# ASSESSMENT REPORT ON THE
# DOC GROUP

**SKEENA MINING DIVISION**
**British Columbia**



**Property Location:**
Latitude 56° 20' North
Longitude 130° 25' West
NTS 104 B/8 West

**Report prepared by:**

Arthur C. Freeze
Keith J. Glover
Brian M. Scott

March, 1989

# ARIS SUMMARY SHEET

District Geologist, Smithers  Off Confidential: 90.02.03

ASSESSMENT REPORT 18622  MINING DIVISION: Skeena

PROPERTY: Doc
LOCATION: LAT 56 20 00 LONG 130 25 00
UTM 09 6243867 412407
NTS 104B08W

CAMP: 050 Stewart Camp

CLAIM(S): Doc 4
OPERATOR(S): Echo Bay Mines
AUTHOR(S): Freeze, A.;Glover, K.J.;Scott, B.M.
REPORT YEAR: 1989, 475 Pages
COMMODITIES
SEARCHED FOR: Gold
KEYWORDS: Triassic,Jurassic,Stuhini Group,Unuk River Formation,Andesite,Tuff
Quartz Veins,Gold,Pyrite,Galena,Chalcopyrite,Sphalerite
Specularite
WORK
DONE: Drilling,Physical,Geological,Geochemical
DIAD 3071.4 m 32 hole(s);BQ ,NQ
Map(s) - 18; Scale(s) - 1:250
GEOL 10.0 ha
Map(s) - 3; Scale(s) - 1:500,1:250
SAMP 1501 sample(s) ;AU,ME
Map(s) - 3; Scale(s) - 1:250
UNDV 231.4 m
RELATED
REPORTS: 05239,05512,08925,15615,16708
MINFILE: 104B 014,104B 015

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## 1. SUMMARY

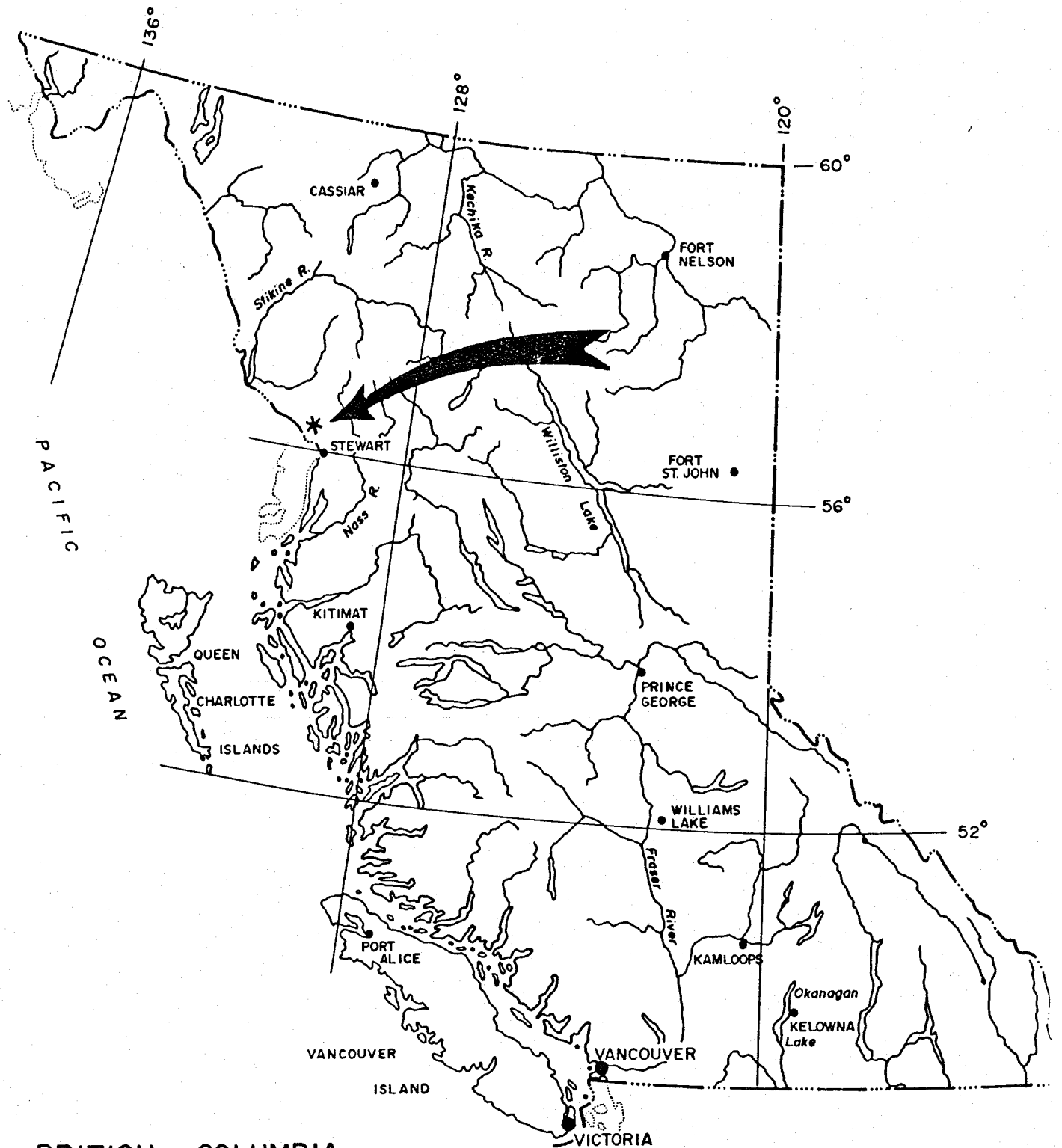
The Doc Property is located in mountainous terrain, 50 kilometres northwest of Stewart, British Columbia. It lies along the western margin of the Intermontane belt, close to the eastern limit of the Coast Plutonic Complex (Figure 1).

Sulphide bearing quartz veins were originally discovered during the 1890's on the western edge of the present property and were the focus of sporadic exploration, until the mid 1980's. These veins have long been recognized for their potential to host mesothermal style gold deposits. They are hosted by volcanic, volcaniclastic and sedimentary rocks of late Triassic to early Jurassic age.

Surface mapping, sampling and drilling, as well as underground development, sampling and drilling were completed during 1986 and 1987 on the Q17 and Q22 veins by joint venture partners, Magna Ventures Ltd. (Magna Ventures) and Silver Princess Resources Inc. (Silver Princess). An ore reserve was calculated based on the results of these work programs. Uncut and undiluted reserves in all categories totalled 207,000 tons grading 0.27 ounces per ton gold and 1.31 ounces per ton silver.

During the autumn of 1988, Echo Bay Mines Ltd. (Echo Bay) entered into a joint venture agreement with Magna and Silver Princess to proceed with further development and reserve definition on the Q17 vein and nearby Q22 vein. This program was completed between October 7th and December 10th, 1988.

Results of this latest phase of testing outline a total Mineral Inventory of 100,851 tons grading 0.258 ounces per ton for Q17 and Q22 veins.




BRITISH COLUMBIA

Scale 1 : 7,500,000 approx.

FIGURE 1

**ECHO BAY MINES LTD**
Suite 354-200 Granville Street, Vancouver, B.C. V6C 1S

DOC PROPERTY

# GENERAL LOCATION MAP

SKEENA M.D., B.C. SOUTH UNUK RIVER

| | | |
|---|---|---|
| Geology by: | Date: | N.T.S.: |
| Drawn by: | Scale: | No.: |

## 2. INTRODUCTION

This report presents the results of the 1988 program, which was financed and managed by Echo Bay Mines on behalf of joint venture partners Magna Ventures and Silver Princess.

Echo Bay's involvement with the project commenced late in the field season. It was not possible to evaluate other attractive vein targets on the property beyond those specifically outlined in the joint venture proposal.

During the 1988 program helicopter-supported surface drilling utilizing one NQ drill and one BQ drill, tested the Q17 and Q22 veins and intersected previously undiscovered veins between the Q22 and Q28 veins. Total meterage drilled was 3,074.1 metres.

A limited surface survey tied key 1988 drill holes to underground survey coordinates. Of the 32 holes drilled, 14 holes intersected sub ore to ore grade gold values over narrow widths. The remaining holes either returned low grade gold values, missed the structure or were abandoned due to bad ground conditions.

Underground development totalling 230 metres on the 1,160 metre level, was completed by Tonto Mining Ltd. along the strike of the Q17 vein west and east from the limit of the former workings. This work required heavy rock bolting and strapping. Development was extended to the limit of vein mineralization.

Along Q17 West Drift, this development exposed a 30 metre strike length of sulphide-rich ore grade mineralization which occurs over a mineable width varying between 1.2 and 2.0 metres.

A crosscut was driven from the eastern limit of the Q17 vein to the projected extension of the Q22 vein. This development reached the Q22 vein, but difficult ground conditions terminated further advance.

All underground workings were mapped in detail. Mapping, designed to assist the search for ore, was specifically oriented towards defining host rocks, phases of alteration, variations in mineralization, as well as attempting to unravel the complex structural history of the rocks surrounding these gold-bearing quartz veins.

Detailed underground sampling of the Q17 vein was accomplished by a systematic collection of muck and face samples, 24 hours per day, on a round by round basis.

While drifting on the vein a 300 pound sample of potential ore bearing material was collected from each drift round. All samples were placed in 45 gallon drums. This material, remains on site in anticipation of a future metallurgical test.

All underground workings were washed and mapped upon completion of the underground development. Back samples were collected at 2 metre intervals along the Q17 West and East drifts to the limits of the vein. Unsafe areas were avoided.

During this phase of exploration a new 40 person camp was erected, slightly downhill and to the northeast of the 1,160 metre portal. All materials and personnel were mobilized to the property by helicopter.

The program for 1989 will include surface mapping of the Q17 and Q22 zones but will emphasize mapping, prospecting and geochemistry of the entire Doc Property.

The objectives are to gain a better understanding of ore controls and deposit types and identify centres of new mineralization requiring drill testing.

## 3. PROPERTY LOCATION AND ACCESS

The Doc Property is located in rugged mountainous terrain 920 kilometres northwest of Vancouver at Latitude 56°20' North and Longitude 130° 25' West. The nearest supply base is Stewart, located 50 kilometres to the southeast. During the mobilization material was also supplied through Tide Lake strip (Granduc) and Bell II (Figure 1).

The property is only accessible by helicopter.

## 4. LOCAL INFRASTRUCTURE

The property straddles the Unuk River and covers an area of approximately 16 kilometres from east to west and thirteen kilometres from north to south. The claims lie generally to the southeast of Gracey Creek and to the northwest of Mount Frank Mackie. The main area of known vein mineralization lies towards the western edge of the claims in relatively accessible terrain at or slightly above treeline (1,180 metres) (Figure 2).

A series of northwest-trending glaciers covers roughly 15 percent of the property. Timber suitable for mine purposes is located on steep hillsides flanking the Unuk River.

The area is notorious for above-average snowfall which limits the effective exploration field season to a few months.

