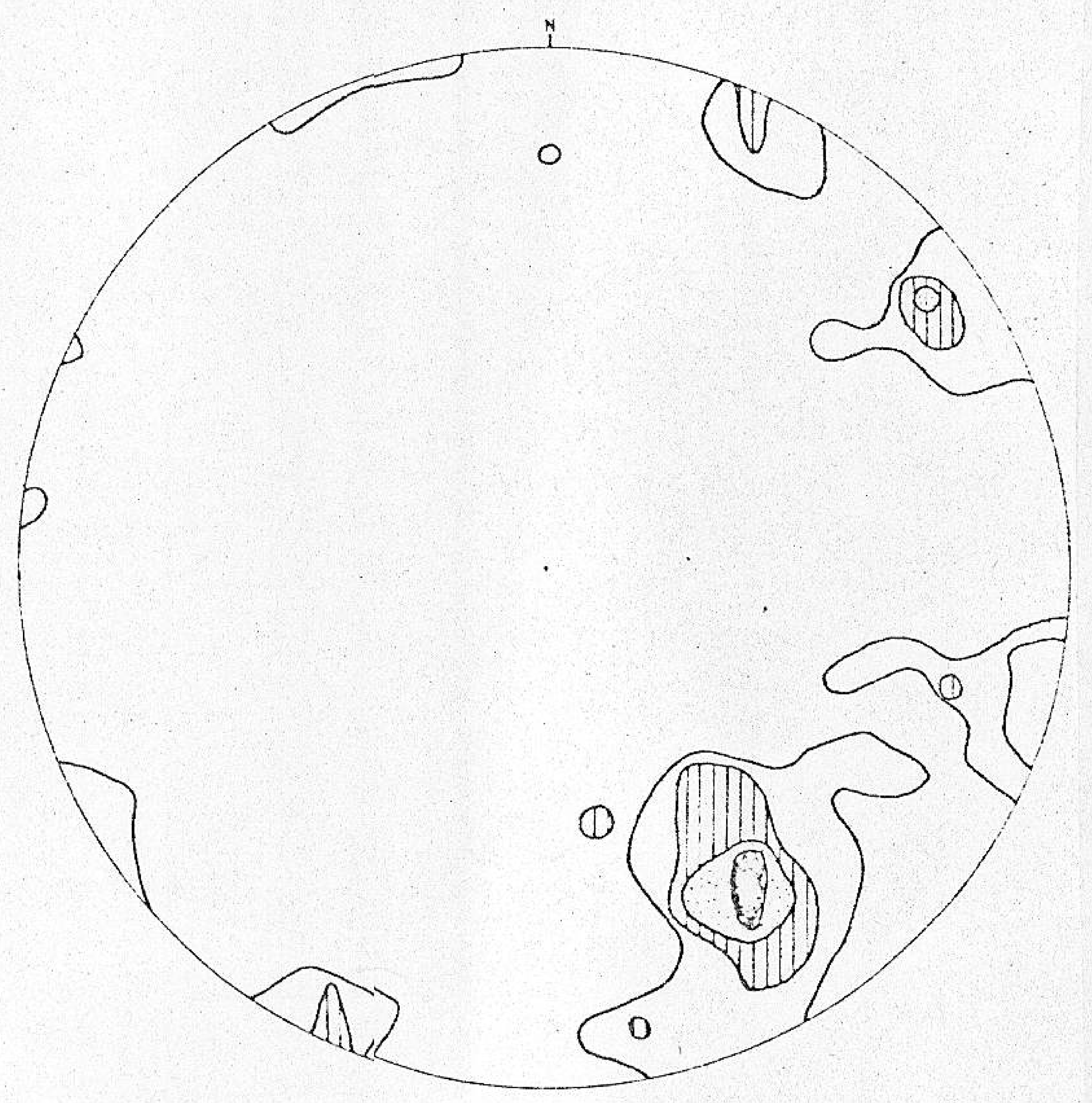
CONTOURS AT
15% 20% 30%



PREFERRED ATTITUDE
058/80NW
097/70S

HIGH ANGLE JOINTS
AREA 7
75 POINTS

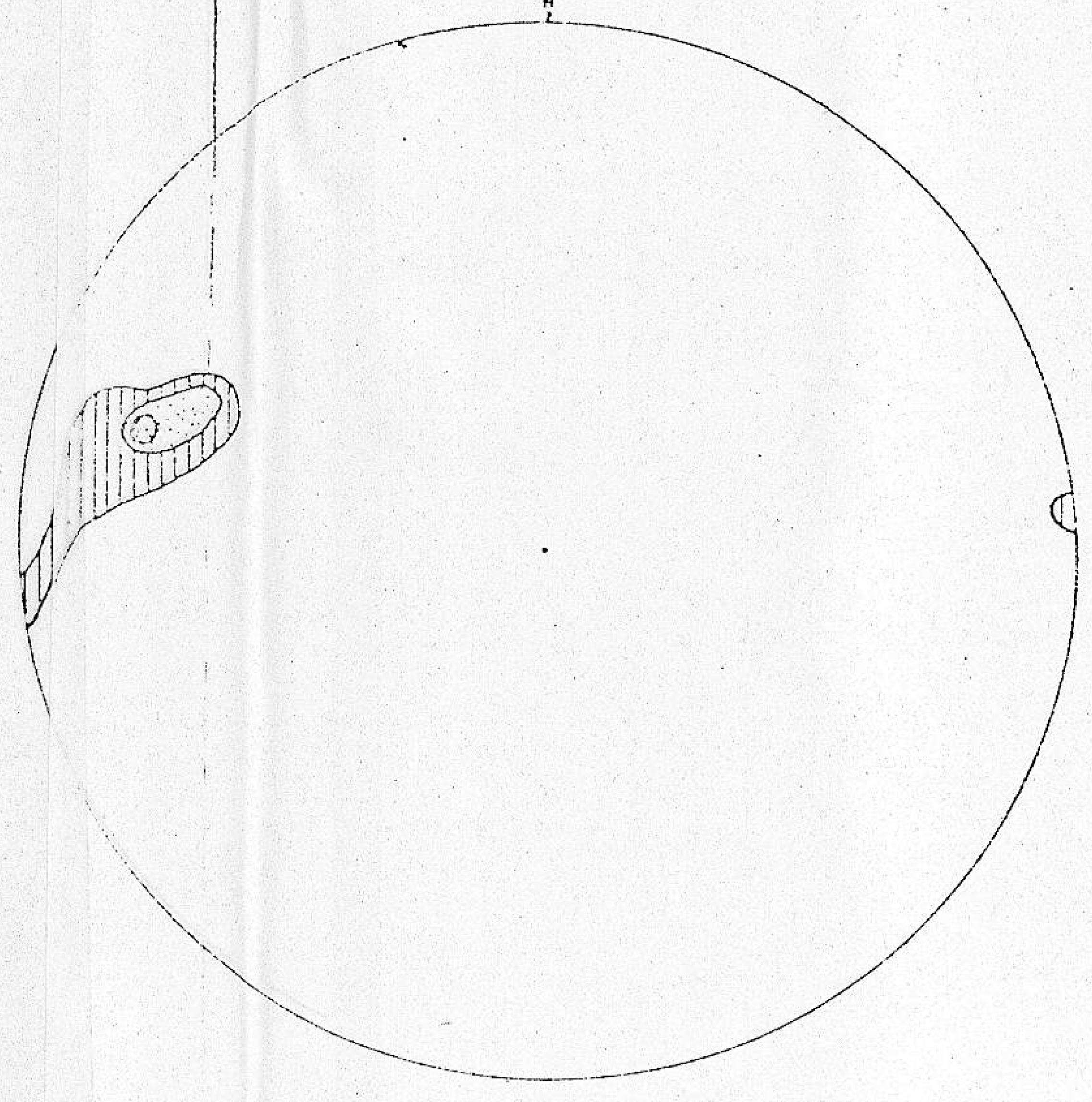
CONTOURS AT
3% 5% 7%



