CARIBBEAN EXPLORATION CORPORATION

EVALUATION REPORT
1967 MINERAL EXPLORATION PROGRAM

BOISE CREEK PROPERTY
NEW WESTMINSTER MINING DIVISION
BRITISH COLUMBIA

January 1968

CHAPMAN, WOOD & GRISWOLD LTD.
NORTH VANCOUVER, BRITISH COLUMBIA

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I

INTRODUCTION

This is a final report on the Pitt Lake - Boise Creek Project. The work done was carried out or supervised by Chapman, Wood & Griswold Ltd. for Caribbean Exploration Corporation as per contract dated January 24, 1967. Work performed on the property is discussed in this report and includes geology, geochemistry, geophysics, diamond drilling, sampling, assaying, and the filing of assessment work with the Department of Mines and Petroleum Resources.

II

SUMMARY AND CONCLUSIONS

A major exploration program has been carried out on the 252-claim Boise Creek property. This work has included geological examinations, geophysical surveys, geochemical soil and silt sampling, diamond drilling, sampling and assaying.

Geologically it was deduced that there is a mineralized zone about half a mile wide and one and a half miles long, oriented north-south with Boise Creek flowing easterly through its centre. This zone is a roof-pendant of Harrison Lake Formation metavolcanics with a halo of inclusion-rich plutonics. The whole mineralized zone is surrounded by barren granitic rocks mainly of quartz diorite and granodiorite composition. The best mineralization is within the inclusion-rich plutonic halo.

More than five hundred soil and silt samples were collected and analyzed for copper and molybdenum. Most of the anomalous areas were tested by diamond drilling and are not related to ore grade material.

Geophysical techniques employed were aeromagnetics, ground magnetics, electromagnetics and induced polarization. The aeromagnetic survey was of a reconnaissance nature but served to define the roof pendant and assist in delineating the mineralized and silicified area. Ground magnetics were employed only in a limited manner to confirm the aeromagnetic results. A Crone "shoot-back" electromagnetic unit was used but soon indicated it was not an appropriate tool. Three lines, totalling 18,800 feet, of induced polarization surveying were done with two resulting anomalies being drilled. The results of this drilling were very discouraging.

Eleven diamond drill holes were attempted with three holes being abandoned in difficult overburden. Total footage drilled was 7,429 feet. Sludge was collected on holes 1, 2, 3, 5, 6 and 9 (holes 4, 7 and 8 were abandoned in overburden). Core from all holes was also split and assayed.

No ore grade material was encountered in diamond drilling. Average values of copper and molybdenum were calculated for all holes and are summarized as follows:

	Average Assay Values			
	Core		Sludge	
D.D.H. No.	Cu %	MoS_2 %	Cu %	MoS_2 %
1-9 (incl.)	0.10	0.015	0.11	0.015
1-11 (incl.)	0.09	0.013		

Assessment work has been filed with the Department of Mines and Certificates of Work for all claims have been received.

In our opinion, the program has adequately tested the prospect. The chances of encountering the quality and quantity of mineralization sufficient to permit economic exploitation under present or foreseeable metal prices and cost structures are too remote to justify further work on this property.

Respectfully submitted,

CHAPMAN, WOOD & GRISWOLD LTD.

V. W. Shuttleworth,
Supervisory Geologist

E.P. Chapman Jr., P.Eng.

January 17, 1968

III

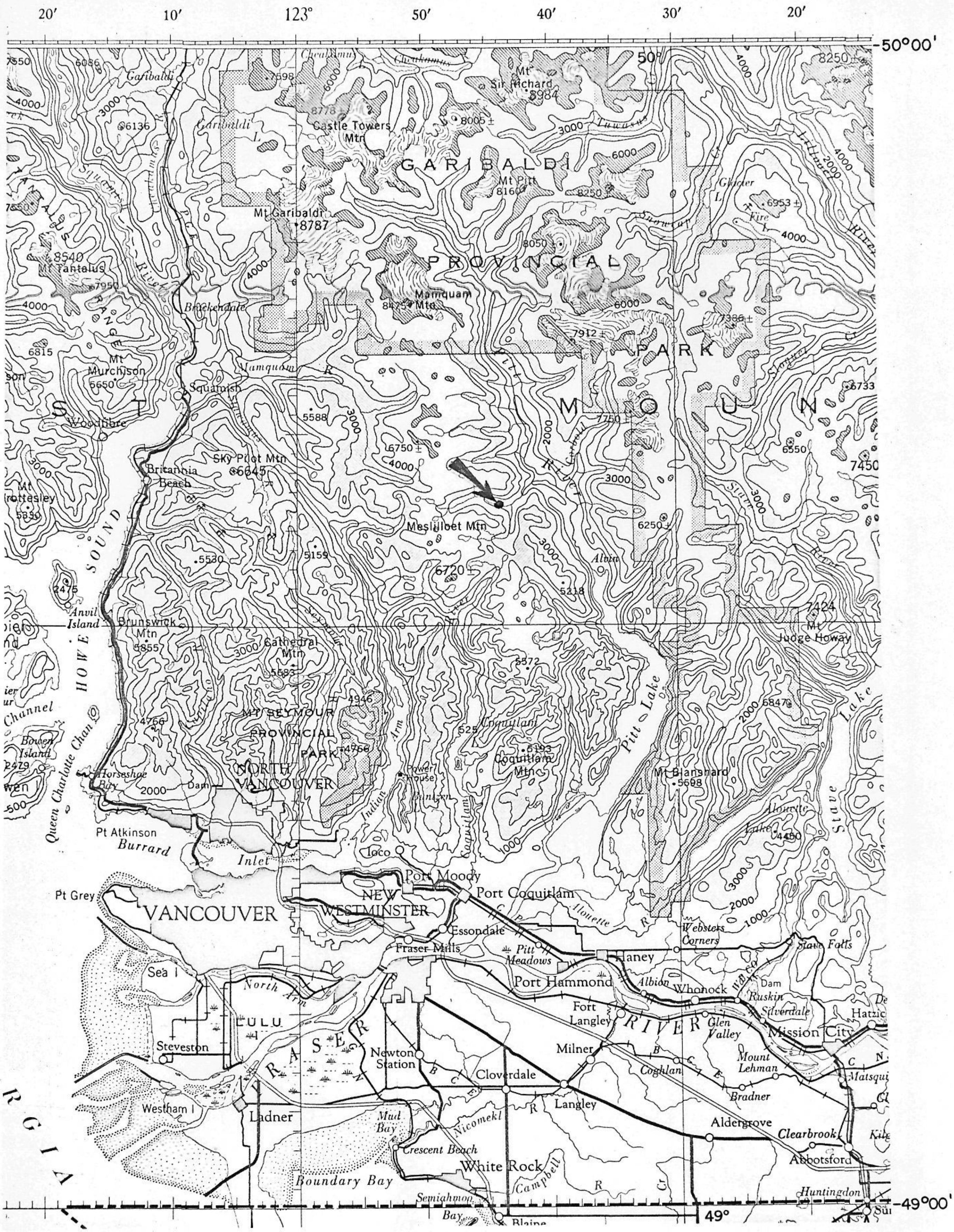
LOCATION AND DESCRIPTION OF PROPERTY

The property, consisting of 251 full-sized and 1 fractional mineral claims, is held by location and agreement with Flagstone Mines Ltd. Flagstone's claims in turn are held by location and agreement. Recorded owners of various claims are B & T Mines Ltd., Bertram I. Nesbitt, Flagstone Mines Ltd. and Caribbean Exploration Corporation.