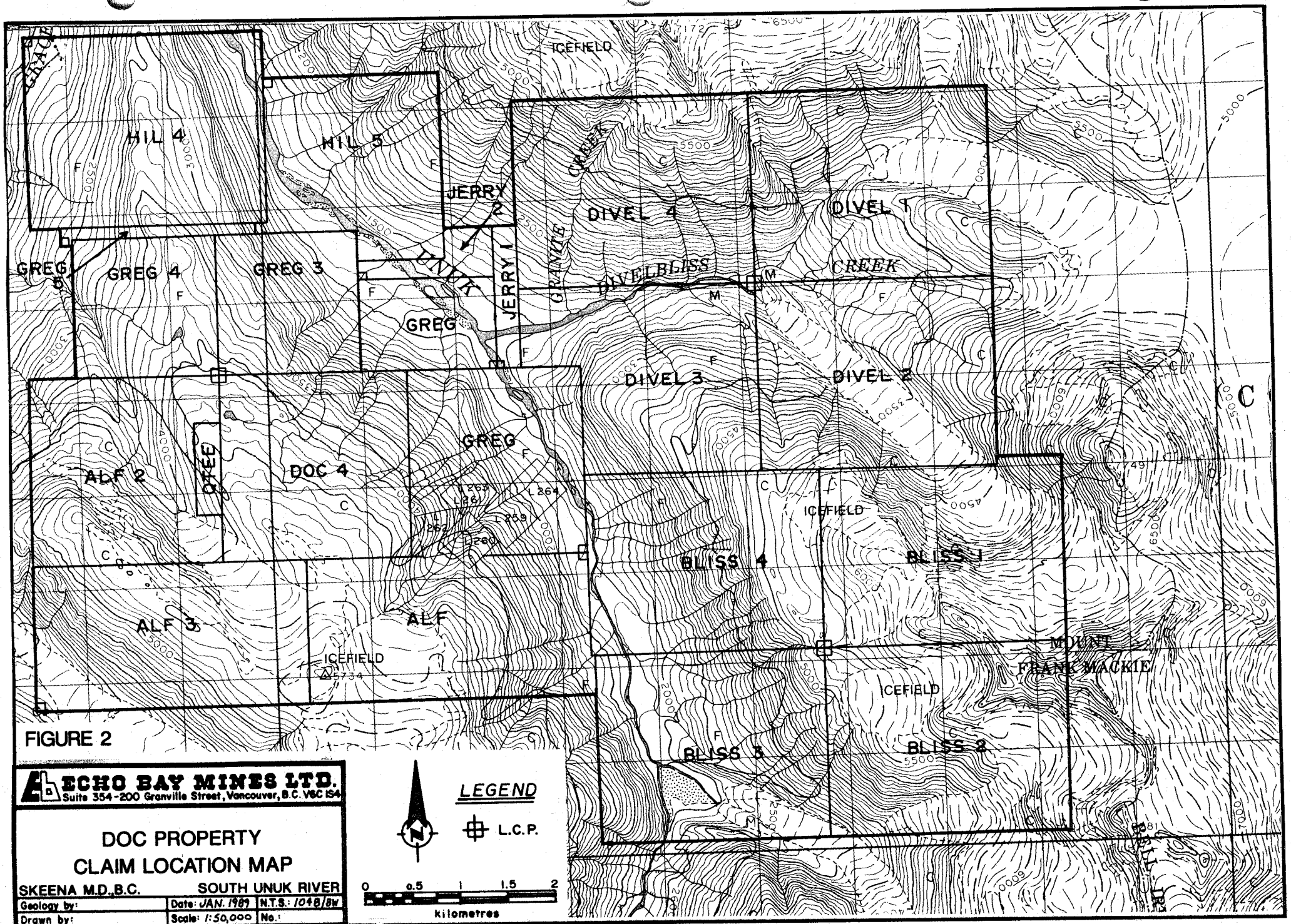



FIGURE 2

**ECHO BAY MINES LTD.**
Suite 354-200 Granville Street, Vancouver, B.C. V6C 1S4

# DOC PROPERTY
# CLAIM LOCATION MAP

SKEENA M.D., B.C. — SOUTH UNUK RIVER

| | | |
|---|---|---|
| Geology by: | Date: JAN. 1989 | N.T.S.: 104B/8W |
| Drawn by: | Scale: 1:50,000 | No.: |

LEGEND

L.C.P.

0 0.5 1 1.5 2
kilometres

## 5. CLAIM STATUS

The Doc Property is located in the Skeena Mining Division and comprises 22 modified grid claims and 6 Crown Grants totalling 322 units and 7,600 hectares (see Figure 2).

During February of 1989, two claim groups were created from a portion of the total claim package to spread work credits from work completed in 1988 on Doc 4 and Alf 2 claims.

Claims Bliss 1, Bliss 2, Divel 2, Hil 4 and Hil 5 require a cash in lieu payment to maintain them in good standing through 1989. The six Crown Grants require a cash payment due December 31st annually.

The claim status and due dates effective February 4th, 1989 are as follows:

| Claim Name | Record No. | No. Units | Expiry Date |
|---|---|---|---|
| Doc 4 | 2139 | 16 | Mar. 4, 1995 |
| Q Tee | 4899 | 2 | Aug. 7, 1995 |
| Greg | 4900 | 16 | Aug. 7, 1995 |
| Greg 2 | 4954 | 6 | Sep. 27, 1995 |
| Greg 3 | 4955 | 9 | Sep. 27, 1995 |
| Greg 4 | 4956 | 9 | Sep. 27, 1995 |
| Alf | 5367 | 18 | May 15, 1993 |
| Alf 2 | 5396 | 16 | June 3, 1994 |
| Alf 3 | 6205 | 18 | May 15, 1994 |
| Hil 4 | 6203 | 20 | June 3, 1989 |
| Hil 5 | 6204 | 16 | June 3, 1989 |
| Divel 1 | 5797 | 20 | Feb. 4, 1995 |
| Divel 2 | 5798 | 20 | Feb. 4, 1990 |
| Divel 3 | 5799 | 20 | Feb. 4, 1995 |
| Divel 4 | 5800 | 20 | Feb. 4, 1995 |

| Claim Name | Record No. | No. Units | Expiry Date |
|---|---|---|---|
| Bliss 1 | 5801 | 20 | Feb. 4, 1990 |
| Bliss 2 | 5802 | 20 | Feb. 4, 1990 |
| Bliss 3 | 5803 | 20 | Feb. 4, 1994 |
| Bliss 4 | 5804 | 20 | Feb. 4, 1994 |
| Greg 5 | 6413 | 4 | Oct. 7, 1991 |
| Jerry 1 | 6476 | 3 | Oct. 23,1989 |
| Jerry 2 | 6477 | 3 | Oct. 23,1989 |

| Crown Grant | Lot No. | Hectares | Expiry Date |
|---|---|---|---|
| Globe | 259 | 20.9 | Dec. 31, 1989 |
| Dartmouth | 260 | 20.43 | " |
| Vancouver | 261 | 3.58 | " |
| Victoria | 262 | 14.73 | " |
| Cyclone | 263 | 16.16 | " |
| Blizzard | 264 | 20.8 | " |

## 6. PROPERTY HISTORY

Mineralization on the present property was originally discovered during the 1890's by prospectors exploring the Unuk River valley via Alaska. Veins on the Globe Crown Grants were developed by trenching and the driving of four short adits. At this location, a small stamp mill was erected and some high grade ore was stockpiled but no shipments were ever made.

During the 1940's Halport Mines Ltd. carried out extensive trenching and completed 1,913 metres of drilling mainly on the Q17 and Q22 veins. At that time all heavy supplies were parachuted to the property by fixed wing aircraft.

During the 1970's, trenching, magnetic and VLF EM surveys were focused on the Q17 and Q22 veins.

During the early 1980's Dupont carried out geological mapping and soil sampling on the property.

In 1985 Silver Princess optioned the key claims from Tom McQuillan, a prospector, and completed blasting, resampling and mapping in the vicinity of the Q17 and Q22 veins.

In 1986 Magna optioned the claims from Silver Princess, added additional contiguous claims to the property and drilled 1,065 metres in 13 holes on the Q17 and Q22 veins. They also completed 33.5 metres of access tunnel, the start of a crosscut to the Q17 vein.

During 1987, Magna completed 377 metres of underground development that exposed the Q17 vein with 3 crosscuts. Eight underground holes totalling 695 metres were drilled in order to test those portions of the Q17 and Q22 veins that are less accessible from surface.

The 1986 and 1987 work by Magna Ventures also involved comprehensive programs of surface mapping, trenching, geochemical sampling and prospecting for new vein occurrences. This work led to the discovery of four new veins.

During 1988, Echo Bay financed and managed the program on behalf of Magna Ventures and Silver Princess. A new 40 person camp was constructed. Two drills completed 3,074.1 metres of drilling to test the Q17, Q22 and Q28 veins. Two hundred and thirty (230) metres of underground development was completed to the west and east of the main adit. This

development included drifting along the Q17 vein and a crosscut to access the Q22 vein.

Some surface prospecting was also carried out during the 1988 program by Magna Ventures prior to Echo Bay's involvement.

## 7. AREA POTENTIAL

The Doc Property lies at the geographic centre of British Columbia's fastest evolving gold mining camp. The Snip and Skyline ore deposits lie 50 kilometres to the northwest; Calpine lies 30 kilometres to the north; Newhawk and Western Canadian Mining deposits lie 20 kilometres to the northeast and Silbak Premier and Big Missouri ore deposits lie 40 kilometres to the south of the property (Figure 3). Known statistics on each deposit are as follows.

| Deposit | Reserves | Grade |
|---|---|---|
| Snip | 1,600,000 tons | 0.7 oz/ton Au |
| Skyline | 1,100,000 tons | 0.7 oz/ton Au, 0.9 oz/ton Ag |
| Calpine | 5.0 million tons | Est. 0.20 oz/ton Au |
| Newhawk | 1,400,000 tons | 0.50 oz/ton Au, 20.17 oz/ton Ag |
| Western Cdn. Mining | 66,000,000 tons | 0.86% Cu,.01 oz/ton Au |
| Silbak Premier | 7,000,000 tons | 0.063 oz/ton Au, 2.59 oz/ton Ag |
| Big Missouri | 1,700,000 tons | 0.09 oz/ton Au, 0.67 oz/ton Ag |

## 8. GEOLOGY

### 8.1 Regional Geologic Setting

The Doc Property is located along the western margin of the Intermontane Belt, close to the eastern limit of the

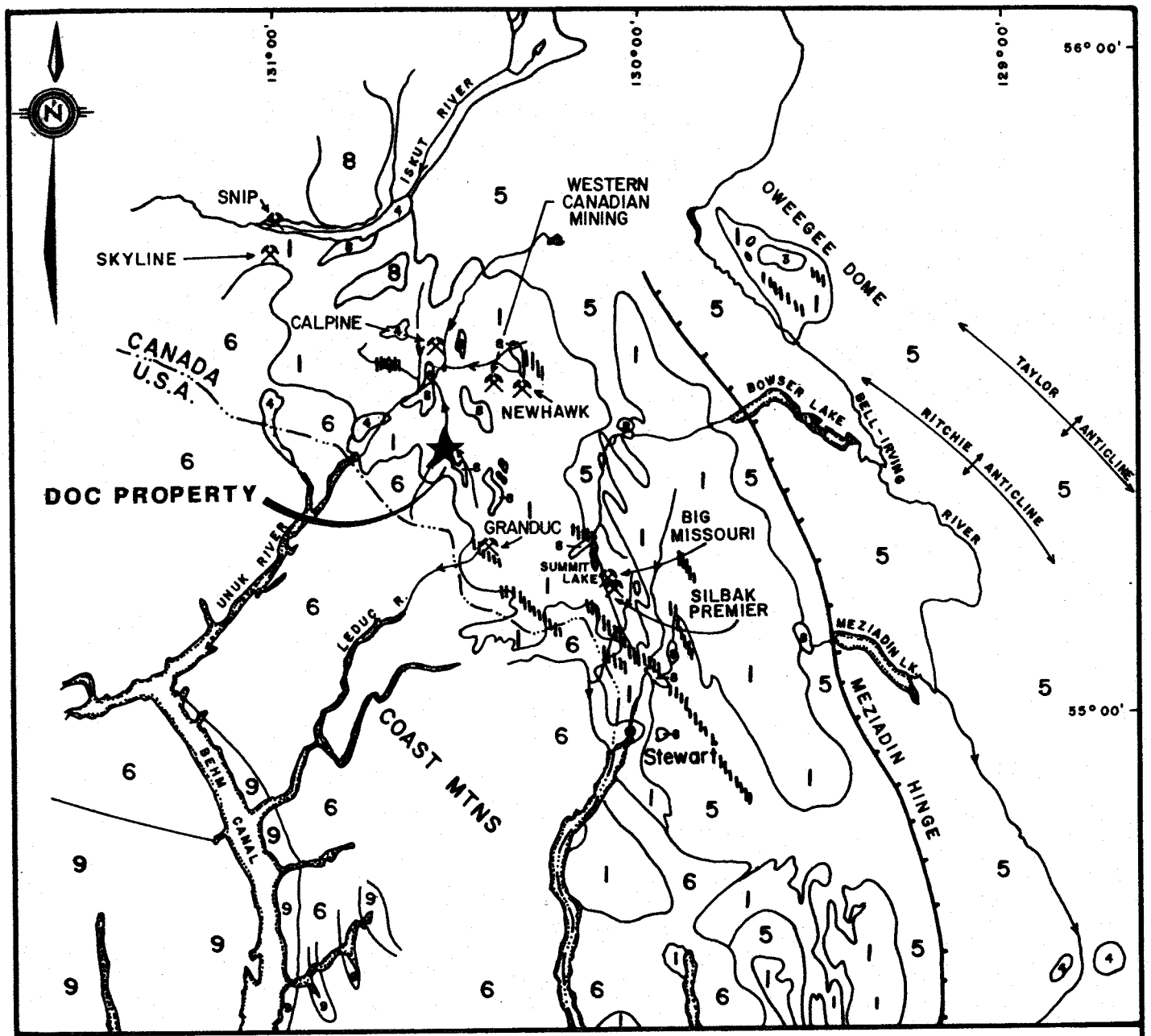
Coast Plutonic Complex (Figure 4). The stratified volcanic, volcaniclastic and sedimentary rocks that underlie most of the property are tentatively assigned to the Upper Triassic to Lower Jurassic (Norian to Toarcian) Unuk River Formation, in the lower part of the Hazelton Group (Britton et al 1989). These rocks form part of a north-northwesterly trending belt of late Paleozoic to Mesozoic strata that extends from Stewart in the south to the Iskut River in the north (See Figure 3).

