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Office of the Regional Manager Mineral
MAY 17 1982
Yukon Territory

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WATSON LAKE, Y.T.
I.A. & N.D.

REPORT ON

DIAMOND DRILLING PROGRAM

CONDUCTED JUNE 15 TO JULY 21, 1981

FOR

CUB JOINT VENTURE

IVO	1-40	- YA36556-YA36595
IVO	41-80	- YA45223-YA45262
IVO	81-128	- YA45639-YA45686
IVO	129-173	- YA55394-YA55438
IVO	174-189	- YA55794-YA55809
IVO	190-212	- YA56356-YA56378
IVO	225-263	- YA65828-YA65866
IVO	264-271	- YA66011-YA66018
IVO	272-286	- YA66827-YA66841
IVO	287-294	- YA67100-YA67107

CLAIM SHEETS 95D/14, 95E/2, 95E/3

WATSON LAKE MINING DISTRICT, YUKON

Latitude 61°03'N

Longitude 127°03'W

C.A. Main, B.Sc.

R.J. Cathro, B.A.Sc., P.Eng.

091027

Indian and Northern Affairs Canada
Affaires indiennes et du Nord Canada

P. O. Box 269
Watson Lake, Yukon
YOA 1CO

13 May, 1982

Office of the Regional Manager Mineral Resources
MAY 17 1982
WHITEHORSE
Yukon Territory

Your file Votre référence

Our file Notre référence

REGIONAL DIRECTOR RESOURCES

Attention: Supervising Mining Recorder

RESTRICTED

Enclosed for your files are Diamond Drill logs submitted by Archer, Cathro & Associates for assessment on the IVO mineral claims located on maps 95-D-14/15 and 95-E-2/3.

Drilling was as follows:

81 - 1	Ivo	128	325 Feet
81 - 2		128	136 Feet
81 - 3		125	195 Feet
81 - 4		126	280 Feet
81 - 5		126	390 Feet
81 - 6		123	342 Feet
81 - 7		123	287 Feet
81 - 8		128	462 Feet
81 - 9		176	425 Feet
81 - 10		179	417 Feet
81 - 11		115	267 Feet
81 - 12		115	444 Feet

Total assessment credit requested is $55,800.00. Drill core is being stored at the IVO campsite.

Yours truly,

Patti L. McLeod
Mining Recorder
Watson Lake Mining District

091027

PLM/nm
encl.

cc: Regional Geologist

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IVO PROPERTY

SUMMARY AND RECOMMENDATIONS

The Ivo property is located in the Logan Mountains of southeastern Yukon. Tungsten mineralization was initially discovered by a prospector working for Union Carbide Canada Ltd in 1971. Subsequent work by CUB Joint Venture (Cassiar Asbestos Corporation Limited, now Brinco Mining Ltd.; Highland-Crow Resources Ltd., an affiliate of Teck Corporation Ltd.; and Union Carbide Canada Limited) in 1978 revealed the presence of unmapped Cambrian limestone and dolomite adjacent to a Cretaceous pluton (the Ivo stock), and resulted in the discovery of a second small showing. The property was staked in 1979, when the stock was explored with grid panning, soil sampling and prospecting. During this work, two more showings and two float occurrences were located. The 1980 program, consisting of ground magnetic and electromagnetic, geochemical and soil panning surveys, outlined an important magnetic conductor coincident with a geochemical anomaly, called the Salivo zone. This zone, located in the southeast part of the property, is particularly attractive because it occurs at the contact between the favourable Sekwi limestone formation and the Salivo stock, which has been found to be distinct from the Ivo stock.

During 1981, the Salivo zone was tested by diamond drilling. It contains scheelite associated with skarns, ranging up to diopside-garnet assemblages, that have developed within the thick and relatively clean Sekwi Formation limestone. Greisen alteration is sometimes found at granite contacts. Tungsten assays from the 1981 drilling ranged up to 0.7% WO_3 in skarn and 0.87% WO_3 in greisen, with the best section (hole 81-4) grading 0.44% WO_3 over a core length of

7.6 m. Moderately intense skarn development is widespread, particularly in the southern part of the zone, although skarn development and mineralization was slightly better in one area (holes 81-4 and 81-5). The 1981 drill program has not tested the complete lateral extent of the zone and no drill hole has tested the base of the limestone section at the granite contact.

The Salivo zone requires further drill testing, particularly downdip and to the west. This program will ascertain if the intrusive contact swings north up Crisake Creek into a septum between the adjacent Ivo and Salivo stocks. The zone also needs drilling laterally away from the intrusive contact to test skarn development at the base of the Sekwi limestone formation.

Early exploration of the Ivo property was directed to evaluation of the small, high-grade showings developed adjacent to the Ivo stock located on the western side of the property. To date, ten of these tungsten-skarn occurences have been discovered, all developed in thin limestone horizons within phyllites of the Backbone Ranges Formation, stratigraphically below the Sekwi Formation. Although specimens assaying in excess of 3 or 4% WO_3 have been found, all occurences have been small in size. Most of these showings have been evaluated except the TF, which was found late in the 1981 season and requires a detailed magnetic survey to confirm its extent. Almost all of the contacts of the Ivo and Salivo stocks have been covered by soil geochemical and ground magnetic surveys and some portions have also been surveyed electromagnetically (EM 16). Three anomalous areas, West Crisake Creek, North Ivo Area, and Tuanipel Creek (NWT) are still unexplained and require further geophysical and geochemical work.

INTRODUCTION

The Ivo property lies between the Coal and Rock Rivers, as shown on Figure 1 and 2 (on following pages). Initial discovery of mineralization was made in 1971 when Union Carbide Canada Ltd (UCEX) located minor amounts of scheelite-bearing, massive sulphide float within the Ivo stock while prospecting a panning anomaly. Subsequent prospecting in 1978 by CUB Joint Venture revealed unmapped Cambrian limestone and dolomite adjacent to the Ivo stock and led to the discovery of high-grade garnet-diopside skarn talus (78 showing). The northern half of the property was staked in 1979 and the intrusive contact, which is mostly overburden covered, was explored with grid panning, soil sampling, and prospecting resulting in the discovery of two more showings (Main and Tuanipel) and two float occurrences (Trevor and North).

The 1980 program continued exploration of the intrusive contact with ground magnetic, electromagnetic, geochemical and soil panning surveys. The main emphasis was on the southern and eastern portions of the stock where surveys outlined the Salivo zone, a magnetic conductor with a coincident, weakly anomalous geochemical expression. This zone was thought to be particularly attractive since it occurred at an intrusive contact with favourable Sekwi limestone. A small showing was subsequently found in outcrop at the north end of the Salivo zone. A geophysical interpretation by J.B. Boniwell dated April, 1981 suggested that the magnetic response of the granitic rocks associated with the Salivo zone is distinctively different from the

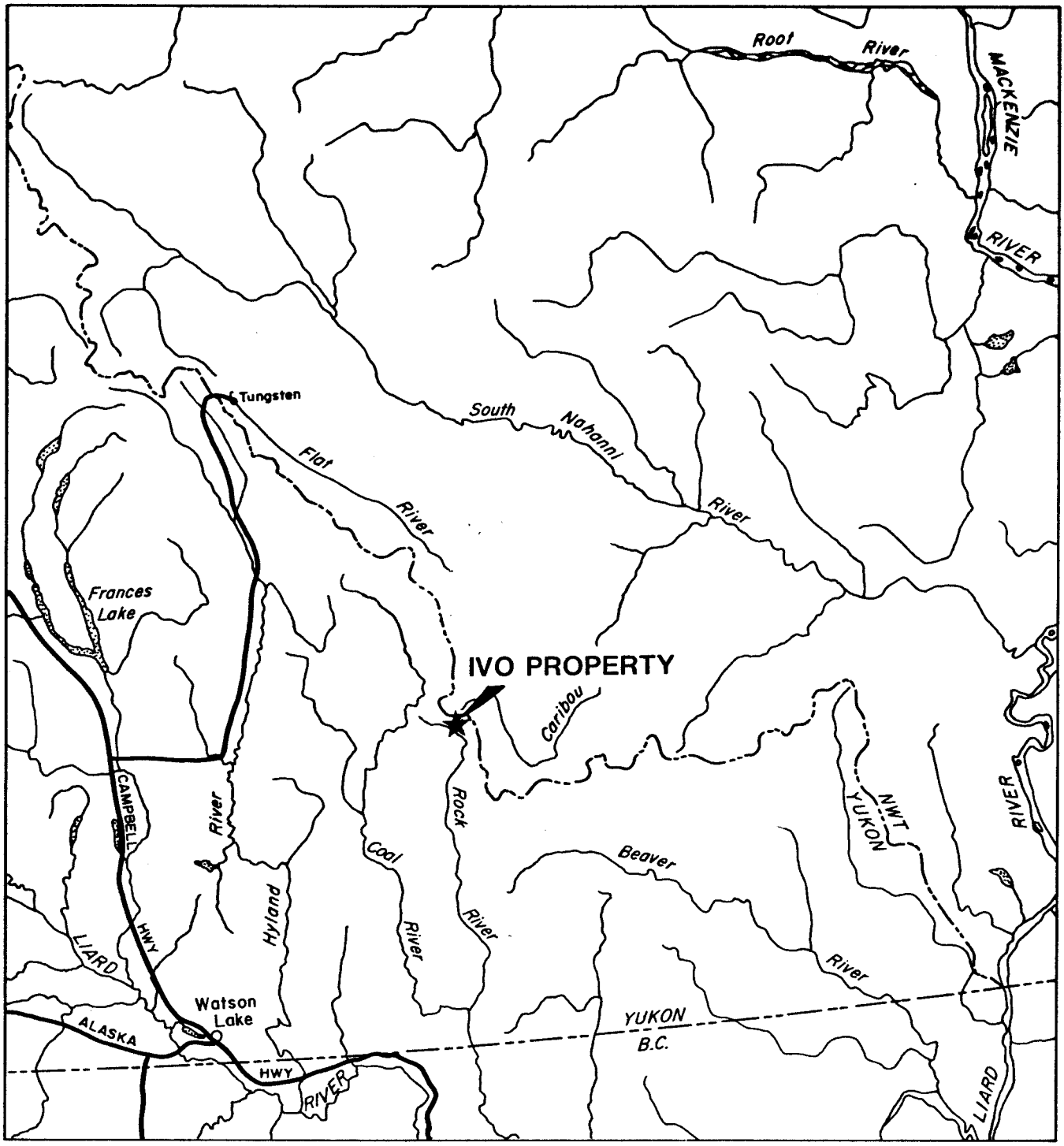


Figure 1

ARCHER, CATHRO & ASSOCIATES (1981) LIMITED

IVO PROPERTY

COAL RIVER DISTRICT

CUB JOINT VENTURE

SCALE – 1:2,000,000

20 0 10 20 40 60 80 Km

10 0 10 20 30 40 50 Miles

To accompany report dated March, 1982

response of the main Ivo stock and that they are completely separate plutons or different phases of the main Ivo pluton.

In 1981, the Salivo zone was tested by diamond drilling and geophysical and geochemical coverage of the Ivo property was completed. Claims were added to protect possible extensions of the contact to the south and east. The geophysical work was completed by contractor W.A. Barclay Exploration Services Ltd. The programs were managed by C.A. Main of Archer, Cathro & Associates (1981) Limited. This report describes the results of the diamond drilling program with a brief description of property geology to aid discussion.

PROPERTY, LOCATION AND ACCESS

The Ivo property consists of 274 contiguous Yukon claims and 5 contiguous NWT claims (equivalent in area to about 72 Yukon claims). The Yukon claims are recorded in the name of Archer, Cathro & Associates (1981) Limited at the Watson Lake Mining Records office and the NWT claims are recorded at the Yellowknife Mining Records office in the name of Union Carbide Canada Ltd. Details of the claim holdings are as follows:

Claims	No.	Mining District	Claim Sheet	Tag Numbers	Expiry Date
Ivo 1-40	40	Watson Lake	95E/3	YA36556-YA36595	22 May/88
41-80	40	"	"	YA45223-YA45262	22 May/87
81-128	40	"	"	YA45639-YA45686	22 May/85
129-173	45	"	"	YA55394-YA55438	22 May/86
174-189	16	"	"	YA55794-YA55809	22 May/86
190-212	23	"	95D/14 95E/2	YA56356-YA56378	22 May/86
225-263	39	"	95D/14 95E/2	YA65828-YA65866	24 June/82
264-271	8	"	95E/3	YA66011-YA66018	3 July/82
272-286	15	"	95E/2	YA66827-YA66841	10 Aug/82
287-294	8	"	95E/2 95E/3	YA67100-YA67107	31 Aug/82
1	16*	Nahanni (NWT)	"	F02067	28 May/85
2	24*	"	"	F02066	28 May/85
3	8*	"	"	F02065	27 Aug/84
4	6*	"	"	F02068	18 Aug/84
5	18*	"	"	F02069	12 Sept/82
Total	346				

* = Yukon Equivalents.

The Ivo property straddles the Yukon-NWT border at latitude 61 03'N and longitude 127 03'W, 140 km northeast of Watson Lake and 125 km southeast of the Cantung Mine. The nearest roads are the Nahanni Range (Cantung) Road 70 km to the west and a winter road from the Alaska Highway to the Mel lead-zinc property, 75 km to the south. Access in 1981 was by float plane from Watson Lake to Crisco Lake which lies 8 km north of the property.

PROPERTY GEOLOGY

Mapping and prospecting in 1981 did not change the description of the country rocks in the Ivo area and the discussion and the Table of Formations (on following page) are largely repetitions of descriptions in previous reports.

TABLE I - TABLE OF FORMATIONS - IVO PROPERTY

TERTIARY AND/OR CRETACEOUS (?)

Tg	SALIVO STOCK:	Biotite granite, commonly porphyritic.
Tqm	IVO STOCK:	Biotite granite, commonly cataclastic.

UPPER CAMBRIAN to ORDOVICIAN

COr	RABBITKETTLE FORMATION:	wavy-banded limestone.

LOWER CAMBRIAN

lCs	SEKWI FORMATION:	limestone and dolomite; swiss cheese limestone.

LOWER CAMBRIAN AND OLDER

lCbrq	BACKBONE RANGES FORMATION:	quartzite, siliceous light grey to purple hornfels
lCbrl	BACKBONE RANGES FORMATION:	siliceous limestone, pebbly limestone.
lCbrd	BACKBONE RANGES FORMATION:	pink to cream dolomite.

LOWER CAMBRIAN (?) AND OLDER

CH	PHYLLITE UNIT:	green muscovite-chlorite phyllite, siltstone, banded argillite, dark grey phyllite, dark grey pyritic hornfels.

However, it was recognized during 1981 that the igneous history of the property is more complex than originally thought. In particular, Boniwell's prediction about the intrusion associated with the Salivo zone was confirmed and a separate pluton named the Salivo stock was identified.

The following is a description of rock units found on the Ivo property:

INTRUSIONS

Tg - Salivo Stock

The Salivo stock is composed of fractured biotite granite with distinctive K-feldspar phenocrysts up to 3 cm long, particularly near the north part of the stock. The stock is oval in shape and about 4 km long and 1.5 km wide, with the long axis oriented north. Core logging indicates that the intrusive contact is steep toward the north end and flatter (about 50 degrees) toward the south. The Salivo stock is undated but its porphyritic texture and the greater intensity of fracturing in the Ivo stock may indicate that the Salivo stock is the younger of the two.

Tgm - Ivo Stock

The Ivo stock is composed of medium-grained, equigranular cataclastic biotite granite. The stock is about 10 km long and 4 km wide, with the long axis oriented north. Host rocks are gently arched over the stock, particularly along the relatively well-exposed northern contact. Irregular, gently-dipping contacts and an abundance of roof pendants indicate that the pluton is only barely unroofed. A fresh biotite-rich sample of the intrusion sent to Doug Archibald,

Queens University returned an age of 60.3 ±1.0 my . This is considerably younger than similar small plutons in the MacKenzie Mountains, where dates of 90 to 100 my are common.

SEDIMENTS

A regional lower Cambrian facies boundary passes through the Ivo property. The boundary is defined by an abrupt change from carbonate on the east to clastic rocks on the west that is accompanied by a general westward thinning of carbonate units and fining of clastic rocks. This facies change is expressed in the sequence of quartzite, phyllite, dolomite and limestone (at least 500 m thick) exposed on the Ivo property. Mapping along strike to the north has shown that these rocks underlie the Sekwi Formation (lCs) and younger Rabbitkettle Formation (COr) and belong mainly to the lower Cambrian Backbone Ranges Formation (lCbrq) and, in part, to the lower Cambrian and older "Phyllite Unit" (CH).

Only four lithologic subdivisions are practical within these rocks underlying the Sekwi Formation: dolomite (lCbrd), limestone (lCbrl), quartzite (lCbrq), and phyllite (CH):

lCbrd

Massive pink and cream weathering dolomite, exposed mainly in the southeastern and southwestern portions of the claim group, is apparently restricted to one stratigraphic horizon. From east to west, its thickness varies from about 250 m to 75 m.

lCbrl

The dolomite is overlain by at least two horizons of distinctive buff to grey weathering, sandy to pebbly limestone. Quartz grains up to 1 cm across form the clastic component. This unit is commonly well bedded with westerly-directed crossbeds up to one metre or more in height.

One apparently continuous limestone horizon directly overlies the dolomite and at least one other occurs within quartzite about 50 m higher in the section. From east to west across the property, the lower limestone varies in thickness from about 30 m to less than 10 m, whereas the upper unit varies from about 3 m to 1 m. Along the northern and western sides of the property, sandy limestone up to 10 m thick forms lenses within both quartzite and phyllite. Neither the configuration nor stratigraphic position of these lenses is certain.

lCbrq and CH

The carbonate rocks just described are enclosed within a sequence of dark grey-green, noncalcareous phyllite and siltstone and interbedded massive, crossbedded, grey quartzite and quartz grit. The clastic rocks have been subdivided into a quartzite unit (lCbrq) and a phyllite unit (CH). The distinction between the two is sometimes arbitrary and depends on the predominance of quartzite or phyllite. All clastic rocks overlying the dolomite are included within the quartzite unit, although phyllite is locally a large component. In general, phyllite with minor sandstone and quartzite underlies the carbonate sequence. However, similar rocks also comprise the westward facies equivalents of the upper members.

Away from the Ivo property, clastic rocks below the Backbone Ranges carbonates have all been mapped as lower Cambrian (?) and Hadrynian "Phyllite Unit" (CH)

lCs

The Backbone Ranges Formation is conformably overlain along the eastern margin of the property by massive limestone and dolomite of the Sekwi Formation (lCs). Although the Sekwi Formation is over 1000 m thick regionally, only the lowermost portion is exposed on the property. This consists of a basal member less than 20 m thick of thin-bedded, brown and grey weathering, nodular "Swiss Cheese" limestone and overlying massive, structureless grey limestone at least 100 m thick.

COr

The Rabbitkettle Formation is exposed east of Salivo Creek, along the extreme east side of the property. The formation is composed of grey weathering, well-bedded to massive, silty limestones, most of which exhibit monotonous, rhythmically alternating beds of silty and calcareous composition that weathered to a distinctive "wavy banded" appearance. The formation is regionally in excess of 1000 m thick and near the Ivo property is at least several hundreds of metres thick.

DRILLING

Introduction

Twelve BQ holes (81-1 to 81-12) were drilled for a total of 1222 m on the Salivo Zone during 1981. Figure 3 (in pocket) shows hole locations and drill statistics. The first holes were suggested by by J.B. Boniwell and the remainder were laid out on the basis of initial

results and spaced to test the entire 4 km length of the Salivo zone.

Drill logs for the 12 holes with accompanying cross-sectional diagrams showing geological and geophysical profiles are included as Appendix One. Figure 4 (in pocket) is a longitudinal representation of the Salivo zone with a correlation between holes.

Drill Hole Geology

The Salivo zone does not outcrop and all geological information has been obtained from drill core. The zone consists of interbedded pelitic and non-pelitic limestones and dolostones that have been variably affected by pyrometasomatic alteration from the Salivo stock. Sixteen thin sections were prepared by Vancouver Petrological Services Ltd. (Vancouver) to assist in the study of these complex assemblages. Their reports are included within Appendix Two. In the descriptions that follow, the following definitions have been used for the terms marble, calcsilicate and skarn:

> A marble is a thermally metamorphosed, variably pure carbonate with greater than 15% calcite and evident bedding. It is usually white to medium grey in colour and is generally lacking in calcsilicate minerals. Crystallinity is not used as a criteria.
>
> A calcsilicate is also thermally metamorphosed, but is probably derived from a more pelitic parent rock than the marble. It is typically massive, pale to medium green, red, or yellow in colour; has up to 15% calcite; generally lacks a crystalline character; and, in most cases, retains some bedding features.
>
> A skarn is thermally and chemically metasomatized to an iron-rich assemblage of pyroxenes, garnets, epidote, tremolite and other calcsilicate minerals. Pyrrhotite, pyrite and magnetite can be present in varying amounts. Bedding features are generally not present.

Table II (on following pages) describes the units encountered in the drill holes. A more complete description of lithologies and textures is included on the drill logs in Appendix One. Although vesuvianite is described in some of the logs, the petrological reports indicate that none is present in the thin sections examined and that a mineral interpreted as vesuvianite is probably red-brown garnet.

As shown on the longitudinal section (Figure 4, in pocket), the only possible marker horizons are seams of unconsolidated sand within marbles near the top of the first ten holes, and zones of biotite hornfels in the last two holes. The wide spacing of the holes (over 300 m) and the lack of skarn outcrop or of an unaltered section makes correlation difficult. Faulting between the drill holes could alter the tentative correlation shown on the longitudinal section.

Except for Holes 81-11 and 81-12, all the intersections are interpreted as lying within the Sekwi Formation. Lack of the "Swiss Cheese" texture normally encountered toward the base of this formation suggests that the drilling has tested the upper portion of this formation. All the holes bottomed in granite and a complete section of limestone has not been observed. Biotite hornfels toward the bottom of Holes 81-11 and 81-12 are similar to rocks elsewhere on the Ivo Property which are believed to be Backbone Ranges Formation. If so, this would indicate that the contact between these two formations may occur within these intersections.

L.A. Dick has demonstrated, in his study of the Mactung and Cantung deposits, ("Comparative Study of the Geology, Mineralogy and Conditions for Formation of Contact Metasomatic Mineral Deposits in the Northwestern Canadian Cordillera", unpublished Ph.D. thesis,

TABLE II - IVO PROPERTY DRILL HOLE GEOLOGY

TERTIARY

SALIVO GRANITE

-biotite, K-feldspar, granite porphyry
-medium to coarse grained, leucocratic with pervasive propylitic alteration that is confined to fine fractures at depth.
-contains 2 to 5% subhedral and euhedral K-feldspar phenocrysts up to 5 cm in a groundmass of 30 to 40% rounded quartz masses and quartz-eyes, 25 to 30% anhedral feldspar, 15 to 20% fine to medium, subhedral and anhedral biotite masses.
-contains occasional zones up to 30 cm wide of quartz diorite composition in gradational contact with granite; quartz diorite contains 40 to 45% plagioclase with some calcic to sodic zonations (slightly to moderately sericitized); 20 to 25% quartz, up to 15% K-feldspar and up to 15% variably chloritized biotite.

(Altered) DIORITIC SALIVO GRANITE

-weakly to strongly altered, medium to coarse-grained melanocratic to leucocratic, includes extremely leached dykes occuring high in drill intersections as well as dioritic zones near the intrusive contact.
-contains 60 to 65% plagioclase and 25 to 30% hornblende.
-contains very occasional anhedral to subhedral, coarse plagioclase phenocrysts.

-there are these varieties of the altered Salivo granite:

Weakly metasomatized

-up to 60% indistinct, fine to very fine-grained plagioclase, up to 25% fine, anhedral quartz masses, 15 to 25% pyrite, up to 5% pyrrhotite and up to 20% aphanitic, medium to dark green diopside and/or sericite.

Strongly metasomatized (greisen)

-up to 25% coarse-grained plagioclase, 25 to 35% interstitial, fine, platy, massive muscovite, up to 15% anhedral calcite masses, up to 15% anhedral quartz, 15 to 25% fine to very coarse-grained anhedral to euhedral pyrite.
-contains up to 8,700 ppm WO_3.

Epidote, Garnet Skarn

-retains an altered "intrusive" appearance.
-represents extreme alteration of intrusive rock (?).
-contains 60 to 70% pale pink to rose (manganese?) epidote replacing plagioclase, up to 25% fine to coarse-grained, aphanitic, dark brown garnet masses, fine interstitial accessory quartz, garnet and/or epidote.

BIOTITE PORPHYRY DYKES
-contains up to 5% medium to dark green, very fine, biotite phenocrysts and 2 to 3% anhedral feldspar phenocrysts in a massive, aphanitic, medium to dark green groundmass.

LOWER CAMBRIAN

Sekwi Formation (?)

Weakly metamorphosed

MARBLE
-variably marmorized, interbedded, white to medium grey, finely crystalline, pure and impure limestones and/or dolostones with occasional interbeds of sandstone, quartzite, unconsolidated sand seams and/or strongly leached zones.

MAGNETITE MARBLE
-grey, variably marmorized, finely crystalline limestones and/or dolostones with greater than 1% magnetite as disseminated grains with hematite and/or as massive laminations, generally with a consistent distribution throughout.

Moderately metamorphosed (and/or metasomatized)

CALCSILICATE
-moderately to strongly bedded, pale green to yellow, aphanitic, massive, composition uncertain

Strongly metasomatized

DIOPSIDE SKARN
-medium to dark green, fine to medium crystalline diopside with minor light to dark red-brown, aphanitic garnet masses and irregular patches and/or massive, aphanitic, white, irregular siliceous patches or laminations.

SILICEOUS-DIOPSIDE SKARN
-as above with 20 to 30% aphanitic and finely crystalline white, siliceous (tremolite?) masses.

MAGNETITE-DIOPSIDE SKARN
-pale yellow to creamy yellow, aphanitic diopside interstitial in up to 20% massive, irregularly laminated magnetite having a fine woodgrain appearance.

DIOPSIDE-TREMOLITE SKARN
-contains 50 to 70% vuggy green to white, finely to coarsely crystalline, diopside, up to 30% tremolite, and occasionally up to 25% red-brown garnet as irregular masses and fine mottles.

DIOPSIDE-GARNET SKARN
-contains up to 75% finely crystalline, irregular masses and sublaminations of medium to dark green diopside intermeshed with 20 to 60% light brown to red, massive garnet as irregular patches and/or laminations and subrounded mottles.
-occasional dark red massive garnet, and accessory, aphanitic and minor subhedral calcite masses and anhedral quartz.

GARNET-EPIDOTE SKARN
-contains up to 85% medium to dark red, massive garnet, occasionally with subhedral outlines and internal zonations; also up to 10% pistachio and medium apple green (clinozoisite), aphanitic, massive epidote.

GARNET-EPIDOTE-DIOPSIDE SKARN
-as above with medium green, aphanitic diopside masses.

EPIDOTE-GARNET-DIOPSIDE SKARN
-very strongly mottled.
-contains 25 to 40% white to very light pinkish, anhedral epidote with 15 to 30% dark red-brown, anhedral garnet, with up to 15% medium green massive, irregular aphanitic diopside, and accessory, anhedral quartz and calcite masses.

BACKBONE RANGES FORMATION (?)

Weakly metamorphosed

MARBLE
-see Sekwi Marble (above).

BIOTITE HORNFELS
-maroon, very finely crystalline, massive biotite with minor pale green to light bluish, subrounded calcsilicate masses with pyrite and pyrrhotite inclusions and as fine fracture in-fillings.

Moderately Metamorphosed

DIOPSIDE-GARNET CALCSILICATE
-moderately to strongly bedded;
-contains up to 20% light to dark red-brown, subrounded and irregular, aphanitic garnet masses and/or up to 90% pale to medium green, aphanitic, massive diopside and accessory aphanitic calcsilicate minerals.

SILICEOUS DIOPSIDE CALCSILICATE
-contains up to 60% pale to medium green, finely crystalline to aphanitic, massive diopside with irregular mottles and fine laminations of aphanitic and finely crystalline tremolite.

Queen's University, September 1980) that skarn development in carbonates varies from a weakly altered domain, or stability field, composed of light coloured, low iron and low sulphur minerals to highly altered assemblages consisting of dark, high iron and high sulphur minerals. The most intense metasomatism occurs close to conduits such as fault zones and the whole system occurs peripheral to an intrusive source of heated siliceous fluids. Lateral and vertical changes in chemical environments, mainly due to de-carbonatization, are critical to the transport and deposition of tungsten minerals, especially scheelite. He concluded that hornfels, often enclosing the carbonates, is the source of iron and sulphur. Chemical environments are characterized by the calcsilicate (and sulphide) minerals present:

STABILITY FIELD	TYPICAL MINERALS	CHEMISTRY
A	Wollastonite, actinolite/tremolite, enstatite	Ca rich
B	Enstatite/hyperstene, vesuvianite, garnet, pyrrhotite	Ca,Mg
C	Diopside, garnet, scheelite, pyrrhotite	Ca,Mg,Fe,W
D	Hedenbergite, biotite, scheelite, pyrrhotite, chalcopyrite	Mg,Fe,W
E	Biotite, pyrrhotite, (amphibole)	Fe, S

Mineral assemblages encountered in the Ivo drill core belong to the lower stability fields (A,B, and C above) of Dick's model. The drill core with a field C assemblage, i.e. garnet-diopside skarn, contained more tungsten than core containing other less well developed skarns. The different fields grade from one to another, inferring that there is a pervasive metasomatic system. The lack of the more highly developed fields indicates that the drilled intersections are distal, either laterally or vertically, from the better mineralized

core of the system, if it exists.

Greisen alteration of the granite may represent unstable conditions in a transporting conduit.

Magnetite in the Ivo core is not a usual constituent of a stable skarn system. Most of the magnetite is probably derived from metamorphosed impurities in the carbonates (as described in the next section) while some of the magnetite that occurs with pyrrhotite is probably related to a sulphur deficient stability field.