PREFERRED ATTITUDE
058/62N
144/79SW

HIGH ANGLE JOINTS
AREA 8
196 POINTS

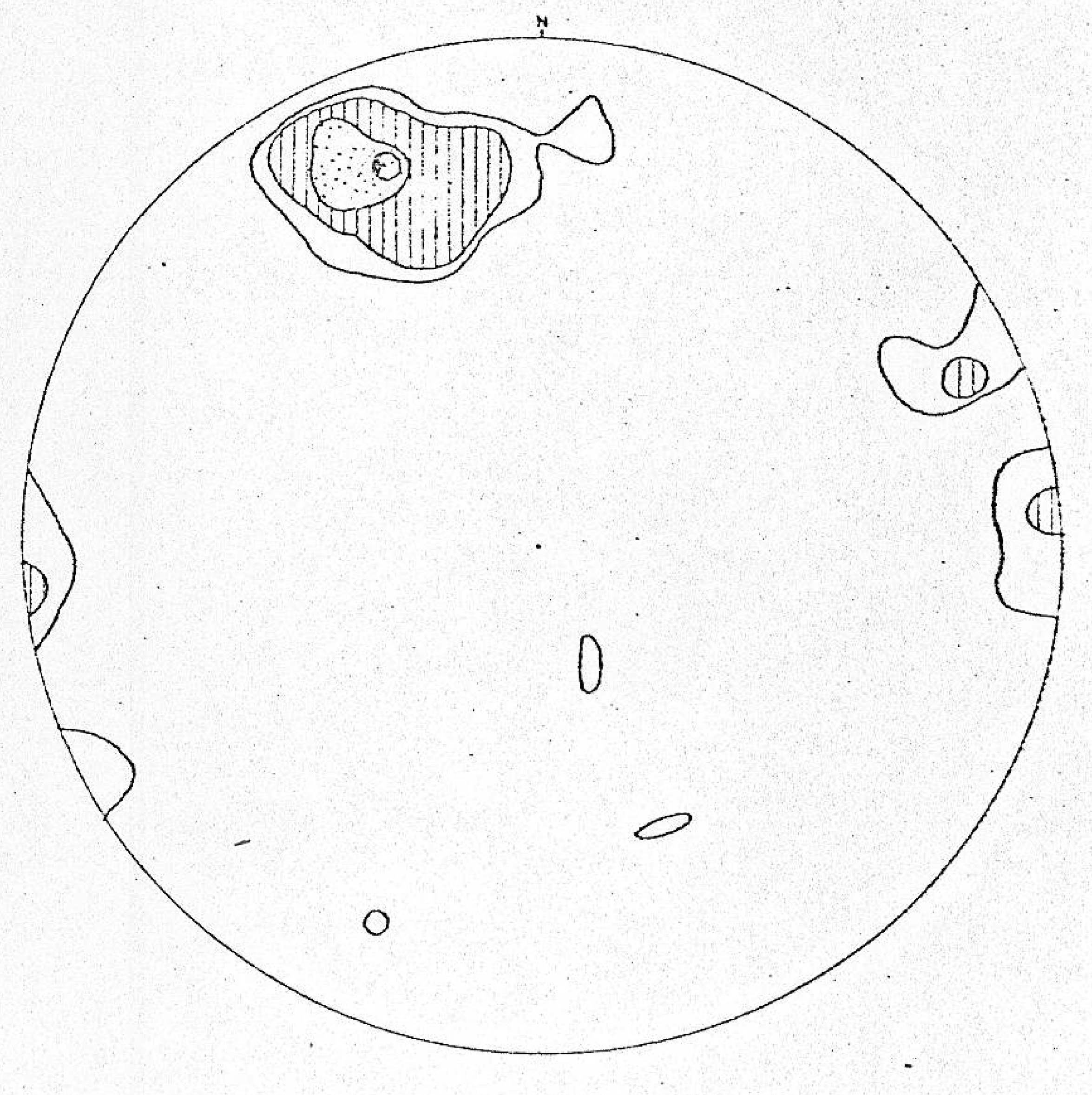
CONTOURS AT
2% 4% 5% 7%



PREFERRED ATTITUDES
015/69S

HIGH ANGLE JOINTS
AREA 9
23 POINTS