They were deposited in an island arc setting along the western flank of Stikine terrane, and are bounded to the east by the Bowser Basin, comprising an onlap assemblage of Middle to Upper Jurassic sedimentary rocks.

For the most part, Mesozoic strata of the Hazelton Group have undergone lower greenschist facies regional metamorphism, but to the west of the South Unuk River, in the western part of the Doc Property, they are characterized by schists and gneisses, the mineralogy of which indicates lower amphibolite grade regional metamorphism (Glover, 1988). This metamorphic foliation defines a penetrative planar fabric that is subparallel to bedding, thus indicating isoclinal folding.

Ductile structures of a similar nature in rocks of the same age are located along the eastern margin of the Coast Plutonic Complex, to the southeast of the Doc Property (Anderson, 1988), and record the earliest recognizable deformational event in the area. The age of this deformation is uncertain, but may be late Early Jurassic.

Intrusive rocks of the Texas Creek plutonic suite of Early Jurassic age (189 - 195 Ma) are regionally widespread in the Stewart, Sulphurets and Iskut areas (Anderson, 1988).




SEDIMENTS - VOLCANICS

1 STEWART COMPLEX - TRIASSIC & JURASSIC

2 SUSTUT ASSEMBLAGE - CRETACEOUS & TERTIARY

3 PALEOZOIC

4 TERTIARY & RECENT VOLCANICS

5 BOWSER ASSEMBLAGE – MIDDLE JURASSIC TO UPPER JURASSIC

INTRUSIVES

6 COAST

7 OMINECA - TOPLEY

8 SKEENA

DYKE SWARMS

9 WRANGELL – REVILLAGIGEDO METAMORPHICS

AFTER: GROVE, 1970

0 10 20 30 40 50

KILOMETERS

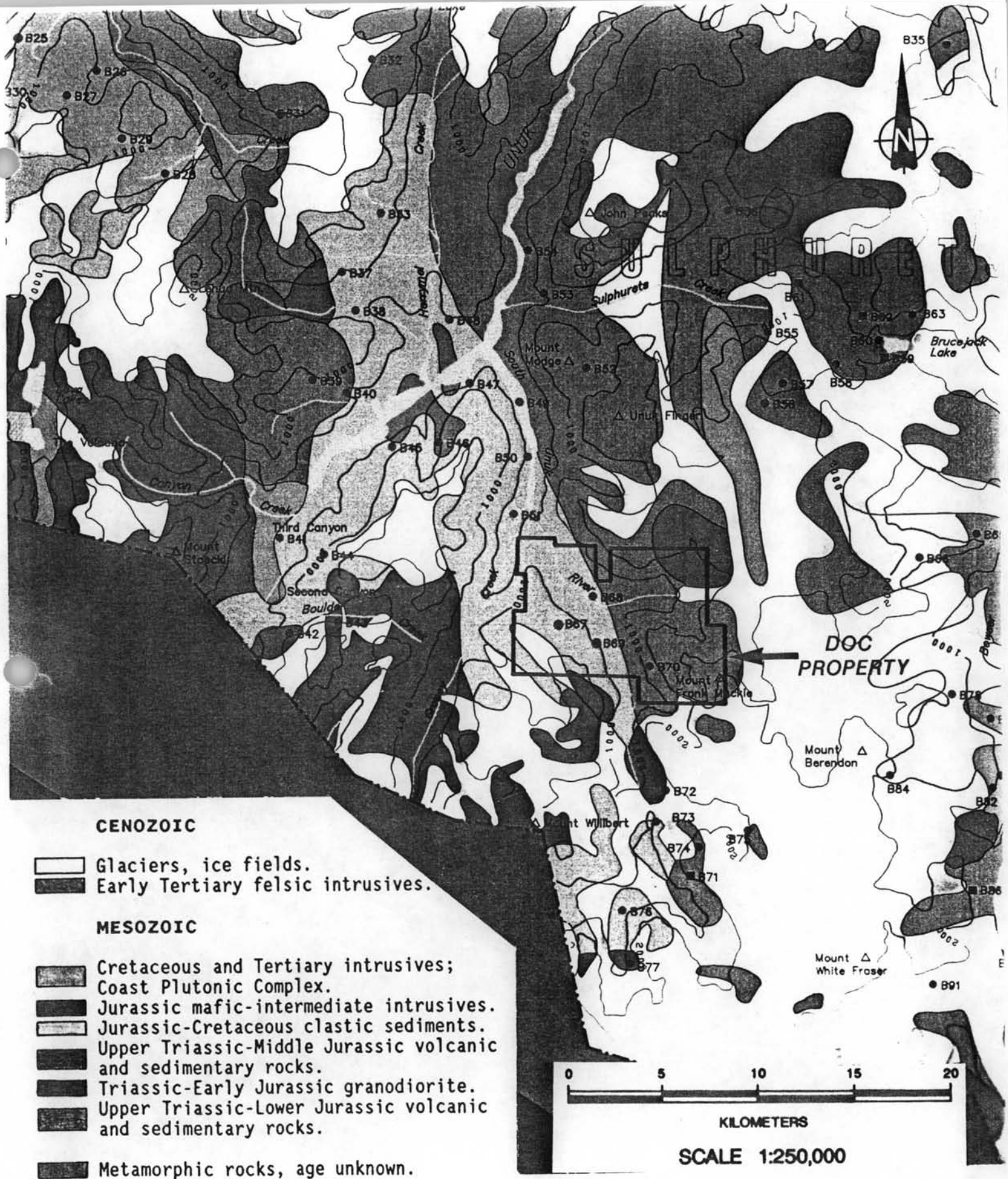
**ECHO BAY MINES LTD.**
Suite 354-200 Granville Street, Vancouver, B.C. V6C 1S4

**DOC PROPERTY**

# REGIONAL SETTING OF THE STEWART MINING CAMP

**SKEENA M.D. - SOUTH UNUK RIVER AREA**

| | | |
|---|---|---|
| N.T.S. 104B/8W | SCALE: 1:1,000,000 | FIG. |
| DATE: JAN. 1988 | DRAWN: J.R./dw | 3 |



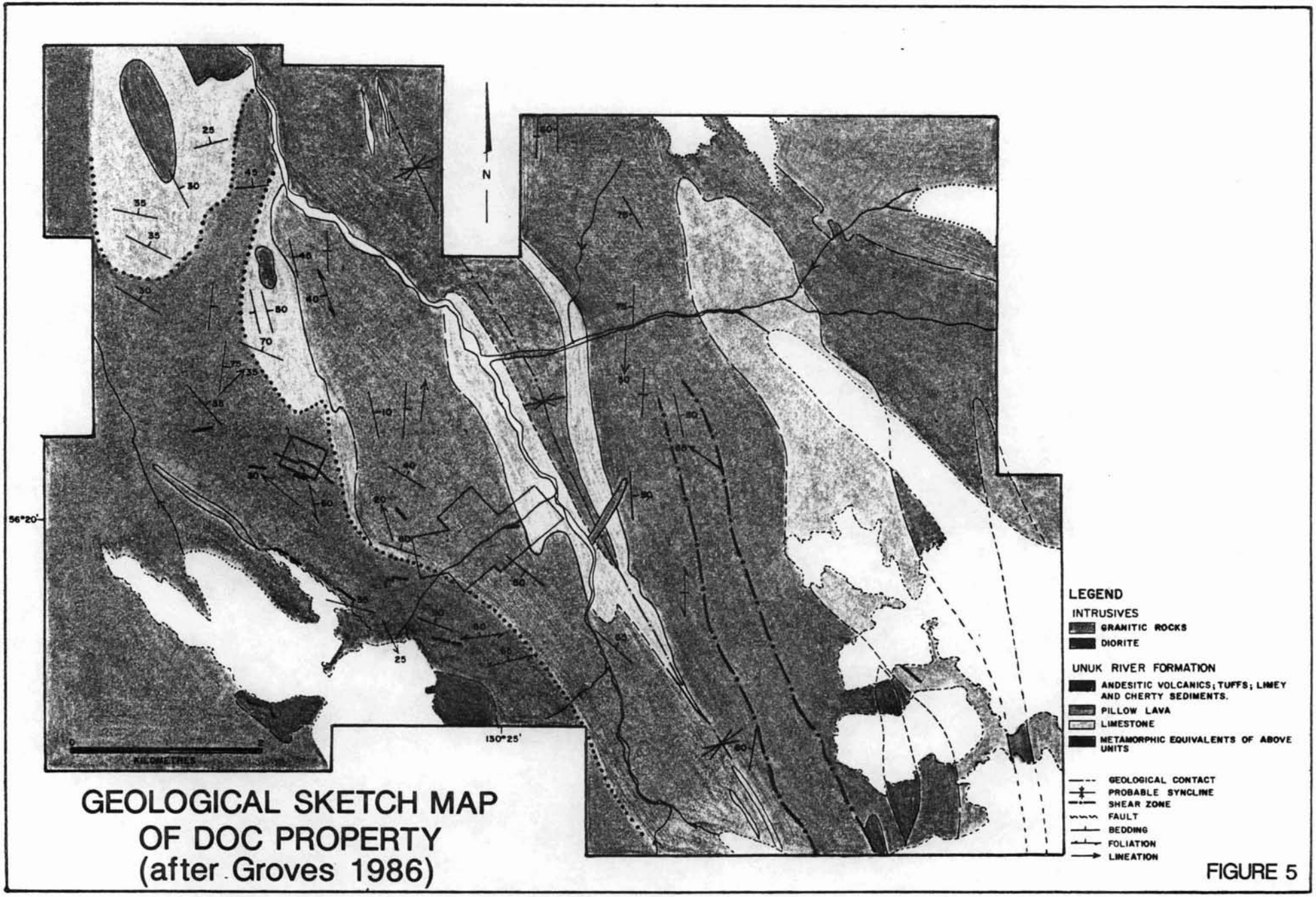

# DOC PROPERTY GEOLOGY & LOCATION MAP

FIGURE 4

They represent calc-alkaline and alkaline plutonism, comprising granodiorite-quartz monzodiorite and syenite intrusions, respectively. They are spatially associated with the Lower Jurassic volcanic rocks with which they are thought to be cogenetic. Alkali feldspar porphyry dykes or syenite plutons are important throughout the Stewart mining camp for the localization of precious metal lodes (Anderson, 1988). These rocks may be represented on the Doc Property by several small, foliated stocks of dioritic to syenitic composition (Grove, 1986; Glover, 1988) (Figure 5). Isoclinally folded and boudined aplite dykes, exposed in the underground workings, may also belong to the Texas Creek plutonic suite.