Drill Hole Mineralization

The drill holes cut carbonates that have been altered by the Salivo stock. Alteration varies from low intensity metamorphic (thermal) effects producing marbles and calcsilicates with some magnetite and little sulphide, to moderately well developed metasomatic (thermal and chemical) effects producing garnet-diopside-pyrrhotite skarns with occasional magnetite from the carbonate rocks and quartz-mica-pyrite greisens from the intrusion. The better developed skarns and greisens carry low quantities of scheelite, molybdoscheelite and rare molybdenite. Arsenopyrite was encountered within the Salivo stock in one hole.

Of the total core, 15.8% or 632 feet (193 m) were split and most of that was assayed or analyzed geochemically in 5 foot (1.5m) sections. Those assay results grading higher than 0.1% WO3 are summarized on Table III (on following page).

Table III - TABLE OF ASSAYS, IVO PROPERTY DRILL CORE

(Only assay values exceeding 0.1% WO3 reported)

HOLE	TOTAL SPLIT (FT)	TOTAL SPLIT (M)	CORE LENGTH (FT)	CORE LENGTH (M)	DEPTH FROM (FT)	DEPTH TO (FT)	GRADE % WO3	GRADE PPM Mo
81-1	97	29.5	--				--	--
81-2	1	.3	--				--	--
81-3	--	--	--				--	--
81-4	90	27.4	5	1.5	142	147	.12	60
			5	1.5	147	152	.17	50
			5	1.5	152	157	.44	50
			5	1.5	157	162	.14	20
			5	1.5	162	167	.41	20
			5	1.5	167	172	.87	60
			5	1.5	172	177	.32	110
		AVERAGE	35	10.5	142	177	.353	53
	Which includes:		25	7.6	152	177	.436	62
81-5	84	25.6	5	1.5	272	277	.49	30
			5	1.5	277	282	.29	15
		AVERAGE	10	3.0	272	282	.365	23
			5	1.5	350	355	.18	2
			5	1.5	355	360	.26	1
			5	1.5	360	365	.19	17
		AVERAGE	15	4.5	350	365	.210	8
81-6	29	8.8	--	---			--	--
81-7	--	---	--	---			--	--
81-8	128	39.0	--	---			--	--
81-9	88.5	26.9	5	1.5	315	320	.17	37
			5	1.5	334	339	.12	7
			3	1.0	356	359	.19	1
81-10	25	7.6	5	1.5	377	382	.10	35
			6	1.8	382	388	.70	31
81-11	18	5.4	--	---			--	--
81-12	71.5	21.7	--	---			--	--

(a) Tungsten - The best tungsten mineralization occurs within a dioritic zone resulting from alteration of the granite at the intrusive contact. The tungsten content in this altered granitic zone is variable:

Hole 4	25.0 feet (7.6 m)	contains	0.44% WO3	(max. 0.87% over 5')
Hole 5	15.0 feet (4.5 m)	contains	0.21% WO3	(max. 0.26% over 5')
Hole 9	5.0 feet (1.5 m)	contains	0.19% WO3	
Hole 10	3.0 feet (0.9 m)	contains	0.70% WO3	

Scheelite and/or molybdoscheelite was observed in trace amounts throughout most of the other skarn units but is most evident in diopside-garnet skarns as inclusions in the diopside and at diopside-garnet interfaces. Scheelite is absent within garnet grains. Coarse grains of scheelite are occasionally rimmed by molybdoscheelite. The best mineralized diopside-garnet skarn is occasionally silicified, often contains minor pyrrhotite and magnetite, and has a variable tungsten content:

Hole 4	5.0 feet (1.5 m)	contains	0.12% WO3	
Hole 5	10.0 feet (3.0 m)	contains	0.37% WO3	(max. 0.49% over 5')
Hole 9	5.0 feet (1.5 m)	contains	0.17% WO3	
Hole 10	8.0 feet (2.4 m)	contains	0.33% WO3	

Mineralization appears to be directly related to the intensity of skarn development. Although various metasomatic zonations between stability fields have been observed in the core, the most favourable biotite-pyrrhotite-scheelite assemblage has not been encountered.

(b) Molybdenum - Molybdenite occurs occasionally in thin fractures and disseminations in the Salivo granite but is rarely seen in the metasediments. The highly altered contact phase of the granite in Hole 81-4 contains up to 1.0% molybdenite (visual estimate) in small rosettes and disseminations over intervals of 5 to 10 cm. However, none of the 5 foot samples of this material assayed greater than 110

ppm Mo. Molybdenum must be an almost ubiquitous constituent of the scheelite in all the drill core since all scheelite, except in the most intensely altered phases of the granite, fluoresces with some tint of yellow. This material is not described as powellite since no assay of tungsten mineralization on the Ivo property has exceeded 200 ppm Mo.

(c) Arsenic - A 1.5 cm vein of quartz containing about 30% arsenopyrite cutting relatively fresh granite at the bottom of Hole 81-8 assayed 9 ppb Au. Minor disseminated arsenopyrite is also present in the adjacent granite.

(d) Copper - Occasional very fine grains of chalcopyrite were seen in diopside skarns. In thin sections, chalcopyrite is sometimes present as inclusions in pyrite and intergrowths with pyrrhotite.

(e) Iron - Pyrrhotite, pyrite and magnetite are relatively common throughout the core. Pyrrhotite occurs mainly near the granite contact in concentrations of up to 25% in greisen zones and up to 10% in adjacent skarns. It can also occur in concentrations of up to 10% in diopside skarns with magnetite, and in thin sections it is present as fine inclusions in magnetite.

Pyrite is present mainly as euhedral crystals in the greisen zones, in concentrations up to 25%. Up to 2% pyrite also occurs as disseminations in all varieties of calcsilicates and skarns and up to 1% in thin fractures in all rock units.

Magnetite is present in concentrations up to 15% along bedding features in marbles and calcsilicates, and up to 10% with pyrrhotite in silicified skarns.

(f) Other metals - Samples assaying better than 0.1% WO3 in hole 4 were assayed for Sn and Au and returned values up to 4 ppm Sn and 172 ppb Au. No sphalerite has been observed in any drill core and there has been no analysis of core for Zn or Pb.

(g) Asbestos - In Hole 81-9, cement grade chrysotile fibre up to 3 mm long occurs with magnetite in an extremely leached, semi-unconsolidated 7 m wide zone. The fibre has probably formed as a result of sodium and silica-rich hydrothermal solutions reacting with a calcareous host.

CONCLUSIONS

The Salivo zone has been shown to be very large although initial drilling returned assays below commercial levels. Assays of 1981 core range up to 0.7% WO3 in skarn and 0.87% WO3 in greisen, with the best section (Hole 81-4) grading 0.44% WO3 over 7.6 m. Moderate skarn development is widespread, particularly at the southern part, and the full lateral extent of the zone has not been tested. The base of the limestone section has not been tested near the granite contact.

Further drilling is required to test for the presence of better developed skarn with a higher grade of scheelite mineralization. Initial drilling has concentrated on testing the carbonate-intrusion contact where it projects to surface. The best mineralization of major tungsten deposits such as Cantung and Mactung occur at some distance away from near surface intrusive contacts, often at the apical tops of related intrusive phases or where structural complexity favours mineral deposition. Two areas near the Salivo Zone are especially promising:

a) downdip to the southeast, away from the intrusive contact, where the base of Sekwi formation would meet the Salivo stock and

b) longitudinally to the south and west along the extension of the Salivo Zone with particular note of whether the zone swings to the north up Crisake Creek.

Respectfully submitted,

ARCHER, CATHRO & ASSOCIATES (1981) LIMITED,

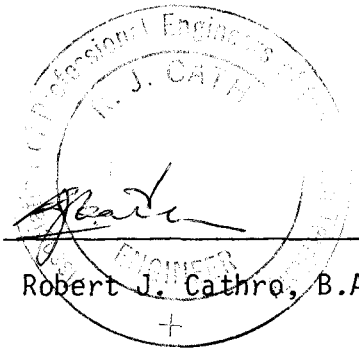
C.A. Main, B.Sc.

R.J. Cathro, B.A.Sc., P. Eng.

STATEMENT OF QUALIFICATIONS

I, Robert J. Cathro, with business addresses in Whitehorse, Yukon Territory and Vancouver, British Columbia, and residential address in West Vancouver, British Columbia, do hereby declare:

1. I am a 1959 graduate of the University of British Columbia in geological engineering.
2. I have been engaged in geological engineering for over twenty years, the past fifteen of which have been as a consultant.
3. I am a registered professional engineer in British Columbia and in Yukon Territory.
4. I have supervised the work described in this report.



Robert J. Cathro, B.A.Sc., P.Eng.

STATEMENT OF QUALIFICATIONS

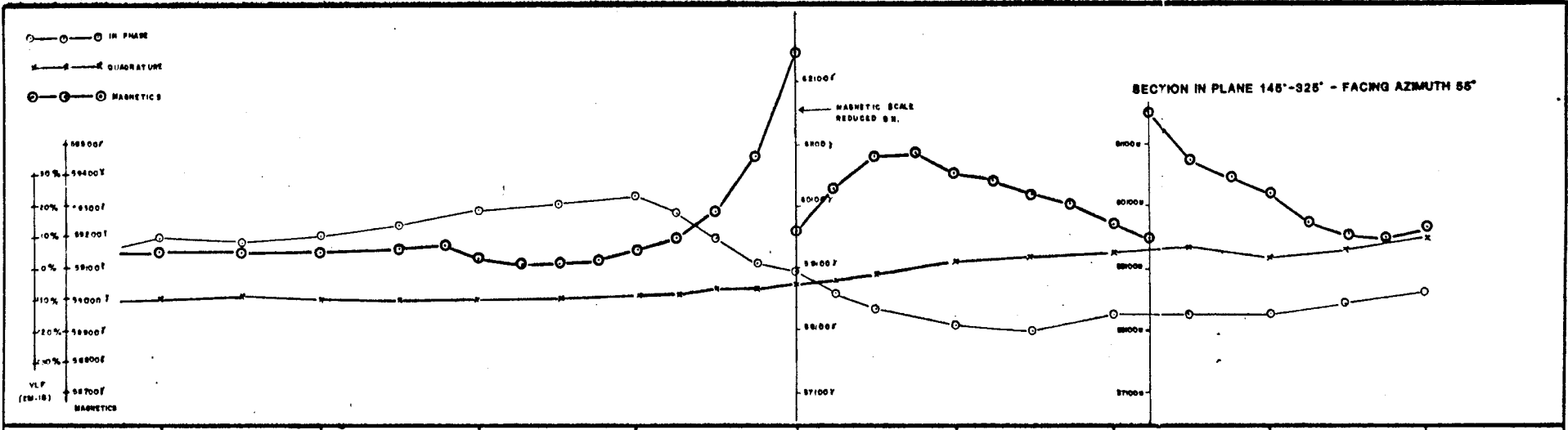
I, Charles A. Main, geologist, with business addresses in Whitehorse, Yukon Territory and Vancouver, British Columbia and residential address in Vancouver, British Columbia, hereby certify that:

1. I graduated from the University of British Columbia in 1971 with a B.Sc. majoring in Geological Sciences and Chemistry.
2. I have been actively engaged as a geologist in mineral exploration since 1971 and as a partner of Archer, Cathro & Associates (1981) Limited since June 1, 1981.
3. I have personally participated in or supervised the field work reported herein and have interpreted all data resulting from this work.

Charles A. Main

Charles A. Main, B.Sc.

APPENDIX ONE



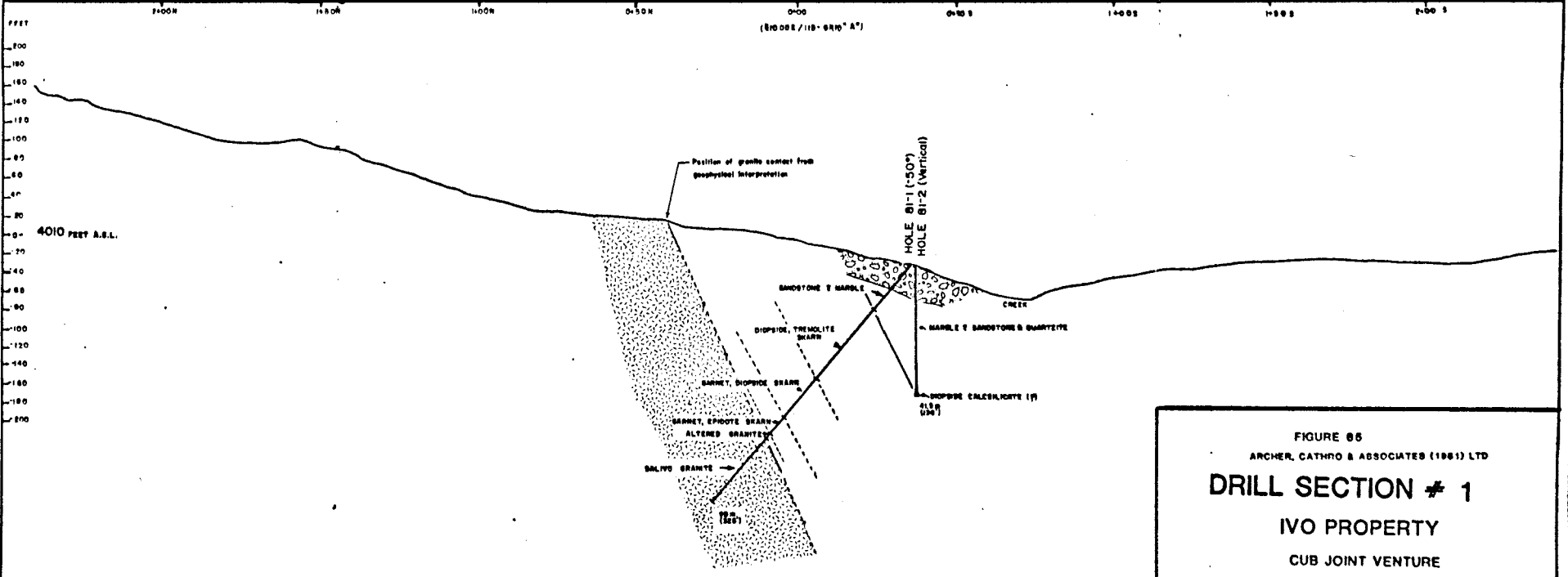


FIGURE 65

ARCHER, CATHRO & ASSOCIATES (1981) LTD

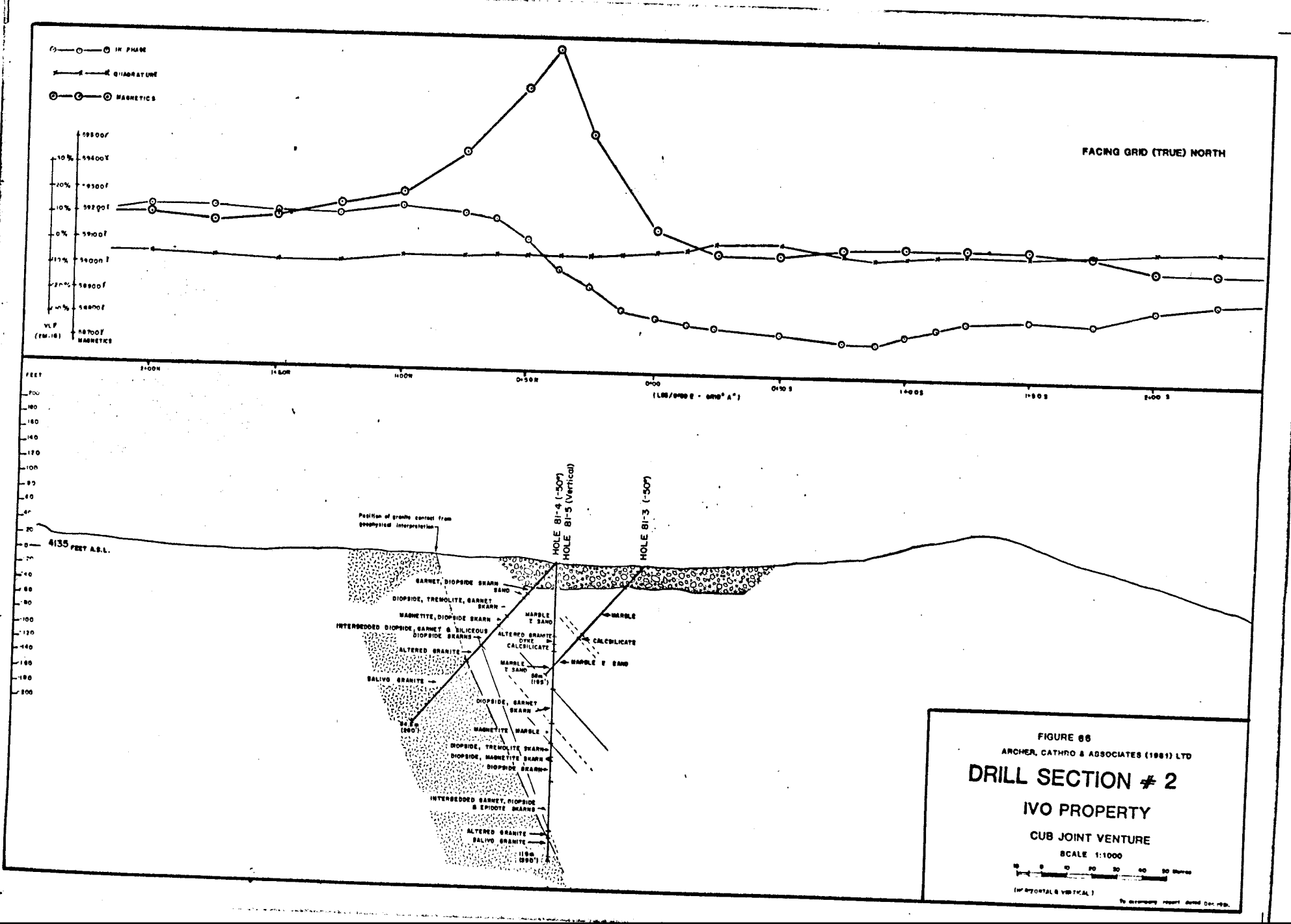
DRILL SECTION # 1

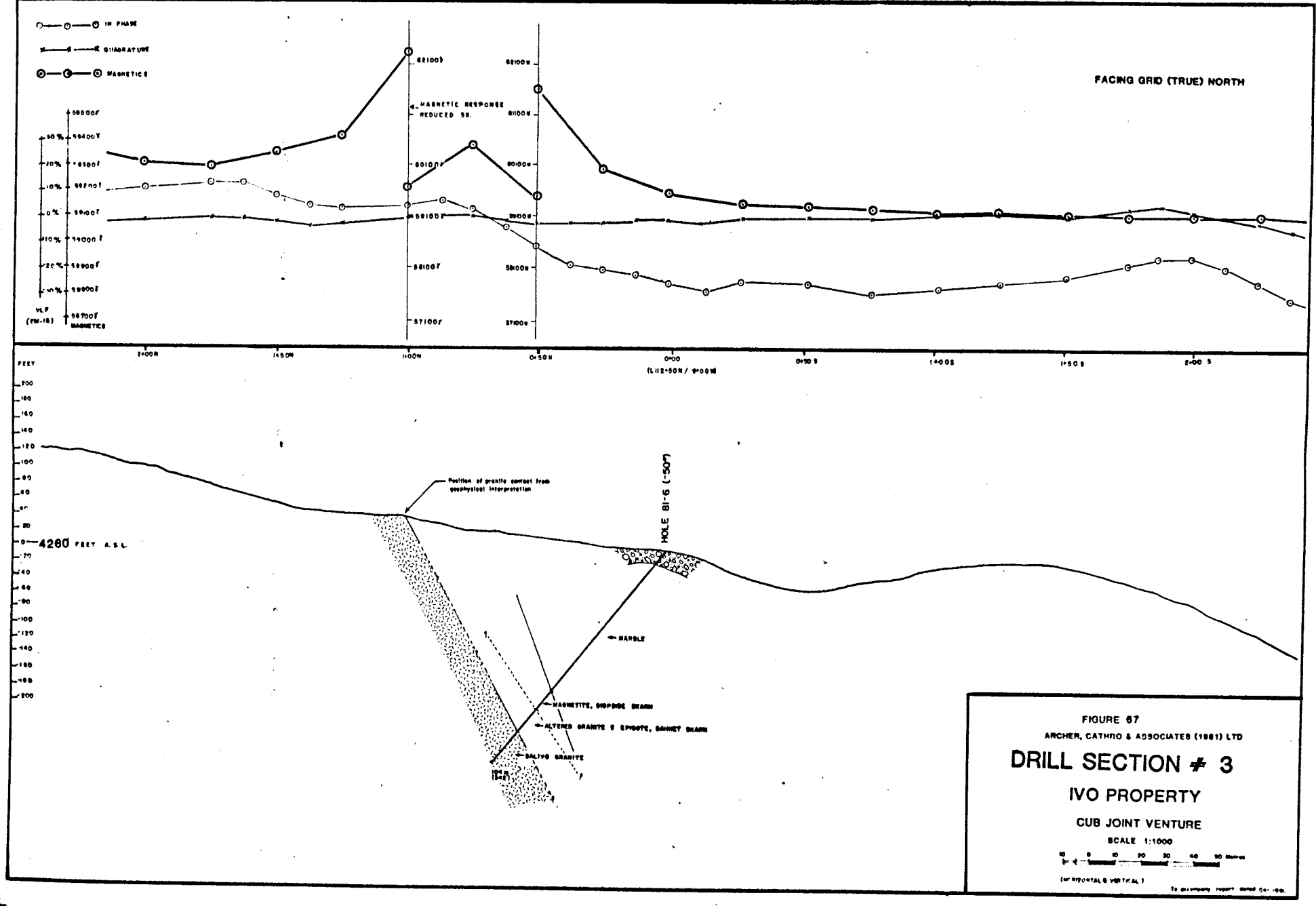
IVO PROPERTY

CUB JOINT VENTURE

SCALE 1:1000

(HORIZONTAL & VERTICAL)


IN PHASE
QUADRATURE
MAGNETICS
FACING GRID (TRUE) NORTH
VLF (FM-16)
MAGNETICS
FEET
4135 FEET A.S.L.
Position of granite contact from geophysical interpretation
HOLE 81-4 (-50°)
HOLE 81-5 (Vertical)
HOLE 81-3 (-50°)
GARNET, DIOPSIDE SKARN
SAND
DIOPSIDE, TREMOLITE, GARNET SKARN
MAGNETITE, DIOPSIDE SKARN
INTERBEDDED DIOPSIDE, GARNET & SILICEOUS DIOPSIDE SKARNS
ALTERED GRANITE
SALIVO GRANITE
MARBLE
MARBLE & SAND
ALTERED GRANITE DYKE
CALCSILICATE
DIOPSIDE, GARNET SKARN
MAGNETITE MARBLE
DIOPSIDE, TREMOLITE SKARN
DIOPSIDE, MAGNETITE SKARN
DIOPSIDE SKARN
INTERBEDDED GARNET, DIOPSIDE & EPIDOTE SKARNS
ALTERED GRANITE
SALIVO GRANITE
FIGURE 66
ARCHER, CATHRO & ASSOCIATES (1981) LTD
DRILL SECTION # 2
IVO PROPERTY
CUB JOINT VENTURE
SCALE 1:1000
(HORIZONTAL & VERTICAL)


IN PHASE
QUADRATURE
MAGNETICS
FACING GRID (TRUE) NORTH
MAGNETIC RESPONSE REDUCED 5X.
VLF (FM-16)
MAGNETICS
2+00N
1+50N
1+00N
0+50N
0+00
0+50 S
1+00 S
1+50 S
2+00 S
(LINE 2+50N / 9+00W)
FEET
4260 FEET A.S.L.
Position of granite contact from geophysical interpretation
HOLE 81-6 (-50°)
MARBLE
MAGNETITE, DIOPSIDE SKARN
ALTERED GRANITE & EPIDOTE, GARNET SKARN
SALIVO GRANITE
FIGURE 67
ARCHER, CATHRO & ASSOCIATES (1981) LTD
DRILL SECTION # 3
IVO PROPERTY
CUB JOINT VENTURE
SCALE 1:1000
(HORIZONTAL & VERTICAL)

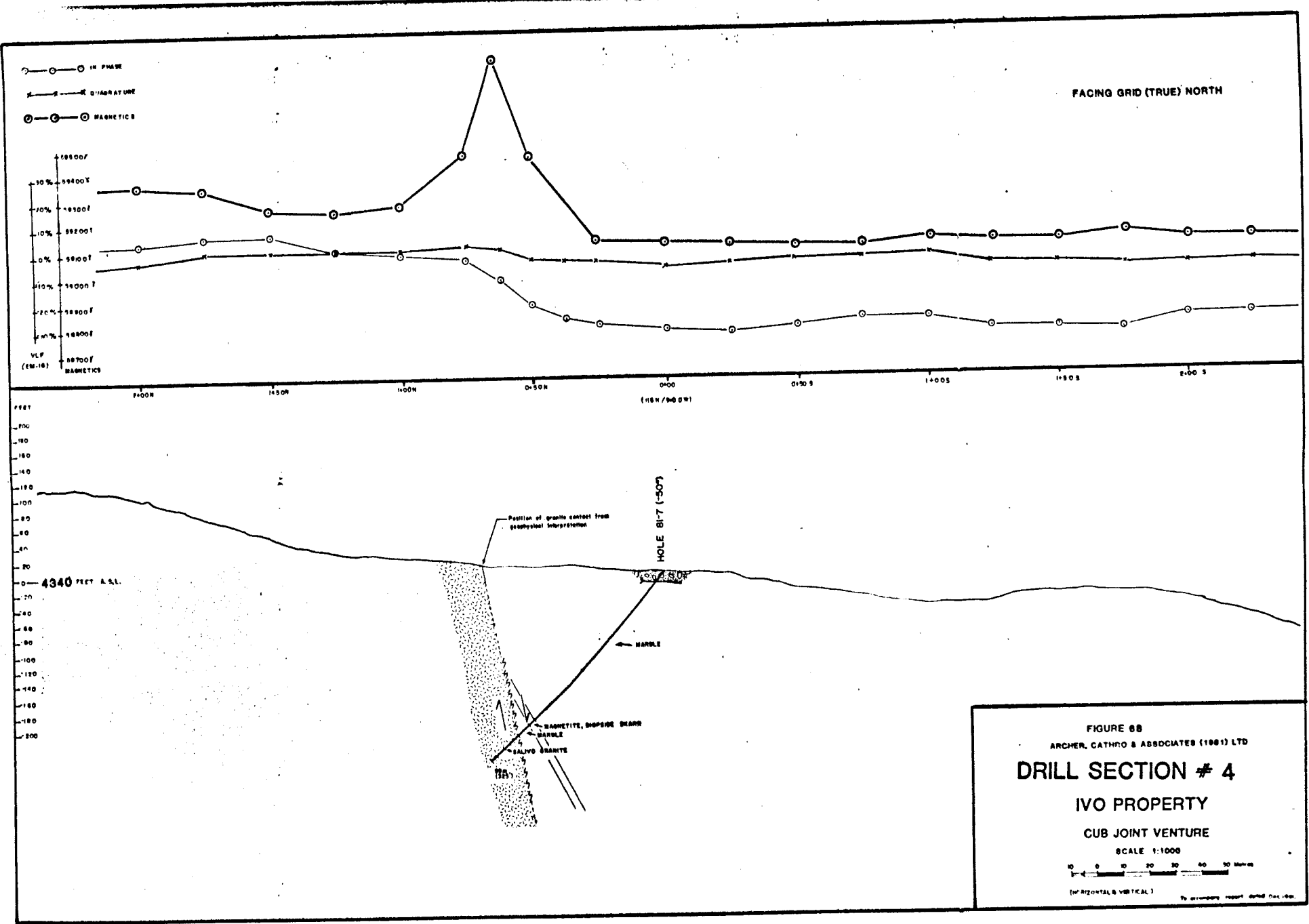


FIGURE 68

ARCHER, CATHRO & ASSOCIATES (1981) LTD

DRILL SECTION # 4

IVO PROPERTY

CUB JOINT VENTURE

SCALE 1:1000

(HORIZONTAL & VERTICAL)

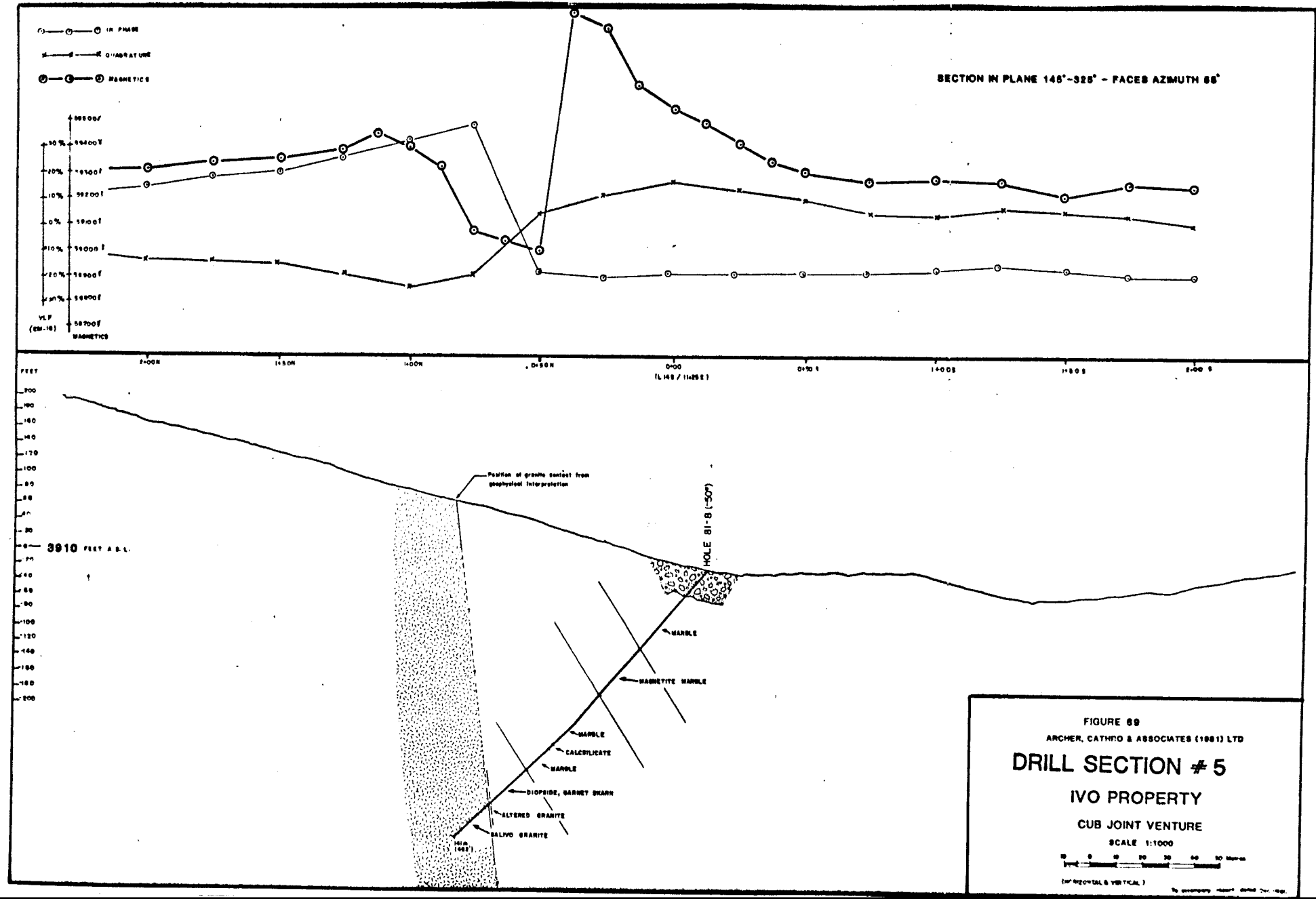


FIGURE 69

ARCHER, CATHRO & ASSOCIATES (1981) LTD

DRILL SECTION # 5

IVO PROPERTY

CUB JOINT VENTURE

SCALE 1:1000

(HORIZONTAL & VERTICAL)