Boise Creek, a western tributary of Pitt River, flows through the middle of the claim groups. The property's centre is at an altitude of about 1,700 feet on Boise Creek, approximately seven miles northwesterly from the north end of Pitt Lake and thirty miles northeasterly from downtown Vancouver; its latitude is 49°35' North and its longitude 122°43' West.

Access originally was by trail up the north side of Boise Creek from Pitt River. During the 1967 field season, access was by helicopter from the Vancouver area or, for sling-loads of freight, from either end of Pitt Lake. Road building up Boise Creek would be difficult and the lack of a road along Pitt Lake would complicate road access.

Elevations on the property range from about 1,500 to 5,500 feet. The terrain is very steep and heavily timbered, being quite typical of the western flank of the Coast Mountains in which it is situated. Deep canyons in Boise Creek and its tributaries make foot travel in some areas quite difficult.



BOISE CREEK LOCATION MAP

SCALE 0 — 8 — 16 — 24 MILES

IV

HISTORY

While the prospect has been known for some time, little previous work had been done on it. The earliest reference known to us is "Molybdenum Deposits of British Columbia," British Columbia Department of Mines Bulletin No. 9, 1940, pp. 53-61, by J. S. Stevenson. Stevenson states that A. O. Woolsey staked six claims on the prospect in 1936. No mention of copper mineralization was made in the report. Apparently Woolsey had a pack-horse trail up Boise Creek and drove several very short adits plus one 25-foot adit. Since that time, only minor, sporadic prospecting seems to have been done. Claims have been located, forfeited and relocated by a few private individuals and small private companies. We have found no references in the British Columbia Department of Mines Annual Reports.

V

GEOLOGICAL ENVIRONMENT

The Boise Creek property lies within the major unit known as Coast Plutonic Rocks, forming part of the Coast Mountains. These Coast plutonics are normally heterogeneous and in the area of interest a partially granitized roof pendant has made the geology extremely complex.

Rock exposures in the area mapped below timberline were limited to creek gorges and cliff faces. Definite contacts between the plutonic rocks and the roof pendant were not seen. Contacts between the rock types are believed to be gradational facies tranisitions.

Isolated granitic rock exposures covered a wide range of rocks from granite to diorite, with quartz diorite and granodiorite being far more abundant. Both composition and texture of the unit mapped as quartz diorite are highly variable. Since contacts appeared gradational and exposures were limited, no serious attempt was made to map the individual granitic facies. In general, however, the more mafic hornblende-rich varieties were adjacent to the roof pendant and graded outward to a more siliceous biotite-rich rock.

The andesitic greenstone unit is thought to be a remnant of the Harrison Lake formation as described by J. A. Roddick in Geological Survey of Canada Memoir 335, "Vancouver North, Coquitlam and Pitt Lake Map Areas, British Columbia." The unit consists of porphyritic meta-andesites and meta-dacites, generally showing varying amounts of granitization. Granitic stringers and patches are common and may form as much as 15 percent of the rock.

The rocks adjoining the pendant are extremely variable and complex, a complete gradation existing between the rocks of the Harrison Lake Formation and the quartz diorites of the Coast Plutonic Rocks. These rocks have been mapped as migmatite but may be better described as an inclusion-rich plutonic complex. They consist of both granitic and non-granitic rocks in varying proportions and represent the intermediate stage between large bodies of pre-granitic rocks and adjoining plutonic rocks.

The mineralized area lies within the migmatite or inclusion-rich granitic complex. This area is about one and a half miles long and half a mile wide, oriented north-south across the Boise Creek Valley with Boise Creek flowing easterly through its centre. Pyrite, chalcopyrite and molybdenite are present in that order of abundance with pyrite being strongly predominant. The chalcopyrite, molybdenite and some of the pyrite appear to have been introduced during the final stages of mineralization and are mainly associated with introduced quartz and carbonate. The sulphides are fairly consistent over a broad area in and near the inclusion-rich plutonic complex. No concentrations of mineralization suitable for any known mining method were found during the exploration program.

Various drill-core samples have been submitted for petrographic and mineralographic analysis.* Some eleven petrographic studies were made. From these studies it is seen that what was mapped as quartz diorite is generally (altered) granodiorite while the andesitic greenstones are usually fine-grained, altered plagioclase porphyries of variable composition.

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* The petrographic studies were made by Dr. H. T. Carswell, a Vancouver petrographer, and the mineralographic study was made made by Dr. A. J. Sinclair, P.Eng., an assistant professor of geology at the University of British Columbia.

The mineralographic study of three drill-core samples describes them as medium-grained leuco-granitic rocks fractured and mineralized by combined open space filling and replacement. In general, introduced gangue is quartz while calcite is present in lesser amounts. Pyrite predates chalcopyrite and molybdenum but age relationships between the latter two are indefinite. No other sulphides were recognized. Pyrite is generally the coarsest grained with molybdenite (normal grain diameters from 0.01 to 0.05 mm) being the finest. The finer sulphides are generally confined to interstitial positions along grain boundaries of gangue minerals. These petrographic and mineralographic reports, by H. T. Carswell, Ph.D., and A. J. Sinclair, Ph.D., respectively, are appended to this report.

A photogeological study of the prospect area revealed an increased fracture density in the area of mineralization with possible flexures crossing the roof pendant. Most of the drilling was under or very near these possible flexures and all drilling was within the high fracture density areas.

A computerized trend analysis of the mineralization at Boise Creek was, after due consideration, not implemented. One reason for rejecting such a program was the incompatible distribution of drill holes (the source of the data). The second factor against such an analysis was the data itself. It was feared that the low mean of the values and their apparently random distribution would result in a relatively high estimated standard deviation in the process of curve fitting. Any trends indicated would likely be so subtle as to lie within the range of uncertainty of the assaying.