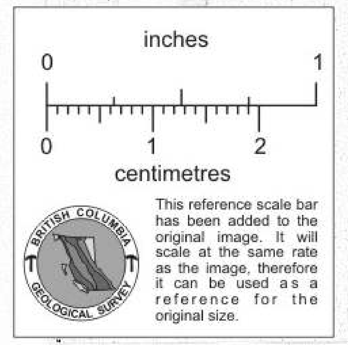
CONTOURS AT
8% 14% 18%

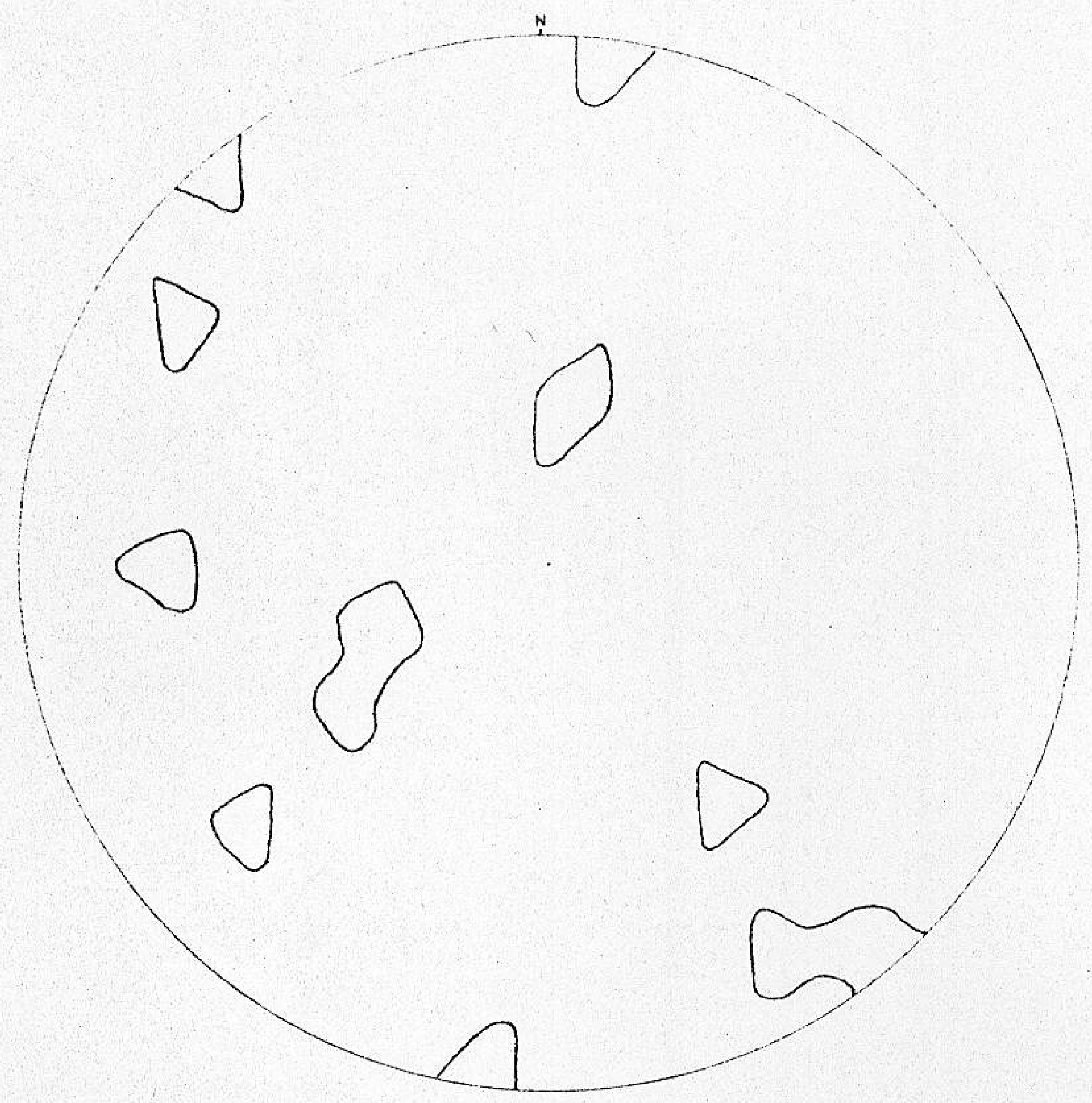


PREFERRED ATTITUDE
028/68S

HIGH ANGLE JOINTS
AREA 10
67 POINTS

CONTOURS AT
3% 5% 15% 18%

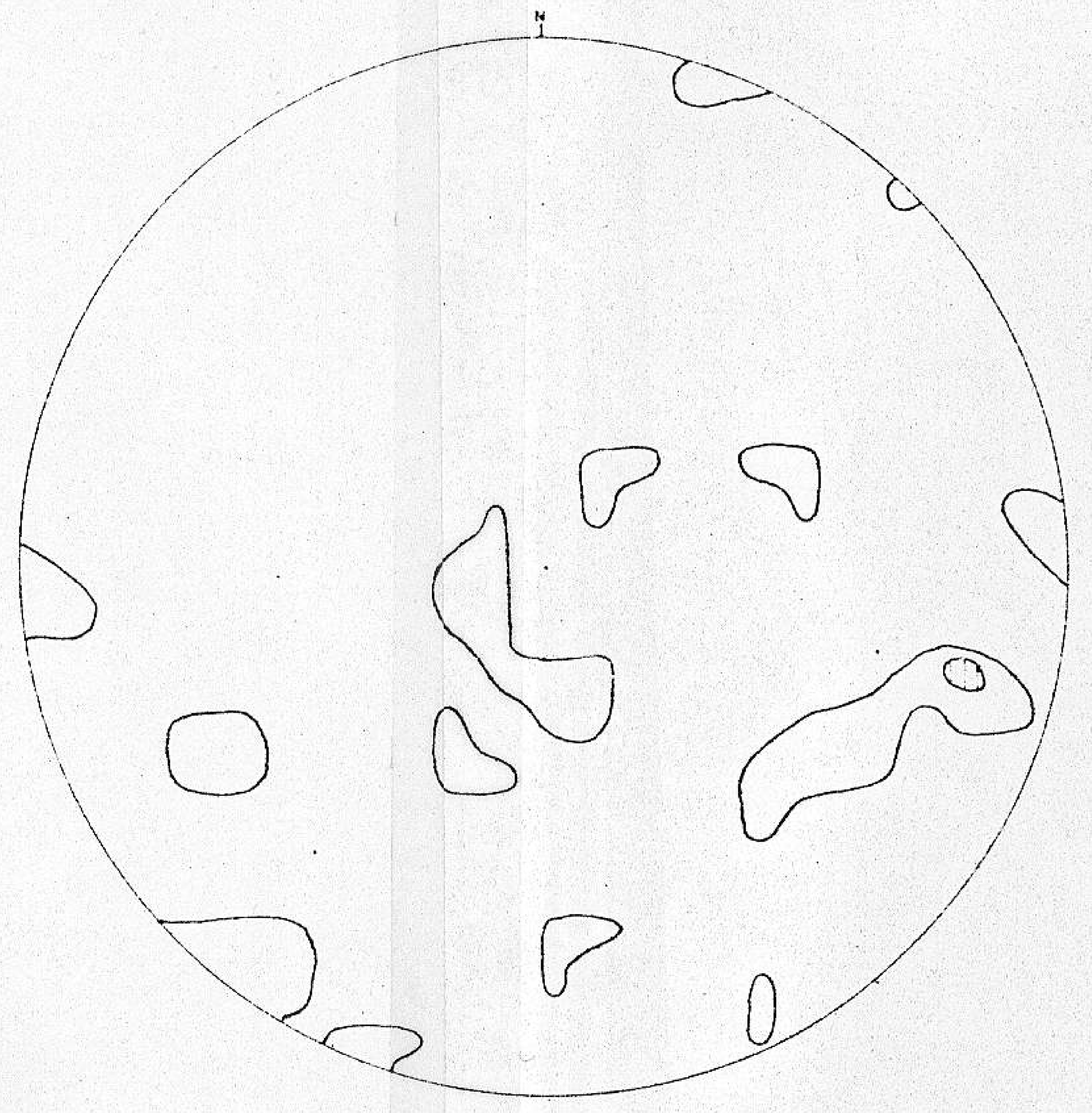