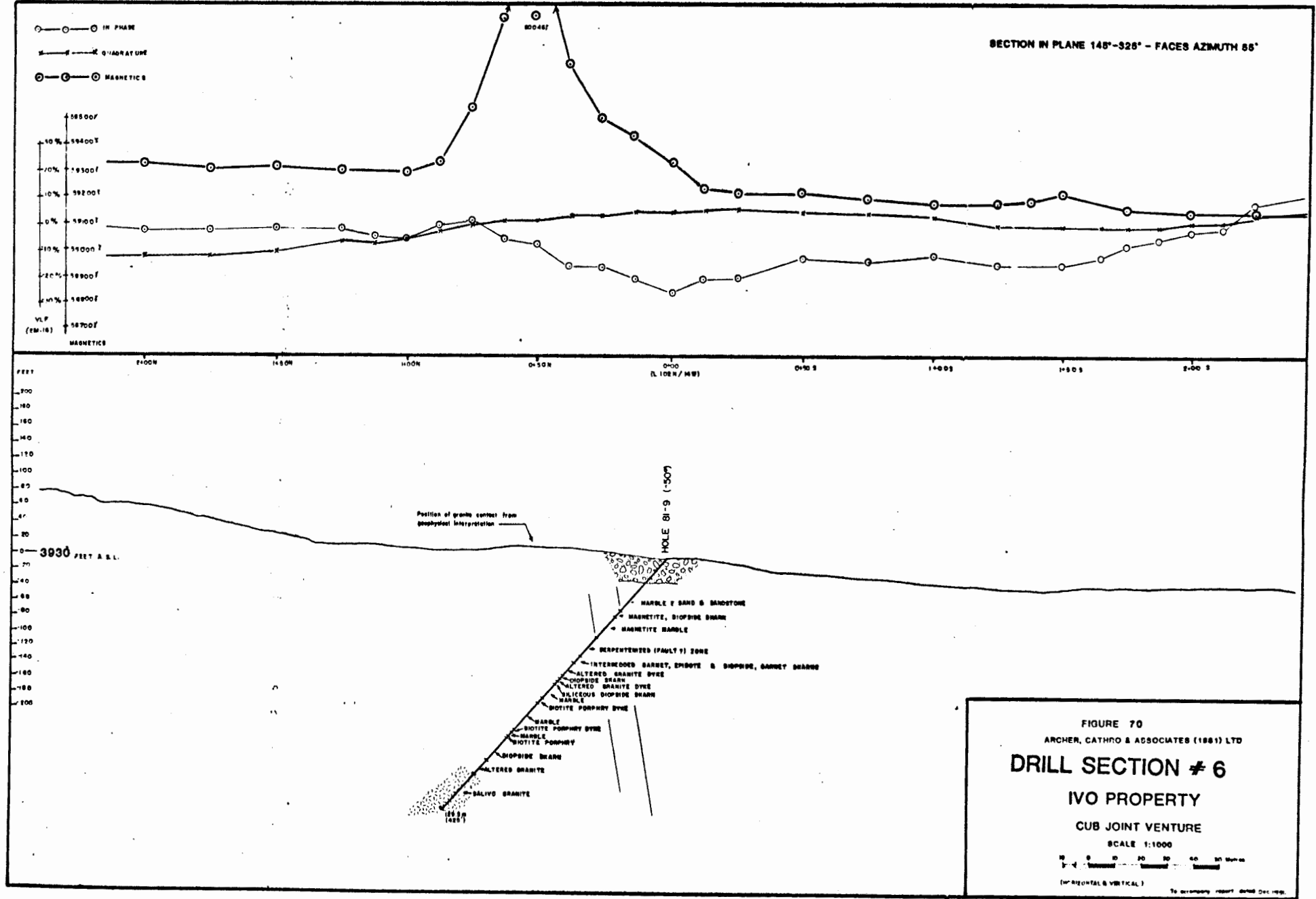


FIGURE 70

ARCHER, CATHRO & ASSOCIATES (1981) LTD

DRILL SECTION # 6

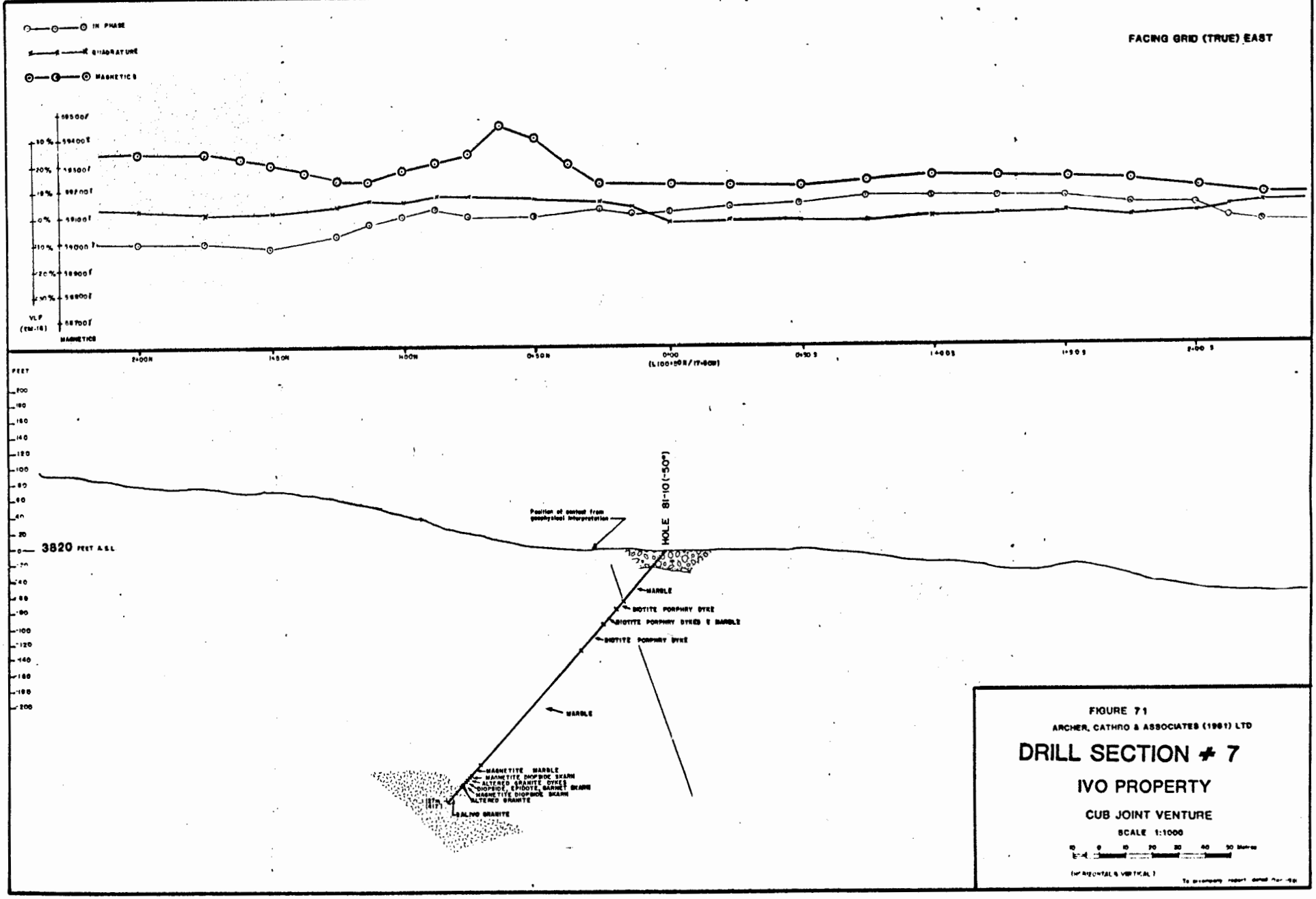
IVO PROPERTY

CUB JOINT VENTURE

SCALE 1:1000

(HORIZONTAL & VERTICAL)

To accompany report dated Dec 1981.


IN PHASE
QUADRATURE
MAGNETICS
FACING GRID (TRUE) EAST
VLF (EM-16)
MAGNETICS
2+00N
1+50N
1+00N
0+50N
0+00 (L100+00E / 17+60N)
0+50S
1+00S
1+50S
2+00S
FEET
3820 FEET A.S.L.
Position of contact from geophysical interpretation
HOLE 81-10 (-50°)
MARBLE
BIOTITE PORPHYRY DYKE
BIOTITE PORPHYRY DYKES & MARBLE
BIOTITE PORPHYRY DYKE
MARBLE
MAGNETITE MARBLE
MAGNETITE DIOPSIDE SKARN
ALTERED GRANITE DYKES
DIOPSIDE, EPIDOTE, GARNET SKARN
MAGNETITE DIOPSIDE SKARN
ALTERED GRANITE
GALENA GRANITE
FIGURE 71
ARCHER, CATHRO & ASSOCIATES (1981) LTD
DRILL SECTION # 7
IVO PROPERTY
CUB JOINT VENTURE
SCALE 1:1000
(HORIZONTAL & VERTICAL)

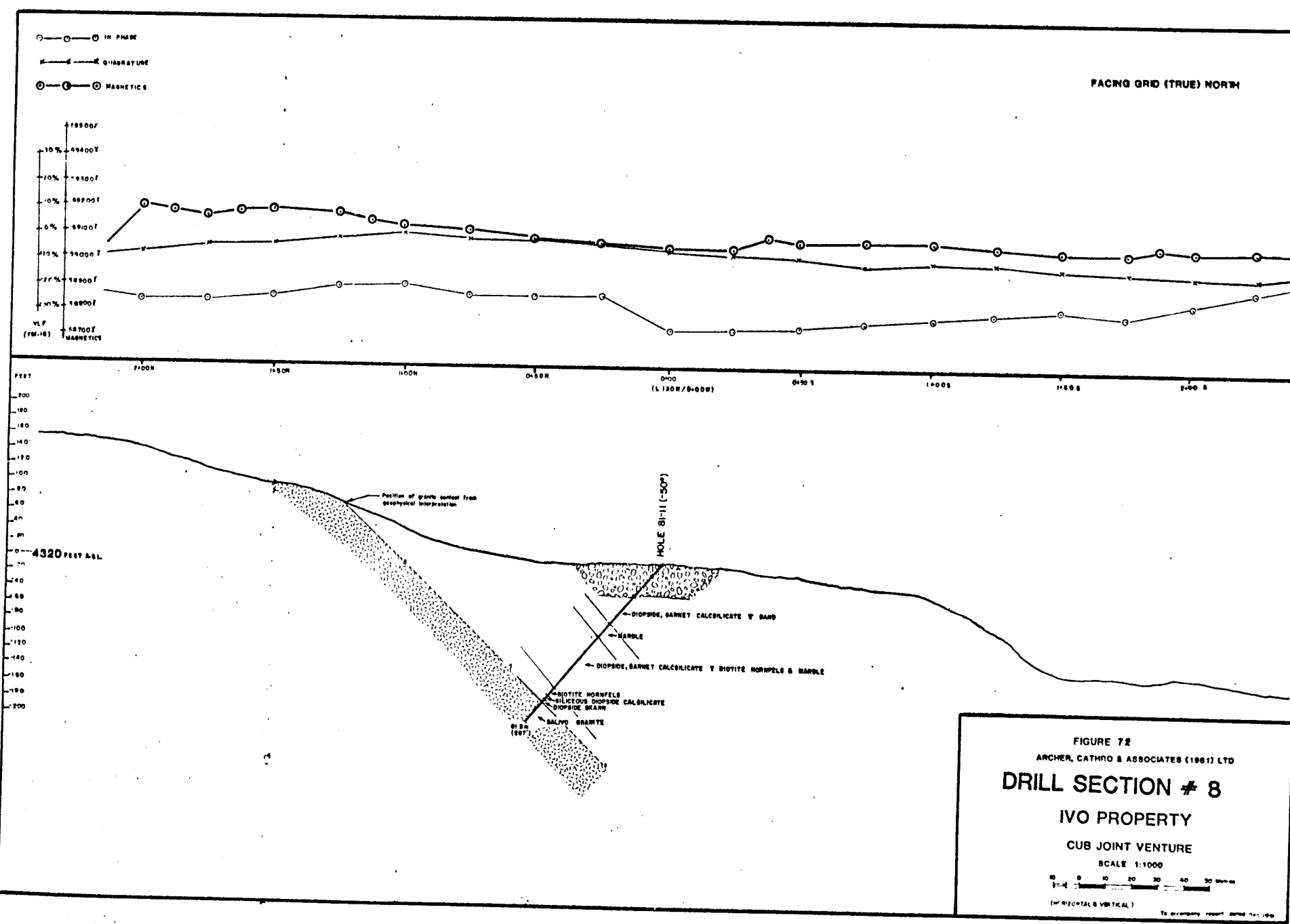


FIGURE 72

ARCHER, CATHRO & ASSOCIATES (1981) LTD

DRILL SECTION # 8

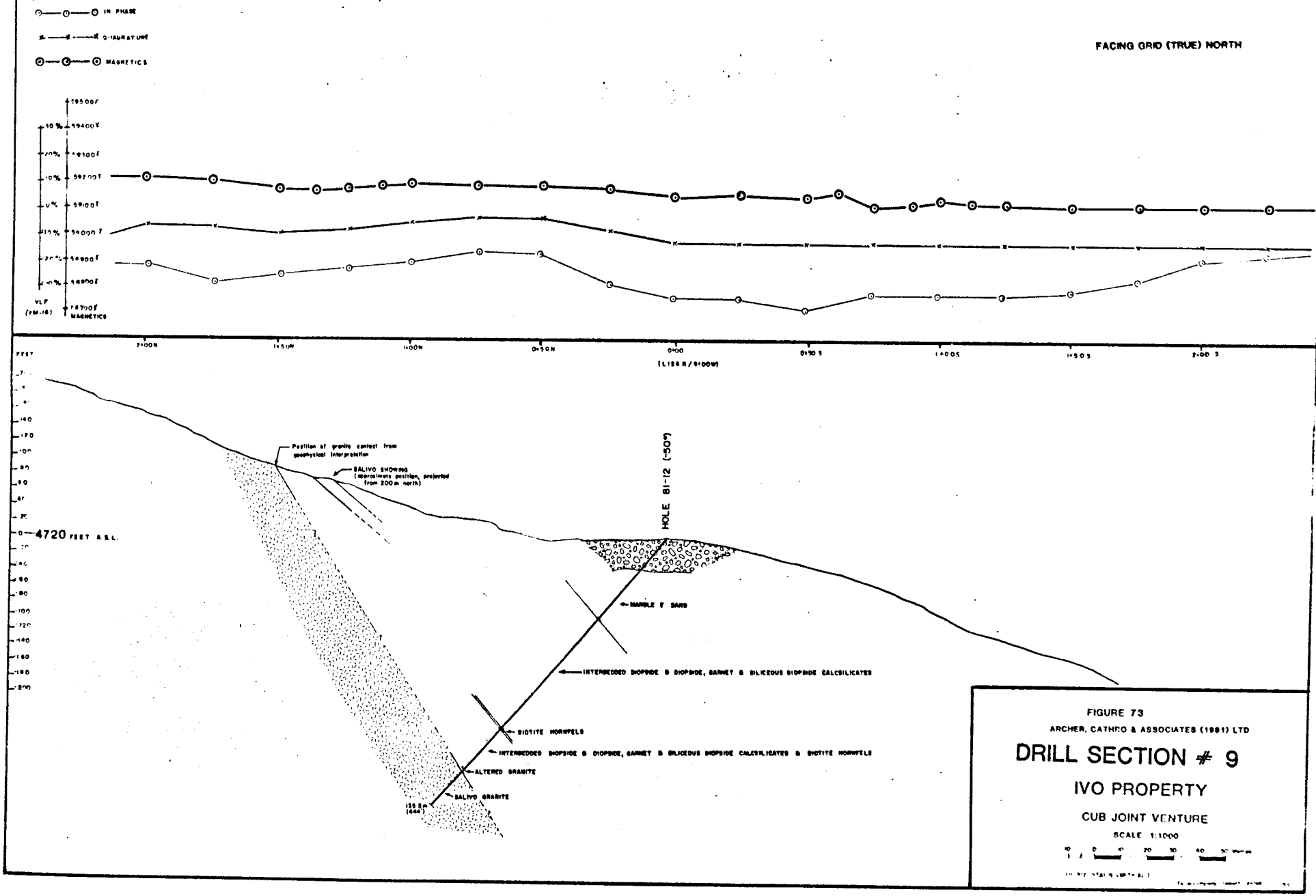
IVO PROPERTY

CUB JOINT VENTURE

SCALE 1:1000

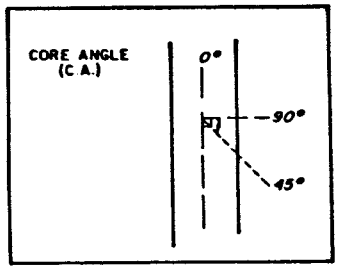
(HORIZONTAL & VERTICAL)

To accompany report dated Dec. 1981


IN PHASE
QUADRATURE
MAGNETICS
FACING GRID (TRUE) NORTH
VLF (FM-16)
MAGNETICS
1+00N
1+50N
2+00N
0+50N
0+00
0+50 S
1+00 S
1+50 S
2+00 S
(LINE R / 9+00W)
FEET
4720 FEET A.S.L.
Position of granite contact from geophysical interpretation
SALIVO SHOWING (approximate position, projected from 200 m north)
HOLE 81-12 (-50°)
MARBLE & SKARN
INTERBEDDED DIOPSIDE & DIOPSIDE, GARNET & SILICEOUS DIOPSIDE CALCSILICATES
BIOTITE HORNFELS
INTERBEDDED DIOPSIDE & DIOPSIDE, GARNET & SILICEOUS DIOPSIDE CALCSILICATES & BIOTITE HORNFELS
ALTERED GRANITE
SALIVO GRANITE
159.5 m (464')
FIGURE 73
ARCHER, CATHRO & ASSOCIATES (1981) LTD
DRILL SECTION # 9
IVO PROPERTY
CUB JOINT VENTURE
SCALE 1:1000

DIAMOND DRILL CORE LOG

PROJECT CUB CLAIM GROUP IVO CORE SIZE BQ HOLE H-81-1 PAGE 1 OF 4
STARTED JUNE 16/81 FINISHED JUNE 19/81 TOTAL DEPTH 325'
LOCATION 102+00N/14+00W COLLAR ELEVATION 4010 ft.A.S.L.
ANGLE 50° AZIMUTH 325

Core Recovery (%)	Footage (ft.)	MAJOR ROCK UNIT	Footage (ft.)	VARIATIONS	% Magnetite	% Pyrrhotite	% Pyrite	Sample Interval (ft.)	ppm WO_3	ppm Mo	Meters
	0	OVERBURDEN	0	LIST OF ABBREVIATIONS							
				alt.-altered/alteration; amph.-amphibole; anh.-anhedral; aph.-aphanitic; assoc.-associated; brn.-brown; c.-coarse; calc.-calcareous; calcsil.-calcsilicate; c.g.-coarse grained; diop.-diopside; diss.-disseminated; dist.-distinct; dk.-dark; ep.-epidote; euh.-euhedral; f.-fine; feld.-feldspar; f.g.-fine grained; fract.-fracture(s); gn.-green; grad.-grades/gradational; hfels.-hornfels; indist.-indistinct(ly); irr.-irregular; lam.-laminated; lt.-light; mag.-magnetite; mass.-massive; med.-medium; m.g.-medium grained; mod.-moderate(ly); p.-pale; perp.-perpendicular (to); pheno.-phenocrysts; plag.-plagioclase; Po.-pyrrhotite; px.-pyroxene; Py.-pyrite; qtz.-quartz; sauss.-saussuritized; seric.-sericitized; serp.-serpentine; sil.-siliceous; sublam.-sublaminated; subh.-subhedral; tr.-trace; trem.-tremolite; v.-very; ves.-vesuvianite; wht.-white; woll.-wollastonite; Xline.-crystalline; occ.-occasional; s.s.-sandstone							
	10		10								5
	20		20								
	30		30								10
			37								
	40	SANDSTONE - wht. to buff, well-rounded qtz. grains -granular to sugary texture, occ. strongly welded -non calc., minor limonite -occ. impure interbeds of marble, C.A.80°, wht. to grey, f. to med. Xline. with hematite perp. f. calc. fract. of gn. serp.	40	Marble			tr.				
				Marble							
	50	Py. - diss. and anh., mass., to m.g. subh. along calc. fract.	50	Sand Seam - unconsolidated, calc. silty sand , with s.s. pebbles							15
100				Sand Seam - as above							
			56.5								
	60	DIOPSIDE TREMOLITE SKARN - p. gn. to wht., decussate, f. to c. Xline., vugs due to carbonate leaching -Diop.-65-75%, anh. to subh., f.g. to c.g., p. to dk. gn. -occ. f.g. to m.g. dk. gn hedenbergite(?) -Trem. -20-25%, f.g. to m.g. subh. masses, p. to dk. gn. -Calcite - anh. mass. to euh., f.g. to c.g., 5% - aph. up to 5% -Qtz. - anh. f.g. -pyrolusite along f. fract., C.A. 5° to 15° -Mag.- diss. and aph. mass. lam. and bands C.A. 55°	60						4	1	1
							tr.	5	1	1	
	70		70	vuggy	to 20			5	30	1	20
			70.5								
				v. friable, occ. mass. kaolinite(?), to 2" wide				5	25	1	
			76.5								
	80		80					5	25	1	
				more competent, occ. f.g., poorly formed, dk. red garnet				5	35	1	
			86								
	90	-Py. - f.g. to c.g., mass. to subh., diss. and along calc. fract. -Po. - f.g. to m.g. and occ. lam. mass. with sil. fract.	90	Diop. v. dk. gn., vugs to 1/4" with trem.				5	15	1	25
					to 20			5	35	1	
	100		100					10	25	1	

DIAMOND DRILL CORE LOG

HOLE M-81-1 PAGE 2 OF 4

PROJECT _____ CLAIM GROUP _____ CORE SIZE _____

STARTED _____ FINISHED _____ TOTAL DEPTH _____

LOCATION _____ COLLAR ELEVATION _____

ANGLE _____ AZIMUTH _____

CORE RECOVERY (%)	DEPTH (ft)	MAJOR ROCK UNIT	DEPTH (m)	VARIATIONS	% Magnetite	% Pyrrhotite	% Pyrite	SAMPLE INTERVAL (ft.)	ppm WO_3	ppm Mo	METERS
	100		100		to 20			see	page	one	30
		DIOPSIDE TREMOLITE SKARN (cont.)		trem. skarn - mass. c.g. med. gn., up to 80% trem.	to 1						
				vuggy, trem. - as above, up to 30%				5	200	1	
				non. calc., kaolinite(?)							
	110		110	sericite - micaceous, masses	to 15		tr.	5	50	3	
			115.2								
			116	sericite - micaceous masses, sublam. with mag. and limonite				5	60	2	
	120		120								35
								5	80	2	
100					to 15		to 5	5	30	3	
	130		130								
			135	trem. grad. indist.	to 10		tr.	5	80	3	
				garnet, grad. up to 10%, lt. to dk. red brn., occ. euh.							40
	140		140		to 15	to 1	to 1	5	100	2	
				hedenbergite(?) - f.g. to m.g., dk. gn. with bleached zones along indist. fract.				5	20	2	
		- grad. contact					tr.	5	50	4	
	150		150								
		GARNET DIOPSIDE SKARN						5	10	5	45
		- med. to dk. red, mottled to subbanded, garnet up to 60-65%, lt. pinkish brn. to dk. red, mass. occ. subh.; occ. mass. yellow	155								
		- Ves.(?) p. brn., mass. up to 15% occ. ves. up to 60% and garnet to 25%		m.g. and f.g. dk. gn. amph.(?)				5	200	4	
	160	- Diop. - 25-35%, med. to p. gn., mass., irr. blebs and bands alternating with garnet/ves. masses; occ. v. dk. gn. f.g. hedenbergite	160				to 1				
		- Calcite - 5-10%, f.g. to m.g. anh., secondary(?) late stage(?) and mass. in thin lam., often with f.g. anh. to subh. hematite, more calcite in garnet-rich sections as aph. inclusions in garnet, garnet replacing calcite(?)		ves.(?) up to 60%				5	50	4	
			169								
	170		170	bleached zone, p. diop. and ves., grad. contacts				5	65	4	50
				two stages of fract.: 1st- C.A. 15°, 2nd. - C.A. 45°			tr.	5	20	3	
			175								
		- Qtz. - anh. f.g., 5%						5	1	2	
		- minor pyrolusite along f. fract.									
	180	- occ. dk. gn. amph. replacing relict fragments(?)	180					5	1	3	
		Py. - f. masses and anh. grains									
			185	- ves.(?) up to 15%, garnet up to 55%				5	1	3	
	190		190	- diop./ep. up to 30%, med. gn. grad. to yellowish gn., with bleached sil. borders, diop. replacing ep.(?)							55
			194.5					5	1	4	
		GARNET EPIDOTE SKARNS		Garnet Epidote Skarn							
	200		200	Garnet Diopside Skarn				5	1	6	

DIAMOND DRILL CORE LOG

HOLE H-81-1 PAGE 3 OF 4

PROJECT _____ CLAIM GROUP _____ CORE SIZE _____
STARTED _____ FINISHED _____ TOTAL DEPTH _____
LOCATION _____ COLLAR ELEVATION _____
ANGLE _____ AZIMUTH _____

CORE RECOVERY (%)	METRES (m)	MAJOR ROCK UNIT	FOOTAGE (ft.)	VARIATIONS	% Magnetite	% Pyrrhotite	% Pyrite	SAMPLE INTERVAL (ft.)	ppm WO_3	ppm Mo	METERS
	200	GARNET EPIDOTE SKARN (cont.) - Garnet up to 75%, mass. red brn., occ. yellow up to 1/4", subh. outlines, zoned lt. brn. and dk. red - Ep. - 5-10%, pistachio gn., aph. masses in close assoc. with calcite and dist. apple gn. aph., mass. clinozoisite - Calcite - up to 10% anh. to subh. in fract., alt. to ep. - Ves.(?) - up to 15%, pinkish tan, - Py. - f.g. to c.g. subh. diss. and aph. masses along calc. fract.	200	Garnet Diopside Skarn (cont)							
	210		203	Garnet Epidote Skarn -Molybdenite - occ. v.f.g., on garnet, no apparent fract. assoc.				4.5	1	4	
			210					6.5	1	26	60
			212	-bleached zone - calc., numerous fract., mass, dk. gn. ep.							
			214	-grad. contacts				5	5	10	
	220		220	- Clinozoisite up to 10%, occ. fract. assoc. with mass. trem.			to 1	5	10	25	
			227.5	grad. fining, est. garnet replacing secondary calcite (?)				5	1	4	
								2.5	1	6	65
	230	SALIVO GRANITE - Biotite, Feld., Granite, Porphyry	230	Altered Diorite - lt. alt., lt. to med. gn., f. Xline., f. mottled -plag. up to 60%, anh. masses -diop. up to 20%, f. aph. masses -v.f.; equivalent to H-81-6/267'		to 2	to 5	5.5	800	30	
100		Qtz. - 35-40%, subrounded qtz. eyes and irr. masses, up to 1/8", occ. subh. in-filling vugs Feld. - 15-20%, indist. and irr. masses up to 1/8" Biotite - 15-20%, f.g. to m.g. anh. to subh., minor chloritization K-Feld.- up to 5%, c.g. anh. to subh. pheno. 1/4" to 1"; some with vague zonation and chlorite/ biotite inclusions due to secondary growth Calcite - up to 5%, aph. with pyrolusite along f. fract.	233	Py. - f.g. diss., euh. and mass. Po. - f.g. diss.							
					tr.			5	25	9	
	240		240	Biotite - feld. grad. c.g. dist. Molybdenite - diss. no fract. assoc.							70
			243					10	1	4	
	250		250					5	200	1	
	260	Altered Diorite - occ. up to 1.5' thick within granite - p. yellowish and gn. qtz. diorite - plag. up to 45%, lt. to med. sericite alt. - qtz. 15-25%, f.g. to m.g., anh. masses, interstitial to plag. - feld. up to 20%, f. anh. masses - minor aph. calcite Py. - tr. f. anh. - grades to fresher granite, occ. sharp contacts	260					tr.				
	270	Py. - tr., f. anh. masses and diss. Po. - f.g. diss. Molybdenite - tr. mass. aph. diss. - fract. assoc. at depth	270	Alt. Diorite							75
	280		280								
			283								
				Alt. Diorite							80
	290		287								
			290	Chalcopyrite - tr., anh. f.g. diss. Molybdenite - in sil. zoned fract. with qtz. and molybdenite core, aph. calcite intermediate zone and f. aph. chlorite borders							
	300		300								85