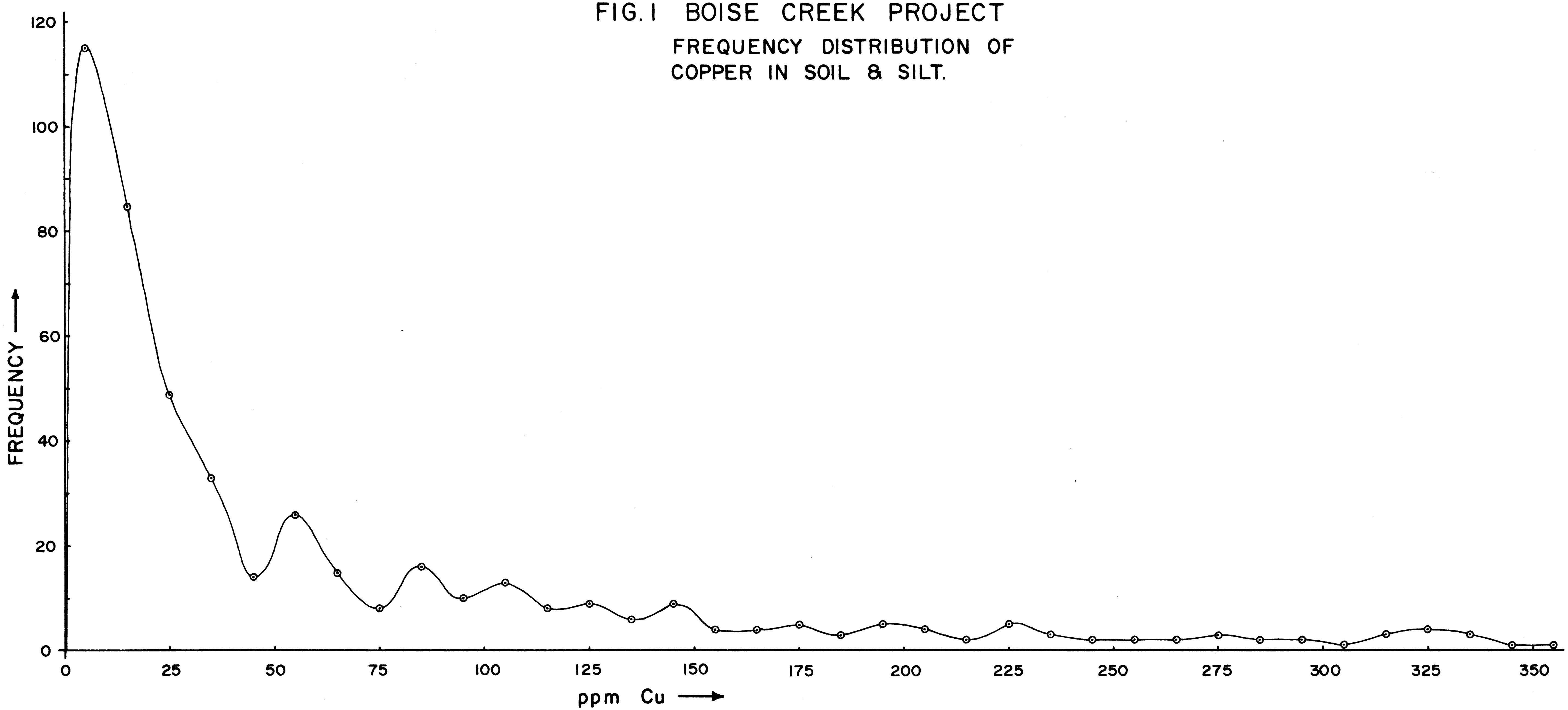
VI

GEOCHEMISTRY

During the field program, 510 soil and 30 stream sediment samples were collected. All of these samples were analyzed for copper and molybdenum by TSL Laboratories Limited, Vancouver. Samples were subjected to a hot hydrochloric acid extraction followed by copper determination by atomic absorption and molybdenum determination by the zinc-dithiol method.

A number of definite anomalies resulted from this work. These anomalies became apparent not from the histograms (figures 1 and 2) but from a study of the actual distribution of the values on the geochemical plans. The histogram of the frequency distribution of copper does confirm that a possible threshold of anomalous values occurs at 65 to 75 ppm (or three times the average background value) of copper in the soil. All but three of the copper anomalies were tested by diamond drilling and are apparently due to sub-economic chalcopyrite mineralization. In the areas of the three untested copper anomalies, the lack of visible mineralization and absence of encouraging geophysical response suggests that the abnormal copper content in the soil is caused by trace quantities of this metal in the underlying rocks. The molybdenum anomalies are due to the presence of very narrow stringers of molybdenite in quartz veins and on the basis of geological examination and drilling results are considered to be unrelated to ore-grade material. There is a possibility that the anomalous copper values are enhanced by a high pyrite content in the local rocks.

FIG. I BOISE CREEK PROJECT
FREQUENCY DISTRIBUTION OF
COPPER IN SOIL & SILT.