PREFERRED ATTITUDE
145/45 NE

APLITE DIKES
AREA 1
12 POINTS

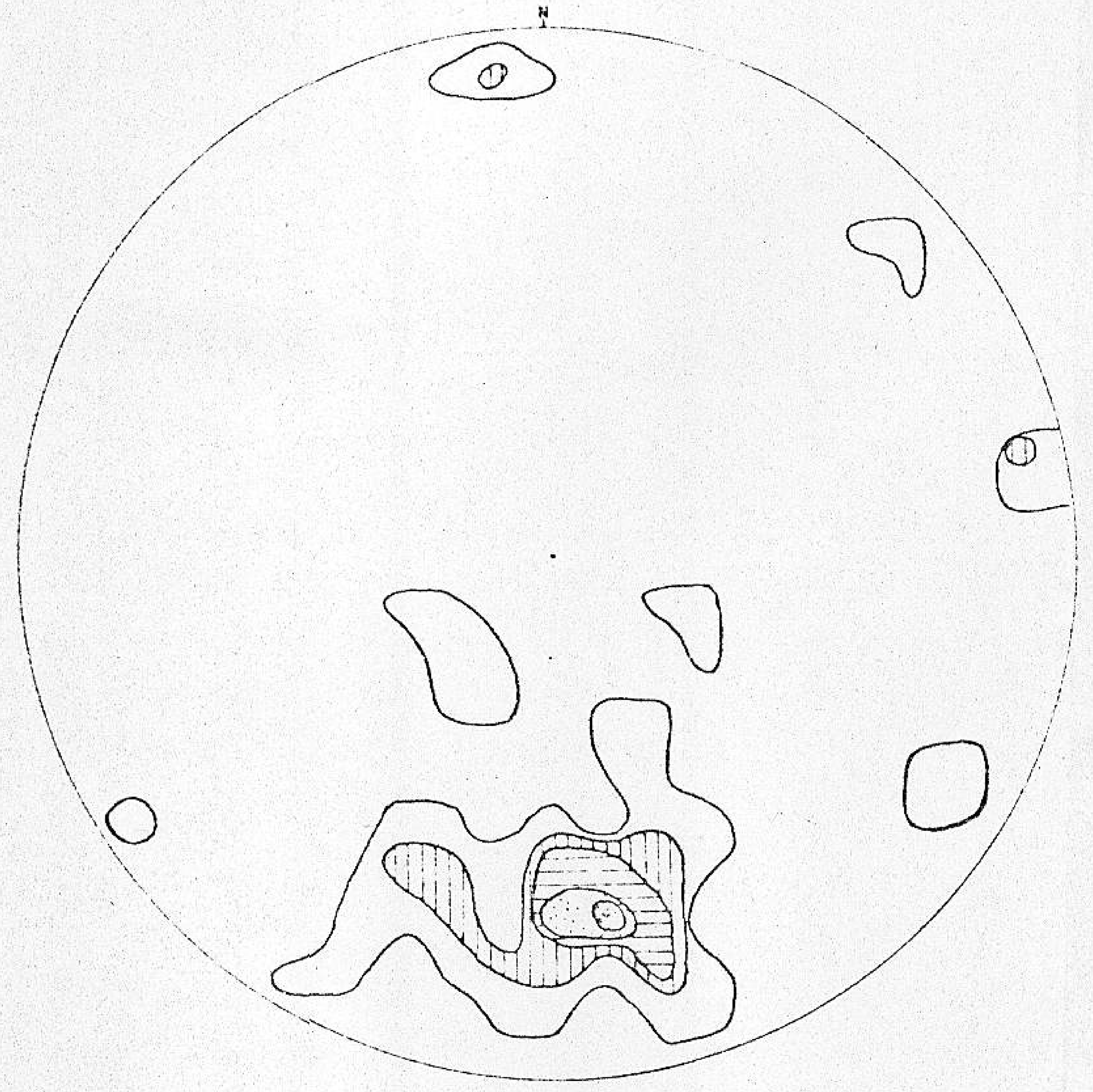
CONTOURS AT
8%



PREFERRED ATTITUDE
014/72 W

APLITE DIKES
AREA 2
21 POINTS