DIAMOND DRILL CORE LOG

HOLE H-81-1 PAGE 4 OF 4

PROJECT _____ CLAIM GROUP _____ CORE SIZE _____

STARTED _____ FINISHED _____ TOTAL DEPTH _____

LOCATION _____ COLLAR ELEVATION _____

ANGLE _____ AZIMUTH _____

CORE RECOVERY (%)	FOOTAGE (ft.)	MAJOR ROCK UNIT	FOOTAGE (ft.)	VARIATIONS	% Magnetite	% Pyrrhotite	% Pyrite	SAMPLE INTERVAL (ft.)	ppm WO_3	ppm Mo	METERS
	300		300								90
		SALIVO GRANITE (cont.)									
		Scheelite - 264', 268', 287', 292', 293' } tr. in calc. fract.									
	310		310		310						
100		Powellite - 287', 292', 293' } tr. in calc. fract.									
	320		318	Alt. Diorite	320						
			324	END OF H-81-1/325'							
	330		330		330						95
	340		340		340						100
	350		350		350						
	360		360		360						105
	370		370		370						
	380		380		380						110
	390		390		390						
	400		400								115

DIAMOND DRILL CORE LOG

PROJECT CUB CLAIM GROUP IVO CORE SIZE BQ HOLE H-81-2 PAGE 1 OF 2
STARTED JUNE 19/81 FINISHED JUNE 21/81 TOTAL DEPTH 136
LOCATION "A" 115+00N/10+40E COLLAR ELEVATION 4010 ft A.S.L.
ANGLE -90° AZIMUTH 325

Footage (ft.)	MAJOR ROCK UNIT	Footage (ft.)	VARIATIONS	% Magnetite	% Pyrrhotite	% Pyrite	Sample Interval (ft.)	ppm WO_3	ppm Mo	Meters
0	OVERBURDEN	0	LIST OF ABBREVIATIONS							
	CORE ANGLE (C.A) 0° / -90° / 45°		alt.-altered/alteration; amph.-amphibole; anh.-anhedral; aph.-aphanitic; assoc.-associated; brn.-brown; c.-coarse; calc.-calcareous; calcsil.-calcsilicate; c.g.-coarse grained; diop.-diopside; diss.-disseminated; dist.-distinct; dk.-dark; ep.-epidote; euh.-euhedral; f.-fine; feld.-feldspar; f.g.-fine grained; fract.-fracture(s); gn.-green; grad.-grades/gradational; hfels.-hornfels; indist.-indistinct; irr.-irregular; lam.-laminated; lt.-light; mag.-magnetite; mass.-massive; med.-medium; m.g.-medium grained; mod.-moderate(ly); p.-pale; perp.-perpendicular (to); pheno.-phenocrysts; plag.-plagioclase; Po.-pyrrhotite; px.-pyroxene; Py.-pyrite; qtz.-quartz; sauss.-saussuritized; seric.-sericitized; serp.-serpentine; sil.-siliceous; sublam.-sublaminated; subh.-subhedral; tr.-trace; trem.-tremolite; v.-very; ves.-vesuvianite; wht.-white; woll.-wollastonite; Xline.-crystalline; occ.-occasional; s.s.-sandstone							
10		10								5
20		20								
30		30								
	INTERBEDDED SANDSTONE/QUARTZITE/MARBLE S.S/Qtz. with calc. matrix interbedded with incompetent pebbly s.s. with s.s. and marble pebbles set in calc. silty matrix Marble - wht. to med. grey, variable impurities, numerous v.f. anh. black hematite(?) f. to med. Xline. occ. throughout section -horizon up to 10" of mass. subh., calcite -Mag. - anh. masses and f. laminations, C.A. 55° -Py. - diss. limonitic grains	32								
40		40								10
		43	Mag. Marble (calcsil.?)	to 70						
		44								
50		50								15
60		60								
		61	Limonite and Py.			tr.				
		66								
70		70	Sand Seams - calc., limonitic silty sand, f. qtz. pebbles throughout = Fault Zone(?)							20
80		80								
90		90	Interbedded Sandstone and Quartzite (Fault Zone)	2 to 5						25
		93	- sand seam - unconsolidated, limonitic silty sand grading to f. lam., C.A. 90° extremely limonitic with mass. lam. mag.							
		95								
		97	Pebbly sand seams as previous							
		99								
100		100								

DIAMOND DRILL CORE LOG

HOLE H-81-2 PAGE 2 OF 2

PROJECT _____ CLAIM GROUP _____ CORE SIZE _____

STARTED _____ FINISHED _____ TOTAL DEPTH _____

LOCATION _____ COLLAR ELEVATION _____

ANGLE _____ AZIMUTH _____

CORE RECOVERED (%)	FOOTAGE (ft)	MAJOR ROCK UNIT	FOOTAGE (ft)	VARIATIONS	% Magnetite	% Pyrrhotite	% Pyrite	SAMPLE INTERVAL (ft.)	ppm WO_3	ppm Mo	METERS
44	100	INTERBEDDED SANDSTONE/QUARTZITE/MARBLE (cont.)	100	Interbedded Sandstone and Quartzite (cont.)							30
	110		105								
55			110				tr.				35
50	120		120								
100	130		130	grad. into p. gn. diop. calcsil.(?), occ. c.g. subh. diop. grain, possibly near intrusive dyke(?) several euh. and subh. k-feld. Xline.				0.5	200	10	40
				END OF H-81-2/136'							
	140		140								45
	150		150								
	160		160								50
	170		170								
	180		180								55
	190		190								
	200		200								

DIAMOND DRILL CORE LOG

HOLE [illegible] PAGE 1 OF 2

PROJECT CUB CLAIM GROUP IVO CORE SIZE BQ

STARTED June 22/81 FINISHED June 23/81 TOTAL DEPTH 195'

LOCATION "A" 8+00S/9+00E COLLAR ELEVATION 4135 ft A.S.L.

ANGLE -50° AZIMUTH 270

CORE RECOVERY (%)	FOOTAGE (ft.)	MAJOR ROCK UNIT	FOOTAGE (m.)	VARIATIONS	% Magnetite	% Pyrrhotite	% Pyrite	SAMPLE INTERVAL (ft.)	ppm WO_3	ppm Mo	METERS
	0	OVERBURDEN	0								
	10		10								5
	20		20								10
	30		30								
			36								
100	40	MARBLE - lt. to med. grey interbedded variably pure and impure marble, dolostones and/or limestones -impurities as nondescript grey masses as in irr. patches and f. lam., C.A.70° - bedding 1-5 ft. mass. to f. Xline. - occ., yellowish gn., translucent serp., assoc. with more sil. horizons, and with mass. chlorite in sil. veining, varies to dk. gn. (and/or olivine) in more impure horizons; forming at expense of calcite(?) - Hematite(?) - 10%, subh. occ. radiating - Py. - mass., along irr. fract. - Po. - aph. mass. - Scheelite - (at 82') tr., in sil. veining	40				tr.to 1				15
	50		50								
	60		60								20
	70		70								
	80		80								25
	90		90								

LIST OF ABBREVIATIONS

alt.-altered/alteration	f.g.-fine grained	Po.-pyrrhotite
amph.-amphibole	fract.-fracture(s)	px.-pyroxene
anh.-anhedral	gn.-green	Py.-pyrite
aph.-aphanitic	grad.-grades/gradational	qtz.-quartz
assoc.-associated	hfels.-hornfels	sauss.-saussuritized
brn.-brown	indist.-indistinct	seric.-sericitized
c.-coarse	irr.-irregular	serp.-serpentine
calc.-calcareous	lam.-laminated	sil.-siliceous
calcsil.-calcsilicate	lt.-light	sublam.-sublaminated
c.g.-coarse grained	mag.-magnetite	subh.-subhedral
diop.-diopside	mass.-massive	tr.-trace
diss.-disseminated	med.-medium	trem.-tremolite
dist.-distinct	m.g.-medium grained	v.-very
dk.-dark	mod.-moderate(ly)	ves.-vesuvianite
ep.-epidote	p.-pale	wht.-white
euh.-euhedral	perp.-perpendicular (to)	woll.-wollastonite
f.-fine	pheno.-phenocrysts	Xline.-crystalline
feld.-feldspar	plag.-plagioclase	occ.-occasional

DIAMOND DRILL CORE LOG

HOLE H-81-3 PAGE 2 OF 2

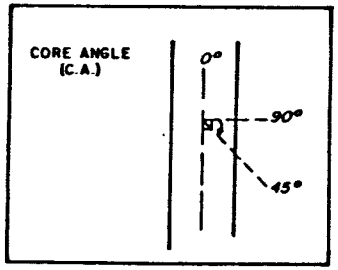
PROJECT _____ CLAIM GROUP _____ CORE SIZE _____
STARTED _____ FINISHED _____ TOTAL DEPTH _____
LOCATION _____ COLLAR ELEVATION _____
ANGLE _____ AZIMUTH _____

CORE RECOVERY (%)	FOOTAGE (ft.)	MAJOR ROCK UNIT	FOOTAGE (ft.)	VARIATIONS	% Magnetite	% Pyrrhotite	% Pyrite	SAMPLE INTERVAL (ft.)	ppm WO_3	ppm Mo	METERS
100	100	MARBLE (cont.)	100	Mag. - lam. mass.	tr.	tr.					30
	110		110								35
	120		120	121 Calcsil. - p. to med. gn., aph. mass., noncalc. irr. contacts, marked by aph., mass. non magnetic black mineral							
	130		128								40
33			130	132 Sand Seam - noncalc., mod. limonitic, unconsolidated silty sand, numerous marble fragments 137							
100	140		140	Sand Seams - as above							45
	150		150								
	160		157	Sand Seam - slightly rusted, noncalc., unconsolidated, variable competent and incompetent silty sand and clayey sand with occ. marble bed(?) boulders (?)							50
50	170		160	- 2' section v. dk. brn. extremely leached, formerly marble(?) calcsil.(?) and med. gn., mass. and f. Xline. diop. calcsil(?), skarn(?) with p. reddish masses poorly developed garnet(?) 167							
	180		170								55
70	190		180	182 extremely leached, incompetent dk. brn., vague f. lam. remnants, interbedded with marble							
	200		190	192 END OF H-81-3/195'							
			200								

DIAMOND DRILL CORE LOG

HOLE H-81-6 PAGE 1 OF 3

PROJECT CDB CLAIM GROUP IVO CORE SIZE BQ
STARTED June 23/81 FINISHED June 26/81 TOTAL DEPTH 280
LOCATION "A"8+00S/8+65E COLLAR ELEVATION 4135 ft A.S.L.
ANGLE -50° AZIMUTH 270°

CORE RECOVERY (%)	FOOTAGE (ft.)	MAJOR ROCK UNIT	FOOTAGE (ft.)	VARIATIONS	% Magnetite	% Pyrrhotite	% Pyrite	SAMPLE INTERVAL (ft.)	ppm WO_3	ppm Mo	METERS
	0	OVERBURDEN	0								
	10		10	LIST OF ABBREVIATIONS alt.-altered/alteration; amph.-amphibole; anh.-anhedral; aph.-aphanitic; assoc.-associated; brn.-brown; c.-coarse; calc.-calcareous; calcsil.-calcsilicate; c.g.-coarse grained; diop.-diopside; diss.-disseminated; dist.-distinct; dk.-dark; ep.-epidote; euh.-euhedral; f.-fine; feld.-feldspar; f.g.-fine grained; fract.-fracture(s); gn.-green; grad.-grades/gradational; hfels.-hornfels; indist.-indistinct; irr.-irregular; lam.-laminated; lt.-light; mag.-magnetite; mass.-massive; med.-medium; m.g.-medium grained; mod.-moderate(ly); p.-pale; perp.-perpendicular (to); pheno.-phenocrysts; plag.-plagioclase; Po.-pyrrhotite; px.-pyroxene; Py.-pyrite; qtz.-quartz; sauss.-saussuritized; seric.-sericitized; serp.-serpentine; sil.-siliceous; sublam.-sublaminated; subh.-subhedral; tr.-trace; trem.-tremolite; v.-very; ves.-vesuvianite; wht.-white; woll.-wollastonite; Xline.-crystalline; occ.-occasional							5
	20		20								
	30		30								10
	40		40								
33	50	GARNET DIOPSIDE SKARN - brn. red., aph. mass. ves. and garnet up to 35%, as irr. patches; subrounded and irr. qtz. mass. up to 10% - occ. f. sil. fract. - similar to H-81-5/333'	46 50	← Scheelite, Powellite - tr.			tr.				15
44	60 70	SAND SEAM - calc. and limonitic silty sand, somewhat competent, vague lam. and remnant grains - extremely leached formerly competent unit(?); pyrolusite present throughout - soft mass. Kaolinite(?) Py. - occ., mass., anh. extremely rusted	57.5 60 70				tr.				20
93	80 90	DIPSIDE TREMOLITE GARNET SKARN - p. gn. aph. and f.g. diop. up to 50% - trem. - up to 20%, f.g. to aph., p. gn. - brn. red garnet up to 25% as angular patches v. mass. to f. mottled - numerous f. vugs and minor recessed calc. fract. (carbonate leaching), pyrolusite on fract. - grad. more competent with depth, less vuggy; diop. up to 60%, mass. and f. Xline. wht. mass. sil. material (trem.?) up to 20%, - mass. irr. patches garnet	73 80 90	← Ep. Garnet Skarn - pink (manganese) ep., see H-81-6/250'				5	50	1	25
								5	20	1	
	100	MAGNETITE DIOPSIDE SKARN	97 100	trem.	to 5			5	40	1	

DIAMOND DRILL CORE LOG

PROJECT _____ CLAIM GROUP _____ CORE SIZE _____
STARTED _____ FINISHED _____ TOTAL DEPTH _____
LOCATION _____ COLLAR ELEVATION _____
ANGLE _____ AZIMUTH _____

HOLE H-81-4 PAGE 2 OF 3

CORE RECOVERY (%)	FOOTAGE (ft.)	MAJOR ROCK UNIT	FOOTAGE (m.)	VARIATIONS	% Magnetite	% Pyrrhotite	% Pyrite	SAMPLE INTERVAL (ft.)	ppm WO_3	ppm Mo	METERS
								see	page	2	
93	100	MAGNETITE DIOPSIDE SKARN (cont.) - irr. patches, swirls and sublam. dk. gn. to yellowish gn. serp. and wht. to creamy yellow diop.(?), numerous f., irr. calc. veinlets	100	Trem.(cont.) - f. anh. to subh., med. to dk. gn. fibrous decussate masses in indist. fract., C.A. 40°				5	20	1	30
	110	Mag.- mass., aph., irr. patches, swirls	104					5	25	1	
46		- dist. irr. contact	110	Mag. - sublam., C.A. 60° and irr. v.f. veinlets, assoc. with sil. veining	to 5			5	100	1	
			117.5					5	75	1	
	120	INTERBEDDED DIOPSIDE/GARNET SKARN AND SILICEOUS DIOPSIDE SKARN Diop. Ves. skarns - diop. dominated horizons interbedded with ves. dominated horizons -contacts grad. to dist. -diop. 40-75%, med. gn., f. to c. Xline., irr. patches -ves. 10-60% - lt. brn. aph. irr., patches and blebs, occ. mass. dk. red garnet within ves., aph. calcite up to 10% -calcite - f. aph. masses, secondary -occ. anh. gn. to blackish trem., in vugs	118.5 120	extremely vuggy, trem.				5	225	2	35
	130		130					5	300	1	
								5	700	40	
	140	Sil. Diop. Skarn - med. to dk. gn. diop. up to 75%, grad. darker with depth -wht. mass. qtz. and calcite mottles	140	Sil. Diop. Skarn - with diop. ves. skarn horizons up to several inches			to 5	5	400	20	40
100			143 144	Sand Seam - extremely limonitic non calc. unconsolidated silty sand, numerous sil. diop. skarn fragments		5		5	1200	60	
		Py. - f. to med., anh. Po. - aph. mass.	147	Alt. Diorite -m.g. to c.g. weakly to mod. alt.;		to		5	1700	50	
	150		150				to 25	5	4400	50	45
			151	Py. grad. v.c.g.,euh. Remnant subh. zoned garnet euh. up to ¼" Severely alt. garnet diop. skarn		1		5	1400	20	
	160		160	- plag. -40-50%, f.g. to c.g. anh. masses, with indist. grain boundaries; interstitial aph. qtz. and med. to dk. gn. mafics -Py.- f. anh. masses, interstitial to plag. -grade to limonitic c.g. strongly alt. diorite - plag. 20-30%, f.g. to c.g., indist. to dist. feld. pheno. up to 1" with eroded grain boundaries, grade severely alt. to ep. - muscovite - 30-50%, f.g. anh. indist. masses Py. - c. masses interstitial to plag., up to 30% grad. less with depth.			to 20	5	4100	20	
		SALIVO GRANITE Biotite, Feld. Granite Porphyry qtz.-up to 60%, rounded qtz. eyes feld.- to 30%, anh., masses biotite - 10-15%, f. irr. masses, chloritized slightly fract. assoc. K-feld. - up to 2%, subh. pheno. up to 3/4", grad. to dist. grain boundaries -occ. calc. v.f. limonitic fract. Py. - aph. mass., along calc. fract., Po. - aph., masses in f. qtz. veining Molybdenite - 1%, diss. masses						to 10	5	8700	60	
	170		170				to tr.	5	3200	110	50
	180		180	grad. to fresh granite							
				biotite present		tr.	tr.				55
	190		190		to 5						
	200		200								

DIAMOND DRILL CORE LOG HOLE H-81-4 PAGE 2 OF 2

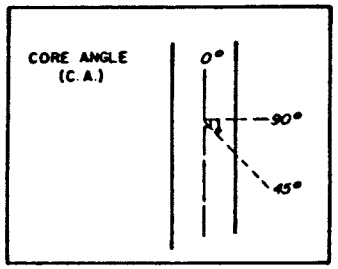
PROJECT _____ CLAIM GROUP _____ CORE SIZE _____
STARTED _____ FINISHED _____ TOTAL DEPTH _____
LOCATION _____ COLLAR ELEVATION _____
ANGLE _____ AZIMUTH _____

CORE RECOVERY (%)	FOOTAGE (ft.)	MAJOR ROCK UNIT	FOOTAGE (ft.)	VARIATIONS	% Magnetite	% Pyrrhotite	% Pyrite	SAMPLE INTERVAL (ft.)	ppm WO_3	ppm Mo	METERS
	200		200								60
	210	SALIVO GRANITE (cont.)	210								65
	220		220								70
	230		230								75
100	240		240								80
	250		250								85
	260		260								
	270		270	Scheelite, Powellite - tr. in fract.							
	280		280	END OF H-81-4/280'							
	290		290								
	300		300								

DIAMOND DRILL CORE LOG

HOLE H-81-5 PAGE 1 OF 4

PROJECT CTB CLAIM GROUP IVO CORE SIZE BQ
STARTED June 26/81 FINISHED June 30/81 TOTAL DEPTH 390'
LOCATION "A" 8+00S/8+65E COLLAR ELEVATION 4135 ft.A.S.L.
ANGLE 90° AZIMUTH

CORE RECOVERY (%)	FOOTAGE (ft.)	MAJOR ROCK UNIT	FOOTAGE (ft.)	VARIATIONS	% Magnetite	% Pyrrhotite	% Pyrite	SAMPLE INTERVAL (ft.)	ppm WO_3	ppm Mo	METERS
	0	OVERBURDEN	0								
				LIST OF ABBREVIATIONS alt.-altered/alteration; amph.-amphibole; anh.-anhedral; aph.-aphanitic; assoc.-associated; brn.-brown; c.-coarse; calc.-calcareous; calcsil.-calcsilicate; c.g.-coarse grained; diop.-diopside; diss.-disseminated; dist.-distinct; dk.-dark; ep.-epidote; euh.-euhedral; f.-fine; feld.-feldspar; f.g.-fine grained; fract.-fracture(s); gn.-green; grad.-grades/gradational; hfels.-hornfels; indist.-indistinct; irr.-irregular; lam.-laminated; lt.-light; mag.-magnetite; mass.-massive; med.-medium; m.g.-medium grained; mod.-moderate(ly); p.-pale; perp.-perpendicular (to); pheno.-phenocrysts; plag.-plagioclase; Po.-pyrrhotite; px.-pyroxene; Py.-pyrite; qtz.-quartz; sauss.-saussuritized; seric.-sericitized; serp.-serpentine; sil.-siliceous; sublam.-sublaminated; subh.-subhedral; tr.-trace; trem.-tremolite; v.-very; ves.-vesuvianite; wht.-white; woll.-wollastonite; Xline.-crystalline; occ.-occasional							
	30		30								5
35	40	MARBLE - lt. to med. grey to wht., interbedded variably pure and impure, beds up to 5', C.A. 40° to 45°; grey nondescript impurities lam. 40 and patchy grey masses - subh. f.g. hematite(?), 2-3%, some radiating habit, assoc. with sil. fract. Py. - v.f.g., diss.	40								
100	50		47 50	Sand Seam - limonitic silty sand			to 1				10
	60		55 60								15
60	70		66 70	Sand Seam - as above Sand Seam - as above							
40	80		80	Sand Seam - more competent than previous remnants of extremely weathered calc. unit(?) Sand Seam - as above							20
	90		90								25
70	100	Granite Dyke - Alt. Diorite	94 100	Sand Seam - as above							

DIAMOND DRILL CORE LOG HOLE H-81-5 PAGE 2 OF 4

PROJECT _____ CLAIM GROUP _____ CORE SIZE _____
STARTED _____ FINISHED _____ TOTAL DEPTH _____
LOCATION _____ COLLAR ELEVATION _____
ANGLE _____ AZIMUTH _____

CORE RECOVERY (%)	FOOTAGE (ft.)	MAJOR ROCK UNIT	FOOTAGE (ft.)	VARIATIONS	% Magnetite	% Pyrrhotite	% Pyrite	SAMPLE INTERVAL (ft.)	ppm WO_3	ppm Mo	METERS
100		GRANITE DYKE - Alt. Diorite(?) (cont.) -									30
		- wht. and gn. mottled, earthy lustre, extremely vuggy, limonitic, feld. highly alt. to clays - earthy lustre (alt. Diorite?)									
		- similar to H-81-9/352' and 388'									
20	110		110		110						
		CALCSILICATE - p. gn. aph. mass., weakly calc.									
			117								
	120		120		120						35
			122	Sand Seam - med. to v. dk. brn., slightly competent, silty to clayey sand, weakly limonitic							
9		MARBLE - interbedded, impure as previous									
			129	Sand Seam - remnants of extremely weathered unit(?), as above							
	130		130		130						40
	140		140		140						
			142								
		MAGNETITE MARBLE - marble as previous									
		- yellow translucent serp. in sil., veining in hematite-rich horizons									
	150		150		150	to 5					45
		Mag. - aph., mass.									
				chalcopyrite - tr., aph. mass.							
				- mag. - aph. mass.							
100				- calc., veinlets transecting mag.							
	160		160	- Po. - mass. aph. close assoc. with p. to med. gn. aph. diop.	160						
			164	contact zone		20	40				
		DIOPSIDE GARNET SKARN - med. gn., mass. and brn. in irr. patches and mottles									
		Diop. - up to 75%, aph., mass.									
	170	Ves.(Garnet?) - up to 20%, patches lacking regular distribution or form	170		170						50
		Accessory Calcite - c., anh. masses, occ. subh. up to 2% aph.									
		Mag. - occ. mass. bleb with calcite									
		Scheelite - 165'-166' tr									
	180	Powellite - 165'-179' tr., diss. and along fract.	180		180	tr.					
											55
	190		190		190						

DIAMOND DRILL CORE LOG HOLE H-81-5 PAGE 3 OF 4

PROJECT _____ CLAIM GROUP _____ CORE SIZE _____
STARTED _____ FINISHED _____ TOTAL DEPTH _____
LOCATION _____ COLLAR ELEVATION _____
ANGLE _____ AZIMUTH _____

CORE RECOVERY (%)	FOOTAGE (ft.)	MAJOR ROCK UNIT	FOOTAGE (ft.)	VARIATIONS	% Magnetite	% Pyrrhotite	% Pyrite	SAMPLE INTERVAL (ft.)	ppm WO_3	ppm Mo	METERS
	200	DIOPSIDE, GARNET SKARN (cont.)	200								60
	210	MAGNETITE MARBLE - interbedded med. grey to wht. variably pure and impure marble with limestone and/or dolostone as previous - numerous sil. fract. C.A. 90° with yellowish gn. serp., some fract. zoned with Py. core and wht. sil. borders - less cal. with depth, formerly dolostones(?) Mag. - aph., mass. patches with serp., in more sil. horizons Powellite - 229'-236' tr.	210		2 ↓ 15		tr.				
	220		220								65
	230	DIOPSIDE TREMOLITE SKARN - p. gn., aph., mass., retaining features of overlying marble in upper 5' grad. to f. Xline. - diop. aph. to f.g. mass. 70-75% - trem. - indist. to f.g. subh., dk. gn. with	230								
	236		236	- grad. contact							
	240	- aph. and c. calcite masses, up to 10% - ves. - grad. from 0-10%, f. indist. patches - occ. dk. gn. mass. hedenbergite - numerous indist. veinlets, C.A. 15°	240		to 15						70
100	250	Mag. - aph.; mass., patches and subbands	250								
	252	DIOPSIDE MAGNETITE SKARN - f. irr. lam. mag. and yellow gn. aph. lam. diop.(up to 75%), minor garnet and trem.(?), v.f. veinlets; woodgrain appearance Scheelite and Powellite - 246'-257.5' tr. - grad. contact	252		10-15						
	257.5		257.5					7	70	1	
	260	DIOPSIDE SKARN - p. grading dk. gn. f. to c. Xline. Diop. - up to 80%, c.g. subh. to aph. and mass. - Accessory indist. mass. ves. and c. masses late stage?, secondary? calcite - aph. calcite 1-2% Mag. - aph., mass. bands and patches Po. - aph. mass. occ. sublam. grading diss.	260					5	75	1	75
	270		270		15	to 10		5	600	1	
	280		280					5	4900	30	80
		- grad. contact		- grad. lt. gn.				5	2400	15	
	288		288					5	225	3	
	290	GARNET/DIOPSIDE AND/OR EPIDOTE SKARNS	290					2	600	5	
	293		293	← silicified zone - mass. aph. wht. and yellow calcsil.(?) ground mass interstitial to irr. bands and masses, dk. grey to black mineral(?)	tr.	1-2					85
	296		296	- grad. contact							
	300		300								

DIAMOND DRILL CORE LOG

HOLE H-81-5 PAGE 4 OF 4

PROJECT _____ CLAIM GROUP _____ CORE SIZE _____
STARTED _____ FINISHED _____ TOTAL DEPTH _____
LOCATION _____ COLLAR ELEVATION _____
ANGLE _____ AZIMUTH _____

CORE RECOVERY (%)	DEPTH (ft.)	MAJOR ROCK UNIT	FOOTAGE (ft.)	VARIATIONS	% Magnetite	% Pyrrhotite	% Pyrite	SAMPLE INTERVAL (ft.)	ppm WO_3	ppm Mo	METERS
	300	**GARNET/DIOPSIDE AND/OR EPIDOTE SKARNS** (cont.) -interbedded, beds 2" to 10" thick, contacts indist. to sharp and irr. Garnet Diop. Ep. - Garnet up to 70%, med. to dk. red mass. anh., some vague with zonations & subh. outline (similar to H-81-4/154') - Diop. - 5-20%, anh. irr. med. gn. masses interstitial to garnet - Calcite - 2-3%, c. rounded masses up to 1/8", occ. subh. grains within masses - Ep. - 2-10%; lt. gn. to yellowish gn. with qtz. and calcite - Qtz. - 2-3% aph. rounded masses Diop. Garnet - diop. up to 80%, p. grad. med. gn. aph. to f. Xline. - Garnet - up to 15%, mass. aph. patches - Calcite - 2-3%, c. rounded masses up to 1/8" - Py. - mass. in sil. veining - Po. - mass., with diop. Ep. Garnet Diop. - strongly mottled - Ep. - 25-40%, wht. to lt. pinkish, anh. f.to c. irr. masses - Garnet - 15-30%, dk. red brn., f. aph. masses - Diop. - up to 15%, med. gn. aph. irr. masses interstitial to ep. - accessory qtz. and calcite	300									
	310		310		310						90
	320		320		320						
	330		330	← strongly mottled Garnet, Ep. Diop. Skarn	330						100
	340		340		340	tr.		5	175	2	
100	350		350	- grad. contact	350	to 15 25	to 10	5	125	4	105
		SALIVO GRANITE - Biotite, Feld., Granite Porphyry - see H-81-1 - K-feld. pheno. grad. from f. anh. indist. to 1" with sharp grain subh. to euh. grain boundaries - weak propylitic alt. along f. calc. fract. throughout fresh granite	352	**Alt. Diorite** - grad. from mod. alt.; with f. to c. irr. indist. plag. mottles up to 75% with indist. interstitial aph. muscovite masses, anh. masses f.g. Py. and Po., qtz. up to 10% and calcite up to 5%, as f. to c. anh. masses, to strongly alt. with plag. as previous up to 45%, coarser interstitial muscovite masses, calcite (up to 15%) and qtz. (up to 15%), euh. Po. as previous with Py. mass. occ. c.g.				5	1800	2	
	360		360		360	15 ↓ tr.		5	2600	1	
			366	←biotite				5	1400	17	
	370		370		370			5	100	38	110
			374	-K-feld. pheno.				5	150	24	
	380		380		380			5	625	13	
								4.5	65	2	115
	390		390	END OF H-81-5/390'	390			5.5	75	2	
											120