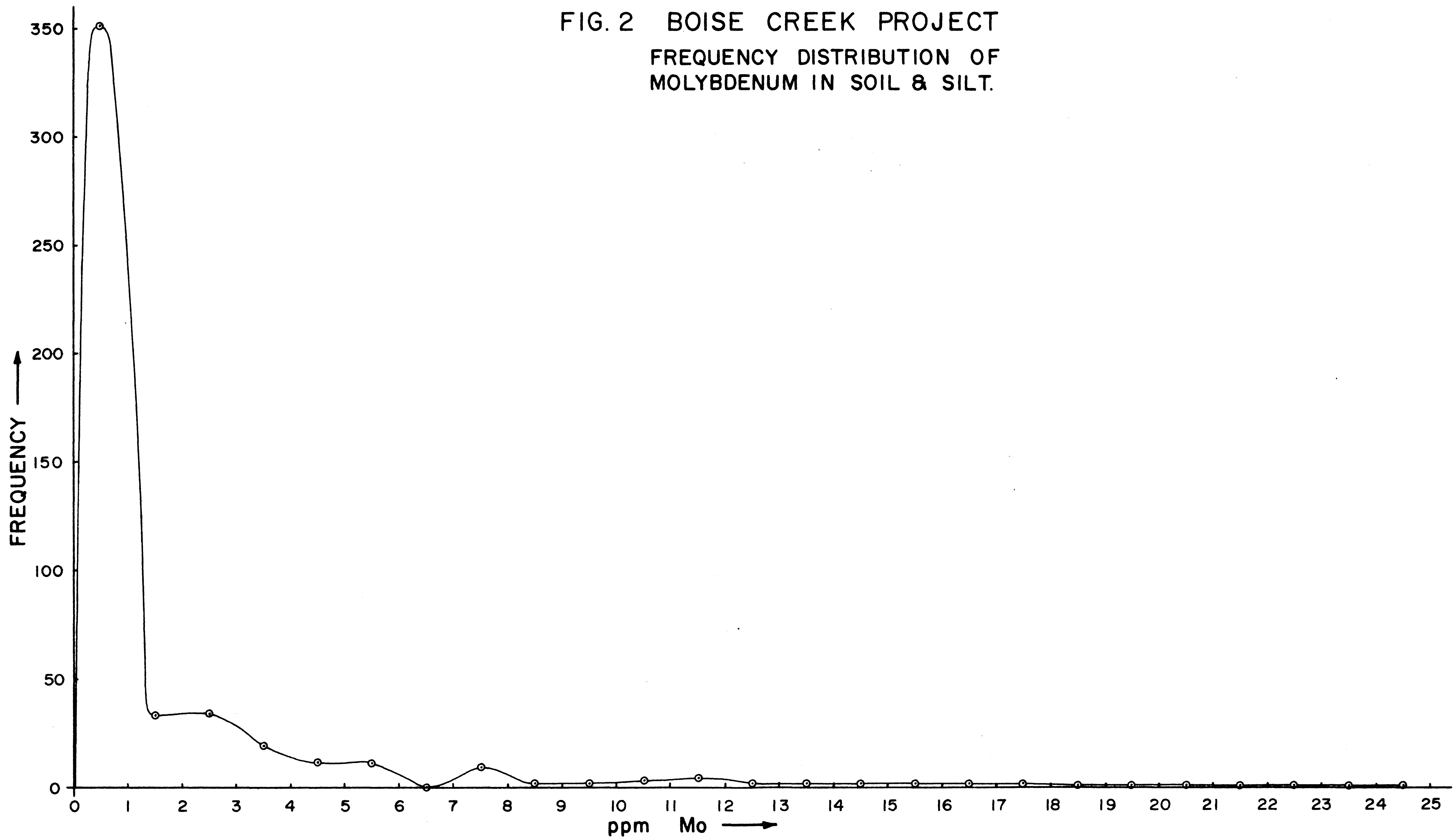


FIG. 2 BOISE CREEK PROJECT
FREQUENCY DISTRIBUTION OF
MOLYBDENUM IN SOIL & SILT.
FREQUENCY
350
300
250
200
150
100
50
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
ppm Mo

VII

GEOPHYSICS

A variety of geophysical techniques were employed in the Boise Creek project. These include aeromagnetics, ground magnetics, electromagnetics and induced polarization. Aeromagnetics and induced polarization were better suited to the area and reports on same were filed for assessment work and are submitted separately. All geophysical work was examined and commented on to various degrees (verbal comments to full reports) by Dr. S. H. Ward, a consulting geophysicist and a professor in the Department of Mineral Technology, University of California, Berkeley.

Dr. Ward's aeromagnetic report emphasized four apparent linear magnetic lows. By nature of the terrain, most of these were inaccessible for examining on the ground. Line B, however, is close to Gash Creek and the extension of its controlling fault to the south of Boise Creek. The magnetic trough may reflect the greater degree of silicification in that area. The 6,800 gamma low crossed by Line B is undoubtedly caused by the roof pendant of Harrison Lake Formation rocks. The other closed depression (6,700 gammas) to the east was not examined in detail, but the prospector's findings in the area were negative and a short distance upstream in Boise Creek the rocks were mapped as quartz diorite with no mineralization or alteration noted. The cause of magnetic trough D may be largely topographic in nature as it follows the deep, narrow valley of Boise Creek quite closely. A McPhar flux-gate magnetometer was employed on the ground but it was quickly apparent that this method was simply confirming the aeromagnetic results but adding no useful information. It was, therefore, not used extensively.

A Crone Junior Electromagnetic unit was employed on the project. This unit employs the "shoot-back" method and is quite useful in rugged terrain such as at Boise Creek. Some 15,000 feet of electromagnetic surveying were completed, but results were inconclusive and indicated E.M. was not an appropriate tool for the area. In most instances where the signal is greater than background, conductivity (judged by the ratio of frequencies) is poor. The probable and often observed explanations of these results at Boise Creek are shears and faults. Where exposed, all such shears and faults were examined.

Induced polarization, the fourth geophysical method employed, offered the greatest promise of assisting in delineating diamond drill targets. Three lines were surveyed, one on each side of and parallel to Boise Creek and one crossing the creek, for a total of 18,800 feet. The variable-frequency method, using a high frequency of 3.0 cycles per second and a low frequency of 0.1 cycle per second, was employed throughout. Base Line and Line 12+00 North were surveyed by R. E. Chaplin, P.Eng. of Vancouver, using a Geoscience unit, while Line 8+00 East was surveyed by Chapman, Wood & Griswold Ltd. using a very similar Heinrichs unit. All three parameters - percent frequency effect, apparent resistivity and apparent metal factor - were plotted. Many metal factor anomalies resulted, some of which could be readily explained by erratic high resistivities obtained in the vicinity of deep canyons such as at 1,400 E on Line 12+00N. Other anomalies did appear valid and were tested by diamond drilling with disappointing results.

All geophysics, together with geochemistry, on the three grid lines is presented in a stacked "profile" or pseudo-section form. On Baseline a metal factor anomaly from 12E to 20E is seen to have good frequency effect and resistivity support along with an erratic geochemical anomaly and very subtle E.M. support. This area was tested by D.D.H. No. 9 with poor results. On Line 12N it is felt that the apparent metal factor anomalies result from the isolated resistivity highs which are likely caused by canyons included within a dipole. While E.M. on Line 12N is stronger, conductivity is rather poor, indicating narrow shears as a probable source. The geochem on this line shows some isolated peaks, many of which are known to be near exposed, moderate mineralization in canyons. Line 8E, the north-south line crossing Boise Creek, has two small but definite metal factor anomalies supported by narrow geochemical anomalies. The soil samples were found to be quite close to exposed veinlets of mineralization. The metal factor-soil anomaly at 20N on this line was tested by diamond drilling, the results of which were very discouraging.

VIII

DIAMOND DRILLING, SAMPLING AND ASSAYING

Diamond drilling comprised the major portion of the exploration program. Eight holes were completed and three more abandoned without reaching bedrock, for a total footage drilled of 7,429 feet. Three holes (No. 1, 2 and 3) tested the aeromagnetic low and visible mineralization in Boise Creek, three more (No. 5, 6 and 11) tested visible mineralization in tributary canyons and two (No. 9 and 10) tested I.P. targets. Sludge was collected at nominally 10-foot intervals on all holes but the last two. Split core samples matching the sludge intervals where sludge was sampled and on 10-foot intervals where it was not were taken from the entire core of all holes except D.D.H. No. 3. Core was sampled from D.D.H. No. 3 on the basis of 10 feet every 50 feet with intervals matching sludge samples.

All core and sludge samples were assayed for copper and molybdenite. A selection of assay pulps were re-run by other laboratories and very good confirmation of the original values were obtained.