Refolding of the early structures, followed by semi-brittle to brittle deformation, including shear zones and faults, are thought to be Cretaceous, although their age is poorly constrained (Britton, 1988). It is during this tectonic episode that the auriferous, pyritic and base metal-bearing mesothermal quartz (carbonate) veins on the Doc Property were emplaced (Figure 5 ).

Siliceous, biotite-rich intrusive rocks of the Coast Plutonic Complex and satellitic bodies are dated as early Tertiary (50-55Ma; Anderson, 1988). They are apparently much fresher than rocks of the older plutonic suites and cross-cut the regional structures. Intrusive rocks of this type occur two kilometres to the west of the property, within the Coast Plutonic Complex, and in the northeastern part of the property (the Divelbliss Creek intrusions of Grove, 1986).




# GEOLOGICAL SKETCH MAP OF DOC PROPERTY (after Groves 1986)

FIGURE 5

## 8.2 Property Geology

### A) Geological Work Performed Prior to 1988

No surface geology map at a detailed scale is available for the whole property. Seraphim in 1948 mapped an area that includes the Q17, Q22 and spatially related veins west of the South Unuk River, in the western part of the property. His M.Sc. thesis provides the only detailed description of the veins themselves prior to this report.

Limited property mapping in the area of the known gold bearing veins was also carried out by Dupont, Silver Princess and Magna Ventures between 1980 and 1988.

From 1964 to 1970 the area covered by the property was part of a regional mapping program, conducted by E.W. Groves of the British Columbia Department of Mines, that included the Unuk River, Salmon River and Anyox areas (Grove, 1986). Figure 5 is an enlarged version of the property geology as depicted on Groves' 1:100,000 scale map of the Unuk River area. Recent work by J. Britton and D. Aldrick of the Geological Survey Branch has identified a north-northwest trending shear zone of probable regional extent that is approximately 600 metres wide and crosses the Doc Property east of the South Unuk River (J. Britton et al, 1989). No values of economic significance are reported from this ankeritic shear zone, but this structure may provide the regional control for gold-bearing structures elsewhere on the property.

### B) Geological Work Performed During 1988

Due to snow cover, no surface mapping was completed on the Doc Property during Echo Bay's 1988 program. Some

limited prospecting was completed by Magna Ventures personnel; prior to Echo Bay's involvement with the project.

Data for this report derives from underground mapping and surface diamond drilling. This data is limited to a relatively small portion of the property, specifically the area of the Q17 and Q22 veins (Figures 6 and 7). The description of the property geology in this report is therefore limited to this area.

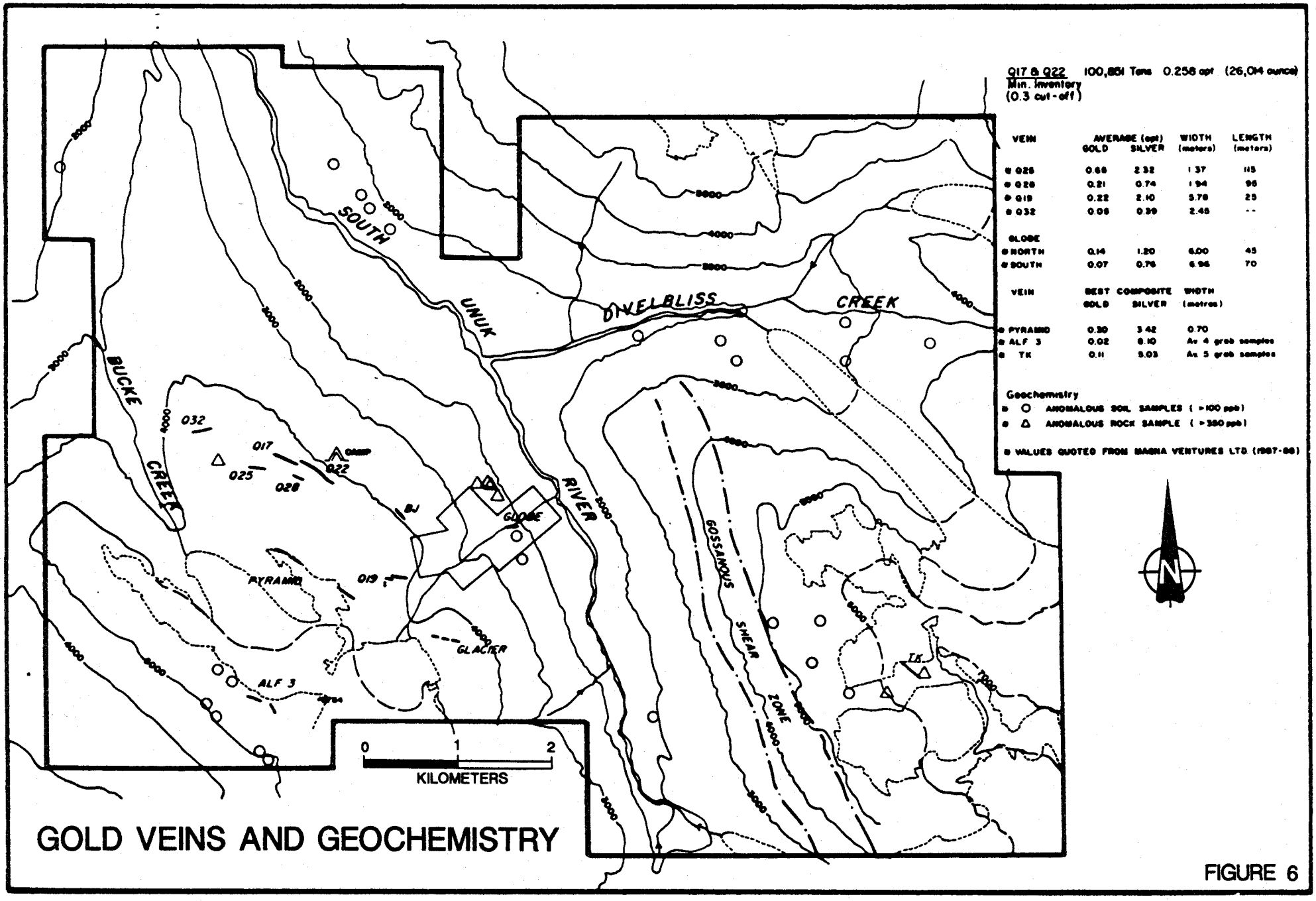
The diamond drill program provided geological control to guide underground development on the Q17 and Q22 veins. Drilling also tested the vertical and horizontal continuity of the veins peripheral to the underground development. The configuration of past and present drilling is portrayed on: plan view (Figure 8, enlargement in sleeve); cross section (Figures 9, 12, in text, 15-29 inclusive in sleeve) and long section (Figures 13, 14 in sleeve).

Underground geological mapping of the 1,160 metre level was completed at 1:250 scale. This mapping, displayed on Figures 10 and 11 in sleeve, focused on lithology, structure and mineralization within and surrounding the Q17 vein and to a lesser extent the Q22 vein.

## C) Detailed Geology

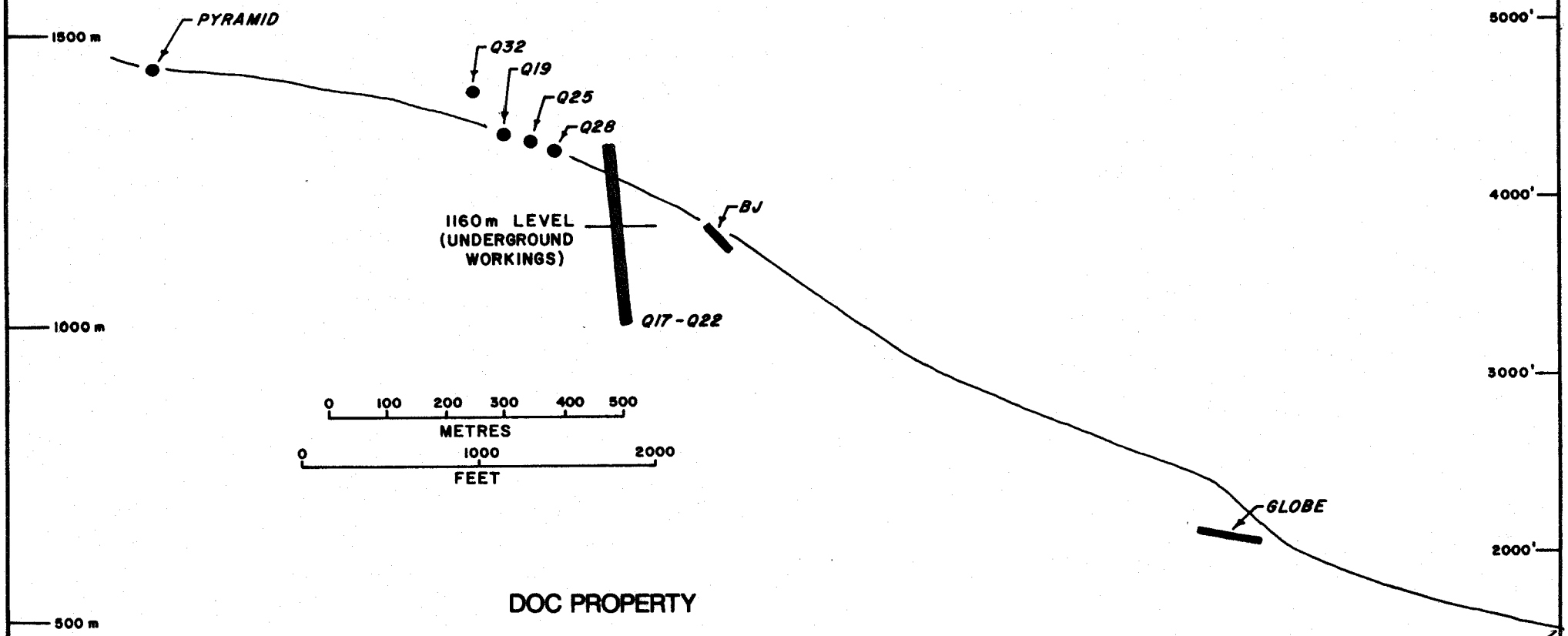
### 1) Lithologic Units

Underground mapping and core logging has exposed a sequence of complexly deformed and regionally metamorphosed volcanic and sedimentary rocks that generally trend toward the northwest. Four lithologic units are identified. They include: mafic to intermediate volcanics (Mv); tuff and tuffaceous sediments (Mt); sedimentary rocks (S) that




# GOLD VEINS AND GEOCHEMISTRY

FIGURE 6




DOC PROPERTY

# SCHEMATIC CROSS SECTION LOOKING NORTH SHOWING THE SPATIAL DISTRIBUTION OF KNOWN GOLD BEARING VEINS

FIGURE 7

include marble (Sm), calcareous siltstone (Sc), and siliceous (cherty) sediments (Ss); and metadiorite (Mi).

The volcaniclastic and sedimentary rocks are fine grained and thinly bedded. These strata are interpreted as distal turbidites, although the degree of metamorphism has obscured diagnostic sedimentary structures. The complexity of the structure and the limited data base preclude any attempt to define the stratigraphic relationships of these units.