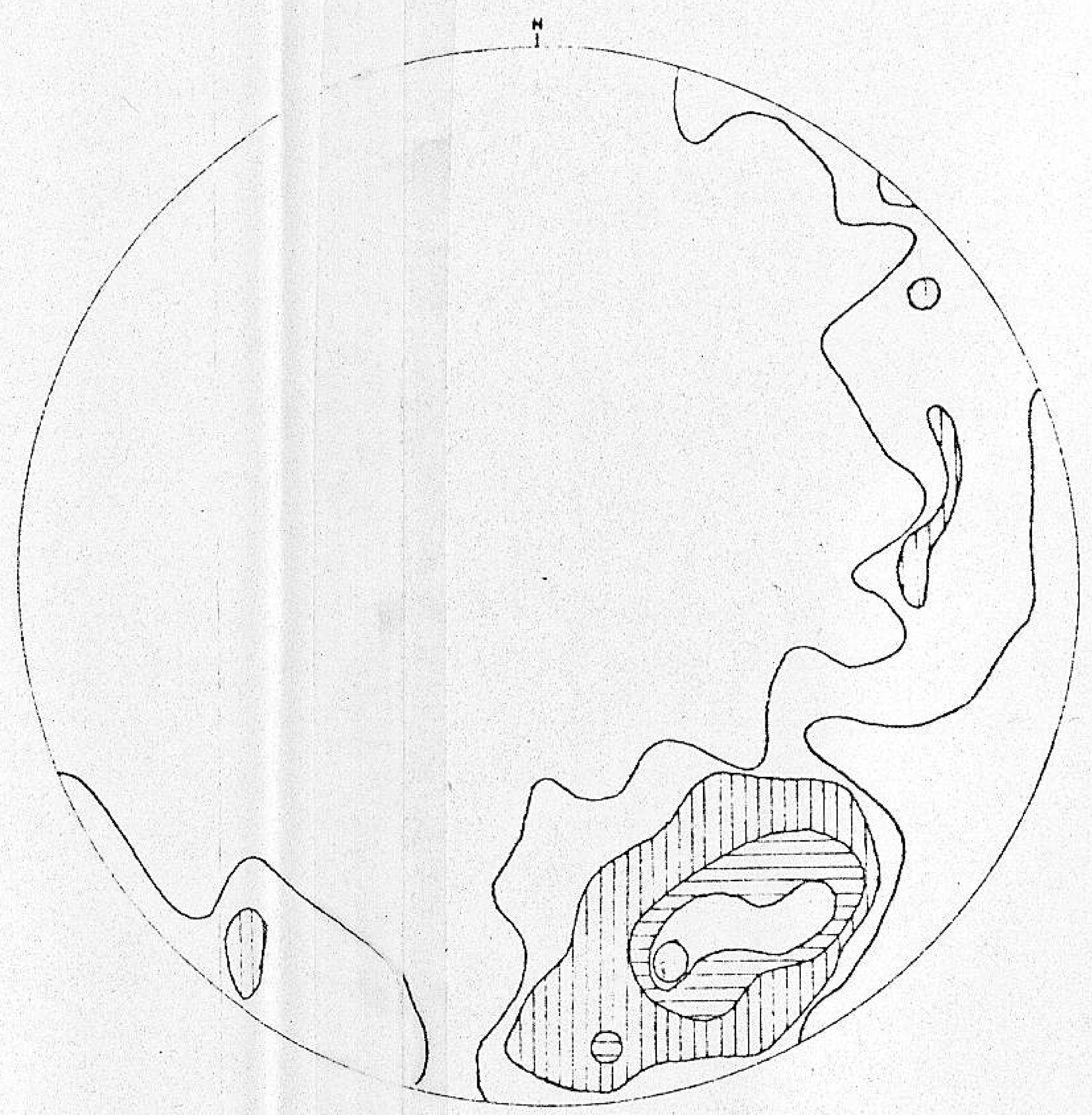
CONTOURS AT
4% 9%



PREFERRED ATTITUDE
082/60N

APLITE DIKES
AREA 4
31 POINTS

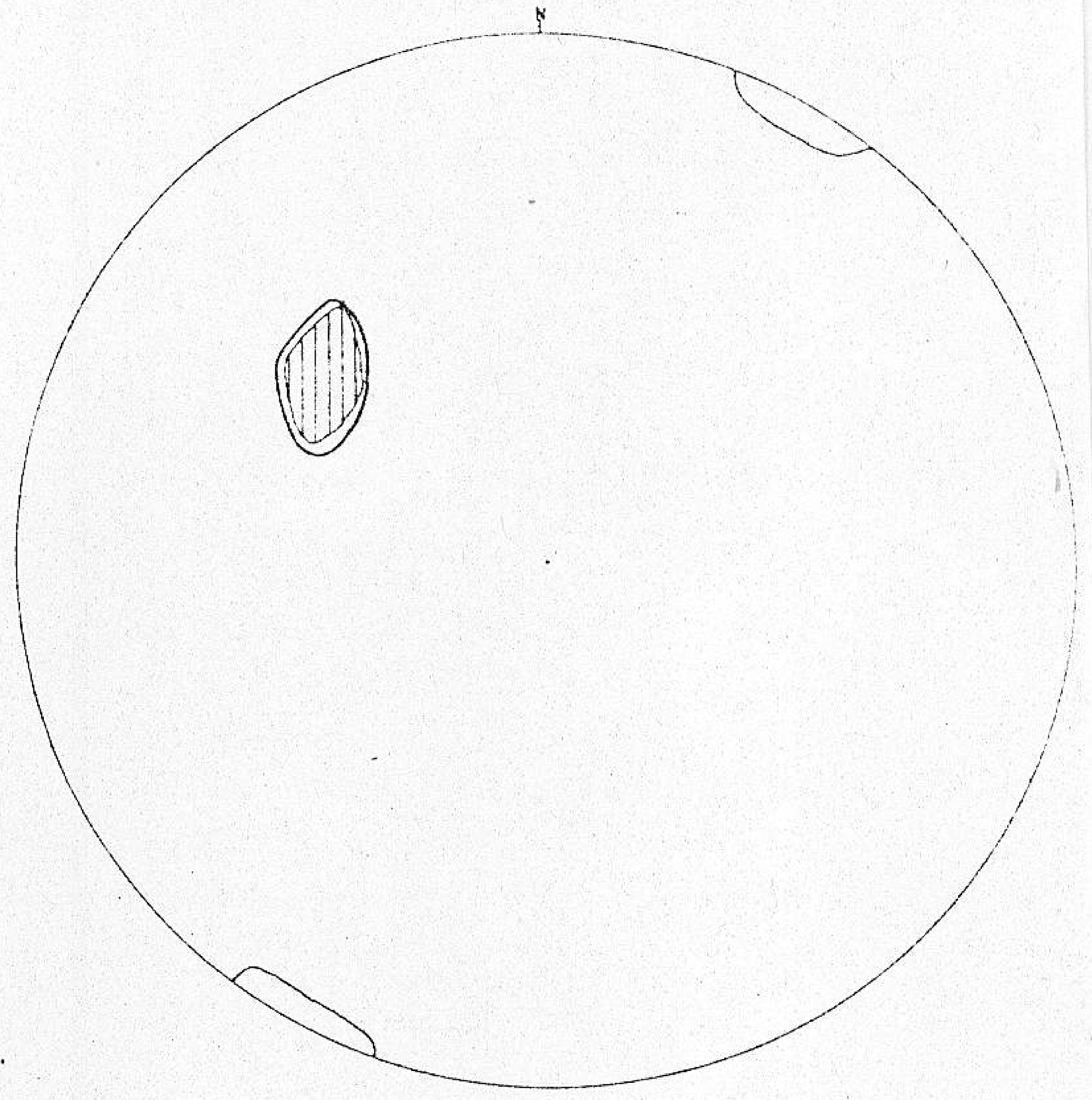
CONTOURS AT
2% 5% 8% 11% 14%



PREFERRED ATTITUDE
074/65N