DIAMOND DRILL CORE LOG

PROJECT CUB CLAIM GROUP IVO HOLE H-81-6 PAGE 1 OF 4

STARTED JULY 1/81 FINISHED JULY 21/81 CORE SIZE BQ

LOCATION 112+50N/9+00W COLLAR ELEVATION 4260 ft.A.S.L. TOTAL DEPTH 342

ANGLE -50° AZIMUTH 270°

CORE RECOVERY (%)	FOOTAGE (m.)	MAJOR ROCK UNIT	FOOTAGE (m.)	VARIATIONS	% Magnetite	% Pyrrhotite	% Pyrite	SAMPLE INTERVAL (ft.)	ppm WO_3	ppm Mo	METERS
	0	**OVERBURDEN**	0								
	10	CORE ANGLE (C.A.) 0° 90° 45°	10								5
	20		20								
	30	**MARBLE** - interbeds of variably pure and impure med. to lt. grey marble - grey nondescript impurities as irr. patches, f. lam. and mottles, occ. dist. subh. hematite - bedding 6" to 5' thick, C.A. 60°; c. Xline to mass. dolostone(?) - occ. c. lam. to 2" mass. aph. pink to med. brn. red garnet and med. gn. diop., 0 to weakly calc. -pyrolusite and limonite following fract. Py. - aph., mass. along fract.	21								
100	40		30								10
	50		40								
	60		50				tr.				15
	70		60								
	80		70								20
	90		80								
	100		90								25
			100								

LIST OF ABBREVIATIONS

alt.-altered/alteration
amph.-amphibole
anh.-anhedral
aph.-aphanitic
assoc.-associated
brn.-brown
c.-coarse
calc.-calcareous
calcsil.-calcsilicate
c.g.-coarse grained
diop.-diopside
diss.-disseminated
dist.-distinct
dk.-dark
ep.-epidote
euh.-euhedral
f.-fine
feld.-feldspar
f.g.-fine grained
fract.-fracture(s)
gn.-green
grad.-grades/gradational
hfels.-hornfels
indist.-indistinct
irr.-irregular
lam.-laminated
lt.-light
mag.-magnetite
mass.-massive
med.-medium
m.g.-medium grained
mod.-moderate(ly)
p.-pale
perp.-perpendicular (to)
pheno.-phenocrysts
plag.-plagioclase
Po.-pyrrhotite
px.-pyroxene
Py.-pyrite
qtz.-quartz
sauss.-saussuritized
seric.-sericitized
serp.-serpentine
sil.-siliceous
sublam.-sublaminated
subh.-subhedral
tr.-trace
trem.-tremolite
v.-very
ves.-vesuvianite
wht.-white
woll.-wollastonite
Xline.-crystalline
occ.-occasional

DIAMOND DRILL CORE LOG

HOLE H-81-6 PAGE 2 OF 4

PROJECT _____ CLAIM GROUP _____ CORE SIZE _____
STARTED _____ FINISHED _____ TOTAL DEPTH _____
LOCATION _____ COLLAR ELEVATION _____
ANGLE _____ AZIMUTH _____

CORE RECOVERY (%)	FOOTAGE (ft.)	MAJOR ROCK UNIT	FOOTAGE (ft.)	VARIATIONS	% Magnetite	% Pyrrhotite	% Pyrite	SAMPLE INTERVAL (ft.)	ppm WO_3	ppm Mo	METERS
	100	MARBLE (cont.)	100								30
	110		110								
	120		120								35
	130		130	numerous incompetent zones of extremely soft p. gn. to wht. to pinkish talc = fault zone (?) - some talc masses to 3/4" thick							
	140		140	talc zone as above			tr.				40
100	150		150								45
	160		160								
	170		170								50
	180		180								
	190		190								55
	200		200								

DIAMOND DRILL CORE LOG

PROJECT _____ CLAIM GROUP _____ CORE SIZE _____
STARTED _____ FINISHED _____ TOTAL DEPTH _____
LOCATION _____ COLLAR ELEVATION _____
ANGLE _____ AZIMUTH _____

HOLE H-81-6 PAGE 1 OF 4

CORE RECOVERY (%)	FOOTAGE (ft.)	MAJOR ROCK UNIT	FOOTAGE (ft.)	VARIATIONS	% Magnetite	% Pyrrhotite	% Pyrite	SAMPLE INTERVAL (ft.)	ppm WO_3	ppm Mo	METERS
60	200	MARBLE (cont.)	200	relatively pure marble, occ. sil. vein with p. yellow serp.(?)							60
	210		210	numerous fract. with limonite and pyrolusite	210		tr.				
100	220		220	= numerous f. diss. yellow to greenish serp., forming at expense of calcite(?)	220						
			224								65
20	230	DIOPSIDE MAGNETITE SKARN - p. gn. to grey, non calc. with woodgrain appearance due to aph. and mass., irr. grey to black mass. aph. mineral and mag. in f. swirls and lam. with interlam. of yellowish gn. aph., mass. diop. -f. irr. calc. and limonitic fract. -most of section soft, easily broken, numerous f. irr. vugs Mag. - aph., mass. lam.	230	incompetent mod. and non limonitic, fragmented	230						
	240		240		240						70
	250		250	mag. grad. = 0	250						
				Trem. Skarn Alt. Diorite - mass. v.c.g. (to 3/8") subh., decussate - c anh. and subh. calcite up to 2% - minor dk. gn. aph. ep. - sharp irr. contacts	1 to tr.			1	650	6	
	260	SALIVO GRANITE - Biotite Feld. Granite Porphyry - see H-81-1 - pervasive propylitic alt. throughout - grad. fresher with depth	260	EPIDOTE GARNET SKARNS AND ALTERED DIORITE - grad. from weakly alt. diorites to ep. garnet skarns 6" to 1.5' thick - Alt. Diorite - f.g. to c.g. indist. irr. plag. mottles 60-75% up to 85% with c. subh. feld. pheno. up to 2% at depth Diop. - up to 30% grad. 10-15% with depth, aph. mass. interstitial to plag. Py. - anh. interstitial irr. masses	260		to 2				75
100	270	Py. - anh. mass., along sil. fract. Scheelite - 254' to 0.1%, along fract. - 261'-300' - tr., diss. Powellite - 254' up to 0.1 in fract.	270	Ep. Garnet Skarns - manganese(?) ep. 60-70% anh. masses, replacing plag. mottles p. pink to rose - garnet 10-25%, dk. brn. f. to c. aph. masses - mass. aph. interstitial limonite, qtz.(?) ep.(?) garnet, med. gn. diop.(?) - v.f. to c. vugs throughout - minor pyrolusite	270			3	500	12	80
	280		280		280			5	200	7	
			285	Py.- anh. mass. in-filling vugs				5	100	5	
	290		290	biotite	290			5	<100	1	85
				extensive limonite, minor chlorite			tr. to 1	5	700	7	
	300		300								

DIAMOND DRILL CORE LOG

HOLE H-81-6 PAGE 4 OF 4

PROJECT _____ CLAIM GROUP _____ CORE SIZE _____

STARTED _____ FINISHED _____ TOTAL DEPTH _____

LOCATION _____ COLLAR ELEVATION _____

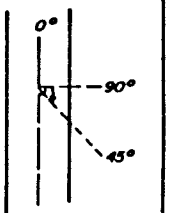
ANGLE _____ AZIMUTH _____

CORE RECOVERY (%)	FOOTAGE (ft.)	MAJOR ROCK UNIT	FOOTAGE (ft.)	VARIATIONS	% Magnetite	% Pyrrhotite	% Pyrite	SAMPLE INTERVAL (ft.)	ppm WO_3	ppm Mo	METERS
	300	SALIVO GRANITE (cont.)	300					5	<100	1	90
	310		310								
	320		320								95
100	330		330								
	340		340	END OF H-81-4/342'							100
	350		350								
	360		360								105
	370		370								
	380		380								110
	390		390								
	400		400								115

DIAMOND DRILL CORE LOG

HOLE H-81-7 PAGE 1 OF 4

PROJECT CUB — CLAIM GROUP IVO — CORE SIZE BQ
STARTED JULY 5/81 — FINISHED JULY 7/81 — TOTAL DEPTH 325 4340 ft. A.S.L.
LOCATION 116+00N/9+00W — COLLAR ELEVATION
ANGLE 50° — AZIMUTH 270°

CORE RECOVERY (%)	FOOTAGE	MAJOR ROCK UNIT	FOOTAGE (m.)	VARIATIONS	% Magnetite	% Pyrrhotite	% Pyrite	SAMPLE INTERVAL (ft.)	ppm WO_3	ppm Mo	METERS
	0	OVERBURDEN	0								
	10	CORE ANGLE (C.A.) 	10	LIST OF ABBREVIATIONS alt.-altered/alteration; amph.-amphibole; anh.-anhedral; aph.-aphanitic; assoc.-associated; brn.-brown; c.-coarse; calc.-calcareous; calcsil.-calcsilicate; c.g.-coarse grained; diop.-diopside; diss.-disseminated; dist.-distinct; dk.-dark; ep.-epidote; euh.-euhedral; f.-fine; feld.-feldspar; f.g.-fine grained; fract.-fracture(s); gn.-green; grad.-grades/gradational; hfels.-hornfels; indist.-indistinct; irr.-irregular; lam.-laminated; lt.-light; mag.-magnetite; mass.-massive; med.-medium; m.g.-medium grained; mod.-moderate(ly); p.-pale; perp.-perpendicular (to); pheno.-phenocrysts; plag.-plagioclase; Po.-pyrrhotite; px.-pyroxene; Py.-pyrite; qtz.-quartz; sauss.-saussuritized; seric.-sericitized; serp.-serpentine; sil.-siliceous; sublam.-sublaminated; subh.-subhedral; tr.-trace; trem.-tremolite; v.-very; ves.-vesuvianite; wht.-white; woll.-wollastonite; Xline.-crystalline; occ.-occasional	10						5
	18										
	20	MARBLE - wht. to med. grey interbedded variably pure and impure marbles, bedding and lam. dist. in impure beds to absent in less impure beds -bedding varies from v. mass. to f., to subh. Xline., 4" to 4' thick, C.A. 65° to 70° -grey indiscript impurities f. irr. masses to broad lam., irr. patches, swirls and spotty diss.	20		20						
100	30		30		30						10
	40	- minor limonite and pyrolusite along f. irr. fract. -occ. f. up to ½" buff to creamy, powdery clay layers -occ. near vertical sil. vein with p. to med. yellow gn. translucent serp.(?), occ. bright yellow serp., forming from calcite(?)	40		40						
	50		50	clay	50						15
	60		60		60						
	70		70	clay	70						20
	80		80		80						
	90		90		90						25
	100		100								

DIAMOND DRILL CORE LOG

HOLE H-81-7 PAGE 2 OF 4

PROJECT _____ CLAIM GROUP _____ CORE SIZE _____

STARTED _____ FINISHED _____ TOTAL DEPTH _____

LOCATION _____ COLLAR ELEVATION _____

ANGLE _____ AZIMUTH _____

CORE RECOVERY (%)	FOOTAGE (ft.)	MAJOR ROCK UNIT	FOOTAGE (ft.)	VARIATIONS	% Magnetite	% Pyrrhotite	% Pyrite	SAMPLE INTERVAL (ft.)	ppm WO_3	ppm Mo	METERS
	100	MARBLE (cont.)	100	Phlogopite (to 15%) and clay alt. zone							30
	110		110								35
	120		120								40
100	130		130								45
	140		140								50
	150		147								55
	160		150	← spotty limonite due to f. diss. Py.(?), lack fract. assoc., some vaguely following relief beds							
	170		160								
	180		169								
	190		170								
	200		180								
			190								
			200								

DIAMOND DRILL CORE LOG

HOLE H-81-7 PAGE 3 OF 4

PROJECT _____ CLAIM GROUP _____ CORE SIZE _____
STARTED _____ FINISHED _____ TOTAL DEPTH _____
LOCATION _____ COLLAR ELEVATION _____
ANGLE _____ AZIMUTH _____

CORE RECOVERY (%)	FOOTAGE (ft.)	MAJOR ROCK UNIT	FOOTAGE (m.)	VARIATIONS	% Magnetite	% Pyrrhotite	% Pyrite	SAMPLE INTERVAL (ft.)	ppm WO_3	ppm Mo	METERS
	200	MARBLE (cont.)	200								60
	210		210		210						
	220		220		220						65
	230		230		230						
	240		240	mass. silicified zone - mass. mag., p. yellow gn. serp., minor limonite - black subh. manganite and mag. along contacts	240 — 70						70
	250		250	Silicified Zone - non calc. wht./gn./lt. grey f. lam., flow appearance, grad. contacts - grad. decrease in mag., serp., more calc.	250		tr.				
100	260	MAGNETITE (WEAK) SKARN - p. gn. grey aph., mass. riddled with irr. dk. gn. thready aph. olivine - f. calc. fract. Mag. - mass., bands and f. lam. Py. - mass., along calc. fract.	260		260 tr. to 5						75
	270	Marble - impure, f. mottled grey, grad. less impure p. grey, numerous silicified sections up to 6" with up to 15%, anh. mass. gn. yellow serp. - occ. calc. fract. Mag. - mass., grad. to 0% with depth	262 270		270 tr.						
	280		279 280	Fault Zone - variably competent-incompetent mass. and banded sheared -calc., sil. indist. mass. mag. lam.	280						80
	290	SALIVO GRANITE - see H-81-1 - reasonably fresh with pervasive propylitic alt.; minor chloritization, limonite and pyrolusite along calc. fract. K-feld. - up to 2%, subh. and anh. - up to 3/4", dist. grain boundaries Py. - mass., along calc. fract. Scheelite - 305'-312', tr. along fract.	290	Fault Breccia extreme chloritization	290		tr.				85
	300		300								

DIAMOND DRILL CORE LOG

HOLE H-81-7 PAGE 4 OF 4

PROJECT _____ CLAIM GROUP _____ CORE SIZE _____

STARTED _____ FINISHED _____ TOTAL DEPTH _____

LOCATION _____ COLLAR ELEVATION _____

ANGLE _____ AZIMUTH _____

CORE RECOVERY (%)	FOOTAGE (ft.)	MAJOR ROCK UNIT	FOOTAGE (m.)	VARIATIONS	% Magnetite	% Pyrrhotite	% Pyrite	SAMPLE INTERVAL (ft.)	ppm WO_3	ppm Mo	METERS
	300	SALIVO GRANITE (cont.)	300								90
	310		310								95
	320		320								100
		END OF H-81-7/325'									105
	330		330								110
	340		340								115
	350		350								
	360		360								
	370		370								
	380		380								
	390		390								

DIAMOND DRILL CORE LOG

HOLE H-81-8 PAGE 1 OF 5

PROJECT CUB CLAIM GROUP IVO CORE SIZE BQ

STARTED JULY 7/81 FINISHED JULY 9/81 TOTAL DEPTH 462

LOCATION "A" 14+00S/11+25E COLLAR ELEVATION 3910 ft A.S.L.

ANGLE -50° AZIMUTH 325

CORE RECOVERY (%)	FOOTAGE (m.)	MAJOR ROCK UNIT	FOOTAGE (m.)	VARIATIONS	% Magnetite	% Pyrrhotite	% Pyrite	SAMPLE INTERVAL (ft.)	ppm WO_3	ppm Mo	METERS
	0	**OVERBURDEN** 	0	**LIST OF ABBREVIATIONS** alt.-altered/alteration; amph.-amphibole; anh.-anhedral; aph.-aphanitic; assoc.-associated; brn.-brown; c.-coarse; calc.-calcareous; calcsil.-calcsilicate; c.g.-coarse grained; diop.-diopside; diss.-disseminated; dist.-distinct; dk.-dark; ep.-epidote; euh.-euhedral; f.-fine; feld.-feldspar; f.g.-fine grained; fract.-fracture(s); gn.-green; grad.-grades/gradational; hfels.-hornfels; indist.-indistinct; irr.-irregular; lam.-laminated; lt.-light; mag.-magnetite; mass.-massive; med.-medium; m.g.-medium grained; mod.-moderate(ly); p.-pale; perp.-perpendicular (to); pheno.-phenocrysts; plag.-plagioclase; Po.-pyrrhotite; px.-pyroxene; Py.-pyrite; qtz.-quartz; sauss.-saussuritized; seric.-sericitized; serp.-serpentine; sil.-siliceous; sublam.-sublaminated; subh.-subhedral; tr.-trace; trem.-tremolite; v.-very; ves.-vesuvianite; wht.-white; woll.-wollastonite; Xline.-crystalline; occ.-occasional							0
	10		10								
	20		20								5
	30		30								
	40		40								10
			44								
100	50	**MARBLE** - wht. to med. grey, interbedded, variably pure and impure marble (and dolostone?) beds 3" to 5" thick, C.A. 70° to 75°, apparent in dist. lam. horizons, absent in less impure horizons up to 20% aph. calcite -impurities as nondescript aph. grey in f. to c. (1") lam., irr. patches, swirls and diss. -occ. f. limonitic fract. and/or pyrolusite	50								15
	60		60								
	70		70								20
	80		80								
	90		90								25
	100		100								

DIAMOND DRILL CORE LOG

HOLE H-81-8 PAGE 2 OF 5

PROJECT _____ CLAIM GROUP _____ CORE SIZE _____

STARTED _____ FINISHED _____ TOTAL DEPTH _____

LOCATION _____ COLLAR ELEVATION _____

ANGLE _____ AZIMUTH _____

CORE RECOVERY (%)	FOOTAGE (ft.)	MAJOR ROCK UNIT	FOOTAGE (m.)	VARIATIONS	% Magnetite	% Pyrrhotite	% Pyrite	SAMPLE INTERVAL (ft.)	ppm WO_3	ppm Mo	METERS
	100	MARBLE (cont.)	100								30
	110		110								35
	120		120	Mag. - mass. along fract. up to ¼" thick							
	130	MAGNETITE MARBLE - impure marble beds similar to upper marble unit Mag. - aph. mass. f. lam. - grad. increase Py. - aph. mass., along calc. fract. Po. - aph. mass. f. lam. masses with mag., some near fine sil. veins (vein related?)	130								
100	140		140	Silicified Zone (vein?) - mass. p. yellow gn. serp.							40
	150		150		5 to 10						45
	160		160								
	170		170								50
	180		175	strongly lam. with f.g. to c.g. dk. gn. to yellow gn. mass.(?) mineral	tr.	to 15					
	190		180	Po.							55
	200		189	- mag. grad. to 0%							
			190								
			200								

DIAMOND DRILL CORE LOG

HOLE H-81-8 PAGE 1 OF 5

PROJECT _____ CLAIM GROUP _____ CORE SIZE _____
STARTED _____ FINISHED _____ TOTAL DEPTH _____
LOCATION _____ COLLAR ELEVATION _____
ANGLE _____ AZIMUTH _____

CORE RECOVERY (%)	FOOTAGE (ft.)	MAJOR ROCK UNIT	FOOTAGE (ft.)	VARIATIONS	% Magnetite	% Pyrrhotite	% Pyrite	SAMPLE INTERVAL (ft.)	ppm WO_3	ppm Mo	METERS
	200	MAGNETITE MARBLE (cont.)	200								60
			205	- gradation to few impurities							
	210	MARBLE - interbedded pure and slightly impure marbles, fewer impurities than previous - bright yellow, f. anh. serp.(?) diss. in specific horizons and in sil. veining, grad.-gn. - occ. f. limonitic fract. with ep.	210								
		Mag. - one occ. aph. mass. f. irr. lam.		← v.c. Xline.							65
	220		220								
			229								
	230		230								
100	240		240								70
	250		250								
	260		260								75
	270		270								
			276								
	280		280	← grad. increase in grey impurities occ. minor calc. fract. in-filled with mass. yellowish gn. to gn. serp.							80
			287								
	290		290	← occ. serp. fract. with diop. ves.; and garnet aph. mass. up to ¼" thick							
			292	- Calcsilicate - as several veins(?) alt. beds(?) up to 1.5', mass. aph. creamy gn. calcsil.(?) interstitial to marble fragments with alt. rims, occ. mass. subrounded ves. -Py. - mass., diss., in more calc. horizons			tr.				85
	300		300								

DIAMOND DRILL CORE LOG

HOLE H-81-8 PAGE 4 OF 5

PROJECT _____ CLAIM GROUP _____ CORE SIZE _____

STARTED _____ FINISHED _____ TOTAL DEPTH _____

LOCATION _____ COLLAR ELEVATION _____

ANGLE _____ AZIMUTH _____

Core Recovery (%)	Footage (ft.)	MAJOR ROCK UNIT	Footage (ft.)	VARIATIONS	% Magnetite	% Pyrrhotite	% Pyrite	Sample Interval (ft.)	ppm WO_3	ppm Mo	Meters
	300	MARBLE (cont.)	300								
			303	← near vertical sil. fract. up to ½" thick with poor to well developed zonation; core of aph. mass. sil. mineral - yellow gn. serp. grading to wht. mass. calc. grading to grey/black aph. mass. non mag. mineral(?) and v.f.g. anh. to subh. mangenite(?)							
	310		310								90
			315								
	320		320								
					<5						100
	330	- grad. contact	330								
			335								
		DIOPSIDE GARNET SKARN									
	340	Diop.- 50-60% med to dk gn., f. Xline masses also up to 25%, mass. anh. p. gn.	340			tr.		6	200	1	
100		Ves.(Garnet)- up to 30%, irr. lt. brn. masses and patches to more regular subbands	342	← diop. grad. to v. p. gn. trem., and ves. up to 5%				5	100	1	
		Garnet - up to 10%, dk. pinkish red and brn. red, within ves. masses		- extremely silicified , 0 to weakly calc.				5	400	13	105
	350	Calcite - up to 10%, secondary, anh. masses - aph. calcite up to 10%	350		to	to	to				
		Mag. - mass. aph. f. to c. lam.	352	- ves. transected by creamy yellow gn. aph. diop. and/or trem.	30	5	5	5	700	39	
		Py. - anh., masses, with calcite and along calc. fract.						5	210	5	
	360	Po. - aph., irr. masses	360					5	400	10	110
			366	← Diopside(?) Skarn - v. p. gn., mass. aph. to f. Xline.				5	300	8	
	370		370	- 0 to weakly calc., equivalent to diop. and/or trem. interstitial to ves. masses of main unit				5	185	3	
			372	- occ., mass., subh. med. gn. trem.				4	125	2	
	380		380					4	410	5	115
				Altered Diorite - mod. to strong. alt. - f. to c. irr. plag. mottled up to 60%, c. subh. to euh. K-feld pheno. up to 2%, and 1" -interstitial f. anh. mass. qtz. up to 15% -interstitial med. gn. aph. mass. and platey muscovite with diop? Chalcopyrite - tr., f. mass.				5	95	3	
	390		390					5	28	1	
								4	32	1	120
	400		398			to 2		4	48	1	
			400								

DIAMOND DRILL CORE LOG

HOLE H-81-8 PAGE 5 OF 5

PROJECT _____ CLAIM GROUP _____ CORE SIZE _____

STARTED _____ FINISHED _____ TOTAL DEPTH _____

LOCATION _____ COLLAR ELEVATION _____

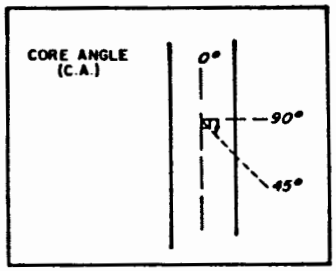
ANGLE _____ AZIMUTH _____

CORE RECOVERY (%)	DEPTH (ft.)	MAJOR ROCK UNIT	FOOTAGE (ft.)	VARIATIONS	% Magnetite	% Pyrrhotite	% Pyrite	SAMPLE INTERVAL (ft.)	ppm WO_3	ppm Mo	METERS
								see	page	4	
	400	SALIVO GRANITE (cont.)	400					3	<100	<10	
		Biotite Feld. Granite Porphyry						5	<100	<10	
	410	Qtz. - up to 50%, anh. masses, up to 1/8"	410		410			5	<100	<10	125
		Feld.- up to 25%, anh. masses, up to 1/8"						5	<100	<10	
		K-feld. - up to 5%, subh. pheno., up to 1", from indist. to dist. grain boundaries									
	420	Biotite - up to 15%, f. to med. platey masses interstitial to qtz. and feld. - mod. chloritized near contact grading less chloritized with depth	420	422 ← Biotite Granite Porphyry Dyke - f. to v. f. biotite to 25% with occ. slightly courser anh. qtz. and feld. porphyry - upper contact sharp, lower grad.	420	tr.	tr.	5	<100	<10	
		Altered Zones - weakly to mod. alt. diorite -occ. lt. to mod. seric., p. to dk. gn., mass. -grading indist. in fresh granite -biotite and plag. absent		428 - also as pods and patches scattered throughout Salivo granite				5	<100	<10	130
	430		430	429 ← Altered Zone	430			5	<100	<10	
		Po. - anh., mass. in all alt. veinlets similar to alt. zones						5	<100	<10	
	440	Py. - mass., anh. diss., subh.	440		440			5	400	50	
		Arsenopyrite - mass., in vein ¼" thick up to 30% and tr. anh. diss. -forming from py.(?)						5	400	50	135
	450		450		450			5	<100	<10	
								5	<100	<10	
	460		460	Altered Zone ← Arsenopyrite in vein — END OF H-81-8/462'	460		10	2	<100	<10	
											140
	470		470		470						
	480		480		480						145
	490		490		490						
	500		500								150

DIAMOND DRILL CORE LOG

HOLE H-81-9 PAGE 1 OF 5

PROJECT CDB CLAIM GROUP IVO CORE SIZE BQ
STARTED July 10/81 FINISHED July 12/81 TOTAL DEPTH 425'
LOCATION 102+00N/14+00W COLLAR ELEVATION 3930 ft A.S.L.
ANGLE -50° AZIMUTH 325

CORE RECOVERY (%)	FOOTAGE (ft.)	MAJOR ROCK UNIT	FOOTAGE (ft.)	VARIATIONS	% Magnetite	% Pyrrhotite	% Pyrite	SAMPLE INTERVAL (ft.)	ppm WO_3	ppm Mo	METERS
	0	OVERBURDEN	0								
	10		10	LIST OF ABBREVIATIONS alt.-altered/alteration; amph.-amphibole; anh.-anhedral; aph.-aphanitic; assoc.-associated; brn.-brown; c.-coarse; calc.-calcareous; calcsil.-calcsilicate; c.g.-coarse grained; diop.-diopside; diss.-disseminated; dist.-distinct; dk.-dark; ep.-epidote; euh.-euhedral; f.-fine; feld.-feldspar; f.g.-fine grained; fract.-fracture(s); gn.-green; grad.-grades/gradational; hfels.-hornfels; indist.-indistinct; irr.-irregular; lam.-laminated; lt.-light; mag.-magnetite; mass.-massive; med.-medium; m.g.-medium grained; mod.-moderate(ly); p.-pale; perp.-perpendicular (to); pheno.-phenocrysts; plag.-plagioclase; Po.-pyrrhotite; px.-pyroxene; Py.-pyrite; qtz.-quartz; sauss.-saussuritized; seric.-sericitized; serp.-serpentine; sil.-siliceous; sublam.-sublaminated; subh.-subhedral; tr.-trace; trem.-tremolite; v.-very; ves.-vesuvianite; wht.-white; woll.-wollastonite; Xline.-crystalline; occ.-occasional							5
	20		20								
	30		30								10
	40		40								
			42								
100	50	MARBLE - wht. to yellowish wht. f. Xline.; mass. dolostone horizons and minor s.s. interbeds, C.A. 50° - minor grey impurities in patches and lam. - occ. anh. mass. yellow serp. throughout more mass. sil. horizons, darker gn. with hematite in near sil. fract. - minor limonite	50	Sand Seam - unconsolidated silty sand, marble fragments (fault zone?)							15
	60		60								
			66								
50	70		70	pure s.s. interbeds, calc. matrix - minor limonite along fract. - mass. yellow gn. serp.(?) and mass. mag. in near vertical calc. fract.							20
			77								
100	80		80								
			89.5								
	90	MAGNETITE MARBLE - interbedded creamy to dk. grey, variably pure and impure - yellow serp. throughout - occ. calc. fract.	90	Mag. Calcsil. (Skarn?) - mass. gn. grey diop.(?) and mass. mag. in f. irr. lam., woodgrain appearance	80						25
	100		100		25						

DIAMOND DRILL CORE LOG

HOLE H-81-9 PAGE 2 OF 5

PROJECT _____ CLAIM GROUP _____ CORE SIZE _____
STARTED _____ FINISHED _____ TOTAL DEPTH _____
LOCATION _____ COLLAR ELEVATION _____
ANGLE _____ AZIMUTH _____

CORE RECOVERY (%)	FOOTAGE (ft.)	MAJOR ROCK UNIT	FOOTAGE (ft.)	VARIATIONS	% Magnetite	% Pyrrhotite	% Pyrite	SAMPLE INTERVAL (ft.)	ppm WO_3	ppm Mo	METERS
	100	MAGNETITE MARBLE (cont.)	100								30
	110		110		110						
100			119	Mag. - grad. less							35
	120		120		120						
					<5						
	130	- grad. contact	130		130						
50			134								
	140	SERPENTINIZED (FAULT?) ZONE - incompetent, well rusted, non calc. severly leached formerly competent unit with serp. fragments throughout - chrysotile as fibrous masses 45%, up to ¼" long in-filling fract. - pictolite as f., fibrous masses, 10%, up to 1/8" in-filling finer fract. - grad. into p. gn. wht., calc. talc, up to 15% dist. remnant, lam., gives woodgrain appearance similar to mag. and calcsil. above - occ. competent p. gn. mass. calcsil. interbed Mag. - v. f. indist. masses, difficult to estimate	140		140							
	150		150		150	10 to 15 (?)					
100	160	- sharp contact	160		160						
				marble limestone fragments - severly clay alt. lam. woodgrain appearance							
	170	INTERBEDDED GARNET EPIDOTE AND DIOPSIDE SKARNS	168 170	Ves.(garnet) - up to 65%; Ep. med. apple gn. mass. aph. up to 20%, calcite up to 10%, accessory qtz. Diop. - med. gn. up to 95%, accessory ves. - beds 6" to 2' thick with grad. contacts	170						50
	180		178 180		180						
		ALTERED GRANITE DIORITE? DYKE - extremely rusted, identification difficult, occ. feld. pheno., feld. severly alt. to clay									
	190		190		190						55
	200	DIOPSIDE SKARN	198 200								