Mafic to intermediate volcanics (Mv):

These rocks are mainly variably chloritized and well foliated andesite (amphibolite), with local epidote and calc-silicate layers and lenses.

Mapping and drilling to date outlines this unit as the most favourable host for gold bearing quartz veins within the detailed area of study.

Mafic to intermediate tuff and tuffaceous sediments (Mt):

This unit consists of 1 to 2 cm. thick alternating gneissic layers of epidote and amphibole, with minor intercalations of calc-silicate. It occurs to the north of the Q17 vein in the underground workings, but has been intersected in diamond drill holes to the south of the Q17 Vein.

Metasediments (S):

This unit comprises 1 to 2 cm thick interbeds of fine-grained siliceous (cherty) sediments (Ss), calc-silicate horizons and calcareous sediments (Sc), minor biotite-rich metapelite and marble (Sm). This unit is located north of unit Mt along the Main Adit,

north of the Q17 vein along the West Drift, and was also encountered to the east in drill hole 88-32 approximately 60 metres below surface.

Metadiorite (Mi):

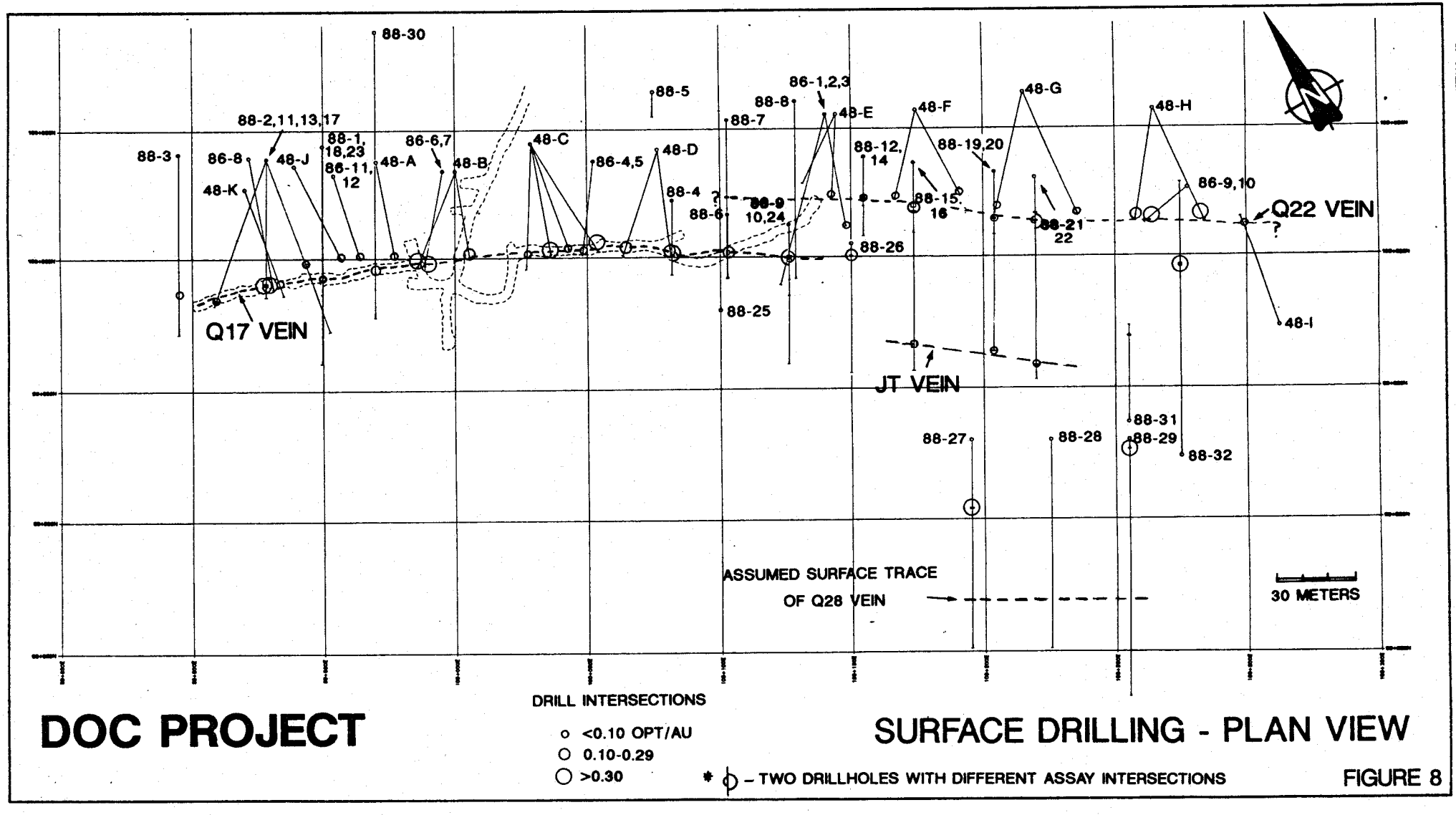
This unit comprises well foliated, medium to coarse grained, variably feldsparphyric diorite. Hornblende is the major ferromagnesian mineral with minor biotite. It is exposed from the portal to 25 metres south of the portal, where it is in fault contact with unit Mt. This is probably close to its intrusive contact, because it becomes progressively finer grained and more chloritized toward its margin. Metadiorite and metagabbro have also been intersected in diamond drill holes, but the relationship of these intersections with the body exposed at the portal is yet to be determined.

## 2) Vein Morphology

THE Q17 VEIN

The shear zone that hosts the Q17 vein is vertical to steeply north dipping and strikes toward the west with an azimuth that varies between 280 and 295 degrees.

Drilling has traced the Q17 vein over a strike length of 250 metres (Figures 8, 9, 13-21). Underground development has exposed the vein over a strike length of 170 metres. The deepest drill test, hole 86-5, cut a quartz stringer-altered zone grading 0.037/1.0 (opt Au/metre) 200 metres below surface.




# DOC PROJECT

## SURFACE DRILLING - PLAN VIEW

FIGURE 8

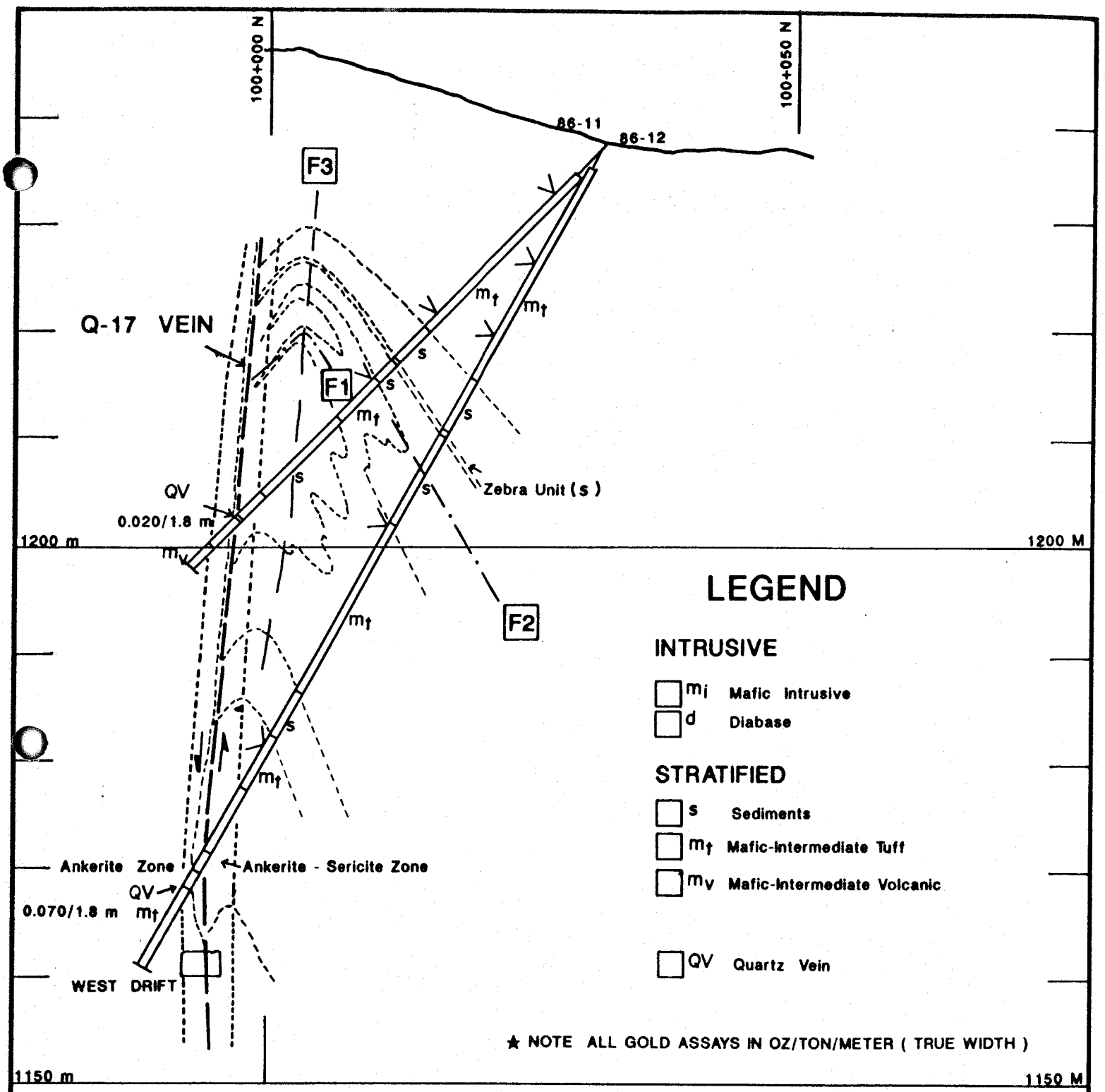



FIGURE 9

| | | | |
|---|---|---|---|
| | | ECHO BAY MINES LTD. | |
| | | TITLE DOC PROPERTY Q17 VEIN<br>DRILL SECTION 99+960 EAST Looking West | |
| | | GEOLOGY BY | DRAWN BY |
| | | N.T.S. 104 B/8 | DATE JAN./89 |
| REVISED BY | DATE | | |

SCALE 1 : 500

DRAWING NO.

