2802

GEOLOGICAL AND GEOCHEMICAL REPORT
ON THE PROPERTY OF
WHIPSAW MINES LTD. (N.P.L.)

by

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and
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STOKES EXPLORATION MANAGEMENT CO. LTD.

November 30, 1970.

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INTRODUCTION

Whipsaw Mines Ltd. (NPL) owns 112 full size mineral claims and fractions in the Whipsaw Creek area, about 16 miles southwest of Princeton, B.C.

Examination and evaluation of these claims was authorized by Mr. C. R. Martin of #707 - 509 Richards Street, Vancouver 2, B.C. on the 30th of May, 1970.

An exploration program was conducted on the ground by Stokes Exploration Management Co. Ltd. (SEMCO) between June 4th and November 30, 1970.

The work consisted of line cutting, geochemical sampling and geological mapping. A photogeological study was made of the property and surrounding area.

In addition to the above, reports and maps pertaining to the project area were reviewed and studied.

The project was supervised from Vancouver by R. B. Stokes, P. Eng.

This report describes and discusses the results of the program.

SUMMARY

1. Whipsaw Mines Ltd. (NPL) owns 112 full size mineral claims and fractions in the Whipsaw Creek area near Princeton, B.C.

2. Stokes Exploration Management Co. Ltd. (SEMCO) carried out geochemical and geological surveys on these claims between June 4th and July 10th, 1970.

3. It was found that the Whipsaw Property is underlain by Nicola group schists and gneisses which are in contact with a phase of the Coast Range intrusives to the west.

4. Sulphide mineralization in the area is related to fault breccia zones, quartz veining and porphyry sills and consists primarily of the minerals chalcopyrite, pyrite, molybdenite, sphalerite and galena.

5. A number of anomalies were indicated from the geochemical sampling undertaken.

6. A program of exploration is warranted to establish the extent and grade of sulphide mineralization in the area.

   This program should consist of more detailed geochemical and geological surveys followed by bulldozing, trenching and diamond drilling, where warranted.

PROPERTY

CLAIMS AND OWNERSHIP

The property owned by Whipsaw Mines Ltd. (NPL) of #707 - 509 Richards Street, Vancouver 2, B.C., consists of 112 full size claims and fractions.

A list of the claims with their respective record numbers and expiry dates is given in Appendix I of this report.

LOCATION AND ACCESS

The Whipsaw Mines' property is located about 16 miles southwest of Princeton, B.C. The claims lie on the north and south sides of Whipsaw Creek at elevations ranging between 4700 and 6000 feet. The geographical position of the claim block centre is 49° 16' North latitude, 120° 43' West longitude.

Access to the area is by a dirt road running along the north side of Whipsaw Creek for a distance of about 12 miles from the Hope-Princeton Highway. A 4-wheel drive vehicle is required to reach the claims except during dry weather conditions.

HISTORY

The history of the metalliferous deposits in the Princeton area goes back to 1885 when gold placers were first worked. It has remained an active area ever since. The most recent announcements were by Newmont Mining Corporation Ltd. who plan to bring the Ingerbelle and Copper Mountain properties into production.

Whipsaw Creek first became an active area when placer gold and platinum were discovered there in the late 1800's. Lead-zinc deposits have been known on either side of Whipsaw Creek at least since 1915

History (Cont'd)

and the area has been active more or less continuously since that time. The Texas Gulf Sulphur Co. has been working on a block of claims for the past few years and in 1968 Silver Tip Exploration Ltd. completed the construction of a small mill which will be used to process high grade ore for a number of showings.

GROUND CONTROL

A base line was established which runs through the Whipsaw Mines property in a generally north-south direction. This line runs between stations 68 + 00 north and 104 + 00 south on a bearing of 026°. The base line intersects the Whipsaw Creek road at station 1 + 00 south.

Cross lines were cut at 800 foot intervals north and south from base line station 0 + 00. These lines run 4500 feet to the east and up to the edge of the Whipsaw claim block to the west. The exact extent of the control grid can be seen on the accompanying geochemical plan in pocket.

All lines were cut out and flagged with cross line stations marked at 200 foot intervals. In areas of steep terrain, the lines were 'slope-corrected'.

GENERAL GEOLOGY
by D.G.Leighton

The geology of the Whipsaw Creek area is relatively complex and much more field work will have to be undertaken before it is fully understood. It is felt that the key factors with respect to economic mineralization have been identified, however, and these are described on the following pages.

The geological data and conclusions described were arrived at in conjunction with Phillip Anderson who worked with the author in the field.

The Whipsaw Creek area is underlain by a succession of volcanic and sedimentary rocks belonging to the Nicola group which is Upper Triassic in age. This unit strikes N 20° W and dips at moderate angles to the west.

Metamorphism has reached an amphibolite grade throughout the sequence but is highest in the west where the Nicola grades into a body of granitic rock known as the Eagle granodiorite. The Eagle granodiorite which is strongly gneissic in character most probably formed from granitization of pre-existing rocks.

In order to extend geological features into areas north and south of the Whipsaw Valley where little or no outcrop is exposed, a detailed geological section was worked out.

The section, which is presented in a later part of this report, contains the following basic units:

a. Eagle Granodiorite
b. Migmatite (Injection) Zone
c. Transition (Clastic Marine) Zone
d. Oscillatory (Volcanic-Pyroclastic) Zone
e. Volcanic Zone

The volcanic zone, characterized by a series of porphyroblastic hornblende schists and massive hornblende schists, is the lowermost unit. It originated as a series of basic massive volcanic flows. The oscillatory zone which marked the termination of volcanic activity corresponds to a series originally of intercalated basic flows and pyroclastic debris.

General Geology (Cont'd)

In outcrop, the oscillatory unit varies between siliceous hornblende gneisses and massive hornblende schists. There is an angular uniformity between the oscillatory and transition zones. The latter reflects a period of clastic sediment deposition and is characterized by well banded acicular hornblende gneisses and schists.