Prospector's chip samples were run by a different assayer whose molybdenite values appear to be consistently high by an average factor of greater than three. Therefore, little faith was placed in the chip sampling results.

Arithmetic averages of the assay results have been calculated. Based on prices of $0.30 per pound for copper and $1.03 per pound for molybdenite, no potential ore grade sections were apparent; thus no more than a simple calculation of the arithmetic average of all values for each hole were calculated. These averages, presented in Table I, show excellent correspondence between core and sludge and an extremely low overall value. The overall average of core assays is 0.09 percent Cu and 0.013 percent MoS_2 with a resulting copper equivalent of 0.13 percent.

TABLE I

SUMMARY OF ASSAY RESULTS

D.D.H. No.	Total Length (ft.)	CORE Assay Length (ft.)	CORE Arithmetic Averages % Cu	CORE Arithmetic Averages % MoS_2	SLUDGE Assay Length (ft.)	SLUDGE Arithmetic Averages % Cu	SLUDGE Arithmetic Averages % MoS_2
1	1537	1425	0.12	0.017	1425	0.12	0.013
2	918	690	0.13	0.013	648	0.13	0.017
3	978	120	0.09	0.016	830	0.12	0.017
4	116	abandoned in overburden			abandoned in overburden		
5	1065	997	0.10	0.012	997	0.12	0.014
6	916	869	0.13	0.018	865	0.12	0.017
7	130	abandoned in overburden			abandoned in overburden		
8	124	abandoned in overburden			abandoned in overburden		
9	655	637	0.05	0.014	637	0.05	0.015
10	540	510	0.08	0.010	sludge not collected		
11	450	431	0.05	0.007	sludge not collected		

Average Assay Values

D.D.H. No.	Core Cu %	Core MoS_2 %	Sludge Cu %	Sludge MoS_2 %
1-9 (incl.)	0.10	0.015	0.11	0.015
1-11 (incl.)	0.09	0.013		

IX

ASSESSMENT WORK

All expenditures acceptable for recording as assessment work have been recorded for all claims possible. The 252 claims were formed into six full sized groups of 40 claims each and assessment work was filed on these, while cash payments in lieu of work of $100 per claim were made on the remaining twelve. The bulk of the assessment was based on the diamond drilling and its associated costs, but geophysical reports covering the aeromagnetic and induced polarization surveys were also submitted.

A total of 1,548 certificates of work were applied for and granted, so that the claims are in good standing for periods ranging from one to 12 years for an average of six years per claim.

APPENDIX I

PETROGRAPHIC REPORTS

DDH-1-106-PF — Altered Plag-Qutz Porphyry

Hand specimen is a v.f.g. white rock with numerous, less than 1 mm, dark green veinlets in several sets. The veinlets contain abundant f.g. pyrite, minor molybdenite(?) and quartz.

Under the microscope, the rock is seen to contain anhedral to subhedral, less than 2 mm, slightly altered plagioclase phenocrysts; subhedral to anhedral, grey, sometimes clustered quartz; and anhedral pseudomorphs less than 1 mm now occupied by chlorite. These minerals occur in a f.g. interlocking matrix of less than 0.1 mm, slightly altered plagioclase and quartz. Some m.g. round quartz grains contain f.g. matrix embayments as in a typical quartz-feldspar porphry. Some clusters of plagioclase contain minor, less than 0.1 mm white mica. Rock in general has been altered to a matted, f.g. aggregate of white mica and chlorite flakes. Plagioclase has been altered to rare epidote and v.f.g. flakes of white mica and chlorite. In places plagioclase has been altered to saussurite and albite or to a brownish argillic alteration. Some patchy quartz appears to have been introduced. Irregular, less than 2 mm quartz veins contain crystals of plagioclase. Some opaques are f.g., ~~and~~ anhedral, and associated with chlorite and white mica. Some opaques are m.g., subhedral to anhedral. Some opaques occur in f.g. quartz veins. Some quartz is strained.

Siliceous ...

DDH-1-119 D. — Granodiorite (Silicified?)

The hand specimen is a quartz-rich, m.g., granitic-looking rock with chloritized mafics and white feldspars. F.g. pyrite and white mica occur along the fractures.

Under the microscope the rock is seen to contain anhedral to interstitial, less than 2 mm, pseudomorphs now containing f.g. chlorite, opaques and white mica; anhedral, less than 2 mm, sometimes interstitial, sometimes clustered, abundant quartz; and anhedral to euhedral, ~~less~~ than 4 mm, altered plagioclase, often untwinned. Anhedral, f.g. quartz inclusions occur in plagioclase. The reverse case is rare. Quartz clusters have numerous plagioclase ~~plates~~ grains as interstitial crystals. Some f.g., subhedral plagioclase occurs in larger plag. phenocrysts of the same composition. Texture might be described as m.g. ~~anthritic~~ aplitic. White mica is in part replaced by chlorite. Plagioclase has been slightly altered to f.g. epidote. Quartz has been strained. Anhedral to subhedral, less than 0.2 mm opaques are associated with chlorite, or occur as equant grains between other crystals.

Remnants (?) of f.g., anhedral, noninterlocking quartz-plagioclase rock may indicate derivation from a f.g., probably porphyritic rock. Quartz may be in part primary because mafics are interstitial ~~with~~ to some quartz. The original phenos of plag. would be the present m.g. crystals in the present anhedral, m.g. qtz.

Texture m.g. aplitic

DDH-1-172A   Altered Granodiorite

Hand specimen is a v.f.g., dark grey rock, containing light coloured, "shattered" fledspar fragments.

Under the microscope, the rock is seen to contain generally v.f.g., fresh, to strongly altered, less than 3 mm, generally euhedral plagioclase; minor, less than 1 mm, subhedral apatite; less than 1 mm, anhedral to subhedral, green amphibole; and pseudomorphs after 4 mm, euhedral rectangular mafic. Minor, f.g., anhedral quartz is present. Some "tremolite " may be primary. The rock has been strongly altered. Minor, f.g., round quartz inclusions occur in plagioclase. Similar inclusions occur in mafic pseudomorphs. Some plagioclase is peppered by v.f.g. round opaques. Some irregular, less than 0.5 mm, chlorite-opaque-quartz veinlets cut the rock. The strongly altered part of the rock contains about 1/10th 0.5 mm, round opaque grains associated with hornblende and chlorite. Hornblende appears to be pseudomorphic after m.g., anhedral to euhedral pyroxene. Vein-like zones, less than 2 mm wide and containing f.g., anhedral, dense hornblende and opaques cut the rock. Quartz veinlets are also present. A 1 mm veinlet of f.g. to v.f.g., interlocking kaolinite crystals, less than 0.1 mm cuts the rock. Less than 1 mm, f.g. (0.5 mm) opaque-quartz veins cut the rock also. F.g. saussurite occurs in the plagioclase which is m.g., euhedral, and makes up most of the rock. There is also much brown argillic alteration of feldspars. The original texture was probably m.g. granitic with some phenocrysts of pyroxene.