VANCAL - 48214

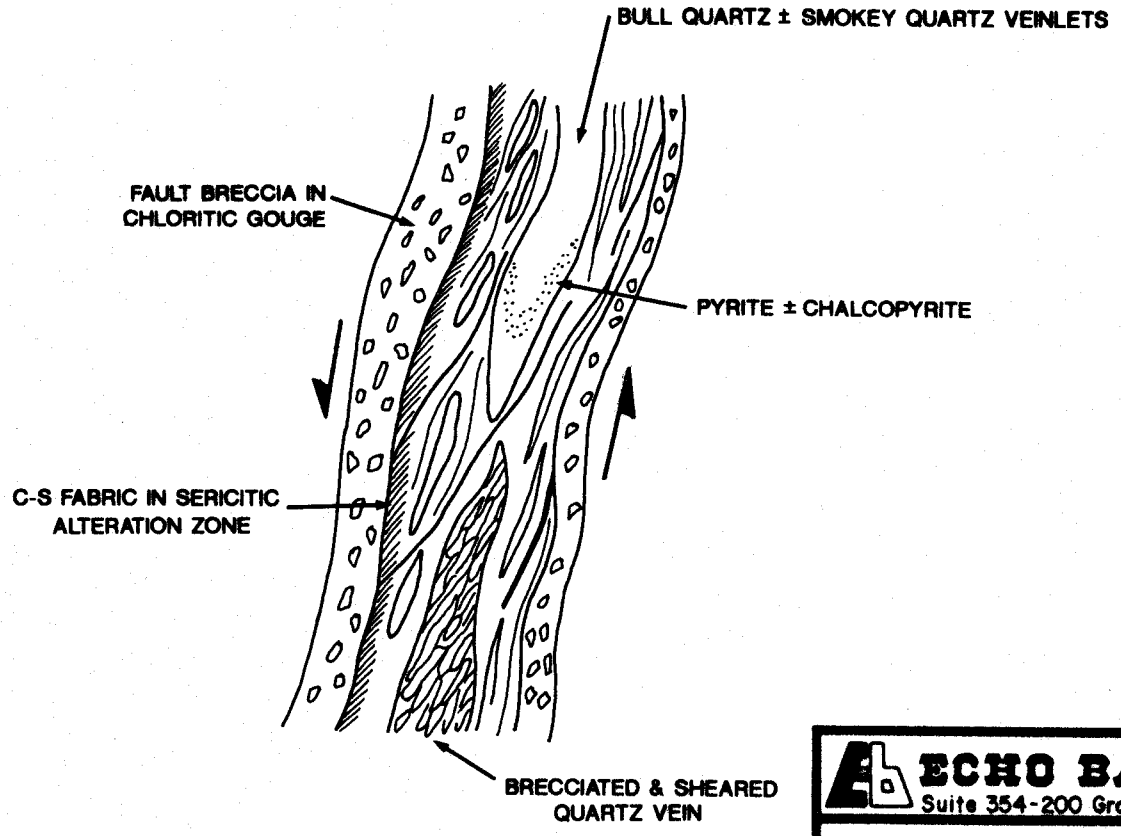



FIGURE 12

**ECHO BAY MINES LTD.**
Suite 354-200 Granville Street, Vancouver, B.C. V6C 1S4

# DOC PROPERTY

## SCHEMATIC CROSS SECTION OF Q17 VEIN MORPHOLOGY AND RELATED STRUCTURES, LOOKING WEST

| | | |
|---|---|---|
| Geology by: | Date: 02/89 | N.T.S.: |
| Drawn by: | Scale: | No. |

The shear zone that hosts the Q17 vein varies between a few centimetres and 5 metres in width, with actual gold bearing vein mineralization (from all data points), averaging between 1.0 and 2.0 metres in width.

The Q17 vein occupies a semi-brittle shear zone. The sense of displacement of the shear zone as documented by shear criteria and synthetic faults indicates reverse movement (north side up) (Figure 12) with a component of right lateral movement (Figure 12).

Detailed work within the study area indicates the vein is best developed within the competent metavolcanic rocks and diminishes in intensity and grade in proximity to sedimentary rocks near the end of the Q17 West Drift (Figure 15). The Q17 vein pinches to a sericitic altered shear zone as it enters calcareous sediments. Hole 88-3 (Figures 8, 15) intersected siliceous and calcareous sediments 5 metres west of the western extent of the underground workings but encountered no vein or shear structure. Hole 88-13 (Figures 8, 16) intersected the altered shear hosted by calcareous sediments 25 metres above the drift.

The Q17 vein appears to pinch in a vertical sense. Drill holes 88-23 (Figures 8, 17) and 88-30 (Figures 8, 18) tested the vein beneath the 1,100 metre level. These were the two deepest holes drilled during the 1988 program. In both cases, no significant thickness of vein or shear was intersected. These holes penetrated a zone of quartz veinlets and sericite alteration; indicating that the vein-plumbing system while present, is narrow at this particular depth. These intersections were sampled, returning values of 0.036/0.4 (opt Au/metre) and 0.082/0.8 (opt Au/metre), respectively.

The Q17 vein pinches and swells in a horizontal sense within the 170 metre zone of underground development. An oxidized shear was intersected in hole 88-17 (Figures 8, 17) about 30 metres vertically above a zone of constriction, that is exposed in the West Drift. This shear occurs between two significant vein intersections; 86-8 (.310/2.0 opt Au/metre) and 88-18 (.535/2.0 metre). (See Long Section, Figure 13 in sleeve).

Late stage faulting likely has had an influence on the Q17 vein. Late faults include Doc 1, 2 and 3. The Doc 2 fault is exposed along the main adit 50 metres northeast of the Q17 vein (Figure 10 in sleeve). The fault strikes at 338 degrees and dips at 45 degrees to the southwest. Drill holes 88-7, 8 and 10 (Figures 8, 20, 21) tested the Q17 vein to the east below the Doc 2 fault. No vein or shear was intersected. Along the East Drift, in the immediate hanging wall of the Doc 2 fault, the Q17 shear does diminish in width and intensity with progression towards the east (Figure 11 in sleeve). Here, the vein feathers out into a series of quartz veinlets, one of which appears to cross the trace of the fault with no apparent offset. It is still uncertain whether the Doc 2 fault cuts and displaces the Q17 vein, or whether the vein simply pinches.

Studies indicate the Q17 vein has undergone various stages of movement over time. Multiple phases of movement are shown by brittle fracturing of the central bull quartz vein and emplacement of sulphides, followed by rebrecciation and shearing of the Q17 vein. This complex kinematic history has obscured the initial geometry of the veins and it is therefore not known whether the same stress conditions gave rise to the original emplacement of the main Q17 vein. However, a model involving initial development of en echelon tension fissures followed by progressive shearing is preferred.

The model proposed above for the kinematic history of the Q17 vein system has important economic implications with respect to the localization of dilatant zones along the vein(s):

a) Vertical movement (north side up) along the shear zone could result in zones of extension and therefore dilation in relatively shallow north dipping sections of the vein(s). This would favour an increase in the width of the vein, and possibly sulphide and gold deposition.

b) In a similar way, right lateral movement along the shear zone would favour development of dilatant zones on the more northwesterly trending portions of the vein.

THE Q22 VEIN

The shear zone that hosts the Q22 vein is vertical to steeply dipping and strikes toward the west with an azimuth that varies between 290 and 300 degrees.

Drilling has defined the Q22 vein as having a strike length of 200 metres (Figures 8, 22-26). Underground development has only penetrated the vein with one crosscut. The vein continues to a depth averaging 75 metres beneath the surface and is erratic in width varying between 0.2 and 3.0 metres.

The most distinctive feature of the Q22 vein is the pinching of the vein at depth. On four separate sections, the shallow test (Holes 88-12, 15, 19 and 21) intersected the Q22 vein whereas the deeper undercuts (Holes 88-14, 16, 20 and 22) intersected only a shear (Figures 22-25 in

sleeve). No drilling has tested the vein deeper than 100 metres from surface and the possibility exists that the vein may re-appear at depth (Figure 14 in sleeve).

Q22 similarities with Q17 include shearing along vein margins and brecciation as well as forms of alteration and mineralization.

THE Q28 VEIN

In 1988 the Q28 vein (Figures 8, 27-29) was tested by three drill holes. None of the holes encountered a vein or structure.

THE JT VEIN

Drilling has tested the newly discovered JT vein over a strike length of 100 metres. The strike of the vein varies between 300 and 310 degrees. The dip is assumed to be steep, and the vein has been tested to a vertical depth of 80 metres below surface. The average width of the vein varies between 1.0 and 2.0 metres. Drill information to date indicates the vein pinches both to the west and east (Figures 8, 23-25.)

The JT vein is similar to the Q17 and Q22 veins. The main portion of the vein is hosted by metavolcanic rock. The vein consists of massive barren quartz and limonitic fractured quartz containing up to 10 percent pyrite. The best gold values occur with sulphides. The vein margins are often but not always sheared and sericitized.

ADDITIONAL NEW VEINS

Two additional new veins were intersected during the 1988 drill program. These veins were penetrated while testing for Q28. In both cases, narrow 0.3-0.6 metre veins were intersected near surface (Figures 8, 26-28).

Hole 88-27 (0.381/0.6 opt Au/metre) and Hole 88-29 (0.716/0.3 opt Au/metre) consist of quartz with sheared margins, limonitic fractures and pyrite. Hole 88-29 also contained 5 percent galena.

3) Structure

Three phases of deformation are evident:

a) The first phase (F1) probably involved isoclinal folds that formed during upper greenschist to lower amphibolite grade regional metamorphism. This is based on gneissic layering that is subparallel to bedding (S0) in the sediments and volcaniclastic rocks, and on a penetrative planar fabric defined by hornblende, biotite and chlorite (retrograde?) in the more massive volcanic and intrusive rocks. Both these planar fabrics are designated S1. A locally pronounced stretch direction and mineral lineation (L1) that plunges from 10 to 30 degrees in a direction 295 to 310 degrees is exposed on S1 surfaces (see stereographic projection, Figure 10 in sleeve). Small-scale isoclinal folds of boudined calc-silicate beds that contain garnet (grossular?), plagioclase, quartz, epidote and biotite are locally present in the massive volcanics. The axes of these folds appear to be parallel to L1.

b) The second phase (F2) is recorded by tight, southerly verging folds of bedding and S1. This folding is reflected stereographically by the distribution of poles to S1, which outlines a girdle whose pi pole plots close to the cluster of L1 lineations (Figure 10 in sleeve). This indicates that F1 and F2 are coaxial. The few small-scale F2 fold axes measured to date support this conclusion. These folds have shallow, north-northeasterly dipping axial planes. A spaced axial plane cleavage (S2) is locally developed, together with intersection and crenulation lineations (L2).

Folding was noted in most drill holes, especially within the thinly bedded sediments and tuffaceous horizons. Folding is less obvious within the massive andesites as they appear to have responded more brittly to regional stress. This may explain the numerous shears and faults in the andesitic (amphibolite) sections observed in core.

The drill cross sections in general suggest abrupt changes in lithologies and thicknesses of units over short distances. Figure 9 displays significant variations in the thickness of volcanic tuffs and sediments (units Mt and S). These variations are believed to be due to a combination of isoclinal folding and facies change. This volcanic-sediment contact is also exposed on the north wall of the Q17 West Drift.

c) The final phase of deformation (F3) coincides with the development of semi-brittle to brittle shear zone(s) which host veins that contain mesothermal gold, silver and base metal mineralization on the property.

Northwesterly trending high angle faults that developed during this phase are generally contractional with their northeast side upthrown. Brittle faults, quartz veinlets, joints and fractures post-date the phases of deformation summarized above and are briefly described in the Appendix 1 of this report (see Detailed Structural Geology).

**4) Mineralization and Alteration**

All quartz veins drill and development tested during 1988 are similar in the style of mineralization and alteration. The following descriptions apply mainly to the Q17 vein as it has been studied in greatest detail. Features pertinent to the other veins will be included where appropriate.

A series of vertical to steeply dipping, west-northwesterly trending quartz-carbonate veins and stringers that cross-cut the lithologic units are exposed in the underground workings. The Q17 vein system, the widest of these veins, is exposed for a strike length of 90 metres along the West Drift and for 50 metres along the East Drift; the intervening 30 metres of strike length is only exposed where the Main Adit crosscuts the vein (Figure 11, in sleeve). The east end of the East Drift has exposed a limited and poorly developed ankeritic section of the Q22 vein system. These two vein systems contain the only economically significant gold values and widths discovered to date in the area of the underground workings.

The mineralized zone of the Q17 vein occupies a semi-brittle shear which varies in width from a few centimetres to 5 metres, although gold values greater than 0.2 ounces per ton rarely carry over more than 2 metres.

Silver values tend to be 5 to 10 times that of the gold values. The vein itself feathers out into a series of stringers immediately west of the Doc 2 fault, along the East Drift and completely disappears at the west end of the West Drift. Gold values are generally less than 0.02 ounces per ton at both ends of the vein.

The Q17 vein system comprises a central bull quartz vein within which pyrite, galena, and minor chalcopyrite and sphalerite stringers are locally developed. Lenses of massive to semi-massive sulphide of similar composition to these stringers are locally present along the margins of the central vein. The best grade gold samples were obtained from occurrences of this type in the West Drift. Sparse development of specular hematite occurs along joint surfaces within the bull quartz.

In Q17 the central bull quartz vein is generally bounded on both sides by brecciated vein material and by sheared ankeritic and sericitic wall rock. Gold values tend to be erratic from these areas and range from below detection to values in excess of 0.3 ounces per ton.