The original rock unit was probably composed of interbedded shales and subgraywacke with occasional quartz sandstones - (especially toward the top).

The migmatite is an injection or mixed zone of interlayered granodiorite with hornblende gneiss. The top of the section is composed of Eagle granodiorite which is structurally conformable with the Nicola group. Both the migmatite and granodiorite are thought to have originated as a series of clastic shallow marine sediments.

In Lower Jurassic time, the area was subjected to pressure from the west which warped the Nicola and earlier formations into a series of shallow north-trending folds. This folding, accompanied by uplift, was associated with the Coast Range orogeny.

During the initial stages of folding, metamorphic grades were high enough that certain belts reached anatexis (melting). The Eagle granodiorite, with its accompanying porphyritic sills, correspond to such a belt.

The heating, associated with formation of the Eagle granodiorite, seems to have locally accentuated pre-existing gentle folds, thus explaining the relatively steep anticline located immediately east of the intrusive unit.

Minor similar folds have been generated by the emplacement of porphyritic and granodiorite sills. These folds generally reflect gross structure (regional strain) where they take the appearance of drag folds.

As the entire sequence cooled (probably accompanied by further uplift) local molten parts remained within the granodiorite giving rise to mineralizing fluids.

General Geology (Cont'd)

The locus of one of these "secondary thermal events" is located about 2 miles north of Whipsaw Creek just west of the Eagle granodiorite - Nicola group contact. The epicentre of this late stage magmatic activity, referred to as the heat source, is established by the following factors:

1. It is the locus of a set of concentric curviliner fracture and fault traces.

2. It is the locus of a manganese dioxide (pyrolusite) halo.

3. It is the locus of a lateral concentric mineral zoning observed in the area.

4. It is characterized by a proliferation of porphyry dikes and sills.

5. It best explains anomalies in the regional fracture pattern and fracture sets observed in its vicinity.

The heat source then is the origin of most, if not all, of the economic mineralization in the Whipsaw Creek area.

A mineral pargenesis has been resolved which indicates emanations from the heat source in the following order:

(1) porphyritic dikes and sills with saussuritizing fluids

(2) pegmatitic (and aplitic) dikes and sills.

(3) quartz-sericite veining

(4) quartz veining (with accompanying mineralization and calcite)

(5) calcite vein filling

Mineralization in the properties of Whipsaw Mines Ltd., Silver Tip Exploration Ltd., and the Texas Gulf Sulphur

General Geology (Cont'd)

Co. include the sulphides of copper, lead, zinc, iron and molybdenum. Gold and Silver too have been recovered from the area. Mineralization is controlled by fault structures and is found either in the faults or in quartz veins associated with them.

The key alteration minerals are epidote, tremolite, actinolite, sericite, chlorite and calcite. In every case, mineralization seems to have been derived from the heat source previously described.

DETAILED GEOLOGY

(1) STRATIGRAPHIC SEQUENCE

All rocks in the Whipsaw Creek area are metamorphosed but, nevertheless, it is possible to make several assumptions as to their origin.

(a) Volcanic Zone

Broadly, the stratigraphically lowest rocks in the project area consist of a series of andesitic to basaltic (tholeiitic) volcanic flows deposited in a fairly deep eugeosynclinal trough in Upper Triassic time.

They have, by analogy, been correlated with Schau's A_1 assemblage - that is, the upper volcanic flow unit of the Nicola Group.

All of the north and central section of the Whipsaw claim block is underlain by these rocks. In outcrop they appear as grading from porphyroblastic hornblende schist to a finer grained, more massive "volcanic" hornblende schist (a field term to distinquish from other hornblende schists).

Interlayering of porphyroblastic and "volcanic" hornblende schists is very regular in the section on the north hill above the mill, and most likely represents an alternation between non-porphyritic flows ("volcanic") and porphyritic flows (porphyroblastic), the phenocrysts acting as nuclei for porphyritic growth.

In thin section (see Appendix II, T.S.15) relict augite phenocrysts can be discerned but are now, like the matrix, completely converted to an amphibole of corresponding metamorphic grade.

Not all of the volcanic assemblage is flow rock however. There is a zone, possibly 600 or more feet wide, containing siliceous banded sediments within the volcanics.

The top of this zone is a distinctive bed (now a quartz banded gneiss) looking, in outcrop like a porphyry sill

Detailed Geology (Cont'd)

or a quartzite. This is overlain by a distinctive volcanic unit characterized by streaked out white feldspar porphroblasts (originally phenocrysts) defining a lineation. These two units form a good correlatable horizon within the volcanics.

The bottom of the volcanic (A_1) unit is not exposed in the Whipsaw claim group and may not outcrop since, further down the creek, the crest of the anticline occurs. The top is well defined and is a massive, foliated, volcanic to porphroblastic hornblende schist (flow) which forms a resistant bed transecting the countryside.

(b) Oscillatory Zone
(refer stratigraphic section)

Above the uppermost flow an increase in felsic content of the rocks results in interbedding of siliceous hornblende gneisses with the hornblende gneisses and schists. True volcanic flows are not found here, since most of the lithology was originally tuffs. Siliceous sections (representing sedimentary interbeds) are regularly interlayered with the tuffs, thus giving rise to the oscillatory nature of the zone.

A typical tuff is seen in thin section 6 (Appendix II). In outcrop the zone is distinguishable by fibrous to matty character of the "hornblende" as well as oscillations.

Thus, the oscillatory zone represents the onset of sedimentation and the cessation of volcanic flows. The previously deposited flows rapidly filled the eugeosynclinal basin so that a medium to shallow water environment was set for further sedimentation. With waning of vulcanism tuffs dominate this transitional unit.

(c) Acicular Hornblende Zone
(refer stratigraphic section)

The next zone, which is entirely sedimentary in origin,

Detailed Geology (Cont'd)

is about 1100 feet thick, and as a unit is distinctive from all other lithiologies. Throughout its length it is characterized by long acicular hornblendes developed on the foliation planes (except in the more pure quartzites) which forms bedding schistosity.