DIAMOND DRILL CORE LOG

HOLE H-81-9 PAGE 3 OF 5

PROJECT _____ CLAIM GROUP _____ CORE SIZE _____
STARTED _____ FINISHED _____ TOTAL DEPTH _____
LOCATION _____ COLLAR ELEVATION _____
ANGLE _____ AZIMUTH _____

CORE RECOVERY (%)	FOOTAGE (ft.)	MAJOR ROCK UNIT	FOOTAGE (ft.)	VARIATIONS	% Magnetite	% Pyrrhotite	% Pyrite	SAMPLE INTERVAL (ft.)	ppm WO_3	ppm Mo	METERS
	200	DIOPSIDE SKARN (cont.) - mass. p. gn. with irr. dk. gn. diop. Mag. - mass.	200								60
		ALTERED DIORITE(?) DYKE - v. limonitic, less alt. than previous, indist. qtz. and feld., up to 15% biotite weakly chloritized	204	- grad. contact	1-2						
	210	SILICEOUS DIOPSIDE SKARN - med. gn. aph. to f. Xline., diop. up to 75%, wht. aph. mass. sil. mottles	210	Po. - mass., indist. bands Py. - in calc. fract.		to 15	tr.				
			213	Po. - mass., irr. patches and bands							
		MARBLE - p. to med. grey, variably pure and impure, interbedded - impurities as irr. patches - more sil. with depth - irr. masses v. dk. gn. to black, aph. masses	217		to 15						
	220		220								65
		MAGNETITE - mass., with gn./black mineral			<5						
	230		230								
				vague lam. C.A. 45° dk. gn. ep. and p. gn. diop.							
	240	BIOTITE PORPHYRY DYKE - med. to dk. gn. aph. calc. matrix up to 75% - v.f.g. biotite up to 20%; anh. feld. up to 10% accessory ep.(?)	239 240	- corresponds to porphyry dykes in H-81-10,11 and 12 - biotite grads. aph., porphyry grad. mass. incompetent - contact skarn, C.A. 45°							70
100			246	sil.							
	250	MARBLE - interbedded variably pure and impure, p. to med. grey to greenish	250								75
	260		260								
	270		270								80
	280		280								
	290		290	sil. talc							85
			293.5								
			295	Biotite Porphyry Dyke - mass. equivalent of above talc							
	300		300								

DIAMOND DRILL CORE LOG HOLE H-81-9 PAGE 4 OF 5

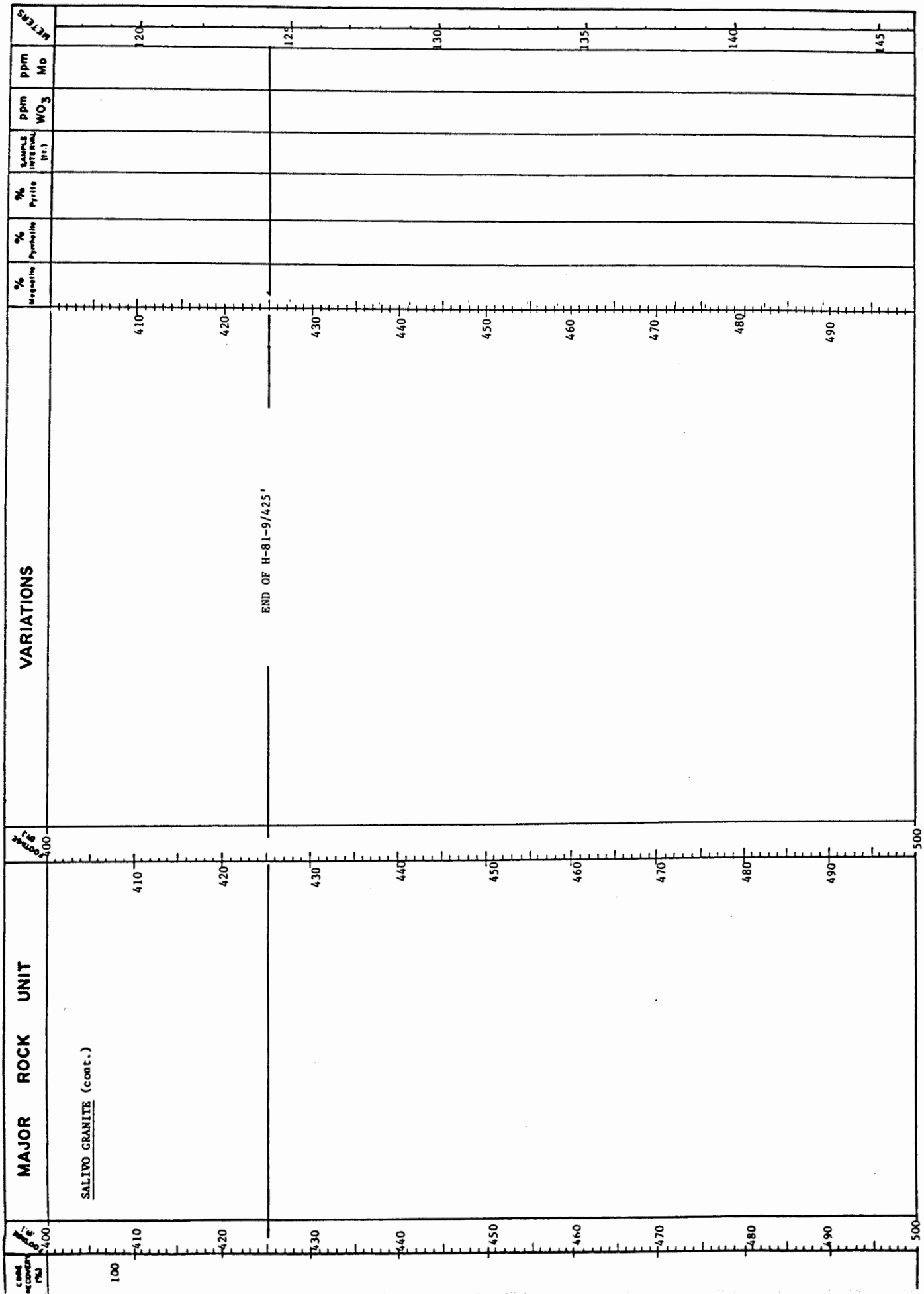
PROJECT _____ CLAIM GROUP _____ CORE SIZE _____
STARTED _____ FINISHED _____ TOTAL DEPTH _____
LOCATION _____ COLLAR ELEVATION _____
ANGLE _____ AZIMUTH _____

CORE RECOVERY (%)	FOOTAGE (ft.)	MAJOR ROCK UNIT	FOOTAGE (ft.)	VARIATIONS	% Magnetite	% Pyrrhotite	% Pyrite	SAMPLE INTERVAL (ft.)	ppm WO_3	ppm Mo	METERS
	300	MARBLE (cont.)	300	talc.							
		BIOTITE PORPHYRY DYKE - biotite, qtz. pheno. as previous, contacts C.A. 80°	303					5.5	210	23	
			306.5					5	260	18	
	310	DIOPSIDE SKARN - med. to dk. gn., f.g. diss. diop. in p. gn. diop. -aph. groundmass -grad. to f. Xline. darker gn., sil. diop. with wht. sil. aph. masses up to 40%, aph. calcite up to 5%	310				tr.	5	378	38	90
			314	Woll.(?) Trem.(?) Skarn - mass. f.g. to c.g. subh. wht. to p. gn., up to 80% trem.(?) woll.(?), grad. contacts							
			316					5	1700	37	
				Ves.- up to 20%, f. irr. patches, confined to relict beds(?) up to 6" thick							
	320	Py. - mass., along calc. fract.	320					5	38	1	
			322								
				Mag. - f. mass. in relict beds(?) up to 6" wide and aph. in f. to c. lam.; grad. less with depth	to 5			4	35	1	95
	330		330								
				ves. - minor irr. patches				5	40	1	
			335	Garnet Diop. Skarn - with secondary calcite, mottled, as H-81-1/ 210'	to 2	tr.		5	1200	7	
	340	SALVO GRANITE - Biotite, Feld. Granite Porphyry - see H-81-1	340	Altered Diorite - weakly grad. to strongly alt., f.g. to c.g. - grad. from slightly alt. med. to dk. gn., with indist. mottling of plag. 60-65%; hornblende 25-30% totally replaced by qtz. and actinolite with accessory ep. and diop.				5	740	1	
100		- pervasive propylitic - alt. throughout, confined to along fract. in fresher granite		Weakly alt.- plag. indist. f.g. to v.f.g., up to 60% - qtz. f. anh. masses up to 25%		to 5	15 to 20				100
			343					5	265	3	
	350	- alt. zones - occ. lt. to extreme seric. diorite - lacking biotite, feld. sometimes present as eroded grains - minor qtz. vein up to ¼" wide	350	- interstitial aph., med. to dk. gn. up to 20%, diop.?, sericite? Py. and Po. - f. anh. mass. Strong alt. - c.g. plag., f. to c. mottles, up to 25% - muscovite 25-35%, v.f. platy masses interstitial to plag. - calcite - anh., masses, up to 15% - qtz. anh. masses up to 20%			20	4.5	320	1	
								3	1900	1	
	360		360	Py. - f. to c. anh. masses and v.c. subh. and euh. up to ¼", 15-25% - indist. anh. plag. pheno. up to ¼"			tr.	5	195	1	105
			362	biotite							
								5	69	1	
	370		370					5	98	1	
			371	Alt. Zone - Po. and chalcopyrite - tr. anh. f.g.							
			376					5	50	1	
	380		380					5	63	1	110
			383				tr.				
				Alt. Zone				5	450	1	
			388								
	390		390	numerous limonitic fract.				3	178	1	
			391								
	400		400								115

DIAMOND DRILL CORE LOG

HOLE H-81-9 PAGE 5 OF 5

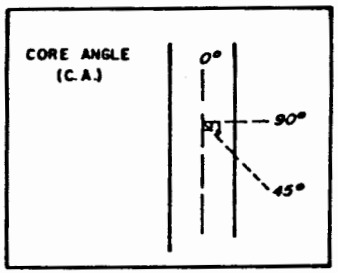
PROJECT _____ CLAIM GROUP _____ CORE SIZE _____
STARTED _____ FINISHED _____ TOTAL DEPTH _____
LOCATION _____ COLLAR ELEVATION _____
ANGLE _____ AZIMUTH _____



DIAMOND DRILL CORE LOG

HOLE H-81-10 PAGE 1 OF 5

PROJECT CUB CLAIM GROUP IVO CORE SIZE BQ
STARTED JULY 12/81 FINISHED JULY 14/81 TOTAL DEPTH 417
LOCATION 100+50N/17+50W COLLAR ELEVATION 3820 ft A.S.L.
ANGLE 50° AZIMUTH 360

FOOTAGE (ft)	MAJOR ROCK UNIT	FOOTAGE (m)	VARIATIONS	% Magnetite	% Pyrrhotite	% Pyrite	SAMPLE INTERVAL (ft.)	ppm WO_3	ppm Mo	METERS
0	OVERBURDEN  	0	LIST OF ABBREVIATIONS alt.-altered/alteration; amph.-amphibole; anh.-anhedral; aph.-aphanitic; assoc.-associated; brn.-brown; c.-coarse; calc.-calcareous; calcsil.-calcsilicate; c.g.-coarse grained; diop.-diopside; diss.-disseminated; dist.-distinct; dk.-dark; ep.-epidote; euh.-euhedral; f.-fine; feld.-feldspar; f.g.-fine grained; fract.-fracture(s); gn.-green; grad.-grades/gradational; hfels.-hornfels; indist.-indistinct; irr.-irregular; lam.-laminated; lt.-light; mag.-magnetite; mass.-massive; med.-medium; m.g.-medium grained; mod.-moderate(ly); p.-pale; perp.-perpendicular (to); pheno.-phenocrysts; plag.-plagioclase; Po.-pyrrhotite; px.-pyroxene; Py.-pyrite; qtz.-quartz; sauss.-saussuritized; seric.-sericitized; serp.-serpentine; sil.-siliceous; sublam.-sublaminated; subh.-subhedral; tr.-trace; trem.-tremolite; v.-very; ves.-vesuvianite; wht.-white; woll.-wollastonite; Xline.-crystalline; occ.-occasional							0
10		10								5
20		20								
30		30								
	MARBLE - wht. to buff to lt. and med. grey; variably pure and impure interbedded marble and/or dolostones, more pure beds v.f. Xline, beds 6" to 5' thick, C.A. 60°, lam. dist. to absent - impurities nondescript med. to dk. grey masses in f. to c. lam., irr. patches and swirls - minor limonite in f. irr. calc. fract. - occ. mass. transparent, yellow to yellow gn. rounded serp. in less. calc. marble horizons, some assoc. with sil. veining	31								
40		40								10
50		50								
60		60								15
70		70								
		78	Silicified Zone - weakly calc. v. mass. aph. non magnetic black mineral (?) with minor mass. and subh. mag., and interstitial yellow serp. and aph. calcite							20
80		80		tr.						
		86								25
90	BIOTITE PORPHYRY DYKE - med. to dk. brn. gn. v.f. biotite pheno. (up to 5%) and anh. feld. pheno. (2-3%) in mass., mod. to aph. med. to dk. gn. groundmass -minor sil. veining, non calc. to weakly calc. in well rusted sections	90								
		93	incompetent, extremely rusted silty material lacking recognizable features. - aph. calcite up to 5%							
		94								
		97	core fragmented							
100		100								

DIAMOND DRILL CORE LOG

HOLE H-81-10 PAGE 2 OF 5

PROJECT _____ CLAIM GROUP _____ CORE SIZE _____

STARTED _____ FINISHED _____ TOTAL DEPTH _____

LOCATION _____ COLLAR ELEVATION _____

ANGLE _____ AZIMUTH _____

CORE RECOVERY (%)	FOOTAGE (ft.)	MAJOR ROCK UNIT	FOOTAGE (ft.)	VARIATIONS	% Magnetite	% Pyrrhotite	% Pyrite	SAMPLE INTERVAL (ft.)	ppm WO_3	ppm Mo	METERS
100	100		100	- core fragmented, biotite qtz. porphyry and wht. mass. to v.f. Xline marble							30
	110		110								
11				- p. gn. calcsil.							
	120		120	- grad. into more competent very rusted porphyry - rusting grad. less with depth along fract.							35
100			126								
	130		130								
											40
40	140		140								
				- relatively fresh porphyry							
	150		150								45
100	160	- contact unobservable, ground core	160								
			167	- grad. mass.							
	170	MARBLE - interbedded, more impure , less pure than marble above dyke, fewer pure beds, f. lam. absent - beds 6" to 3' thick, C.A. 60° - occ. p. gn. to yellow gn. subh. and mass. serp. Py. - anh., mass. along f. calc. fract. Mag. - f. f.g. to m.g. bladed, random orientation confined to specific beds	170								50
	180		180	- grad. acicular dk. grey (gn?) hematite(?) grad. to decussate in specific beds forming from grey impurities							
					5		tr.				55
	190		190								
	200		200								

DIAMOND DRILL CORE LOG

HOLE H-81-10 PAGE 3 OF 5

PROJECT _____ CLAIM GROUP _____ CORE SIZE _____
STARTED _____ FINISHED _____ TOTAL DEPTH _____
LOCATION _____ COLLAR ELEVATION _____
ANGLE _____ AZIMUTH _____

CORE RECOVERY (%)	FOOTAGE (ft.)	MAJOR ROCK UNIT	FOOTAGE (ft.)	VARIATIONS	% Magnetite	% Pyrrhotite	% Pyrite	SAMPLE INTERVAL (ft.)	ppm WO_3	ppm Mo	METERS
	200		200								60
	210	**MARBLE** (cont.) Scheelite - 368'-381' - tr. Powellite - 364'-368' - tr., v.f. 368'-376' - to 0.1% 376'-380' - tr. 380'-381' - to 0.2% - occurs in wht. aph. sil. patches similar to those in Sil. Diop. Calcsil.	210								65
	220		220								
	230		230		5						70
	240		240								
	250		250								75
	260		260								
	270		270	← v.c.g., subh. to euh. qtz. crystal, in-filling vug 1/2" wide							80
	280		280								
	290		290								85
	300		300								

DIAMOND DRILL CORE LOG

HOLE H-81-10 PAGE 4 OF 5

PROJECT _____ CLAIM GROUP _____ CORE SIZE _____
STARTED _____ FINISHED _____ TOTAL DEPTH _____
LOCATION _____ COLLAR ELEVATION _____
ANGLE _____ AZIMUTH _____

CORE RECOVERY (%)	FOOTAGE (ft.)	METERS	MAJOR ROCK UNIT	FOOTAGE (ft.)	VARIATIONS	% Magnetite	% Pyrrhotite	% Pyrite	SAMPLE INTERVAL (ft.)	ppm WO_3	ppm Mo
	300			300							
				307	grad. appearance of yellowish gn. serp. some as fine bladed crystals						
				310	Silicified Zone - 1½" thick, med. to dk. gn. mass. diop. up to 60%		to 10				
	310			311	Po. - mass. anh.	310					
	320	90		320		320					
	330			330		330					
				331	black mineral(?) coarsens		3-5	tr.			
					Po. - f. anh. masses, assoc. with black mineral(?) masses						
	340	95		340	Py. - f. anh. lam.	340					
				342							
				347			tr. to 3				
100	350	100		350	beds with dk. grey mineral(?) fewer and finer	350					
				352	Po. - anh. masses						
				357							
	360	105	MAGNETITE MARBLE - dk. grey to black - mass. black aph. mineral(?) (up to 30%) mottles and irr. lam.; up to 15% aph. calcite - mass. patches gn. yellow serp. within calc. and sil. swirls and patches - p. to dk. gn. patches mass. diop. calcsil. and thin p. gn. calcsil. interbeds Mag. - aph. mass. Po. - irr., masses within wht. lam. Py. - f. diss. in irr. sil. and calc. masses Scheelite - 368'-381' - f. diss. in sil. and calc. masses Powellite - 364'-368' tr 368'-376' up to 0.1%	360		360	to 25	to 2	tr. to 5	4	190	12
	370			370	Mag. Diop. Skarn - mass. aph. p. yellow gn. diop. with irr. mass. lam. mag.	370			6	312	44
					Alt. Granite (Diorite?) Dyke			to 5			
					v. dk. gn. diop. skarn(?)				4	210	7
					Alt. Diorite Dyke			tr.			
	380	110		380	Diop. Ep. Garnet Skarn - f. to c. mottle diop. med. gn. up to 50%, ep.(plag.?) up to 35%, garnet 10%, formerly diorite(?)	380			5	1000	35
					Mag. Diop. Skarn						
				385	- grad. contact				6	7000	31
					Alt. Diorite - v. weakly to mod. alt. f.g. to c.g.	to 15					
	390		SALIVO GRANITE Biotite Feld. Granite Porphyry - see H-81-1 K-feld. - pheno. up to 2%, anh. up to 1½", most poorly developed -pervasive propylitic alt. throughout, along fract. -occ. f. calc. fract.	390	- see H-81-9	390		tr.			
		120									
	400			400							

DIAMOND DRILL CORE LOG

HOLE H-81-10 PAGE 5 OF 5

PROJECT _____ CLAIM GROUP _____ CORE SIZE _____

STARTED _____ FINISHED _____ TOTAL DEPTH _____

LOCATION _____ COLLAR ELEVATION _____

ANGLE _____ AZIMUTH _____

CORE RECOVERY (%)	FOOTAGE (ft.)	MAJOR ROCK UNIT	FOOTAGE (ft.)	VARIATIONS	% Magnetite	% Pyrrhotite	% Pyrite	SAMPLE INTERVAL (ft.)	ppm WO_3	ppm Mo	METERS
	400	SALIVO GRANITE (cont.)	400								125
	410		410								
				END OF H-81-10/417'							130
	420		420								
	430		430								135
	440		440								
	450		450								140
	460		460								
	470		470								145
	480		480								
	490		490								
	500		500								150

DIAMOND DRILL CORE LOG

HOLE H-81-11 PAGE 1 OF 3

PROJECT CUB CLAIM GROUP IVO CORE SIZE BQ
STARTED JULY 15/81 FINISHED JULY 16/81 TOTAL DEPTH 267
LOCATION 130+00N/9+00W COLLAR ELEVATION 4320 ft A.S.L.
ANGLE 50° AZIMUTH 270°

CORE RECOVERY (%)	FOOTAGE (m)	MAJOR ROCK UNIT	FOOTAGE (m)	VARIATIONS	% Magnetite	% Pyrrhotite	% Pyrite	SAMPLE INTERVAL (ft.)	ppm WO_3	ppm Mo	METERS
	0	**OVERBURDEN**	0								
	10	CORE ANGLE (C.A.) 0° 90° 45°	10								5
	20		20								
	30		30								10
	40		40								
	50		50								15
	60		60								
100	70	**DIOPSIDE, GARNET CALCSILICATE** - p. gn. to mottled wht. aph., mass. and f. Xline. with occ. f. marble beds, C.A. 80°, calcite up to 15% mass. wht. with grey mottling calcsil. Diop. - p. to med. gn., interbeds of aph., mass. and f. Xline., 50-70% Ves./Garnet - up to 30%, anh., intermeshed brn. and pink to red irr. patches and sublam. Calcite - aph. 0 to 5%	70								20
56			72	Sand Seam - f., silty sand, slightly rusted							
	80		76	Fault Zone							25
100			85	wht. mass. calcsil. grad. gn., spotted appearance due to indist. aph. lt. grey mineral							
	90		90								
	100		100								

LIST OF ABBREVIATIONS

alt.-altered/alteration	f.g.-fine grained	Po.-pyrrhotite
amph.-amphibole	fract.-fracture(s)	px.-pyroxene
anh.-anhedral	gn.-green	Py.-pyrite
aph.-aphanitic	grad.-grades/gradational	qtz.-quartz
assoc.-associated	hfels.-hornfels	sauss.-saussuritized
brn.-brown	indist.-indistinct	seric.-sericitized
c.-coarse	irr.-irregular	serp.-serpentine
calc.-calcareous	lam.-laminated	sil.-siliceous
calcsil.-calcsilicate	lt.-light	sublam.-sublaminated
c.g.-coarse grained	mag.-magnetite	subh.-subhedral
diop.-diopside	mass.-massive	tr.-trace
diss.-disseminated	med.-medium	trem.-tremolite
dist.-distinct	m.g.-medium grained	v.-very
dk.-dark	mod.-moderate(ly)	ves.-vesuvianite
ep.-epidote	p.-pale	wht.-white
euh.-euhedral	perp.-perpendicular (to)	woll.-wollastonite
f.-fine	pheno.-phenocrysts	Xline.-crystalline
feld.-feldspar	plag.-plagioclase	occ.-occasional

DIAMOND DRILL CORE LOG

HOLE [illegible] PAGE 2 OF 2

PROJECT _____ CLAIM GROUP _____
STARTED _____ FINISHED _____ CORE SIZE _____
LOCATION _____ COLLAR ELEVATION _____ TOTAL DEPTH _____
ANGLE _____ AZIMUTH _____

CORE RECOVERY (%)	FOOTAGE (ft.)	MAJOR ROCK UNIT	FOOTAGE (ft.)	VARIATIONS	% Magnetite	% Pyrrhotite	% Pyrite	SAMPLE INTERVAL (ft.)	ppm WO_3	ppm Mo	METERS
	100	DIOPSIDE, GARNET CALCSILICATE (cont.)	100	- calcsil. (cont.)							30
		MARBLE - thinly bedded (to 4"), C.A. 80° - med. to dk. grey, mass., f. mottled with grey and brn. pelitic(?) impurities up to 15%, interbeds of lam. marble	105								
	110		110	Calcsil. - v.f. beds (to 4") c. lam. biotite hfels. interbedded with sil. diop. calcsil. - p. to med. gn. diop, up to 65%, up to 15% wht. sil. blebs and lam., and lt. red brn. ves. irr. patches and sublam., non calc. to weakly calc.							
			115								
	120		120	strongly lam. calcsil.							35
		DIOPSIDE GARNET CALCSILICATE - with marble (up to 2' thick) biotite hfels. (up to 2" thick), sil. diop., and diop. calcsil. with ves. up to 1" thick	121					3	100	10	
	130	- irr. masses and subbands diop. intermeshed with ves. (garnet) irr. sublam., patches, and rounded masses (up to 1/4")	130								
	140	- diop.- p. to med. gn. and v.f. Xline., up to 80%	140	Biotite hfels. banding							40
		- ves.(garnet) - lt. to med. pinkish brn. to brn. aph. mass., 30 to 60%, occ. horizon with dk. red subh. garnet in rounded masses									
	150	- trem.(?) - f. wht. mass. interstitial to diop. and ves., occ. up to 65% in sil. diop. calcsil. - trem./diop. contacts indist., trem. alt. to diop.(?)	150				tr.				45
100	160	Marbles - dk. gn. grey, f. mottled, as 105'	160								
		Diop. Calcsil.- diop. up to 80%, p. to med. mass. and f. Xline.	165	Biotite hfels. banding							
	170	Biotite Hfels. - in beds and lam., 1/4 to 2" thick, interlayered with diop. calcsil. and wht. mass. aph. sil. bands	171								50
		Py - v.f. anh. mass. and diss.									
	180	Scheelite - 122' - tr., f.g. 125' - tr., f.g.	180	fault zone(?)							
	190		190	trem., garnet, minor diop. Biotite hfels.							55
	200		200								

DIAMOND DRILL CORE LOG

HOLE H-81-11 PAGE 1 OF 1

PROJECT _____ CLAIM GROUP _____ CORE SIZE _____
STARTED _____ FINISHED _____ TOTAL DEPTH _____
LOCATION _____ COLLAR ELEVATION _____
ANGLE _____ AZIMUTH _____

CORE RECOVERY (%)	FOOTAGE (ft.)	MAJOR ROCK UNIT	FOOTAGE (m.)	VARIATIONS	% Magnetite	% Pyrrhotite	% Pyrite	SAMPLE INTERVAL (ft.)	ppm WO_3	ppm Mo	METERS
	200	CALCSILICATE (cont.)	200	← grad. increase in biotite hfels. interstitial to diop.			tr.				60
100	210	Biotite Hfels - mass. reddish purple, v.f.g. mass. biotite, non calc. med. gn. to p. blue gn. calcsil. and up to 5%, as irr. and subrounded aph. mass. and fract. in-filling - corresponds to H-81-12/305' - grad. contact	208 210 219								
	220	Sil. Diop. Calcsil. - p. to med. gn. f. Xline. to aph. diop. up to 60%; irr. mottles and indist. lam. wht. aph. and f. Xline. trem.(?) up to 40%; occ. anh. mass. garnet up to 1/2"	220	- f. to med. anh. qtz. feld. and biotite mass. (up to 30%, - weakly chloritized, minor limonitic fract. - contacts irr. dist., C.A. approx. 85° to 90° - Py. - anh. diss., f. mass.			tr.				65
		Granite Dyke						5	<100	<10	
	230	Diop. Skarn - med. to dk. gn. grad. darker, f. Xline. to aph., up to 10% calcite, aph. calcite -occ. horizon mass. ves. up to 15% with anh. dk. red garnet and gn. clinozoisite, occ. black, aph. mineral(?) in-filling f. fract. - thin (up to 6" thick) gn. calcsil. and f. lam. grey marble Scheelite - tr. v.f.; 234' -236', 239', 240' Po. - lam., anh. mass., in 1½" band - tr. in sil. vein in marble	230			to 5		5	<100	<10	
	240		239.5 240.5	← contact grad. marble to diop., ves., garnet skarn to Salivo granite				5	<100	<20	70
		SALIVO GRANITE		← plag. pheno.							
	250	Qtz. - up to 45%, anh., irr. mass., f.g. to m.g. Feld. - up to 30% anh. mass. f.g. to m.g. Biotite - 10-15% f. mass. interstitial to qtz. and feld. K-feld. - pheno. up to 2%, subh. most ¼" up to 3/4", poorly developed indist. occ. sharp grain boundaries, also up to 20% anh. irr. mass. f.g. to m.g. -lacks strongly alt. contact zone typical of previous intersections - pervasive propylitic alt. throughout	250 252 253	← alt. zone, extensive limonite along calc. fract.			tr.				75
	260		260								
	267			END OF H-81-11/267'							
	270	Alt. Zone - occ. strong seric. and/or sauss. lacking biotite and plag. pheno. or those present extremely eroded; grades into fresher granite, qtz. diorite(?) Py - occ. f. anh. mass.	270								80
	280		280								
	290		290								85
	300		300								

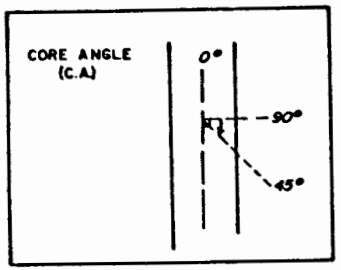
DIAMOND DRILL CORE LOG

HOLE H-81-12 PAGE 1 OF 5

PROJECT CUB CLAIM GROUP IVO CORE SIZE BQ
STARTED JULY 18/81 FINISHED JULY 20/81 TOTAL DEPTH 444'
LOCATION 126+00N/9+00W COLLAR ELEVATION 4720 ft A.S.L.
ANGLE -50° AZIMUTH 270