APLITE DIKES
AREA 5
172 POINTS

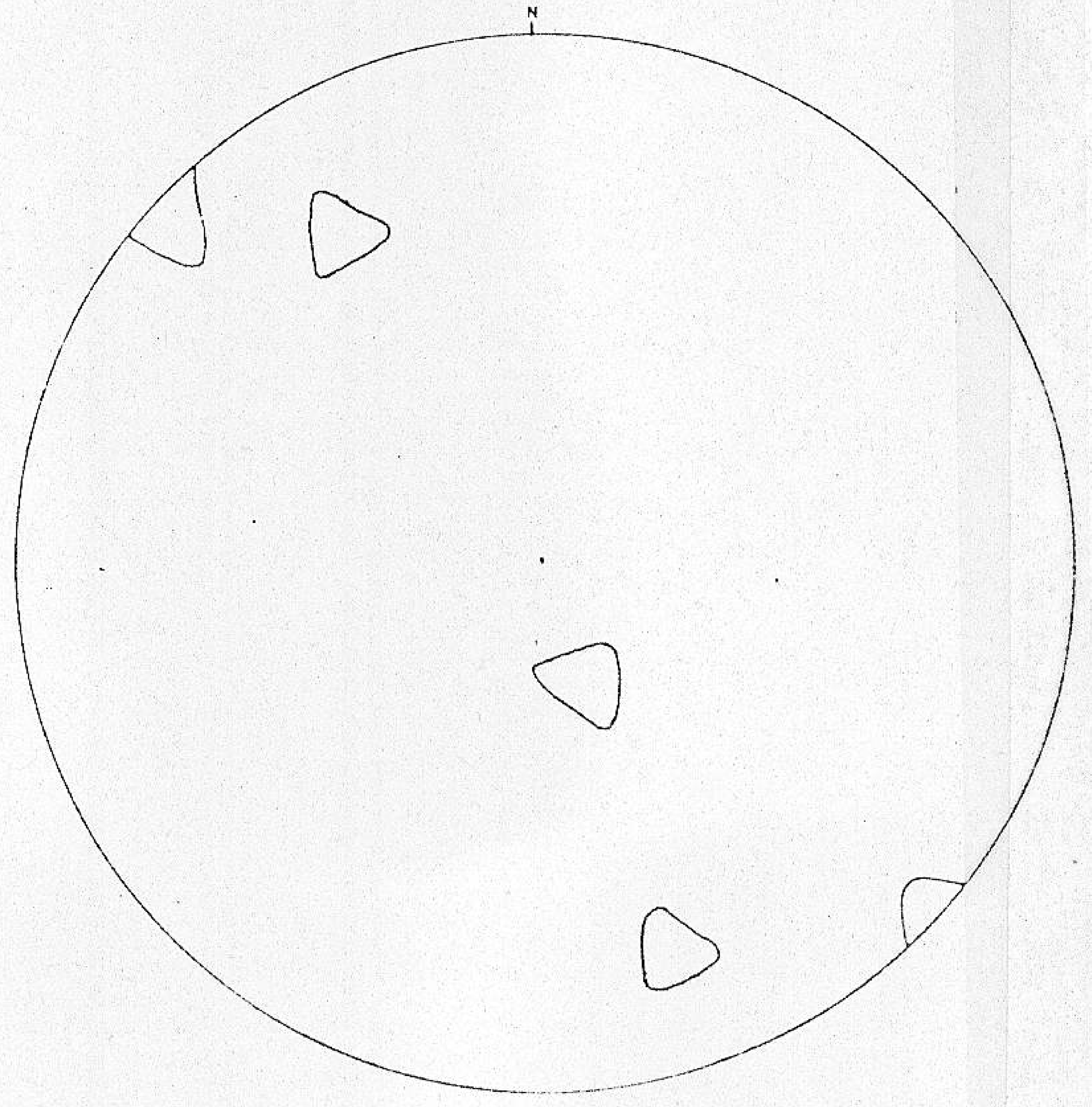
CONTOURS AT
1% 2.5% 5% 7% 8%



PREFERRED ATTITUDE
045/45SE

APLITE DIKES
AREA 6
4 POINTS

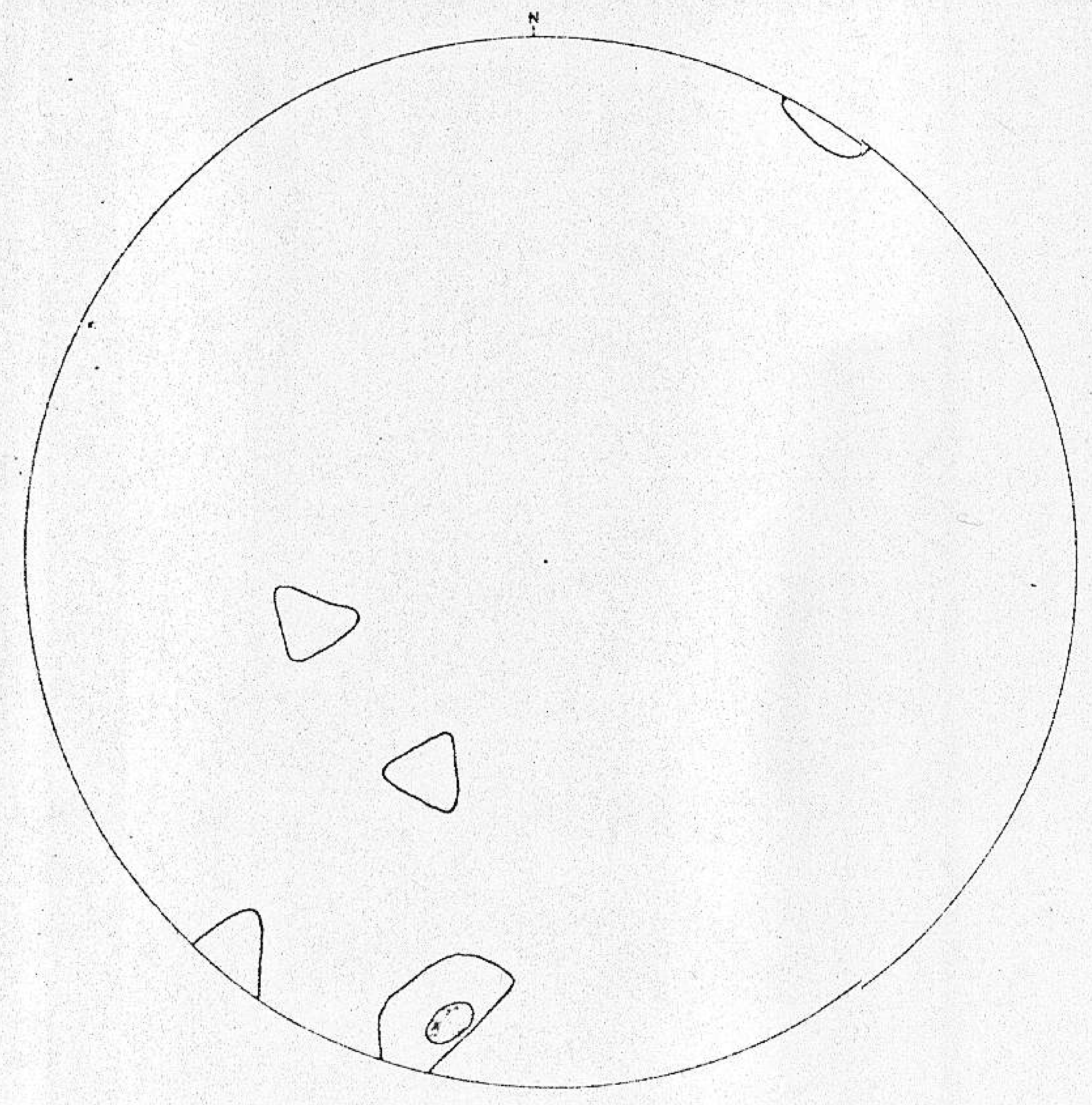
CONTOURS AT