Particularly characteristic of this unit is fine quartz banding and a high silicic content unseen in lower lithologies.

Within the zone, correlation is difficult; marker beds are scarce and lithologic appearance can vary greatly in an outcrop. The lower most section is more feldspathic, consisting of colour banded delicate siliceous gneisses suggestive of partly tuffaceous origin.

These grade to banded hornblende quartzites and continue to the top of the section as interbedded acicular hornblende schists and hornblende quartzites - simply a varying of the two components - hornblende and quartz.

A typical lithology is Thin Section 13 (Appendix II).

The unit, as a whole, is of quartz wacke composition, with feldspar content very low. The sedimentary environment was therefore, a quiet water moderate to shallow marine basin, with a slow influx of immature quartz rich sediments. Source rocks were likely sandstones and shales from a low landmass to the 'south and southeast'.[4]

There is, however, a distinct uncomformity, visible in outcrop as a series of small angular unconformities, near the base of the acicular hornblende zone. This is taken to represent a period of quiescence between previous volcanic activity and eventual clastic sediment deposition.

Near the unconformity (which also defines the base of the unit) there are some minor sedimentary structures and possible disturbed bedding.

Detailed Geology (Cont'd)

At the top of the acicular zone is a 3 foot wide pure white quartzite bed which forms a resistant and distinct marker bed used in correlation.

(d) Migmatite Zone
(refer stratigraphic section)

A "true" migmatite is defined as equal proportions of intrusive rock and country rock "mixed" together. This migmatite zone satisfies this requirement and is so named as a descriptive field term. Its beginning is marked by the first appearance of granodiorite sills in the surrounding schists and gneisses just above the white quartzite marker bed.

Throughout the migmatite there is evidence that some of the granodiorite sills and quartz veins have been injected. (As for example: small granodiorite sills are seen to bulge stratigraphy aside toward their terminus.) However, it is unlikely that much granodiorite is of injection origin.

Compositionally, the sediments of the migmatite are very similar to those of the acicular hornblende zone. Some of the schists are more highly folded, gneisses show a distinct fine granular appearance, and biotite is present in both gneisses and migmatite, suggesting both have a similar genesis.

Granodiorite bodies are almost without exception sills, whereas later quartz bodies are dykes. It is probable that much of the granodiorite was originally sedimentary and the metamorphic grade reached was high enough to melt the silicic fractions -- causing banding segregation.

Further evidence for the granodiorite being sedimentary comes from the fact that, in the middle of a granodiorite rich section lies lies a limestone unit, containing a 5 foot wide pure gray marble bed. Further, the granodiorite is strongly gneissic parallel to stratigraphy.

Detailed Geology (Cont'd)

At the base of the migmatite zone, is a peculiar body described in the field as a "Muscovite granite". Thin section studies revealed an unusual sodic composition, consisting almost entirely of albite and quartz with some aluminous garnet. This may be an original sedimentary quartz bed rich in sodium-aluminum clay and feldspar.

However, it has been melted (silicic composition) and shows some cross cutting relations.

Further investigation, petrographic and analytical work should be done on the granodiorite in the migmatite zone to determine with more certainty its origin, as it is genetically connected to all mineralization in the area.

(e) Eagle Granodiorite
(see stratigraphic section)

Previous workers in the area have assumed the Eagle granodiorite to be an intrusive body. Detailed work accomplished so far shows that it was most probably a sedimentary feldspathic arenite which logically continues on from lower sedimentary lithologies. Therefore, it is presently believed to be a para-allochthonous granodiorite.

The top of the migmatite zone is marked by the diminution of interlayered gneisses in the granodiorite. Above this, the lower part of the Eagle granodiorite is inhomogeneous with mafic and felsic banding throughout.

Thus, with increasing silicic content upward and increasing temperature toward the granodiorite belt, semi melting of the sediments has occurred, partly homogenizing original sedimentary bedding. Upwards, the granodiorite grades to a homogeneous medium grained biotite granodiorite continuing for several miles to the west with only minor variations in banding, biotite content and grain size. The granodiorite is gneissic throughout.

Detailed Geology (Cont'd)

(f) Other Lithologies
(refer stratigraphic section)

(i) Porphyries

These are feldspar amphibole porphyries with phenocrysts mainly of plagioclase, orthoclase, and hornblende. They are found as sill injections throughout the acicular hornblende and migmatite zones but rarely in lower zones. They are, as a rule, saussuritized and mineralized.

Their abundance is greatest north of Whipsaw Creek on the western boundary of the Texas Gulf Sulphur claims where they occur as massive swarms. The porphyries are genetically related to the heat source.

(ii) Pegmatite (and aplite)

These bodies are semiconformable and partly cross cutting. Within the granodiorite, pegmatite seems to be a minor phase of the granodiorite. Pegmatite and the chilled equivalent (in thinner dykes), aplite, are most prolific in the upper part of the migmatite zone where they show definite evidence of an injection origin, bulging aside the stratigraphy as do granodiorite injections.

Macroscopically, their lowest limit is the base of the of the migmatite zone but microscopically they may grade to quartz sericite veins away from their source and hence permeate the lower units. Quartz veins are further discussed in "Mineralization".

(iii) The possibility of an ultrabasic pyroxenite body exists since, at one time, platinum (as well as gold) was panned in Whipsaw Creek. Such a unit is

Detailed Geology (Cont'd)

suspected to occur somewhere in the northwest section of the Whipsaw Claim Group but has not, as yet, been found. If an ultrabasic unit exists on the property, it may be mineralized. Further work should determine this.

(2) METAMORPHISM

Metamorphism appears to have reached an amphibolite grade throughout the area, probably in the medium pressure series -- the Abukuma amphibolite.