Quartz-carbonate stringers peripheral to the Q17 vein exhibit a similar mineralogy and morphology to the main vein, but are less sheared, contain significantly less base metals and commonly include late stringers of dark green chlorite.

In drill core, veins were found to occur mainly as barren massive milky quartz with variably brecciated and sheared margins. Mineralization was found to occur mainly as pyrite within and peripheral to the vein in areas of shearing and brecciation. Intersections containing fresh pyrite and base metals generally yielded superior values to those vein intersections with oxidized and leached pyrite.

In drill core alteration associated with the quartz veining varies from centimetres to a 10 metre-thick zone of sericite, ankerite and quartz stringers with disseminated pyrite. Low grade gold values are always associated with alteration zones.

Late stage rebrecciation of the vein system under brittle conditions is shown by narrow zones of randomly oriented fault breccia in a gouge matrix that comprises chlorite, clay or ankerite. In the central part of the West Drift virtually the entire vein is brecciated in this way. It is interesting to note that here the vein is intensely oxidized; no sulphides are evident within the vein itself and gold values are erratic. Therefore, it is probable that late stage remobilization, possibly by ground waters, has resulted in the leaching of sulphides and the transport of gold from this area of the vein.

Assay results indicate several types of gold occurrences:

a) associated with finely disseminated pyrite in sericitized wall rock adjacent to quartz-carbonate veins and stringers;

b) associated with massive to semi-massive sulphide pods and lenses comprising galena, chalcopyrite and sphalerite - the lenses are commonly marginal to the main central quartz vein;

c) associated with sulphide disseminations and stringers in areas where the central quartz vein has been brittly fractured.

d) The initial work on surface outcrops of the Q17 vein by Seraphim indicated an additional association of gold with specularite. If this turns out to be the case, then it probably represents a final phase of gold deposition, because occurrences of specularite in the underground workings all appear to be late stage fracture fillings that post-date the major movement along the shear zone.

The highest grade intersections are invariably found in association with sulphides in occurrences of types b) and c).

## 9. DEVELOPMENT

### 9.1 Drilling Summary

Diamond drilling commenced on October 11, 1988 and terminated on December 3, 1988. The program completed 3,074.1 metres (10,085.6 feet) of drilling in 32 drill holes. Falcon Drilling Ltd. of Prince George, B.C. completed 2,230.4 metres in 25 BQ holes and Connors Drilling Ltd. of Kamloops, B.C. completed 843.7 metres in 7 NQ holes (Tables 1, 2) (Figure 8). For a summary on the individual drill holes with the best assay intervals see Appendix 2. Individual drill logs with all assays are located in Appendix 3.

Core samples were fire assayed (1 assay ton) by Chemex Labs., and Acme Analytical Labs. of Vancouver, B.C. The entire core was photographed and sampled when analysing the main mineralized vein systems. Sampling was also carried out in altered and mineralized zones adjacent to the veins. All assay results (both surface and underground) are included in Appendix 7.

ECHO BAY MINES LTD.
1988 DRILL PROGRAM
FACT SUMMARY SHEET

Table ____

| Hole # | Coordinates Easting | Coordinates Northing | Elevation Metres | Dip | Azimuth | Depth metres | Core Size | Intersections | Length meters | Grade oz/t/metre |
|---|---|---|---|---|---|---|---|---|---|---|
| 88-1 | 99+950 | 100+044 | 1237 | -60 | 205 | 88.1 | BQ | Lost hole | -- | -- |
| 88-2 | 99+929 | 100+039 | 1237 | -60 | 205 | 106.4 | BQ | 95.2-97.2 | 2.0 | .375/0.8 vein |
| 88-3 | 99+894 | 100+040 | 1251 | -50 | 205 | 106.9 | BQ | -- | -- | -- |
| 88-4 | 100+082 | 100+022 | 1216 | -60 | 205 | 57.6 | BQ | 42.1-43.0 | 0.9 | .429/0.9 vein |
| 88-5 | 100+075 | 100+064 | 1210 | -55 | 205 | 16.7 | BQ | Lost hole | -- | -- |
| 88-6 | 100+103 | 100+017 | 1219 | -60 | 205 | 48.5 | BQ | 28.2-31.3 | 3.1 | .155/3.1 vein |
| 88-7 | 100+102 | 100+054 | 1203 | -55 | 205 | 106.4 | BQ | 51.4-52.2 | 0.8 | .111/0.8 vein |
| 88-8 | 100+128 | 100+060 | 1202 | -50 | 205 | 106.4 | BQ | -- | -- | -- |
| 88-9 | 100+126 | 100+012 | 1234 | -55 | 205 | 36.9 | BQ | 21.0-22.0 | 1.0 | .130/1.0 vein or .094/2.0 |
| 88-10 | 100+126 | 100+012 | 1234 | -75 | 205 | 103.4 | BQ | -- | -- | -- |
| 88-11 | 99+929 | 100+039 | 1237 | -45 | 225 | 46.9 | NQ | Lost hole | -- | -- |
| 88-12 | 100+155 | 100+039 | 1209 | -45 | 205 | 43.6 | BQ | 21.0-22.7 | 1.7 | .052/1.7 vein |
| 88-13 | 99+929 | 100+039 | 1237 | -45 | 225 | 84.5 | NQ | 81.0-82.0 | 1.0 | .092/1.0 shear |
| 88-14 | 100+155 | 100+039 | 1209 | -75 | 205 | 72.8 | BQ | 61.5-63.0 | 1.5 | .030/1.5 shear |
| 88-15 | 100+173 | 100+036 | 1214 | -45 | 205 | 112.5 | BQ | 22.2-23.9<br>96.7-100.3 | 1.7<br>3.6 | .110/1.7 vein<br>.099/3.6 vein |
| 88-16 | 100+173 | 100+036 | 1214 | -70 | 205 | 78.9 | BQ | 54.8-57.5 | 2.7 | to be sampled in 1989 |

ECHO BAY MINES LTD.
1988 DRILL PROGRAM
FACT SUMMARY SHEET

Table 1

| Hole # | Coordinates Easting | Coordinates Northing | Elevation Metres | Dip | Azimuth | Depth metres | Core Size | Intersections | Length meters | Grade oz/t/metre |
|---|---|---|---|---|---|---|---|---|---|---|
| 88-17 | 99+929 | 100+039 | 1237 | -45 | 186 | 99.4 | NQ | 61.2-62.2 | 1.0 | .074/1.0 shear |
| 88-18 | 99+950 | 100+044 | 1237 | -45 | 205 | 117.7 | NQ | 71.0-73.0 | 2.0 | .535/2.0 vein |
| 88-19 | 100+204 | 100+033 | 1215 | -45 | 205 | 96.9 | BQ | 25.3-26.0<br>96.7-96.9 | 0.7<br>0.2 | .046/0.7 vein<br>.014/0.2 vein |
| 88-20 | 100+204 | 100+033 | 1215 | -75 | 205 | 93.6 | BQ | 45.8-48.2 | 2.4 | .049/0.9 Shear |
| 88-21 | 100+220 | 100+031 | 1217 | -45 | 205 | 109.4 | BQ | 23.6-24.6<br>101.2-103.0 | 1.0<br>1.8 | .124/1.0 Vein<br>.018/1.0 Vein |
| 88-22 | 100+220 | 100+131 | 1218 | -75 | 205 | 53.0 | BQ | 40.6-41.2 | 0.6 | .793/0.6 Shear |
| 88-23 | 99+950 | 100+044 | 1237 | -72 | 205 | 185.2 | NQ | 172.2-173.2 | 1.0 | .036/0.4 Shear |
| 88-24 | 100+126 | 100+012 | 1234 | -60 | 205 | 104.2 | BQ | 27.7-28.8 | 1.1 | .668/0.7 Vein |
| 88-25 | 100+100 | 99+980 | 1230 | -50 | 025 | 119.2 | NQ | 33.6-35.1 | 1.5 | .411/1.5 Vein |
| 88-26 | 100+155 | 100+005 | 1219 | -55 | 205 | 85.0 | BQ | 7.9-8.8 | 0.9 | .190/0.9 Vein |
| 88-27 | 100+195 | 99+930 | 1225 | -45 | 205 | 106.4 | BQ | 36.4-37.0 | 0.6 | .381/0.6 Vein |
| 88-28 | 100+225 | 99+930 | 1225 | -45 | 205 | 109.1 | BQ | -- | -- | -- |
| 88-29 | 100+255 | 99+933 | 1225 | -45 | 205 | 136.8 | BQ | 5.3-5.6 | 0.3 | .716/0.3 Vein |
| 88-30 | 99+970 | 100+087 | 1226 | -55 | 205 | 190.8 | NQ | 166.7-167.5 | 0.8 | .082/0.8 Vein |
| 88-31 | 100+255 | 100+937 | 1225 | -65 | 025 | 87.5 | BQ | 77.8-78.7 | 0.9 | .018/0.4 Shear |
| 88-32 | 100+275 | 99+923 | 1235 | -50 | 025 | 163.4 | BQ | 112.2-114.6 | 2.4 | .342/1.4 Vein |

Table 2

# ECHO BAY MINES LTD.
# DOC PROPERTY
# 1988 SURFACE DRILLING RESULTS

**SUMMARY** 32 holes drilled for 3,074.1 m (10,085.6 feet)

**OBJECTIVES**
- o Provide geologic control for underground drifting.
- o Test vertical and lateral continuity of the Q-17 and Q22 vein systems.

| RESULTS | Assays (oz/t/m) true width | | | No Inter-section | Lost Hole |
|---|---|---|---|---|---|
| | 0.10 | 0.1 - 0.29 | 0.30 | | |
| Q-17 Vein (tested by 20 holes) | 88-9 (.094/1.10)<br>88-13 (.067/1.40)<br>88-17 (.074/.70)<br>88-30 (.040/.57) | 88-6 (.155/1.80)<br>88-26 (.190/.52) | 88-2 (.374/.80) [40% recovery]<br>88-4 (.429/.45)<br>88-18 (.535/1.40)<br>88-24 (.668/.55) [64% recovery]<br>88-25 (.411/.96) | 88-3<br>88-7<br>88-8<br>88-10<br>88-15 | 88-1<br>88-5<br>88-11<br>88-23 |
| Q-22 (tested by 13 holes) | 88-12 (.052/1.2)<br>88-14 (.030/.40)<br>88-15 (.090/1.70)<br>88-19 (.046/.50)<br>88-20 (.044/.40) | 88-7 (.111/.46)<br>88-21 (.124/.70) | 88-22 (.793/.20)<br>*88-32 (.389/2.4) [58% recovery] | 88-8<br>88-16<br>88-25 | 88-5 |
| Q28 (tested by 3 holes | | | | 88-27<br>88-28<br>88-29 | |
| JT (tested by 7 holes) | 89-15 (.099/2.55)<br>88-19 (.014/.14)<br>88-21 (.018/1.30) [55% recovery]<br>88-31 (.018/.40) | | | 88-24<br>88-26<br>88-32 | **88-19 |
| New Veins | | | 88-27 (.381/.43)<br>88-29 (.716/.21)<br>*88-32 (.389/2.4) [58% recovery] | | |

* Possibly a new vein or a fault offset of Q-22
** 88-19 was lost 0.2 m into the JT vein.

Drill hole collar locations were surveyed (using a Brunton compass and hip chain) by triangulation from grid coordinates on the existing baseline and from previous collar locations. Halfway through the program several of the 1986 and 1988 drill hole collars were resurveyed using a theodolite.

At present it is not known whether drill indicated deviations from the usual orientation of the vein are apparent or real in areas where adequate survey control is lacking. This concern will be remedied by a detailed surface survey to pick up all drill holes during the 1989 field season.

The diamond drill holes were down hole surveyed by acid tests for the shallow holes and by Sperry Sun tests for the deep holes. The Sperry Sun tests indicate that the holes shallowed or steepened by only 1-4 degrees, with the azimuth deviating by as little as 0.5-1.0 degree.