CORE RECOVERY (%)	FOOTAGE (ft.)	METERS	MAJOR ROCK UNIT	FOOTAGE (ft.)	VARIATIONS	% Magnetite	% Pyrrhotite	% Pyrite	SAMPLE INTERVAL (ft.)	ppm WO_3	ppm Mo
	0		OVERBURDEN	0							
	10			10							
	20			20							
	30			30							
	40			40							
	50			50							
100	60		MARBLE - lt. to med. grey to wht., marblization variable, v. weak to strong - bedding and lam. grade from dist., C.A. 75° to 80° to indist. in lt. grey beds, to absent in more mass. wht. beds	51							
	70		Py. - anh. masses along f., irr. fract.	70							
33			(unit represents low intensity alteration of interbedded pure and impure limestone and/or dolostones)					tr.			
	80			77	weakly calc.						
				80	Sand Seam - unconsolidated, rusty, silty sand, fragments of marble present near lower contact, thickness uncertain due to poor recovery						
				87							
75	90			90	Sand Seam - as above						
100				95	weakly calc.						
	100			100							

CORE ANGLE (C.A)



LIST OF ABBREVIATIONS

alt.-altered/alteration	f.g.-fine grained	Po.-pyrrhotite
amph.-amphibole	fract.-fracture(s)	px.-pyroxene
anh.-anhedral	gn.-green	Py.-pyrite
aph.-aphanitic	grad.-grades/gradational	qtz.-quartz
assoc.-associated	hfels.-hornfels	sauss.-saussuritized
brn.-brown	indist.-indistinct	seric.-sericitized
c.-coarse	irr.-irregular	serp.-serpentine
calc.-calcareous	lam.-laminated	sil.-siliceous
calcsil.-calcsilicate	lt.-light	sublam.-sublaminated
c.g.-coarse grained	mag.-magnetite	subh.-subhedral
diop.-diopside	mass.-massive	tr.-trace
diss.-disseminated	med.-medium	trem.-tremolite
dist.-distinct	m.g.-medium grained	v.-very
dk.-dark	mod.-moderate(ly)	ves.-vesuvianite
ep.-epidote	p.-pale	wht.-white
euh.-euhedral	perp.-perpendicular (to)	woll.-wollastonite
f.-fine	pheno.-phenocrysts	Xline.-crystalline
feld.-feldspar	plag.-plagioclase	occ.-occasional

DIAMOND DRILL CORE LOG

HOLE H-81-12 PAGE 2 OF 5

PROJECT _____ CLAIM GROUP _____ CORE SIZE _____
STARTED _____ FINISHED _____ TOTAL DEPTH _____
LOCATION _____ COLLAR ELEVATION _____
ANGLE _____ AZIMUTH _____

Footage (ft.)	MAJOR ROCK UNIT	Footage (ft.)	VARIATIONS	% Magnetite	% Pyrrhotite	% Pyrite	Sample Interval (ft.)	ppm WO_3	ppm Mo	Meters
100		100								
110	MARBLE (cont.)	110								30
120		120	121 ← extensive limonitic fract.			tr.				
130		130	126							35
140	DIOPSIDE/GARNET CALCSILICATES - interbeds of diop. and diop. with garnet - bedding 1' to 2' thick with contacts grad. to sharp, C.A. 75° to 80° - Diop. Calcsil. - p. gn., aph., mass. diop., 0 to 5% aph. calcite - Sil. Diop. Calcsil - as above, with up to 20% aph. wht., sil. patches and lam. - Diop., Garnet Calcsil. - up to 50% p. to med. gn. aph. diop. in irr. masses intermeshed with up to 40%, lt. to med. pinkish brn. garnet in irr. bands, patches and subrounded masses, occ. up to 15% f.g. subh. wht. to v.p. gn. trem., decussate texture SCHEELITE - 139' to 144' tr. to 0.1%, f.g. diss. - 148.5 to 196 tr., f.g. to c.g. - assoc. with diop. and at diop./garnet contacts Py. - f. anh. mass.	140	141 ← mottled appearance, garnet in subrounded patches and irr. masses				6.5	<100	<10	40
150		150	145				5	<100	<10	
160		160	151 ← Sil. Diop. Calcsil. 153			tr.	5	<100	<10	
170		170	169.5 - grad. contact Diop. Calcsil. - up to 15% calcite - tr. zircon, v. f.g. diss. in 2.5" wide silicified zone Py.- elongated masses, and minor f.g. diss.			tr to 1	5	<100	<10	45
180		180	175 - Marble, poorly bedded, f.g. to m.g., lt. grey to wht. 182 - grad. contact 185				5	<100	<10	50
190		190	Calcsil. - p. gn., mass., aph. with irr. pink and wht. patches - f.g., subh. wht., trem. in wht. patches 192 Marble (Calcsil.?) - med. to dk. grey, mass. up to 15% calcite			tr.	5	<100	<10	
200		200	196 Diop. Calcsil. - v.f.g. Xline., p. gn. to gn. grey, 5% calcite				5	<100	<10	55

DIAMOND DRILL CORE LOG

HOLE E-81-12 PAGE 3 OF 5

PROJECT _____ CLAIM GROUP _____ CORE SIZE _____

STARTED _____ FINISHED _____ TOTAL DEPTH _____

LOCATION _____ COLLAR ELEVATION _____

ANGLE _____ AZIMUTH _____

CORE RECOVERY (%)	FOOTAGE (m.)	MAJOR ROCK UNIT	FOOTAGE (m.)	VARIATIONS	% Magnetite	% Pyrrhotite	% Pyrite	SAMPLE INTERVAL (ft.)	ppm WO_3	ppm Mo	METERS
	200	DIOPSIDE/GARNET CALCSILICATES (cont.)	200								
	210		210		210						60
			212	Calcsil. - med. to dk. grey, f. lam.	tr.						
			216	- mag. in thin irr. mass. along contacts	tr.						
			217	alternating p. gn./pink/wht./grey and brn. grey bedding (1"), weakly calc.							
	220		220		220						65
			221	- mass. pinkish purple, mottled in med. to dk. grey sil. groundmass							
			226								
				molybdenite - one anh. subrounded mass, 1/8"							
	230		230		230						70
	240		240		240						
100	250		250		250						75
			255	Diop. Skarn - med. to dk. gn. grey, finely mottled, anh. diop. and blackish amph. (?), weak skarn							
	260		260	- minor lam. dk. gn. px., low calcite content	260						
			261	- mass. diop. calcsil. bands near lower contact							
				- bedding thickness varies 6" to 2', contacts dist. and irr.							
				- garnet and diop. occur alternating c. irr. discontinuous lam.; minor biotite hfels. lam. (see 305')							
				- minor beds dk. to med. grey calcsil. marble							
	270		270		270						80
	280		280		280						
	290		290		290		tr.				85
	300		300								

DIAMOND DRILL CORE LOG

HOLE H-81-12 PAGE 4 OF 5

PROJECT _____ CLAIM GROUP _____ CORE SIZE _____
STARTED _____ FINISHED _____ TOTAL DEPTH _____
LOCATION _____ COLLAR ELEVATION _____
ANGLE _____ AZIMUTH _____

CORE RECOVERY (%)	FOOTAGE (ft)	MAJOR ROCK UNIT	FOOTAGE (ft)	VARIATIONS	% Magnetite	% Pyrrhotite	% Pyrite	SAMPLE INTERVAL (ft.)	ppm WO_3	ppm Mo	METERS
	300	DIOPSIDE/GARNET CALCSILICATES (cont.)	300								
		BIOTITE HORNFELS - mass, reddish purple, v.f.g. biotite, non calc., gn to v.p. blue gn., irr. and subrounded aph. mass., lam. and fract. in-filling, with wht. sil. rims and inclusions, similar to H-81-11/210 Py. and Po. - anh. masses within calcsil. blebs and fract.	305								
	310		310			tr.	tr.				90
			315								
	320	INTERBEDDED DIOPSIDE, GARNET CALCSILICATE, SILICEOUS DIOPSIDE CALCSILICATE, DIOPSIDE CALCSILICATE AND BIOTITE HORNFELS - beds 2" to 1.5', contacts sharp to grad. - biotite hfels. f. to c. lam. with diop. calcsil. Sil. Diop. Calcsil. - - wht. to v. p. gn. subh. f.g. trem. decussate texture occurs in wht. masses - aph. wht. masses = aph. trem.(?) - diop. forming from wht. masses or vice versa(?)	320				to 2			95
	330		330								
	340		340								
		Py. - anh. mass. in biotite hfels.									
100	350		350								100
	360		360								105
	370		370								
	380	- grad. contact	380	diop. calcsil.							110
		SALIVO GRANITE	381	QUARTZ DIORITE (381' to 382') - m.g. to c.g.; weakly to mod. seric. feld, 25 to 35%, sub. pheno. up to ¼", 1 to 2% - qtz. - med. to c. anh. masses and rounded qtz. eyes, 15 to 25% - biotite - f.g. to m.g. anh. and subh. masses, 0 to 15%							
			382	K-feld. pheno.							
	390		390								115
			395	Biotite Granite Dyke - v.f.g. Salivo granite(?), with up to 10% biotite, - C.A. of contacts 45°							
	400		396								
			400								

DIAMOND DRILL CORE LOG

PROJECT _____ CLAIM GROUP _____ CORE SIZE _____
STARTED _____ FINISHED _____ TOTAL DEPTH _____
LOCATION _____ COLLAR ELEVATION _____
ANGLE _____ AZIMUTH _____

CORE RECOVERY (%)	FOOTAGE (ft.)	MAJOR ROCK UNIT	FOOTAGE (ft.)	VARIATIONS	% Magnetite	% Pyrrhotite	% Pyrite	SAMPLE INTERVAL (ft.)	ppm WO_3	ppm Mo	METERS
100	400	SALIVO GRANITE (cont.) - qtz. up to 45%, anh. grey subrounded to round qtz. eyes up to 1/8" - feld. up to 35% - grades from mod. seric. med. gn. anh. grains and minor platey masses, with irr. indist. grain boundaries to dist. anh. grains up to 1/8" - K-feld. - up to 5%, pheno. up to ¼" - grades from indist. weakly sauss. masses to c. anh. and subh. grains to dist. - some pheno. with indist. zoning - biotite - anh. and subh. f.g. to m.g. and in masses up to 20% - occ. calc. limonitic, f. - pervasive propylitic throughout fresh granite	400	- occ. zones up to 1.5 of mod. seric. diorite grading indist. in fresher granite - numerous calc. limonitic fract.							
	410		410								120
	420		420								125
	430		430								
	440		440	END OF H-81-12/444'							130
	450		450								
	460		460								135
	470		470								
	480		480								140
	490		490								
	500		500								

APPENDIX TWO

Vancouver Petrographics Ltd.

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Report for: Cub Joint Venture,
attn. Sandy Main,
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1016 - 510 West Hastings,
VANCOUVER , B.C., V6B 1L8

Invoice 2888

Samples: 11 drill core specimens

Four polished thin sections and one polished block were made in order to attempt to answer the questions in your letter. You requested only one polished thin section.

The samples are summarized below:

81-5-163 : garnet-diopside skarn with pyrrhotite, minor chalcopyrite

81-5-164 : diopsidic marble, with patches of magnetite-hematite and veins of calcite-serpentine-chlorite?-magnetite-pyrite

81-5-178 : garnet-diopside skarn, interstitial hornblende, calcite, quartz

81-5-214 : zoned skarn vein in marble; core of pyrite-(magnetite-chalcopyrite-calcite), rimmed by tremolite, grading outward to tremolite-calcite-pyrite-chalcopyrite-magnetite, grading outward to calcite-olivine(partly altered to serpentine)-tremolite-pyrite-chalcopyrite-magnetite. In the report the amphibole is described by the name actinolite; the sample is probably of the magnesium-rich end member, tremolite.

81-5-320 : diopside skarn with veins of garnet and of calcite-gypsum?

81-5-252 : diopside-magnetite skarn with veins of garnet and of tremolite

81-6-264 : epidote-garnet skarn after diorite

81-6-267 : altered diorite; plagioclase slightly altered to epidote patches, metasomatic diopside added, biotite is altered to chlorite-(actinolite-epidote), patches of secondary epidote?, veins of calcite-epidote

81-9-350 : altered diorite; rock strongly replaced to the assemblage muscovite-quartz-calcite-pyrite with minor chalcopyrite and arsenopyrite

141

81-9-~~441~~ : slightly altered diorite; plagioclase slightly altered to calcite and to epidote, hornblende completely replaced by quartz-actinolite or quartz-chlorite ± calcite in both assemblages, minor secondary biotite with pyrite and diopside with altered hornblende.

81-12-435 : quartz diorite, variable alteration from one side to the other of the section; 1) fresh biotite, plagioclase slightly altered to sericite, 2) biotite replaced by chlorite, plagioclase moderately altered to sericite, 3) biotite replaced by muscovite-Ti oxide, plagioclase strongly altered to sericite and patches of calcite.

Almost all of the questions posed in your letter were answered in the study. A few minerals were not positively identified because of fineness of grain size or lack of sufficient grains in the section. No vesuvianite was seen in any of the samples.

John Payne
October 1981

81-5-163 Garnet-Diopside Skarn (Po-[Cpy-Mt])

The rock is a patchy skarn dominated by garnet, with patches up to a few mm across of clinopyroxene (diopside), and minor interstitial actinolite and calcite. Sulfides and magnetite occur in interstitial patches and fractures, the latter mainly in garnet.

garnet	55-60%	
pyroxene	20-25	
pyrrhotite	17-20	(slightly altered to pyrite 1-1½% of rock)
actinolite	2- 2½	
calcite	1- 1½	
chalcopyrite	½-1	
magnetite	½-1	

Garnet forms medium to very coarse grained aggregates with minor inclusions of diopside and actinolite. Locally it is irregularly intergrown with calcite. Elsewhere it forms minor to moderately abundant irregular patches up to 0.2 mm across in diopside patches.

Diopside occurs in patches up to several mm across. It varies widely in texture from some extremely fine to fine grained irregular aggregates, to medium grained aggregates with interlocking grain borders.

Actinolite occurs in interstitial patches as grains averaging 0.05-0.2 mm in size. Color varies from colorless to green, with the green variety showing pleochroism from very pale or light green to light green or medium green respectively. A few clusters consist of fibrous aggregates of grains averaging 0.2-0.3 mm long. In places it is associated with calcite.

Calcite forms irregular interstitial patches in garnet and diopside with the largest being 1 mm across.

The sulfides and magnetite occur together, and generally show the same textural relations to the silicates. They all occur in very irregular interstitial patches and fractures. Pyrrhotite is by far the most abundant; it is strongly anisotropic and strongly magnetic. Patches are up to a few mm across, and generally larger patches do not contain inclusions or intergrowths of other minerals. Pyrrhotite is altered locally to pyrite. The latter forms grains averaging 0.05-0.2 mm in size generally intergrown with extremely fine grained non-reflective secondary mineral(s). One large interstitial patch up to 2 mm across is completely altered to dusty pyrite.

Chalcopyrite occurs in irregular, fine grained intergrowths with pyrrhotite, especially in elongate and irregular vein-like zones, and also occurs alone in patches in diopside and actinolite. In the latter, some grains are up to 0.3 mm in size and relatively equant, but most of the chalcopyrite occurs in very fine grained clusters of grains intergrown with the silicates.

Magnetite occurs in grains averaging 0.05-0.3 mm in size. It does not generally occur in the narrower veins, but does form irregular, commonly elongated aggregates on the borders of sulfide patches. Much of the magnetite contains abundant extremely fine grained pyrrhotite as disseminated equant grains.

81-5-164 Diopsidic Marble, patches of Magnetite-Hematite, veins of Calcite-Serpentine-Chlorite?-Magnetite-Pyrite

The rock is variable in texture with finer and coarser grained patches. It is cut by a vein dominated by calcite and serpentine, with lesser chlorite and disseminated magnetite. A second similar vein contains pyrite.

calcite	70-75%
diopside	15-20
hematite	3- 4
serpentine	2- 3
magnetite	minor (in section, more in rock)
pyrrhotite	minor
pyrite	trace

veins
calcite-serpentine-chlorite-(magnetite-pyrite)

Calcite forms an aggregate of equant grains, ranging in size in patches from finer grained patches averaging 0.05-0.2 mm in grain size to coarser grained patches averaging 1 mm in grain size. Most of the rock is of the finer grained variety.

Diopside occurs in two modes, as irregularly disseminated very fine, rounded grains averaging 0.02-0.07 mm in size, and as scattered coarser grains up to 1 mm across. The latter commonly have very irregular outlines against calcite, and commonly occur in coarser grained patches of calcite.

Hematite and magnetite form in patches in the rock up to 2 cm in size. The oxides occur as disseminated flakes and aggregates of equant grains averaging 0.03-0.2 mm in size, with a few flakes up to a few mm long. Most of the mineral in the section is hematite, with moderate to strong anisotropism. The magnetic properties of the rock indicate that much of the opaque at the end of the sample (not in the section) is magnetite. Pyrrhotite occurs as a replacement of some hematite flakes; it forms extremely fine to very fine grains along grain borders & in irregular patches in hematite.

Serpentine forms a few patches up to a few mm across, associated with late veins. The mineral has a light yellow to greenish yellow color in hand sample. It forms extremely fine to very fine grained aggregates of irregular flakes. The mineral is very soft and has low relief and very low birefringence. Larger flakes show lenght-slow character, whereas smaller flakes appear to be length-fast.

Pyrite forms scattered grains up to 0.02 mm in grain size with hematite and pyrrhotite. Pyrrhotite forms scattered grains from 0.02 to 0.1 mm in size in calcite and diopside aggregates.

The main vein consists of an aggregate of extremely fine grained calcite, commonly in patches, fine grained serpentine, commonly in subparallel orientation perpendicular to vein walls, and patches of chlorite?, also oriented perpendicular to vein walls. The chlorite is colorless aith moderate birefringence (0.010+), and is distinguished mainly by its length-fast character from micas and talc. Chlorite patches are up to 0.15 mm long. The vein averages 1 mm in width. Magnetite forms disseminated extremely fine to very fine grains in parts of the vein.

The minor vein consists mainly of extremely fine grained calcite oriented in subparallel, fibrous-like zones at a moderate angle to vein walls. Minor chlorite? occurs in patches up to 0.2 mm in size on one border. The vein contains a patch of elongated pyrite grains up to 2 mm in length, and oriented parallel to vein walls.

81-5-178 Diopside-Garnet Skarn

The rock is a coarse grained skarn composed mainly of garnet with patches up to a few mm across of diopside. Interstitial hornblende and calcite are locally abundant. Minor pyrite and magnetite occur in interstitial zones and fractures.

garnet	70-75%
diopside	17-20
hornblende	0.5
actinolite	3- 4
calcite	1- 1½
quartz	½- 1
magnetite	minor
pyrite	trace

Garnet forms mainly as a coarse grained aggregate of grains whose boundaries cannot be distinguished from fractures. Locally garnet appears to be brecciated into a very fine grained aggregate with minor pyroxene? or actinolite along fractures in the breccia. It commonly contains irregular to equant inclusions of diopside ranging widely in grain size up to 2 mm.

Diopside occurs with garnet as described above, and in diopside-rich patches up to a few mm across. These consist mainly of medium to coarse anhedral grains, a few up to 2 mm in size. Diopside is commonly altered along grain borders and in irregular patches extending into grains to fibrous actinolite. The latter forms grains averaging 0.1-0.2 mm in length. On the border of one large interstitial calcite patch, diopside is strongly altered to actinolite, with the latter forming a complete or almost complete replacement of diopside grains adjacent to the calcite. Here actinolite grains are up to 0.5 mm long.

Hornblende forms scattered interstitial grains from 0.3-0.7 mm in size. The color ranges widely, from light yellow green to medium bluish green in some grains, to medium to dark brownish bluish green in others. The darker the color, generally the stronger the pleochroism Most hornblende grains occur interstitial to garnet.

Calcite forms one large patch up to 5 mm across, consisting of a single grain, probably one of the last minerals to be precipitated, and probably forming in a cavity in the garnet-diopside host. Along the border diopside is strongly altered to actinolite as described above. Calcite also forms scattered much finer grained interstitial patches, mainly in garnet, and averaging 0.05-0.2 mm in size.

Quartz forms irregular to elongate interstitial patches in garnet averaging 0.05-0.1 mm in size, with the largest up to 0.5 mm across.

Magnetite occurs as scattered interstitial grains and aggregates averaging 0.03-0.07 mm in size, and may be the opaque which occurs along some veinlets in garnet. This mineral also may be pyrrhotite.

Pyrite was recognized as one cubic grain 0.4 mm to the side, which occurs in an interstitial patche of actinolite, formed by replacement of diopside.

No vesuvianite was seen; the garnet is completely opaque in crossed nicols.

81-5-214 Skarn Vein in Limestone

The rock is zoned as in the sketch, with many borders gradational.

Zone 1 Marble

This zone is the host rock which has been recrystallized into a marble with mosaic texture and grains averaging 0.2-0.4 mm in size.

Zone 2 Calcite-Olivine(Serpentine)-Actinolite-Sulfide-Oxide

This zone is dominated by calcite, with patches of olivine and of sulfide-oxide. Actinolite commonly occurs intergrown intimately with calcite.

Calcite forms a mosaic of grains similar to those in zone 1.

Olivine occurs in grains and clusters of grains averaging 0.5-1 mm in size. In some patches olivine is nearly fresh, with only slight alteration on fractures and grain borders to serpentine. In others alteration is more intense, with scattered convexly shaped olivine remnants surrounded by a massive aggregate of very fine grained serpentine. Still others consist entirely of serpentine. Magnetite and sulfides occur in patches up to 1.5 mm in size. These commonly are intimately intergrown with silicates and calcite. Some patches consist entirely of magnetite. Others contain cores of pyrite with thin, irregular rims of magnetite. Some consist of chalcopyrite, generally rimmed by magnetite. Actinolite generally forms fibrous aggregates up to 0.5 mm long, generally intimately intergrown with calcite. In places, clusters of actinolite aggregates form a matted texture.

Zone 2a same as 2 but more sulfide-oxide, gradational to zone 3

This is a veinlike zone which occurs only on one side of the main vein. It contains more abundant magnetite and sulfide-magnetite patches than zone 2. Also actinolite is more abundant as prismatic grains up to 1 mm long, irregularly intergrown with calcite. Serpentine forms patches up to 1 mm in size, with locally minor relic olivine cores.

Zone 3 Actinolite-Calcite-Sulfides

This zone is dominated by actinolite as prismatic grains averaging 0.3-0.7 mm in length, and with a slightly preferred orientation perpendicular to vein walls. These are intergrown with calcite as grains averaging 0.2-0.3 mm in size. Sulfides with minor magnetite occur in patches as in zone 2. Where magnetite is present it rims sulfides, but many sulfide patches are intergrown with actinolite without any magnetite rims on the sulfides. Commonly chalcopyrite and pyrite occur in separate patches, with pyrite much more abundant than chalcopyrite.

Zone 3a Actinolite

This narrow irregular zone is composed almost entirely of irregular to slightly oriented aggregates of actinolite prismatic grains as in zone 3, with only minor sulfides and calcite.

Zone 4 Pyrite-(Chalcopyrite-Calcite-Magnetite-Pyrrhotite)

This zone is dominated by medium to coarse grained pyrite, with

(continued)

with thin rims of magnetite, and scattered to moderately abundant inclusions of chalcopyrite and lesser ones of pyrrhotite. The interstitial material is mainly very fine to fine grained calcite. Commonly magnetite forms rims along the sides of the vein with coarse pyrite in the core of the vein; the magnetite rims contain moderately abundant irregular inclusions of chalcopyrite and much fewer ones of pyrite.

81-5-320 Diopside Skarn with veins of Garnet and of Calcite-Gypsum?

The rock is a medium to coarse grained diopside skarn cut by earlier veins dominated by garnet, and later veinlets of calcite-gypsum with patches of opaque (sulfide or magnetite).

diopside	93-95
garnet	2- 3
calcite	2- 3
gypsum	0.2
opaque	0.2
epidote	minor
quartz	trace
sphene	minor
serpentine	trace

Diopside forms an anhedral aggregate of equant grains averaging 0.5-1 mm in size, with a few over 1.5 mm across. Scattered through the rock are a few subhedral to euhedral grains 0.2-0.4 mm long of sphene. One patch 0.2 mm across consists of extremely fine grained serpentine.

Garnet forms one major vein up to 1 mm wide. It contains minor interstitial calcite and lesser quartz. Garnet also forms a few irregula patches up to 2 mm across in the rock near the garnet vein; these probably are of replacement origin, and formed at the same time as the garnet vein. One patch in the vein contains extremely fine grained epidote with scattered grains of garnet up to 0.2 mm in size; this patch is 1.5 mm across and occurs in the widest part of the vein.

The rock is fractured moderately. A few of these fractures contain minor garnet as irregular grains, in part formed by replacement of diopside.

Another set of fractures are filled by veinlets up to 0.1 mm wide of calcite and lesser gypsum? Calcite forms grains averaging 0.05-0.15 mm in size. Gypsum forms elongated grains with the following properties: very low relief, birefringence 0.010, one perfect cleavage (not develope in all grains), parallel extinction, length-slow. Opaque occurs in some parts of the calcite-rich veins, and is locally concentrated at vein intersections. Opaque grains are up to 0.5 mm long and 0.05 mm wide.

81-5-252 Diopside-Magnetite Skarn with veins of Garnet and of Tremolite

The rock has a variable texture, with extremely fine grained to very fine grained patches grading sharply into coarser grained patches. Magnetite is concentrated in the coarser grained patches. Some of these have the appearance of veins. Later veinlets which cut the rock consist of garnet and of tremolite.

diopside	90-92%
magnetite	7- 8
garnet	2- 2½
tremolite	minor
pyrite	trace

Diopside occurs in extremely fine to very fine grained patches of equant grains in a mosaic texture. These grade sharply into coarser grained patches with a variety of textures. Generally coarser patches consist of prismatic to equant grains averaging 0.1-0.4 mm in grain size. Locally grains are up to 1 mm long. Some patches show subradiating aggregates of grains up to 0.5 mm long.

Magnetite occurs as patches of grains averaging 0.2-0.5 mm in size, with a few over 1 mm across. Magnetite generally is intimately intergrown along the borders of patches with diopside. Minor pyrite grains averaging 0.02-0.03 mm in size occur in a few magnetite patches. No other opaque mineral was seen.

Garnet forms a few wispy veinlets averaging 0.02 mm in width. It also occurs in interstitial patches in some very fine grained diopside, and as coarser interstitial grains locally in coarser diopside patches. The patches and veinlets probably have the same origin.

Tremolite occurs as wispy veinlets up to 0.05 mm wide and up to 0.5 mm long. A few appear to be associated with garnet veinlets, but they probably represent a later stage of hydrothermal activity.

Near one end of the section is an unusual veinlike zone composed of extremely to very fine grained diopside with a subparallel orientatic of trains of grains perpendicular to the vein walls. This zone has a sharp contact with veinlike zones of medium grained diopside-magnetite.

The overall distribution of magnetite appears to be following an original foliation in the sedimentary rock; however, other interpretations of this texture are possible.

81-6-264 Epidote-Garnet Skarn

The rock is an irregular medium to fine grained epidote-rich skarn with coarser garnet grains and patches, and interstitial quartz and actinolite. The parent probably was a diorite similar to sample 81-6-267. Patches of very soft minerals in the hand sample were not preserved in thin section. These were examined as powders in mineral oils.

epidote	65-70%	(pink mineral)
garnet	20-25	
quartz	3- 5	
actinolite	0.5	
apatite	trace	
opaque	0.2	
soft patches	2- 3	

Epidote forms patches which may in part represent outlines of original plagioclase grains. Epidote commonly forms columnar aggregates of grains from 0.2-0.5 mm in length. Some of these are slightly curved or radiating. Interstitial cavities up to 0.2 mm in size are present in some patches, and against these epidote grains are euhedral. Epidote also occurs as irregular extremely fine to very fine grained patches. The interference color is bright blue to white or yellow.

Garnet forms a few coarse grains up to 3 mm across, and finer grained aggregates. Some coarse grains have well developed concentric zones of anomalous extinction, showing a pseudohexagonal twin pattern. Many finer grained patches appear to be interstitial to epidote, suggesting again that epidote is after plagioclase and garnet after interstitial mafic grains (in part).

Quartz occurs mainly with epidote as interstitial patches up to a few mm across, with grains averaging 0.5 mm in size. Contacts with epidote are very irregular. Actinolite occurs in ragged columnar grains and aggregates associated with quartz and epidote in interstitial patches. The mineral is pale to medium green in color. Grains average 0.2-0.3 mm in length.

Apatite forms scattered subhedral to euhedral prismatic grains up to 0.3 mm long and 0.15 mm across.

Opaque (hematite after pyrite) occurs as scattered grains and clusters of grains averaging 0.05-0.2 mm in size, with one cubic grain 0.4 mm across. The grains are mainly opaque with scattered patches of dark brown to reddish brown hematite along the borders.

The minerals in the soft patches in the hand sample were scraped onto a glass plate and examined in oils of R.I. 1.55 and 1.57. The only grains which could be identified were those of quartz and actinolite. The remaining material had very high relief and moderate birefringence, and might be epidote. No clay minerals were seen.

81-6-267 Altered Diorite

The rock is a medium to coarse grained diorite which has been altered with the addition of diopside, minor epidote, and veins of calcite-epidote.

plagioclase	80-85%		
diopside	15-17		
biotite	minor		
hornblende	trace		
apatite	trace		
sphene	trace		
zircon	trace		
calcite	trace	epidote?	0.3%

veinlets
calcite-epidote±quartz

Plagioclase forms equant anhedral grains averaging 1 to 2 mm in size. They show slight signs of cataclastic deformation, with crushed, bent, and slightly rotated grains and fragments. A few grains show compositional zoning from more-calcic cores to more-sodic rims, indicating original fractionation in the magma. Some grains are slightly to moderately altered to dusty epidote, either as disseminated grains or dense patches. Interstitial to coarser plagioclase are irregular patches of very fine grained plagioclase, possibly representing the final crystallization product of the original magma.

Diopside forms patches of anhedral grains from 0.3-0.7 mm in size, with a few over 1 mm across. The mineral has a distinctive pale apple green color. Distribution of grains and their texture indicate that diopside is a metasomatic mineral, formed by replacement of plagioclase and/or mafic minerals (see below).

Biotite forms two equant books from 0.5-0.7 mm in size. They are completely replaced by pseudomorphic chlorite, with a pale to light green color and a light to bright blue interference color. Actinolite and epidote? form minor patches up to 0.15 mm in size in the chlorite grains. The grains are surrounded by an extremely fine to very fine grained aggregate of diopside.