An element of ambiguity lies in the fact that there are no diagnostic parageneses in the rocks to give an accurate indication of grade. The sedimentary rocks are uniformly low in free alumina and the volcanics lacking in free alumina, hence, no diagnostic pelitic assemblages are formed.

Calcium is not abundant enough, except in the limestone, to form calcic assemblages, but seems to be super abundant in the late hydrothermal stages.

Since the volcanics are so deficient in alumina, hornblende is, in fact, not a stable mineral; ferroactinolite takes its place. This is a pale green amphibole, fibrous like actinolite, and between actinolite and hornblende in composition. Field distinction is virtually impossible, so throughout, the term hornblende has been attached to the volcanic schists for sake of simplicity.

Thus, parageneses in the volcanics are uniformly:

Ferroactinolite + Augite + Plagioclase
Ferroactinolite + Plagioclase and
Ferroactinolite + Biotite + Plagioclase + Augite

The transition from ferroactinolite to hornblende is relatively rapid (100 to 200 feet) so an alumina isopleth can be drawn, (see accompanying Geological Map), which represents the

Detailed Geology (Cont'd)

onset of sedimentary deposition. This may also be an isograd since hornblende is stable at higher temperatures than ferro-actinolite.

In the metasediments lithologies are:

Hornblende + Augite + Plagioclase in the lower section
to Hornblende + Augite + Plagioclase + Quartz
to Hornblende + Augite + Quartz.

In the limestone the paragenesis is:

Calcite + Grossularite + Diopside

All these assemblages are stable over temperature and pressure ranges of:

500° to 700° C., $\frac{1}{2}$ to 6 Kilobars

A figure of 650° and 2 kilobars seems reasonable, but further determinations are required.

The temperatures attained are sufficient to melt a body of granite composition and considerably soften a body of granodiorite composition -- something which has evidently occurred.

Thus, the Eagle granodiorite, if originally sediments, would have been softened enough to destroy bedding and leave only a gneissosity. Likewise, if it intruded during metamorphism it would assume a similar gneissosity. Either way, metamorphism is related to a linear heat source along the length of the Eagle granodiorite.

On the south hill of Whipsaw Creek an oval shaped air photo feature outlines what appears to be a local heat flow anomaly, because outcrop there shows rotated, assimilated and stoped blocks of gneiss in the granodiorite with some softening and folding of the gneiss.

Retrograde metamorphism is also present and takes the form of

Detailed Geology (Cont'd)

extensive saussuritization of porphyries, sericitization and minor saussuritization of metavolcanics and metasediments, and saussuritization of parts of the granodiorite and pegmatite. The common saussurite assemblage is:

Sericite + Albite + Epidote + Quartz + Calcite + Chlorite

for basic compositions and

Sericite + Quartz + Albite + Epidote

for more silicic compositions and is characteristic of greenschist grade metamorphism. On further cooling, saussurite grades imperceptably into quartz-sericite veining bearing abundant mineralization, and is discussed later. The saussurite fluids have borne some pyrite and rarely chalcopyrite.

(3) STRUCTURE

(a) FOLDING

The major fold in the region is an inclined asymmetric anticline with a steep westerly dipping limb and a shallow easterly dipping limb. The axial trace is much to the east of the claim group so the stratigraphy observed from volcanics to granodiorite is that of the steep western limb.

The regional strike of the rocks is about 155°, with 160° common in the migmatite, but verging to 140° and less to the east in the volcanics as the nose of the fold is approached.

Minor folds are not abundant, but where seen, are a hybrid of a flexural movement with a similar style appearance and may represent two different styles of folding. Usually, the similar folds are very tight crinkles without axial plane cleavage. The strike of many minor folds is parallel to the strike of the bedding, accounting for their scarcity and tightness. This implies that the maximum compressive stress was perpendicular to bedding (the dominant foliation) during folding and thus accounts for the very drawn out flattened nature of the amphiboles and micas. The stress direction is consistent with the regional picture.

Flexural style folding postdates the main metamorphism as minor fold crumples can be seen to transect mineral orientation lineation. They show a consistent sense of movement of south-west over north-east and therefore reflect the major structure. The similar style plications are associated with (or possible cause by) granodiorite injections in the migmatite, and would be earlier than flexural buckling, if two types are distinguished. A major "minor fold" is present in the area (See Geological Map) and is a monoclinal flexure, or local steepening of the beds. It seems very likely that this is an accurate reflection of the major structure, and, if so, has important bearings on genesis of the rocks, especially the granodiorite.

(b) FAULTING & FRACTURING

There are many sets of fractures and faults in the area - some consistently mineralized, and others consistently unmineralized. A prominent set is a series of very small faults and fractures striking 070° to 080° and dipping steeply to the north. They show both left and right lateral movement (only an inch or so) offsetting bedding but are everywhere present. These are believed to be related to an extremely broad warping on east-west axes associated with the Eagle granodiorite body.

Economically, the most important outcome of metamorphism was the production of an anatectic melt at a somewhat shallow depth (one to two miles). Its composition was largely granitic, but some mafic material had been

Detailed Geology (Cont'd)

incorporated into it, as revealed by the compositions of augite, hornblende, plagioclase and orthoclase porphyry dykes, particularly on the Texas Gulf Property. As cooling proceeded, this magma built up a volatile pressure head and began to come up, impressing itself on the above rocks as a series of concentric curvilinear fractures.

These are discussed in "Photogeology". Hence this magma expressed itself on the north hill of Whipsaw Creek, but never actually extruded. Instead, contained under the sediments, it displayed a complex history of evolution, giving rise to all mineralization (except syngenetic) in the area.

Therefore, this heat source, with regard to fractures, produced the curvilinears, consistent shallow south dipping fractures now mineralized (best seen in Whipsaw Creek), and most of the regional fracture pattern semi radial about the heat source (See Photogeologic Compilation Map). Much of the minor fracturing throughout the area is quite late and postdates quartz vein injection.