Andesite

DDH-2-103 FP   Qtz-Plag Porphyry

The hand specimen is a pyrite-bearing, light grey rock with f.g., subhedral, vague white feldspar phenocrysts.

Under the mircoscope the rock was seen to contain less than 3 mm, subhedral, complexly twinned, sometimes clustered, partly altered plagioclase crystals; minor, less than 1 mm, sometimes clustered, round quartz; and euhedral to anhedral pseudomorphs now ~~occupy the~~ occupied by f.g. chlorite. Less than 0.5 mm matrix contains f.g., anhedral quartz; f.g. euhedral plagioclase; f.g., anhedral chlorite; f.g., euhedral biotite; and f.g., euhedral white mica. Brown, less than 1 mm clusters of f.g. chlorite appear with apatite and quartz. Certain zones of some plagioclase and phenocrysts are strongly saussuritized. Anhedral groundmass plagioclase is strongly altered to v.f.g. white mica. Chlorite replaces white mica to some extent. Less than 5 mm, subhedral pseudomorphs, containing f.g. chlorite contain also opaques which are round ~~and~~ to platey. Some opaques are m.g., associated with chlorite. Some round, f.g. opaques appear in chlorite and apatite.

DDH-2-162 QF Altered Granodiorite

In hand specimen, rock is a v.f.g., silicified, light green-grey rock cut by thin pyrite-bearing veinlets. A light colored, quartz-rich patch, 5 cm long, appears in the hand specimen.

Under the microscope, the rock is seen to contain 5 mm, generally altered, subhedral to interstitial feldspar grains; f.g., interstitial, altered, sometimes zoned plagioclase; less than 2 mm, sometimes clustered, anhedral quartz; minor, m.g. to f.g., anhedral apatite; and minor, f.g., interstitial to replacing orthoclase. Some quartz occurs as less than 2 mm, round clusters. K-feldspar in part replaces plagioclase as small, irregular patches.

Some feldspars have been strongly altered to white mica and brown clay. Identifiable plagioclase has been altered to less than 0.5 mm white mica, carbonate, kaolin (?) and some brown clay. Kaolinite (?) tends to occur alone in certain feldspar grains, however. A 1 mm thick, v.f.g. kaolinite (?) veinlet cuts the rock. Some f.g. chlorite occurs in plagioclase grains and may be the result of alteration. Opaque grains are associated with f.g. white mica, chlorite, altered plagioclase, and kaolinite (?).

Migmatite - Mainly Dioritic

DDH-2-251-DP Altered Diorite

The hand specimen reveals a m.g., granitic rock, with olive-green mafics in a groundmass of grey feldspar with some quartz. Some mafics are interstitial with feldspar. Some pyrite is present.

Under the microscope the rock is seen to contain less than 3 mm, euhedral to anhedral plagioclase; less than 2 mm, interstitial to anhedral quartz; minor, euhedral to interstitial, less than 1 cm hornblende phenocrysts; euhedral, less than 1 mm biotite and chlorite; minor opaques; and f.g. apatite. Hornblende contains abundant, subhedral biotite, but Euhedral hornblende is clear of such biotite. Plagioclase is slightly oriented. Some quartz is interstitial whereas some is round and clustered. F.g., wormy plagioclase-quartz intergrowths are present. Some less than 2 mm clusters of less than 0.5 mm biotite grains contain numerous opaques. Plagioclase has been strongly saussuritized in places. Plagioclase contains also f.g. biotite and chlorite. Some feldspar has been altered to kaolinite (?). Chlorite replaces biotite, and possibly replaces hornblende. Less than 0.5 mm opaques are associated with various mafics and especially chlorite. Many opaques are v.f.g., round, and occur in plagioclase. Similarly many opaques occur as f.g. in hornblende. Numerous, less than 0.5 mm veinlets of biotite and chlorite are present.

(as scratched on slide)

DDH2-407 DC

Strongly Altered and Silicified (a) Rock

The hand specimen is v.f.g., medium grey and contains a few white feldspar ghosts, with quartz veinlets containing minor chalcopyrite and pyrite.

Thin Section.

Rock is seen to consist of a former feldspar, now strongly altered and silicified to a fine grained mass of matted, v.f.g. white mica, unveined chlorite , clays, and f.g. to m.g., euhedral, sometimes clustered quartz. Quartz occurs as disseminated f.g. in white mica groundmass to less than 3 mm, anhedral, clustered, grains. White mica is apparently a replacement of feldspar, as is minor, v.f.g. carbonate. M.g., anhedral, round, opaque grains less than 5 mm are present. Veinlets of f.g., white clay contain also quartz, opaques, carbonate and chlorite. Some kaolinite veinlets contain remnants of anhydrite, which are m.g. Some f.g., round anhydrite inclusions occur in opaques. Opaques are cut by kaolinite. Many less than 0.5 mm, anhedral opaques are disseminated throughout the rock. Chlorite is associated with opaques. Various veinlets are sub-parallel. Some pseudomorphs of feldspars, less than 1mm in size, occur in quartz veinlets. Quartz is strained.

(as scratched on slide)

DDH-2-407 DC

Migmatite - Mainly Andesitic

Altered Plagioclase Porphyry (b)

The hand specimen is v.f.g., med. grey, and contains a few 1 cm, euhedral, grey feldspar ghosts, Quartz veinlets, minor , f.g. calcophyrite. In thin section, remnants of the original rock are seen to contain rare, euhedral, less than 1 mm, altered plagioclase ghosts in a less than 0.2 mm, slightly interlocking groundmass with anhedral, intermediate plagioclase and anhedral quartz. Ghost phenocrysts of plagioclase are euhedral, less than 1 mm, ~~and~~ cut by carbonate, quartz veinlets and replaced by saussurite. Introduced, anhedral, f.g. to m.g. quartz contains opaques. Strongly argillized patches are present, probably representing former phenocrysts. Some of the argillized groundmass cuts quartz grains. Less than 1 mm, dark gray, f.g. epidotized patches contain also minor carbonate. Some of the groundmass is argillized. Some less than 1 mm quartz clusters, as well as less than 1.5 mm wide quartz veins are present. A quartz vein contains minor, euhedral, less than 2 mm, intermediate plagioclase. Less than 2 mm, anhedral pyrite occurs in the quartz. Some opaques are f.g. in the f.g. quartz-chlorite clusters. Some opaques occur in less than 0.2 mm veinlets.

The original rock was probably a f.g. plagioclase-quartz aggregate with minor phenocrysts of feldspar now strongly altered. M.g. to f.g., anhedral quartz and other alteration minerals have been superimposed.