Hornblende (or actinolite) forms scattered grains up to 0.3 mm across. The mineral is pale to medium brownish green in color. It may be a primary mineral in the igneous rock. One unusual interstitial patch up to 1.2 mm across and a few much smaller patches averaging 0.1 mm in size consist of a light green mineral with very low birefringence The mineral has the texture of an interstitial hornblende grain, but the interference color suggests chlorite or possibly epidote. One other interstitial patch has a pale green color and high relief; it is a single grain 1.5 mm long with an irregular outline against plagioclase. The birefringence is about 0.015-0.020. The mineral has one moderately developed cleavage with an inclined extinction of about 15°. It is not positively identified; the optical properties are fairly similar to those of epidote.

Apatite forms scattered subhedral prismatic grains up to 0.5 mm long. Sphene forms a few elongate subhedral grains averaging 0.3 mm in length. Zircon forms a few elongate euhedral prismatic grains up to 0.3 mm long. Calcite forms scattered interstitial patches averaging 0.03 mm in size, with a few up to 0.2 mm across.

The rock is cut by a few veinlets up to 0.2 mm wide of fine graine calcite and epidote, with minor quartz in some calcite veinlets.

81-9-441 Slightly Altered Diorite + Pyrite

The rock is a medium to coarse grained diorite which has been slightly to moderately altered, with some brecciation and introduction of pyrite, especially along breccia fractures. Mafic minerals are variably altered to quartz-actinolite or quartz-chlorite, with or without calcite and opaque. Minor secondary biotite is present.

plagioclase	60-65%	
hornblende	25-30	
quartz	2- 3	
sphene	0.3	
apatite	minor	
epidote	1- 1½	
calcite	0.3	
biotite	0.3	
diopside	minor	
opaque	5- 7	(magnetite and pyrite) (no polished section)

Plagioclase forms grains averaging 1-2 mm in size in anhedral aggregates with lesser hornblende. Grains generally are relatively fresh, with scattered alteration patches of calcite and of epidote. In much of the rock are irregular veinlike breccia zones containing plagioclase averaging 0.2-0.5 mm in size, with opaque common as zones averaging 0.02-0.03 mm wide along breccia fractures.

Hornblende forms equant to prismatic grains up to 2 mm long. These are completely replaced by secondary assemblages with a variety of textures. Most common are aggregates of medium grained quartz and pseudomorphic, ragged actinolite. Also abundant are aggregates of quartz and fine grained flakes of chlorite. Calcite occurs in minor to moderately abundant amounts in some altered grains of both types. Opaque occurs in a few altered grains as patches up to 0.5 mm in size.

Quartz forms interstitial grains averaging 0.2-0.3 mm in size.

Sphene occurs mainly with hornblende as subhedral grains and clusters of grains averaging 0.05-0.25 mm in length.

Apatite forms scattered subhedral prismatic grains averaging 0.07-0.1 mm in length.

Epidote forms patches up to 0.7 mm in size, either with plagioclase or with mafic clusters. Calcite is commonly in very irregular patches associated with plagioclase or epidote. Secondary biotite forms extremely fine grained, light to medium brown patches averaging 0.1-0.5 mm in size associated with opaque (pyrite). Diopside occurs in a fine grained patch 0.7 mm across on the border of a mafic cluster.

Opaque occurs in a few patches up to a few mm across and in the groundmass of breccia veins. Magnetite occurs throughout the rock and pyrite is concentrated in patches.

81-9-350 Altered Diorite (Muscovite-Quartz-Calcite-Pyrite-Cpy)

The rock is a coarse grained diorite which was strongly replaced and the original texture destroyed in the zones of replacement.

plagioclase	15-17%
muscovite	30-35
quartz	12-15
calcite	15-20
pyrite	20-25
Ti-oxide	1½-2
apatite	0.2
chalcopyrite	minor
zircon	trace
arsenopyrite	0.2

Plagioclase forms equant grains from 1 to 2 mm in average size. Some have very irregular borders against quartz, with the texture suggesting that quartz is replacing plagioclase. Generally plagioclase grains appear fresh, with scattered patches of very fine to fine graine muscovite.

Muscovite occurs in two main modes, as subradiating aggregates of flakes averaging 0.5-1 mm in size, and as extremely fine grained aggregates of flakes in random orientation. Gradations between the two types exist. Commonly associated with muscovite are patches of Ti-oxide. Thes commonly are elongate or aggregates of elongate prismatic grains up to 0.7 mm in length.

Quartz forms medium to very coarse grains intergrown with muscovite, calcite, and plagioclase, and locally with pyrite. Replacement textures occur along plagioclase grains as described above.

Calcite forms anhedral to elongate subhedral grains up to 1.5 mm in size. It commonly is concentrated in patches, and associated with muscovite and to a lesser extent with quartz. It is common in interstitial zones in the pyrite patch.

Pyrite occurs mainly in a large patch composed of medium to coarse grains, some with euhedral outlines against muscovite, calcite, and quartz. Most grains do not contain any inclusions. One pyrite grain 0.7 mm across away from the main patch contains a few inclusions up to 0.15 mm in size of chalcopyrite, and one grain in the patch contains an inclusion 0.2 mm across of an aggregate of fine grained Ti-oxide. Pyrite forms scattered grains away from the main patch averaging 0.5-1 mm in size; some of these show euhedral cubic outlines.

Apatite forms subhedral to euhedral stubby prismatic grains from 0.2-0.5 mm long.

Chalcopyrite occurs with pyrite as described above, and is more common as grains up to 0.2 mm across associated with quartz or calcite. Minor chalcopyrite is intergrown with muscovite.

Zircon forms a few euhedral to subhedral grains from 0.03 to 0.2 mm in size.

Arsenopyrite forms a few grains from 0.3-0.8 mm in size away from the main pyrite cluster. The mineral is paler in color than pyrite and has a weak anisotropism. Grains are anhedral and equant to slightly elongated.

The stable alteration assemblage is muscovite-quartz-calcite-pyrite.

81-12-435 Quartz Diorite with variable alteration

The rock is a medium to coarse grained quartz diorite with a variable grain size with a few coarse phenocrysts and some patches of fine grained groundmass. Alteration ranges from fresh at one side to intense at the other, with details described below.

plagioclase	40-45%	
quartz	20-25	
K-feldspar	15-17	
biotite	15-17	
opaque	½- 1	(some magnetite)
apatite	trace	
sphene	trace	
zircon	trace	
hornblende	trace	calcite 3- 4%

Plagioclase forms subhedral to euhedral grains from 0.5 to 1.5 mm in size. A few grains show compositional zoning from more-calcic cores to more-sodic rims. In the freshest part of the rock, plagioclase is fresh to slightly altered to very fine grained sericite. As alteration intensityincreases, plagioclase becomes increasingly strongly altered to very fine grained sericite with scattered patches of calcite.

Quartz forms interstitial grains and patches averaging 0.3-0.5 mm in grain size, with a few coarser patches with grains up to 1.5 mm in size. Quartz is interstitial to plagioclase.

K-feldspar occurs in the groundmass as irregular interstitial grains from 0.2-0.5 mm in size. It also forms a few megacrysts up to 10 mm in size in the most strongly altered part of the rock. These contain irregular inclusions of plagioclase. Probably K-feldspar was formed during alteration in the most intensely altered zone, whereas interstitial K-feldspar probably is of primary origin. Thus, the present composition of the rock is granodiorite, whereas the original would have less that 10% K-feldspar, and would be classified as a quartz diorite. Some K-feldspar grains contain inclusions of calcite.

Biotite forms equant books averaging 0.5-1.5 mm in size. Fresh biotite is pleochroic from light to dark brown. Here and there it contains subhedral to euhedral prismatic zircon grains up to 0.1 mm long; some of these inclusions are surroudned by a dark color halo in biotite. In moderately altered parts of the rock, biotite is strongly altered to completely altered to pseudomorphic chlorite with scattered Ti-oxide patches. Chlorite is pleochroic from pale to light green, with interference color from blue to purple. In more strongly altered parts of the rock (the end with the K-feldspar megacrysts), biotite is completely replaced by pseudomorphic muscovite and very abundant extremely fine grained Ti-oxide. Calcite occurs in some altered biotite in both intensities of alteration.

Opaque forms a few anhedral grains from 1 to 1.5 mm in size, and scattered finer grains averaging 0.05-0.2 mm across. The rock is slightly magnetic, suggesting that some of these are magnetite. Magnetite is altered in the chloritic and muscovitic alteration zones.

Apatite forms scattered subhedral to euhedral prismatic grains from 0.05-0.1 mm in size. Sphene forms a few wedge-shaped euhedral grains up to 0.3 mm in size; some are associated with opaque patches. Zircon forms a few prismatic grains as described above. Hornblende forms one euhedral prismatic grain 1.5 mm long. It is completely altered to extremely fine grained Ti-oxide, fine grained opaque, and unidentified silicates. Calcite occurs in veinlets and patches throughout the rock, but mainly in the alteration zones. Patches are up to 0.5 mm across (in K-feldspar megacrysts), and veins average 0.03-0.05 mm wide.

Specimen : 81-1-1 (57')

Classification : Diopside-tremolite skarn

Mineralogy :		
	Diopside/hedenbergite	60%
	Tremolite/actinolite	25%
	Calcite	10%
	Quartz	5%

Texture : Decussate, course grained, with idioblastic crystal faces of pyroxene and amphibole against calcite and quartz.

Diopside/hedenbergite forms large (up to 7 mms. long) prismatic, subidioblastic crystals oriented in random fashion, as well as more uniformly dimensioned granoblastic aggregates. Twinned varieties are present. Most of the diopside is fractured and contains minor small patches of secondary calcite. These resemble alteration textures. Diopside has also been altered, and locally considerably so, to fibrous uralite. This form of tremolite/actinolite is intimately associated with fine, irregular masses of calcite. Locally some beautifully developped slender prismatic crystals grow on idioblastic diopside, into quartz and calcite, sometimes taking on the same twinning habit as that of the crystals on which they grow. Some crystals of diopside are rimmed by 'flame-like' tremolite. (tremolite and diopside are best distinguished, in this thin section, by their differences in extinction angle and refractive indeces)
Calcite is intimately associated with fibrous tremolite/actinolite, occurs as a patchwork replacement in diopside/hedenbergite and forms larger xenoblastic grains in association with late stage quartz.

Specimen : 81-1-2 (76')

Classification : Diopside-tremolite skarn

Mineralogy :		
	Diopside/hedenbergite	70-75%
	Tremolite/actinolite	15%
	Calcite	10%
	Plagioclase	1%
	Opaques	<1%

Texture : Decussate, medium grained.

Diopside/hedenbergite occurs as subidioblastic crystals which are locally slightly fractured and are in many instances altered to uralite (tremolite/actinolite). Some of the crystals are distinctly twinned.
Tremolite/actinolite, derived from diopside as described above, is fibrous and often skeletal in appearance, having been replaced by calcite at a fairly late stage in the formation of this rock. Some of the tremolite present may however be of primary origin.(metamorphic)
Calcite forms fairly large (up to 4 mm.) xenoblastic grains interstitial to diopside and tremolite. The latter often have idioblastic boundaries against calcite. In a few cases calcite is poikiloblastic, enclosing cleavage fragments of clinopyroxene and in a few cases it is in optical continuity across aggregate diopside/hedenbergite.
Plagioclase, composition An-64 (labradorite) as determined on a single grain, occurs as a few .7 mm. sized xenoblaszic grains.
Opaques are scattered as small grains throughout the rock. Local patches of limonitic in, principally along fractures, give the handspecimen a somewhat reddish-brown appearance.

Specimen : 81-1-3 (136')

Classification : Diopside-tremolite skarn

Mineralogy :		
	Diopside/hedenbergite	70%
	Tremolite/actinolite	15-20%
	Calcite	10%
	Sphene	<1%
	Opaques	1%

Texture : Decussate, medium-course grained.

Diopside forms xenoblastic and subidioblastic prismatic grains of up to 6 mms. in length. These essentially form a coursegrained aggregate with minor amounts of interstitial material (mostly calcite). The diopside is fractured and shows evidence of alteration to tremolite/actinolite and replacement by calcite. Several twinned grains are present. The bottom of the section is composed of finer grained aggregate granular diopside, separated from the courser grained material by a narrow (2 mm.) seam of fine grained, felted tremolite/actinolite(?).
Tremolite/actinolite, secondary after diopside, forms skeletal, fibrous grains which are often largely replaced by calcite. It shows very faint green pleochroism. Some diopside grains are surrounded by tremolite/actinolite rims where they are in contact with calcite.
Calcite occurs interstitial to diopside and replaces both diopside and tremolite. It also forms a few small veinlets which cut across the rock, probably along fractures.
Sphene is present as a few single grains (up to .8 mms.) and small aggregates. It is mostly idioblastic, showing typical rhombic cross-sections. It is clearly recognizable due to it's extremely high relief. One aggregate is associated with a .5 mm. sized aggregate of granular opaque material.
Opaques : a few small xenoblastic grains and aggregates are scattered through the ock. The larger ones (up to 2 mms. in size) show some evidence of having formed interstitial to diopside, which is here largely replaced by tremolite/actinolite. One of the opaque grains is surrounded by cloudy, pseudo-colloform, nondescript material.

Specimen : 81-1-4 (153')

Classification : Garnet-diopside skarn

Mineralogy :		
	Garnet	60%
	Diopside/hedenbergite	25%
	Calcite	10%
	Actinolite(?)	3-4%
	Quartz	1%
	Opaques	trace

Texture : Irregular

Garnet forms large (cms.), ill defined aggregates enclosing pockets of diopside and calcite. These aggregates are fractured and veined by calcite and show irregular, patchy alteration textures. Some of the garnets may enclose diopside and calcite poikilitically, but most of the enclosed minerals appear to be of secondary origin. Locally a faint zonation is visible under non-polarized light.
Diopside occurs as granular aggregates(composed of grains up to .7 mms. in size) etween and enclosed by course grained aggregate garnet which has idioblastic crystal faces against diopside. In a finer grained variety is associated with minor calvite and forms irregular, granular aggregates. A few single grains are marginally altered to a dark green/bluish-green amphibole.
Calcite occurs in irregular patches replacing garnet and as xenoblastic grains associated with diopside. Some of it is fairly coursegrained and is associated

81-1-4 (153') continued

with quartz as a late stage mineral.
Amphibole, probably actinolitic in composition (small ext. angle) forms small, fibrous, sometimes radiating aggregates and small xenoblastic to subidioblastic grains. They are distinctly dark green/bluish-green pleochroic and locally show evidence of being associated with diopside, possibly as a secondary alteration product.
Quartz forms a few clear, xenoblastic grains within garnet.
Opaques occur as a few small (up to .2 mms.) grains surrounded by limonite stains.

Specimen 81-1-5 (210')

Classification : Garnet-epidote skarn

Mineralogy :		
	Garnet	65-70%
	Calcite	15%
	Epidote/clinozoisite	10%
	Quartz	5%
	Amphibole	1-2%
	Chlorite	<1%
	Opaques	<1%

Texture : Irregular

Garnet : large, red coloured xenoblastic crystals form ill defined aggregates on the handspecimen scale. Some of these show well developped crystal faces but mostly they are rather irregular in shape. Localized areas within the garnet are anomalously birefringent. In these areas a fine zonation is visible. This garnet probably belongs in the grossularite/andradite series. Much of the garnet encloses small patches of calcite and epidote/clinozoisite as well as abit of granular quartz. These patches resemble alteration textures. The garnet aggregates are cut by fractures which do not penetrate into neighbouring minerals. These are sometimes healed by epidote and calcite. It appears that the garnet has reacted with calcite and quartz at a late stage in the development of this rock. A few small, often radiating chlorite aggregates are present as well. These are undoubtedly of secondary nature.
Epidote/clinozoisite : a few subidioblastic grains (up to 2 mms. in size) are associated with garnet. These probably formed synchronous to or slightly after the garnet. They are cracked and have been affected to some extent by later calcite and quartz. Most ot the epidote in this rock, however, replaces skeletal and fibrous amphibole and is associated with late stage calcite and quartz.
Amphibole : actinolite/tremolite(?) is present as fibrous, skeletal remnants between garnet aggregates. It is locally faint green pleochroic. Most of this material has been replaced by epidote, quartz and calcita and in many instances only a fibrous structure indicates this mineral was once present. It may itself have been a secondary mineral (after diopside?)
Calcite occurs as patches within garnet and replacing amphibole in association with epidote. It is also present as large xenoblstic to subidioblastic grains associated with quartz.
Quartz forms a few small (1mm.) grains with well developped crystal faces. These are associated with calcite between garnet aggregates. It is also present in a few granular aggregates in and around garnet.
Chlorite occurs within garnet associated with epidote/clinozoisite, in patches. Some aggregates of radiating spherulitic chlorite are present as well.
Opaques are present as a few subidioblastic grains associated with course grained calcite and quartz. These are probably pyrite, and are surrounded by narrow limonite rims.

Ivo 1

Ivo 2

Ivo 3

Ivo 4

Ivo 5

IVO

NORTHWEST TERRITORIES

YUKON TERRITORY

127°00W

61°00N

27°00'

5310±

3500

5000

4000

FIGURE 2
ARCHER, CATHRO & ASSOCIATES (1981) LTD.
LOCATION MAP
IVO 1-212;225-294 (YUKON)
IVO 1-5 (NWT)

DRILLING STATISTICS

(ALL HOLES ARE BQ)

Hole	Azimuth	Dip	Depth (ft)	Depth (m)	Coordinates	
81-1	325°	-50	325	99.1	11+00S(grid A)	10+40E(grid A)
81-2	–	Vert.	136	41.5	11+00S(grid A)	10+40E(grid A)
81-3	270°	-50	195	59.4	8+00S(grid A)	9+00E(grid A)
81-4	270°	-50	280	85.3	8+05S(grid A)	8+70E(grid A)
81-5	–	Vert.	390	118.9	8+05S(grid A)	8+70E(grid A)
81-6	270°	-50	342	104.2	112+50N	9+00W
81-7	270°	-50	325	99.1	116+00N	9+00W
81-8	325°	-50	462	140.8	14+00S(grid A)	11+25E(grid A)
81-9	325°	-50	425	129.5	102+00N	14+00W
81-10	360°	-50	417	127.1	100+50N	17+50W
81-11	270°	-50	267	81.4	130+00N	9+00W
81-12	270°	-50	444	135.3	126+00N	9+00W
	Total		4008	1221.6		

LEGEND

- 81-7 ● 1981 DRILL HOLE
- 1981 DRILL SECTION
- BONNIWELL'S PROPOSED HOLES (1980)

Figure 3

ARCHER, CATHRO & ASSOCIATES (1981) LTD.

LOCATION MAP

DRILL HOLES AND SECTIONS

IVO CLAIM GROUP

CUB JOINT VENTURE

SCALE – 1:20,000

200 100 0 100 200 300 400 500 600 Metres

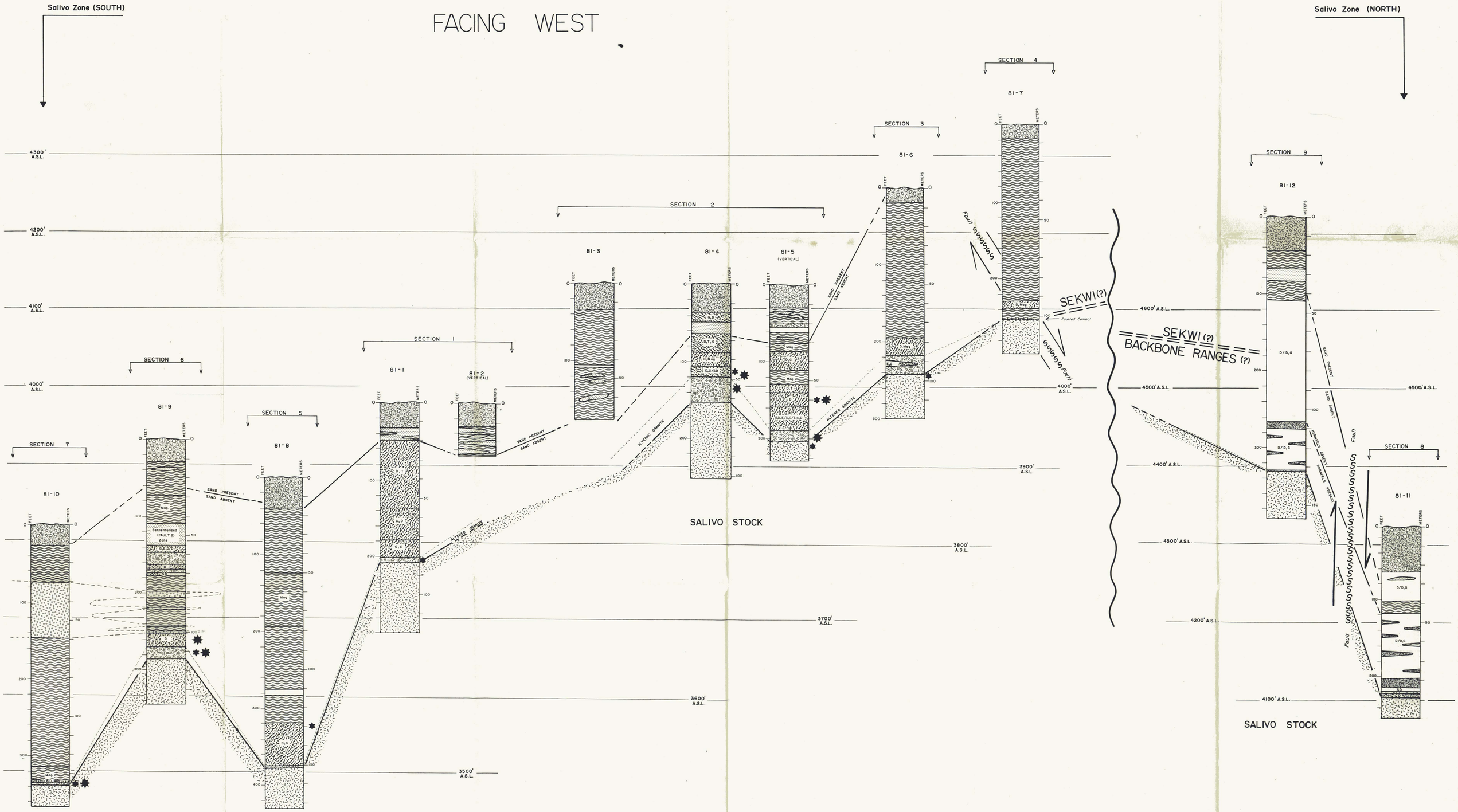
200 100 0 100 200 400 600 Yards

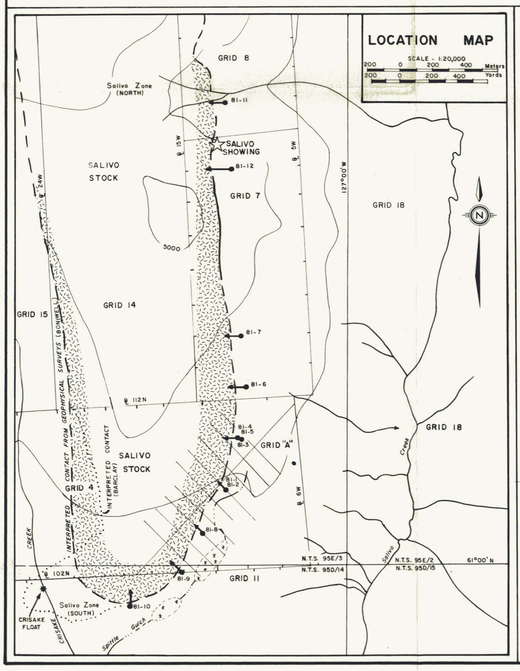
091027

To accompany report dated March/82

Association of Professional Engineers of the Yukon Territory
R. J. CATHRO
GEOLOGICAL
ENGINEER

FACING WEST





TERTIARY

INTRUSIONS

Salivo Granite

-biotite, K-feldspar granite porphyry
-medium to coarse grained, leucocratic with pervasive propylitic alteration that is confined to fine fractures at depth
-contains subhedral & euhedral K-feldspar 2 to 5%, up to 2", in a groundmass of rounded quartz masses & quartz-eyes 30 to 40%, anhedral feldspar 25 to 30%, fine to medium, subhedral & anhedral biotite masses 15 to 20%
-contains occasional zones of quartz diorite composition up to 1.5' wide, in gradational contact with granite; plagioclase 40 to 45% some with calcic to sodic zonations, slightly to moderately sericitized; quartz 20 to 25%, K-feldspar up to 15% & variably chloritized biotite up to 15%

Altered (Dioritic) Salivo Granite

-weakly to strongly altered medium to coarse grained melanocratic to leucocratic, includes extremely leached dykes high in drill intersections & dioritic zones near the intrusive contact: plagioclase 60 to 65% & hornblende 25 to30%
-very occasional anhedral to subhedral, coarse plagioclase phenocrysts

Weakly metasomatized: indistinct, fine to very fine grained plagioclase up to 60%, fine, anhedral quartz masses up to 25%, pyrite 15 to 25%, pyrrhotite up to 5% & up to 20% aphanitic, medium to dark green diopside &/or sericite

Strongly metasomatized ("Greissen"): coarse grained plagioclase up to 25%, interstitial, fine, platey, massive muscovite 25 to 35%, anhedral calcite masses up to 15%, anhedral quartz up to 15%, fine to very coarse grained anhedral to euhedral pyrite 15 to 25%, up to 8,700 PPM WO_3

Epidote, Garnet Skarn

-retains altered zone "intrusive" appearance, represents extreme alteration of intrusive (?)
-pale pink to rose (manganese?) epidote 60 to 70%, replacing plagioclase, fine to coarse grained, aphanitic, dark brown garnet masses up to 25%, fine interstitial accessory quartz, garnet &/or epidote

Biotite Porphyry Dykes

-medium to dark green, very fine biotite phenocrysts up to 5% & anhedral feldspar phenocrysts 2 to 3% in a massive, aphanitic, medium to dark green groundmass

LOWER CAMBRIAN

SEKWI FORMATION (?)

WEAKLY METAMORPHOSED

Marble

-variably marblized, interbedded, white to medium grey, finely crystalline, pure & impure limestones &/or dolostones with occasional interbeds of sandstone, quartzite, unconsolidated sand seams &/or strongly leached zones:

Magnetite Marble

-grey, variably marblized, finely crystalline limestones &/or dolostones with greater than 5% magnetite as disseminated grains with hematite &/or as massive laminations

MODERATELY METAMORPHOSED (&/OR METASOMATIZED)

Calcsilicate

-moderately to strongly bedded, pale green to yellow, aphanitic, massive, composition uncertain

STRONGLY METASOMATIZED

Diopside Skarn

-medium to dark green, fine to medium crystalline diopside with minor light to dark red/brown, aphanitic garnet masses & irregular patches &/or massive, aphanitic, white, irregular siliceous patches or laminations

Siliceous Diopside Skarn

-as above with aphanitic & finely crystalline white, siliceous (tremolite ?) masses 20 to 30%

Magnetite Diopside Skarn

-pale yellow to creamy yellow, aphanitic diopside interstial to massive, irregularly laminated magnetite up to 20%, having a fine woodgrain appearance

Diopside Tremolite Skarn

-pale green to white, finely to coarsely crystalline, vuggy
-diopside 50 to 75%, tremolite up to 30%, occasionally with red/brown garnet up to 25% as irregular masses & fine mottles

Diopside Garnet Skarn

-finely crystalline, irregular masses & sublaminations of medium to dark green diopside up to 75% intermeshed with light brown to red, massive garnet 20 to 60% as irregular patches &/or laminations & subrounded mottles, occasional dark red massive garnet, accessory, aphanitic & minor subhedral calcite masses & anhedral quartz

Garnet Epidote Skarn

-medium to dark red, massive garnet up to 85%, occasionally with subhedral outlines & internal zonations, pistachio & medium apple green (clinozosite), aphanitic, massive epidote up to 10%

Garnet Epidote Diopside Skarn

-as above with medium green, aphanitic diopside masses

Epidote Garnet Diopside Skarn

-very strongly mottled
-white to very light pinkish, anhedral epidote 25 to 40% with dark red/brown, anhedral garnet 15 to 30% with medium green massive, irregular aphanitic diopside up to 15%, accessory, anhedral quartz & calcite masses

BACKBONE RANGES FORMATION (?)

WEAKLY METAMORPHOSED

Marble

-see Sekwi Marble (above)

Biotite Hornfels

-maroon, very finely crystalline, massive biotite with minor pale green to light bluish, subrounded calcsilicate masses with pyrite & pyrrhotite inclusions & as fine fracture in-fillings

MODERATELY METAMORPHOSED

Diopside Garnet Calcsilicate

-moderately to strongly bedded; light to dark red/brown, subrounded & irregular, aphanitic garnet masses up to 20% &/or pale to medium green, aphanitic, massive diopside up to 90%, accessory aphanitic calcite

Siliceous Diopside Calcsilicate

-pale to medium green, finely crystalline to aphanitic, massive diopside up to 60% with irregular mottles & fine laminations of aphanitic & finely crystalline tremolite

KEY

- Overburden
- Sand seam
- Minor unit occurring within more extensive unit
- D Diopside
- G Garnet
- E Epidote
- T Tremolite
- DG -indicates composition of skarn or calcsilicate
- D,G -components are intermingled
- D/G -components are in separate alternating beds
- Geologic contact: projected, assumed, inferred
- Dyke contact, Limit of alteration
- Fault with direction of relative movement
- 500 to 1000 ppm WO_3
- +1000 ppm WO_3

Association of Professional Engineers, Geologists & Geophysicists of Alberta — J. CATHRO — GEOLOGICAL ENGINEER

Figure 4

ARCHER, CATHRO & ASSOCIATES (1981) LTD.

LONGITUDINAL SECTION
(SALIVO ZONE)
IVO PROPERTY

CUB JOINT VENTURE

Vertical Scale: 0 10 20 30 40 50 METERS
Horizontal Scale: (Schematic) 0 20 40 60 80 100 110 FEET

091027

To accompany report dated March/82