The development of three major fault breccia zones in the project area is an important event economically but they cannot, as yet, be attributed to any one cause. They must, necessarily, be formed after porphyry, pegmatite and aplite intrusion, since these fragments are found in the breccia, but predate hydrothermal quartz vein activity. It seems most likely that at the end of pegmatite intrusion a high volatile head was built up, and then rapidly released along certain zones of weakness. Offset along the breccia zones appears to be nil.

That volatile pressure played a key part in the history of the evolving magma is proven by the presence of consistent reverse zoning in plagioclase phenocrysts in the porphyries examined in thin section.

Detailed Geology (Cont'd)

(4) PHOTOGEOLOGY

A photogeological survey was made of the Whipsaw property and surrounding area. The study compared fracture densities and delineated primary structural features. In keeping with standard practice lineations exceeding 10,000 feet in length are defined as faults and those less than 10,000 feet as fractures.

The photogrammetric work was done using a Hilger and Watts S.B. 180 mirror stereoscope.

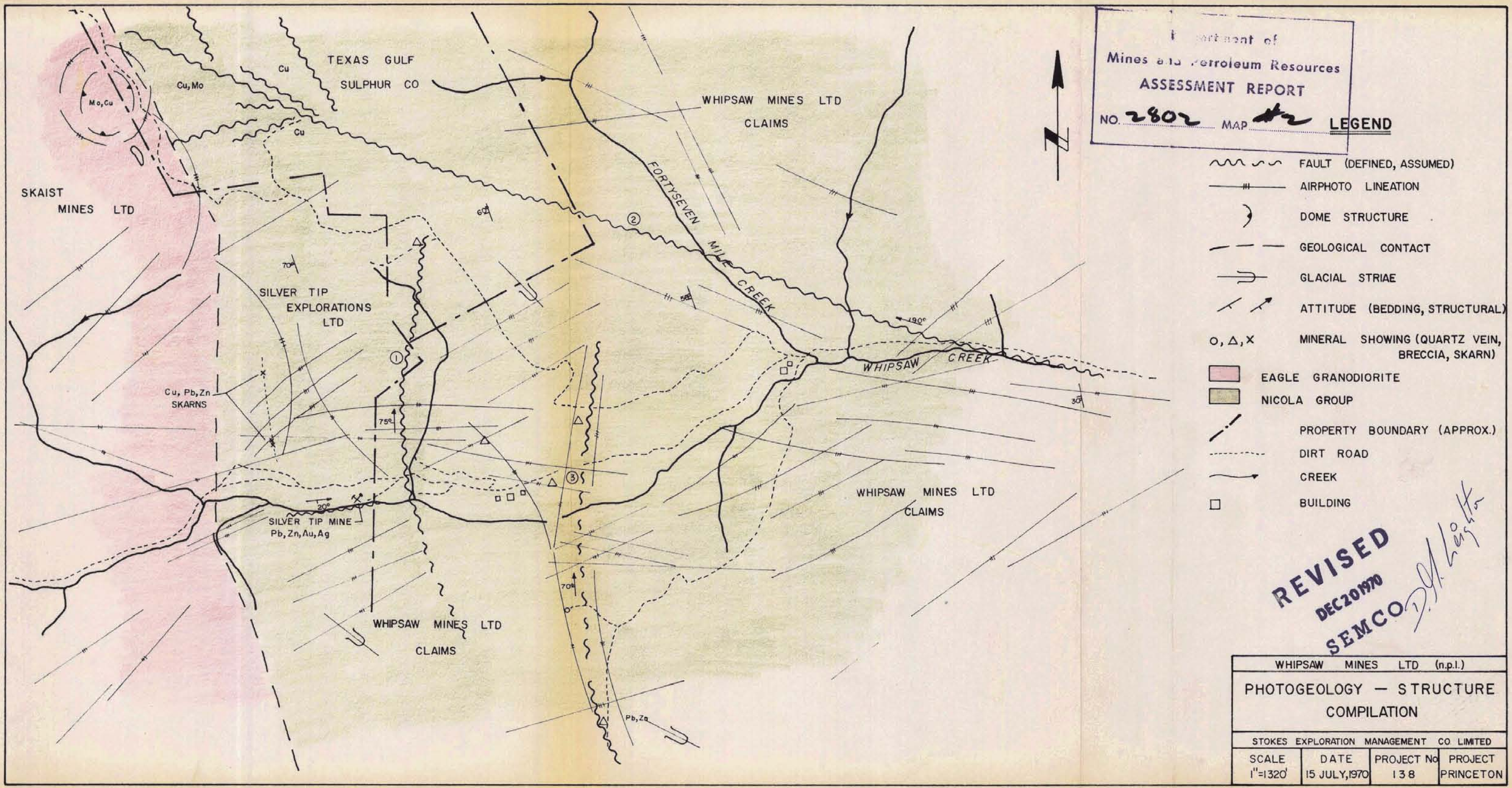
Results of the survey are presented on an accompanying plan - scale 1 inch equals approximately 1320 feet. This plan shows photo lineaments in relation to topographic and cultural features.

The three prominent airphoto traces indicated 1, 2, and 3 are important structures controlling mineralization which were found and studied on the ground. The first two are part of a belt of brecciation located to the east of the Eagle granodiorite. The third corresponds to a fault which runs, for part of its length, up Whipsaw Creek.

Bedding, which trends at 155°, can be seen with difficulty on the airphotos. Since dips are relatively steep, bedding lineation are straight except on the steeper parts of Whipsaw Valley where they diverge slightly to the west.

Glacial striations, variable between 300° and 310°, are visible at higher elevations. These indicate an ice movement from the northwest to southeast.

Two groups of fracture sets are indicated on the airphotos. Most of the fracturing is steep but individual fracture planes dipping as low as 20° have been identified. Set F_1 strikes at 280° $\pm$ 10° and set F_2 at 280° $\pm$ 10°. It is probably the relatively high density of these fracture intersections that originally caused the development of Whipsaw Valley as a ressessvie topographic feature.


Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 2802 MAP #2
LEGEND
FAULT (DEFINED, ASSUMED)
AIRPHOTO LINEATION
DOME STRUCTURE
GEOLOGICAL CONTACT
GLACIAL STRIAE
ATTITUDE (BEDDING, STRUCTURAL)
MINERAL SHOWING (QUARTZ VEIN, BRECCIA, SKARN)
EAGLE GRANODIORITE
NICOLA GROUP
PROPERTY BOUNDARY (APPROX.)
DIRT ROAD
CREEK
BUILDING
TEXAS GULF SULPHUR CO
SKAIST MINES LTD
SILVER TIP EXPLORATIONS LTD
WHIPSAW MINES LTD CLAIMS
FORTYSEVEN MILE CREEK
WHIPSAW CREEK
SILVER TIP MINE
Pb, Zn, Au, Ag
Cu, Pb, Zn SKARNS
Cu, Mo
Mo, Cu
Cu
Pb, Zn
REVISED
DEC 20 1970
SEMCO
WHIPSAW MINES LTD (n.p.l.)
PHOTOGEOLOGY — STRUCTURE COMPILATION
STOKES EXPLORATION MANAGEMENT CO LIMITED
SCALE 1"=1320'
DATE 15 JULY, 1970
PROJECT No 138
PROJECT PRINCETON

Detailed Geology (Cont'd)

The above features: bedding, glacial striae, and fracture traces are shown on the accompanying plan entitled 'PHOTOGEOLOGY - COMPILATION'.

An important structure is indicated by the set of concentric curvilinear fracture traces that are shown immediately to the west of the Texas Gulf Sulphur Co. claim block. This 'dome' feature is considered to mark the locus of late stage magmatic activity and the source of most, if not all, of the economic mineralization in the Whipsaw Creek area. There is a strong relationship between the conjunctions of fracture intersections and domes with mineralized areas.

(5) SULPHIDE MINERALIZATION

(a) OCCURRENCE

Both epigenetic and syngenetic mineralization have been found on the claim group. Syngenetic mineralization occurs as finely disseminated pyrite (less than 1%) and possibly some chalcopyrite throughout the Nicola Volcanics, the tuffs and the acicular hornblende schists. It is not economical but genetically could be the source of epigenetic mineralization where it has been melted from the volcanics at depth.

The porphyry sills on the Texas Gulf Sulphur group are mineralized with pyrite and chalcopyrite (malachite) consistently but have not been observed as carrying any large amounts of sulphides (usually less than ¼% Cu.). They are not considered alone, to be of economical potential. The two structures of greatest interest, and bear the main mineralization in the area, are fault breccia zones and quartz sericite veins. Both occur on the Whipsaw claim group.

The main north-south breccia is exposed in a trench on Texas Gulf Sulphur's property and bears pyrite, sphalerite

Detailed Geology (Cont'd)

and chalcopyrite in a quartz gangue (Appendix II, T.S.2). The grade is about ½% copper from one sample studied. This breccia zone is known to continue down onto the Whipsaw property and crosses Whipsaw Creek near the Mike showing, where a gossan can be seen.

The showing itself is a sheared, mineralized zone between two closely spaced fault planes which are offshoots of the breccia zone. The breccia is not exposed here but has been drilled previously. Core from the holes showed the existence of the breccia bearing pyrite, sphalerite, chalcopyrite and galena.

Anticipating a good geochemical response, the breccia was sampled, results are discussed later. It appears that this zone may continue for some distance over the claim group.

So far, three other breccia zones have been discovered. The Night & Day property about 1 mile south of Whipsaw Creek is an old showing which has been drilled. Core data showed a breccia bearing pyrite, sphalerite, and malachite. (See Appendix II, T.S. 3). On regional strike with the Night & Day showing is another small showing on the north hill of Whipsaw Creek. It too is a breccia zone (and quartz vein) which contains abundant pyrite, with sphalerite, chalcopyrite and possibly chalcocite.

If these two are the same breccia zone, a potential for mineralization exists along its length and is likely to be enhanced were the breccia is cut by other fractures or curvilinear features. Further, and more intensive examination and sampling is hoped to establish an extent and grade of mineralization that exist in these breccias.

Another breccia zone was examined on the north hill of Whipsaw Creek just below the Texas Gulf Sulphur road. Like all the other breccias it shows extensive sericitization and silicification and bears pyrite sphalerite and argentiferous galena. Its occurrence seems to be related to a curvilinear feature which continues through Whipsaw ground.

Detailed Geology (Cont'd)

Another major showing is the Five Fissures on the south hill of Whipsaw Creek. It is a quartz sericite vein which has strongly bleached surrounding hornblende schists. Drill core shows pyrite, sphalerite, chalcopyrite and galena associated with the vein. Underground working was carried on at one time.