(as scratched on slide)

(c)

DDH-2-407 DC Fg. Altered Granodiorite

The hand specimen is v.f.g., med. grey, and contains chalcophyrite and pyrite-bearing quartz veins and a few white feldspar ghosts less than 1 cm.

Unaltered rock is granitic in texture. Under the microscope, the rock ~~seems~~ is seen to consist of f.g. matted white mica, chlorite and brown clay alterations, probably replacing feldspar. Much m.g. to f.g. anhedral quartz is present, probably the result of silicification. In the more strongly altered areas, quartz is f.g. The original rock contains euhedral plagioclase and perhaps introduced interstitial quartz. Even in this relatively unaltered rock, some saussuritization and white mica alteration occur. Quartz is f.g. to m.g. and disseminated to clustered. Quartz clusters measure less than 2 mm in size.

Brown clay predominates in some f.g., completely altered areas. Plagioclase has been strongly altered mainly to white mica as v.f.grains, or to f.g. chlorite. Some veinlets of v.f.g. kaolinite are present. Minor carbonate veinlets are completely enclosed in opaques. Some carbonate occur as veinlets in kaolinite. Some quartz-clay veinlets, less than 3 mm, cut the rock and contain m.g. opaques. Some round, less than 0.2 mm sphene occurs in carbonate. Some f.g., round, pure kaolinite aggregates occur as less than 2 mm patches as well as veinlets. Some vein quartz contains inclusions of f.g., round white mica and aggregates of vein kaolinite. Opaques occur as m.g. anhedra as well as much finer grained disseminated, anhedral ~~opaques~~ grains.

DDH-2-78D Altered Plag.-Hornbl. Porph.

The hand specimen is a pyrite-bearing, m.g. to f.g. rock, containing f.g. grey ghosts of feldspar.

Under the microscope the rock is seen to contain less than 4 mm, strongly zoned, subhedral to euhedral plagioclase phenocrysts; diffuse, subhedral biotite after a 4 mm hornblende crystal also containing chlorite, apatite and opaques; and anhedral to interstitial, less than 1 mm quartz. Some plagioclase phenocrysts are complexly twinned, and some are clustered. Most quartz appears to have been introduced. Phenocrysts occur in a f.g. (less than 0.5 mm) matrix containing euhedral plagioclase; subhedral quartz; euhedral, less than 0.2 mm chlorite; anhedral, less than 3 mm, irregular opaques in chlorite patches; and subhedral, less than 0.5 mm biotite.

Plagioclase has been altered to f.g. kaolinite (?) in separate crystals; to f.g. saussurite and albite; and to v.f.g. white mica crystals. Groundmass plagioclase is less altered but slightly saussuritized. There is a slight orientation of plagioclase phenocrysts. Some opaques are round, less than 1 mm, and contain inclusions of biotite, carbonate(?) and composite plagioclase. Some opaques are associated with chloritized pseudomorphs.

PETROGRAPHY OF THREE ROCK SPECIMENS

Prepared for: CYPRUS EXPLORATION CORP. LTD.

Prepared by: H.T. CARSWELL, Ph. D., Petrographer

November 1967

→ Boise Ck - MINERALOGY

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H. T. CARSWELL, Ph. D., PETROGRAPHER

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684 - 5661

MINERALOGY

Only critical properties of important minerals are noted here.

Chlorite (?) colourless to green pleo.; parallel extinction; opt. (+), low 2V; anom. muddy interference.

Anhydrite high pos. relief; high birefr.; 3 cleavages; 2 sets poly. twinning inclined to cleavage; biax. (+), 2V≈ 40 ca. parallel extinction.

Illite mod. pos. rel.; length - slow; high birefr.; flakes parallel cleavage; uniaxial (-); parallel extinction. 2V=0°

White Mica as illite, but 2V appreciable; birchbark texture near ext.

Kaolinite mod. pos. rel.; low birefr.; length - fast; near parallel ext.

Hole 6- Footage specimen

PETROGRAPHY

Specimen 6-911 - Altered Quartz Gabbro ?

The hand specimen reveals a medium-grey, apparently f.g. rock containing relatively sparse white feldspar megacrysts and an angular, f.g. dark fragment (?).

Microscopic study reveals that, disregarding alteration products, the rock contains about:-

20%	Quartz	
75%	Plagioclase	- generally unzoned, but crystals vary from An_{20} to An_{co}
0.5%	Apatite	
5%	Opaques	

Also: Anhydrite, white mica, chlorite, carbonate.

Less than 4 mm, euhedral, altered plagioclase occurs with round to interstitial, sometimes clustered quartz. Some quartz has slightly replaced plagioclase. Most of the quartz contains v.f.g., dark, round, abundant inclusions, and fills interstices. Such quartz is probably primary; but some clear, round quartz looks introduced. Fine-grained, subhedral apatite is present. Some patches strongly altered to f.g. chlorite, anhydrite, white mica (?) and carbonate may be pseudomorphous after a mafic mineral or lithic fragments.

Abundant, f.g. anhydrite, chlorite, white mica, and carbonate replace plagioclase in part. Plagioclase has been albitized in part. Chlorite contains flakes of v.f.g. magnetite(?) Some less than 0.1 beads of opaques follow a linear zone in the rock. M.g., round opaque grains are also present; especially near chlorite.

Thin chlorite-anhydrite veinlets cut plagioclase.

Quartz has been strained, and plagioclase bent.

Hole Footage

Specimen 11-160 - Strongly Silicified Rock

The specimen consists of a silicified rock cut by a 3 mm wide quartz vein. Medium-grained pyrite and f.g. molybdenite are common near the walls of the vein.

Generally round, less than 0.5 mm quartz grains with interstitial to euhedral, f.g., completely altered feldspars make up the wall rock.

Groundmass plagioclase has been altered to f.g. illite (?), white mica, and koalinite (?). Very minor crystals of these phyllasilicates occur in quartz. Minor opaques are associated with f.g. mica.

The vein consists of m.g. to f.g. sutured, generally elongate, anhedral quartz grains with less than 7 mm, generally subhedral to interstitial pyrite which contains quartz inclusions. The veinlet is cut by minute veinlets and fillings of carbonate which contain a very few, fan-like, v.f.g. chlorite (?) grains.

Quartz in general contains abundant, scattered, v.f.g., round, dark inclusions.

The original wall rock contained euhedral feldspar crystals, and therefore may be of igneous origin.

Specimen 10-230 - Granodiorite

60%	Plagioclase - mod. pos. to neutral relief; some oscill. zoning; most unzoned; much untwinned; Cb-Ab-12,5 (An_{32}), opt. (+); to Ano
30%	Quartz
5%	Illite
3%	Chlorite
1%	Opaques

Holes Footnotes

Specimen 10-230 - Granodiorite (cont'd)

The rock contains euhedral, altered, less than 4 mm, plagioclase; round to interstititial, less than 3 mm quartz; less than 0.5 mm flakey illite; and less than 5 mm, subhedral opaques. Minor, f.g. carbonate is also present; as is minor, f.g. round zircon.