A drill summary for the various veins tested is as follows;

Q17 VEIN

The Q17 vein was tested by twenty drill holes during 1988. Seven of twenty holes returned gold values in excess of 0.1 ounces per ton.

Sulphide rich portions varying between 5 and 50 percent in 0.1 to 1.0 metre zones occur as disseminations, fracture coatings and as blebs within vuggy quartz. The presence of specularite and/or galena along with the pyrite has been found to be correlative with superior gold values. Drill holes that assayed sub ore to ore grade values are as

follows (opt Au/metre): 88-2 - 0.37/0.8, 88-4 - 0.429/0.9, 88-18 - 0.535/2.0, 88-24 - 0.668/0.7, and 88-25 - 0.411/1.5.

Five holes did not intersect any vein, and four holes were abandoned prior to target depth.

Q22 VEIN

The Q22 vein structure was tested in 1988 by thirteen drill holes. Four of those holes returned gold values greater than 0.1 ounces per ton. Drill holes that assayed sub ore to ore grade values are as follows (opt Au/metre): 88-7 - 0.111/0.8, 88-21 - 0.124/1.0, 88-22 - 0.793/0.6 and possibly 88-32 - 0.456/0.7.

Two holes did not intersect any vein material and one hole was abandoned prior to target depth.

The Q22 intersections show a poor correlation with vein thickness and sulphide content. The highest gold values were obtained from an oxidized shear with trace pyrite (Hole 88-22, Figure 25).

JT VEIN

The JT vein was first intersected by hole 88-15 which was drilled to test the Q17 vein extension to the east. This new vein lies approximately 50 metres grid south of the Q22 vein, between sections 100+150E and 100+260E. It was tested by seven holes, of which four returned anomalous but low gold values. Drill hole results are as follows (opt Au/metre): 88-15 -0.100/3.6, 88-19 - 0.014/0.2 opt; 88-21 - 0.018/1.0 and 88-31 - 0.018/0.4.

ADDITIONAL NEW VEINS

Three drill holes designed to test the Q28 vein did not encounter the Q28 vein or any shear related to that vein. Two of the three holes hit narrow veins near surface. The assay for hole 88-27 was 0.381/0.6 (opt Au/metre) and the assay for hole 88-29 containing galena with pyrite was 0.716/0.3 (opt Au/metre).

## 9.2 Underground Development Summary

Tonto Mine Services Ltd. was granted a contract to complete between 200 and 250 metres of trackless 2.5 metre x 3.0 metre tunnel.

Much of the drifting on Q17 West Drift and East Drift was carried out on a cost effective 2 heading basis.

In total, 230 metres (762 feet) of development was completed in 25 days. Extensive strapping and rock bolting was required to maintain the back while drifting both west and east on the Q17 vein. In total 4 timber sets were required for major ground support; two at the intersection of the Doc 2 fault on Q17 East Drift and two at the intersection of the Q22 vein. The portal was also retimbered.

All of Tonto's equipment is stored on site and will have to be demobilized under better weather conditions during the summer of 1989.

## 9.3 Sampling Procedures

### A) Drill Core

Drill core was sampled whole in order to gain a more representative sample. Representative intervals from hangingwall, vein and footwall were analysed for gold and silver. In total 376 samples were collected (Appendix 3).

### B) Muck Sampling

Three individual samples were collected from each round of advance believed to be sub ore to ore grade material. Each sample contained a representative selection of 5 cm x 5 cm material taken from the undisturbed muck pile. These samples were then assayed for gold and silver, and the results averaged arithmetically. In total 198 samples were collected (Figure 30, Appendix 4).

### C) Face Sampling

After every round of advance each face was sampled in two parallel, horizontal sample lines, separated by approximately 1.0 metre. Each line comprised a series of samples that ideally crossed from vein hangingwall to vein footwall. The sample length varied depending on compositional changes across the face. In total 615 samples were collected (Figure 31, Appendix 5).

### D) Back Sampling

Back samples were collected at 2.0 metre intervals perpendicular to the strike of the vein. A minimum of 3 samples were taken from the footwall to the hangingwall of the vein along each sample line for the drift advance on Q17

West and East. Additional samples were collected to reflect variations in alteration and mineralization, if warranted. In total 312 samples were analysed for gold and silver (Figure 32, Appendix 6).

## 10. CONCLUSIONS

### 10.1 Summary

The 1988 exploration and development program on the Doc Property was designed to test the Q17 and Q22 vein systems with the purpose of establishing drill and development indicated reserves of 500,000 tons grading 0.3-0.4 opt gold. A mineral inventory (ore reserve) for the Q-17 and Q-22 vein systems was completed using all available data. Data used includes: Halport Mines (1940's trenching and drilling); Silver Princess (1985 trenching); Magna Ventures (1986-1987, trenching, surface drilling, underground drilling); Echo Bay (1988 drilling, underground sampling). Results of calculations from all categories grading greater than 0.100 opt gold has generated a figure of 100,851 tons grading 0.258 opt gold.

The program did conclusively establish that gold mineralization contained within the Q17 West vein could justify a production decision providing tonnage at indicated widths and grades could be dramatically increased.

Due to the remoteness of the location of the project, it is perceived that mutually accessible deposits totalling a minimum of 1,000,000 tons grading in excess of 0.6 ounces per ton gold will be the minimum required to sustain a profitable mining operation.

The future challenge is to define structural controls (dilatant zones) wherein significant tonnages of these mineralized lenses can be anticipated and developed by one coherent mining operation.

## 10.2 Underground Mapping

Underground mapping and sampling provided the data base from which the following conclusions can be drawn.

**a)** The Q17 vein occupies a semi brittle shear zone for a maximum strike length of 170 metres as exposed underground.

**b)** The vein has undergone a complex history of deformation during which time, sulphide-precious metal deposition and remobilization took place. Ore grade mineralization within the Q17 vein is restricted to zones of limited strike extent. These high grade zones may represent ore shoots, but insufficient data is available to define their geometry.

**c)** Development to date indicates the vein is best developed within the metavolcanic units and diminishes in proximity to sediments.

## 10.3 Surface Drilling

Drill testing was carried out to provide geological control for underground drifting as well as defining the vertical and horizontal continuity of mineralization on the Q17 and Q22 vein systems. Some holes targeted more than one vein. The results of the 32 hole - 3,074.1 metre test, and the drilling related conclusions, are as follows.

**a) Geologic Impressions**

The overall geometry of the vein systems, based on drill core studies and underground mapping, is that of vertical to steeply north dipping lenses that pinch and swell in a horizontal and vertical sense. Evidence to date suggests that the Q17 vein pinches abruptly within the sediments to the west around Section 99+900E. To the east the Q17 vein appears to dissipate near Section 100+150E. The quartz veins also appear to pinch in a vertical sense. The Q17 vein narrows at a depth of approximately 200 metres below surface, while the Q22 vein pinches at a depth of 75 metres beneath the surface.

Gold mineralization is hosted mainly by brecciated limonitic quartz with pyrite. Gold values are highest where the pyrite appears fresh and un-oxidized. Specularite and galena were observed occasionally in the drill core, and correlate with anomalous gold values.

**b) Analytical Results**

Of the 20 holes that tested the Q17 vein: four returned assays less than 0.10 opt Au; two returned assays between 0.10 and 0.29 opt Au; five returned assays exceeding 0.30 opt Au; five did not intersect a vein and four were abandoned prior to target depth.

Of the 13 holes that tested the Q22 vein: five returned assays less than 0.10 opt Au; two returned assays between 0.1 and 0.29 opt Au; two returned assays exceeding 0.30 opt Au; three did not intersect any vein material and one was abandoned prior to target depth.

Of the 3 holes that tested the Q28 vein; there were no vein intersections.

Of the 7 holes that tested the newly discovered JT vein, four returned assays less than 0.10 opt Au and three did not intersect any vein material.

Apart from JT vein, three holes intersected previously undiscovered veins with all three intersections exceeding 0.3 opt Au.

### 10.4 Underground Development

The 1988 phase of underground development was designed to test the grade continuity of the Q17 vein on the 1,160 metre level; access the Q22 vein and test ground conditions while drifting along the vein(s). Results of this testing are as follows:

a) The Q17 vein is transitional from gold bearing-sulphide rich, to barren, sulphide poor sections. There appear to be two shoots on the Q17 vein at the 1,160 metre level; one in the area of the three original crosscuts, and one near the limit of Q17 West Drift.

b) Underground sampling indicates that there appears to be little if any nugget effect for gold mineralization.

c) Precious metal grades increase with increasing sulphide content. Best gold grades occur in sulphide lenses comprising abundant pyrite with lesser chalcopyrite, galena and sphalerite. Gold is also known to occur with late stage specular hematite.

**d)** The Q22 vein extension was exposed by underground development. Where exposed, this shear contains slightly anomalous gold values, but is heavily sheared - oxidized and the ground is extremely unstable.

**e)** With extensive strapping and split set rock bolting it was possible to secure the ground so that development on the Q17 vein could advance safely.

**f)** The ground is broken and there may be support problems during the spring runoff.

## 11. RECOMMENDATIONS

A thorough surface evaluation of the entire Doc property is proposed for 1989. This exploration will define new drill targets that may be tested during the autumn of 1989. Proposals are as follows.

**Phase I**

Prior to the field season, preliminary work will involve:

a) a regional compilation of all data available to assist exploration on the claims,
b) a compilation and assimilation of all available property data,
c) an evaluation of the trace element signature of mineralization within and adjacent to Q17 and Q22 veins,
d) further studies to define the geometry, petrology and mineralogy of the Q17 and Q22 veins,
e) radiometric age determinations.

**Phase II**

Property exploration will define new areas of vein mineralization or structural trends with the potential to yield 500,000 to 1,000,000 tons of ore grade mineralization similar to that exposed in portions of the Q17 vein along the 1,160 metre level.

**Phase III**

Contingent on encouraging results from Phase II, a 2000 metre drill program is proposed to follow up the most attractive target(s) generated during the summer program.

Report by: _____

A. C. Freeze

_____

K. G. Glover

_____

B. M. Scott

## COST STATEMENT

| | | |
|---|---|---|
| A) | Salaries Geology | |
| | Art Freeze - 60 days at $300/day | $18,000 |
| | Murray Strachan - 60 days at $300/day | 18,000 |
| | Brian Scott - 60 days at $250/day | 15,000 |
| | Tim Sandberg - 60 days at $250/day | 15,000 |
| | Jim Touw - 60 days at $250/day | 15,000 |
| B) | Food Costs | |
| | 30 people x 60 days x $27/day | 48,600 |
| C) | Camp Construction | |
| | (40 man camp by Jempland Construction, materials and labour) | 485,000 |
| D) | Helicopter (VIH, NMH, EB206) | 620,000 |
| E) | Fixed Wing | 10,000 |
| F) | Fuel (Diesel, Jet B, Propane) | 50,000 |
| G) | Underground Drifting | |
| | 230 metres at $2,087/metre | 480,000 |
| H) | Surface Drilling | |
| | Falcon Drilling - 2230.1 metres at $92/m | 205,000 |
| | Connors Drilling - 844 metres at $112/m | 94,400 |
| J) | Assays | |
| | 1501 samples at $23.30 | 35,000 |
| K) | Communications | 30,000 |
| L) | Freight | 25,000 |
| M) | Expediting | 30,000 |
| | TOTAL | $2,194,000 |

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**STATEMENT OF QUALIFICATION**

I, Brian Scott, of 371 West Kings Rd., North Vancouver, B.C., certify that:

1) I am a geologist employed by Echo Bay Mines Ltd. Exploration Department, Vancouver, B.C.

2) I have practiced geology for the past 5 years in Canada.

3) I am a graduate of Lakehead University, Thunder Bay, Ontario, with an Honours Bachelor of Science degree in geology.

Brian Scott
Vancouver, British Columbia

Date: March 23, 1989