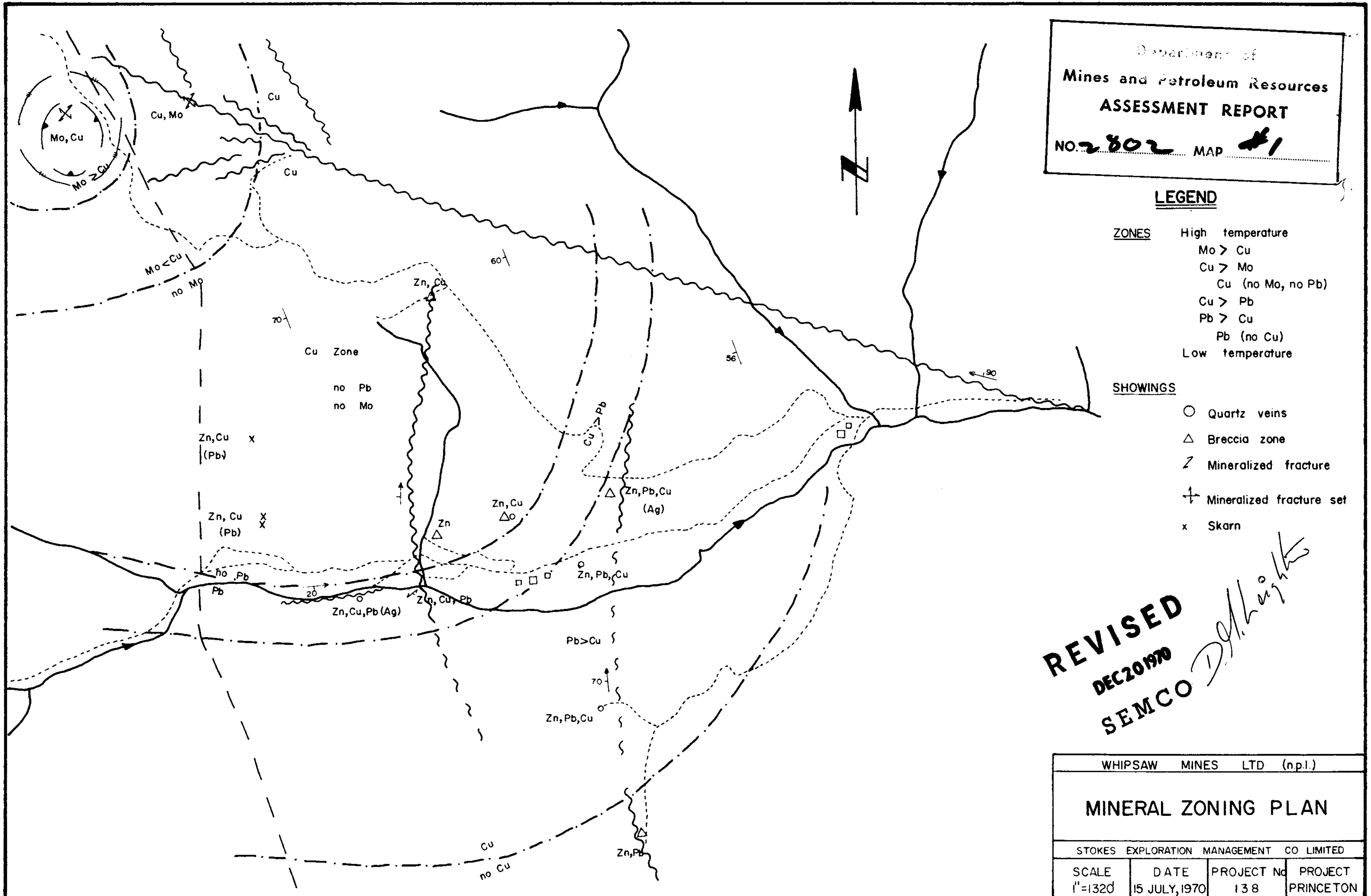
Another old showing immediately east of the mill on the Whipsaw Creek road is a quartz vein very similar to the showing above the mill. Here pyrite, sphalerite, galena and chalcopyrite occur.

Silver Tip Explorations Ltd. are presently progressing with an adit on Whipsaw Creek in the southwest corner of the map. The mineralization (although not observed) is believed to be in a quartz sericite vein filling on east-west trending shallow south dipping fractures, of which there are many near the creek. Sphalerite and pyrite, galena, chalcopyrite (and reportedly silver in the galena) are present.

Finally, there are a series of skarn showings associated with the limestone unit north of the creek. The Marion and L172 showings are skarns in the limestone, but mineralization has been introduced by quartz sericite veins, especially well displayed in the showing encountered on the north hill traverse. Mineralization consists of sphalerite and pyrite, chalcopyrite and a little galena in a garnet, epidote, diopside skarn.

Two other showings, not on the geological map, but indicated on the photogeological compilation are a chalcopyrite with minor molybdenite on Texas Gulf ground, and a molybdenite chalcopyrite showing west of it. Besides being of economical interest, their occurrence is important to the regional zoning picture.

In summary, potential for copper-lead-zinc mineralization (with possible silver) exists on the Wh ipsaw ground. Of


Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 2802 MAP #1
LEGEND
ZONES
High temperature
Mo > Cu
Cu > Mo
Cu (no Mo, no Pb)
Cu > Pb
Pb > Cu
Pb (no Cu)
Low temperature
SHOWINGS
Quartz veins
Breccia zone
Mineralized fracture
Mineralized fracture set
Skarn
REVISED
DEC 20 1970
SEMCO
WHIPSAW MINES LTD (n.p.l.)
MINERAL ZONING PLAN
STOKES EXPLORATION MANAGEMENT CO LIMITED
SCALE 1"=1320
DATE 15 JULY, 1970
PROJECT No 138
PROJECT PRINCETON
Mo, Cu
Cu, Mo
Cu
Mo ≥ Cu
Cu
Mo<Cu
no Mo
Zn, Cu
Cu Zone
no Pb
no Mo
Zn, Cu (Pb)
Zn, Cu (Pb)
Zn, Cu
Zn
Cu > Pb
Zn, Pb, Cu (Ag)
no Pb
Pb
Zn, Cu, Pb (Ag)
Zn, Cu, Pb
Zn, Pb, Cu
Pb>Cu
Zn, Pb, Cu
Cu
no Cu
Zn, Pb
60
70
56
90
20
70

particular interest are breccia zones and quartz veins which are at present only meagerly and randomly exposed. Further work should include assessment of these features by sampling, trenching or diamond drilling.

(b) ZONING AND PARGENESIS

There is a distinct zonal arrangement to sulphide mineralization in the area. It is concentric about the heat source outlined by curvilinears, from which the mineralizing fluids clearly emanated.