Illite has been altered to chlorite in part. Plagioclase has been slightly saussuritized and albitized, as well as altered to v.f.g. illite and carbonates. Minor clusters of f.g. illite and chlorite are present.

Fine-to-medium grain opaque grains are commonly associated with chlorite.

H. T. Carswell

H.T. CARSWELL, Ph. D.

Petrographer

November 16, 1967

APPENDIX II

MINERALOGRAPHIC REPORT

Core Specimens TAKEN by D. Tully at Boise Creek

A MINERALOGRAPHIC REPORT

ON

THREE DIAMOND DRILL CORE SPECIMENS

FOR

CYPRESS EXPLORATION

INTRODUCTION

Three specimens of diamond drill core were submitted to the writer by Dr. H. Carswell in the name of Mr. D. Tulley, for the purpose of mineralographic description. The specimens were labelled 6-911', 10-230', and 11-160'. Mr. G. E. Montgomery prepared a mounted polished section of each of the specimens. A mineralographic report based on these polished sections follows.

SUMMARY AND CONCLUSIONS

1. Host rock is a medium-grained leuco-"granitic" rock that has been fractured and mineralized by a combination of open space filling and replacement.

2. Introduced gangue is mainly quartz with a lesser amount of calcite.

3. Sulphides recognized are pyrite (earliest) and chalcopyrite and molybdenite (later). Age relations of chalcopyrite and molybdenite are uncertain. This uncertainty may result from two periods of molybdenite mineralization between which chalcopyrite was deposited.

4. For the most part sulphides occur as monomineralic grains, which accounts for the uncertainty in paragenesis.

5. There is a great disparity in grain size for the different sulphides. Pyrite is the coarsest grained, and molybdenite is finest grained with

chalcopyrite intermediate in size. Pyrite grains are commonly 0.1 to more than 1.0 mm. diameter with most grains being near the coarse limit. Chalcopyrite grains are mostly in the range 0.1 to 0.5 mm. diameter although a few are coarser and a few are finer. Molybdenite grains are normally from 0.01 to 0.05 mm. diameter although a few lath-shaped grains are up to 0.3 mm. long.

6. The coarser sulphides tend to be more regular, equidimensional grains, whereas the finer grains are highly irregular in outline and are confined to interstitial positions along grain boundaries of gangue minerals.

DESCRIPTIONS OF SPECIMENS

No. 6-911'

Specimen: Chip of diamond drill core containing a few irregular masses of pyrite disseminated through grey, medium-grained granitic gangue material containing local patches of white, coarse-grained quartz.

Polished Section:

Pyrite--anhedral to subhedral grains disseminated sporadically within irregular replacement veins consisting mainly of quartz and a lesser amount of calcite. For the most part these grains are not in contact with other sulphides although rarely chalcopyrite is seen surrounding relict anhedral cores of pyrite. Size of individual grains ranges from 0.1 to about 1.0 mm. diameter.

Chalcopyrite--equidimensional to highly irregular in shape. Size ranges from 0.01 to 0.5 mm. diameter. Mainly in contact with introduced quartz and carbonate.

Molybdenite--trace amounts as highly irregular intergrowths with gangue and chalcopyrite. Also, rarely, as minute rounded inclusions in chalcopyrite. Appears younger than chalcopyrite. Grain diameters highly variable but normally of the order of 0.01 mm. Replaces pyrite definitely. Some of the smallest grains have lath-shaped forms.

Gangue--unidentified rock material plus introduced quartz and calcite.

No. 10-230'.

Specimen: Medium-grained, leucocratic, granitic rock containing a small amount of disseminated pyrite as anhedral grains up to 2 mm. in diameter. Cut by thin fractures along which the rock appears to have been chloritized and along which quartz and pyrite have been introduced.

Polished Section:

Pyrite--large, anhedral grains, equidimensional, in places with numerous minute inclusions of gangue and rarely molybdenite and chalcopyrite. A few grains show some good crystal faces.

Molybdenite--mainly as minute, irregular grains interstitial to gangue. Less commonly associated with chalcopyrite as inclusions in, and rims around, chalcopyrite grains. Some inclusions are lath-shaped suggesting early deposition of molybdenite although age relations are uncertain. Molybdenite appears locally to replace pyrite, but age relations are uncertain in this polished section.

Chalcopyrite--rarely as minute, rounded inclusions in pyrite where age relations are uncertain. Rarely as minute, equidimensional grains up to 0.1 mm. diameter in gangue, and less commonly in contact with molybdenite in which case molybdenite occurs both as rounded inclusions in chalcppyrite and as discontinuous rims surrounding chalcopyrite. Age relations of chalcopyrite and molybdenite are conflicting based on standard textural interpretation.

No. 11-160'.

Specimen: Fine-grained, leucocratic, granitic rock containing about 5% disseminated, medium-grained pyrite masses, and cut by a 1" quartz vein containing scattered, large, irregular masses of pyrite from 0.5 to 1.0 mm. in diameter.

Polished Section:

Pyrite--Large masses (single crystals), mainly with ahhedral form, but rarely with some development of crystal faces. Grains mostly about 1.0 mm. in diameter and a few contain gangue inclusions. Not observed in contact with other sulphides except for a single small inclusion of chalcopyrite in one large pyrite grain. Mainly confined to an irregular quartz-carbonate vein cutting rock.

Chalcopyrite--confined to one very small area of the polished section at contact of quartz vein and host rock. Occurs as medium-grained, irregular masses with numerous irregular protrusions extending between grains of surrounding material. Size is 0.2 to 1.0 mm. diameter. The larger grains contain irregular inclusions of gangue. Not seen in contact with other sulphides except for one grain which contains a small relict grain of pyrite.

Molybdenite--trace amounts as minute masses in interstitial spaces in quartz. Rarely up to 0.05 mm. in diameter. Not observed in contact with other sulphides. In one small area of the polished surface molybdenite occurs as lath-shaped crystals about 0.3 mm. long. In hand specimen these local concentrations of molybdenite appear spatially related to some pyrite grains but the two were not observed in contact and age relations are uncertain.

Gangue--granitic host rock and introduced quartz.

PARAGENESIS

Age relations are not well exhibited in these polished sections because grain contacts between different sulphides are rare. However, pyrite is fairly certainly the earliest sulphide deposited. There is conflicting evidence as to age relations of chalcopyrite and molybdenite, and they appear to be contemporaneous in part. One possible explanation is that there were 2 periods of molybdenite deposition with chalcopyrite deposition being intermediate between the two.

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Dr. A. J. Sinclair, P. Eng.,
November 28, 1967