20% 45%



PREFERRED ATTITUDE
070

APLITE DIKES
AREA 10
4 POINTS

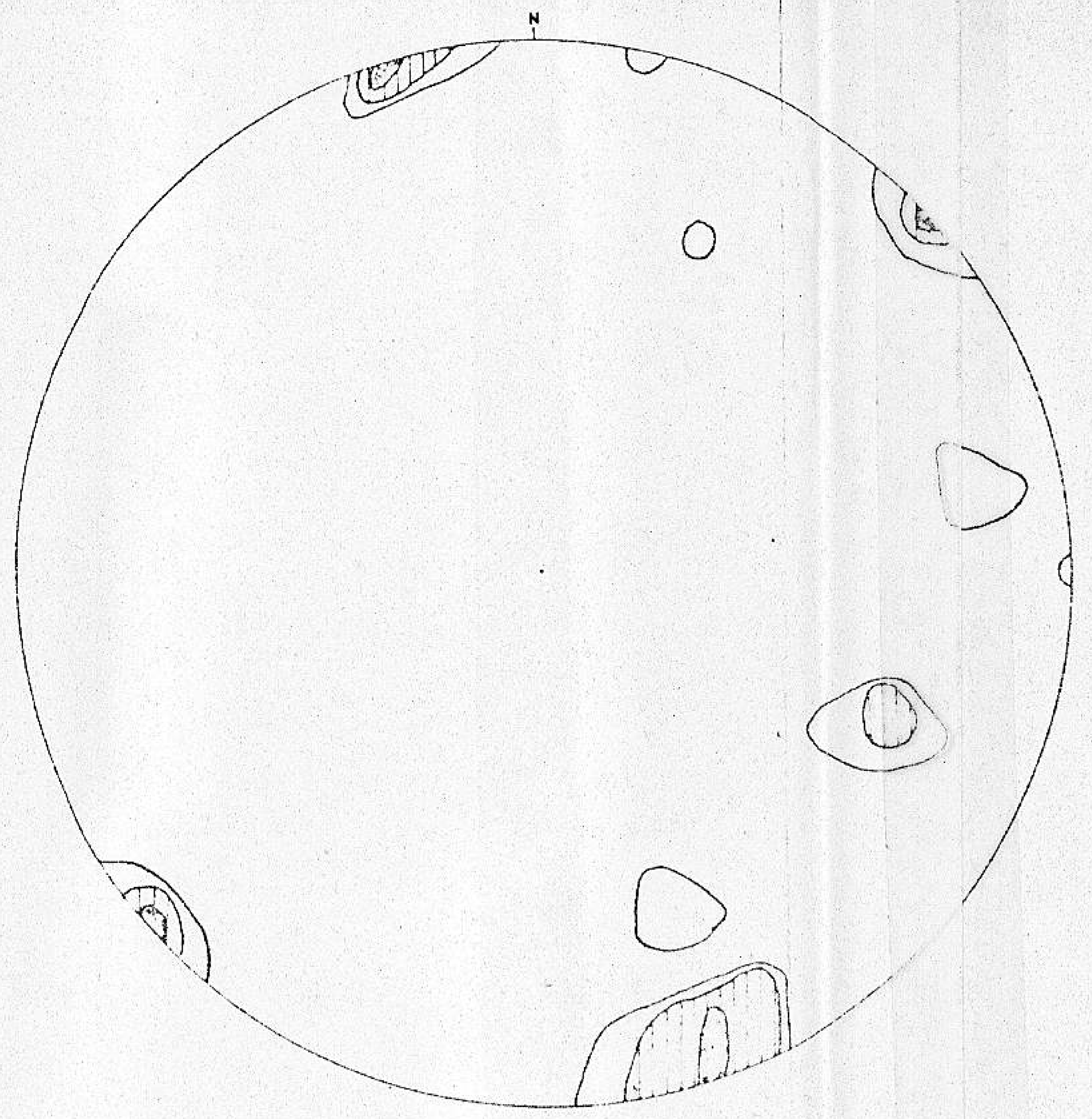
CONTOURS AT
25%



PREFERRED ATTITUDES
102/80N

APLITE DIKES
AREA 3
5 POINTS

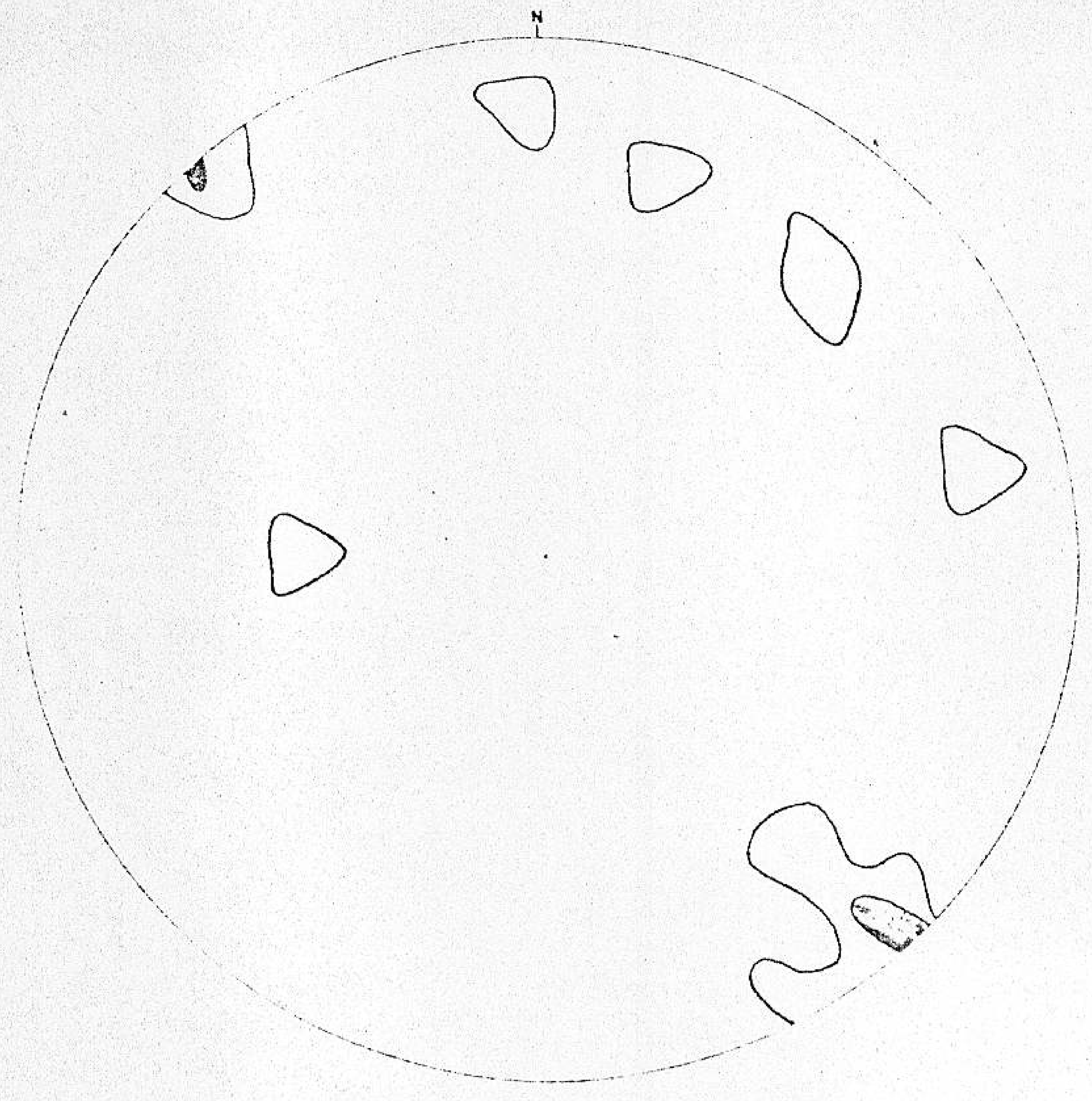
CCONTOURS AT
220% 40%



PREFERRED ATTITUDES
074/V
138/V

APLITE DIKES
AREA 8
51 POINTS

CONTOURS AT
3%, 5% [illegible]



PREFERRED ATTITUDE
050/V

APLITE DIKES
AREA 7
11 POINTS

CONTOURS AT
9% 19%