The following zones can be defined quite well, and are shown on the Mineral Zoning Plan:

(i)	Molybdenite greater than chalcopyrite	Mo, Cu
(ii)	Chalcopyrite greater than molybdenite	Cu, Mo
(iii)	Sphalerite and chalcopyrite	Zn, Cu
(iv)	Sphalerite, galena greater than chalcopyrite	Zn, Cu, Pb
(v)	Sphalerite, galena greater than chalcopyrite	Zn, Pb, Cu
(vi)	Sphalerite and galena, no chalcopyrite	Zn, Pb

This represents a simple decrease in temperature through the vein and breccia network away from the heat source. The anomaly in skarn deposits' minerals could be caused by the different host rock lithology and chalcophile affinity.

The regional zoning picture is useful in further exploration since it indicates where minerals should and should not be found. Sphalerite, however, is abundantly disseminated throughout the whole area, for nearly every thin section examined had minor disseminated sphalerite. Also where pyrite was present, it was usually rimmed by sphalerite.

This implies there is also a regional paragenesis to sulphide mineralization. Indeed, chalcopyrite is surrounded by pyrite which is surrounded by sphalerite, while galena is admixed with sphalerite.

Detailed Geology (Cont'd)

The paragenesis is therefore:

Molybdenite
Chalcopyrite
Pyrite
Sphalerite
(Galena)

all representing a decrease in temperature with time.

(c) ALTERATION AND GANGUE

The gangue minerals further substantiate the picture of zoning and paragenesis. From highest temperature to lowest temperature, the gangue is:

Quartz crystals + chlorite (+ topaz?)
Quartz + sericite
Quartz + sericite + calcite
Quartz + calcite

Further, in the Night & Day breccia, a gangue paragenesis is observed from:

Quartz + sericite
to Quartz + calcite
to Calcite

These concepts are consistent with a solidified but evolving magmatic body expelling hydrothermal fluids and volatiles throughout its cooling history.

(6) SUMMARY GEOLOGICAL HISTORY

Both the premineralization history and mineralization history of the Whipsaw Creek area are involved, and clearly, more work needs to be done toward understanding it, before a complete evaluation of the property can be made.

Detailed Geology (Cont'd)

A provisional geological history of the area is presented here. Its primary purpose is to illustrate:

(a) the geological history is complex
(b) veining and breccia history is also complex
(c) many conclusions are tentative since several age relations have not, as yet, been observed

History:

1. Deposition of Nicola volcanics with overlying tuffs in Upper Triassic Time.

2. Non depositional diastem or unconformity.

3. Deposition of Whipsaw sediments.

4. Continued deposition of sediments now called Eagle granodiorite (possibility of intrusion).

5. Metamorphism of sediments as a result of down warping into a synclinal trough.

   (a) At highest heat flow, anatectic magma produced. Sediments homogenized to granodiorite, softened and injected. Local stoping. Local quartz sweating and injection.

   (b) Granodiorite injection accompanied by local similar folding.

6. Waning of metamorphism and cooling of anatectic magma. Porphyry intrusion accompanied or followed by saussuritization. Minor mineralization with porphyries. Probably local flexural buckling.

7. Pegmatitic and aplite intrusion

   - Cooling period accompanied by volatile build up --

Detailed Geology (Cont'd)

8. Brecciation along zones followed by silicification.

   (a) Quartz sericite filling of breccia zone and veining in country rock carrying major mineralization. Zoning, paragenesis.

9. Quartz-calcite veining followed by calcite vein filling.

10. Uplift continuing and development of regional fracture pattern on brittle break up of rocks. Development of Whipsaw Creek in highly fractured zone.

GEOCHEMICAL SURVEY

(1) FIELD PROCEDURE

A total of 933 soil samples were collected at 200 foot intervals along the Whipsaw grid lines. Samples were obtained with mattocks which were satisfactory for the soil conditions encountered. Soil was taken from the "B" soil horizon where possible or otherwise from the top two inches of the "C" zone. Sample material was placed in 3" x 5" water resistant kraft paper envelopes. Specially designed sample books were used to record field data. Information recorded included location, soil type, colour, slope, sampler and date. All sample locations were marked with appropriately numbered yellow flagging.

(2) SOIL CONDITIONS

The Whipsaw Creek area is charaterized by light to moderate rainfall. Brown zoned aridic soils have developed in a few locations, especially at higher elevations. In most places, however, soil is dominated by a grey clay-rich type of glacial origin.

(3) RESULTS

Geochemical results are presented on a 1:inch to 500 foot plan (See pocket). Threshold values were determined from a statistical evaluation of the sample assay results.

The average value for the area was found to be 56.5 ppm for copper. The threshold value was defined at 100 ppm. See Appendix III for a description of the trace element analysis procedure used. Bondar-Clegg and Co. Ltd. of North Vancouver, B.C. prepared and processed all samples.

The highly anomalous line corresponds to a (mineralized?) fault zone which was identified during photogeological studies and later found on the ground. This area should be surveyed out and the parts located on the property of Whipsaw Mines Ltd. trenched and/or diamond drilled.

Geochemical Survey (Cont'd)

The other geochemically anomalous areas shown should be "detailed" by additional sampling on a closer spaced grid. These areas should then be trenched using a D7-E bulldozer, of equivalent machine. Any mineralization intersected will determine the need for further work.

Other mineralization fault zones discovered on the project area should be sampled throughout their length in a manner anologous to the B^Z line. Any anomalous areas defined should then be trenched and/or drilled.

It must be stressed that due to the glacial origin of soils in much of the project area, mineralized zones may not show up in soil sample results. Therefore, poor geochemical results do not necessarily negate the potential of some areas. This is particularly true in the vicinity of kame terraces.

In addition to the above, it is recommended that work be done to determine the best element and analysis procedure to be used in the future.

All known mineral occurrences should be sampled and tested for various elements. It may be found, for example, that silver is the best elemental indication of economic mineralization.

CONCLUSIONS AND RECOMMENDATIONS

Work done to date indicates that the property of Whipsaw Mines Ltd. has potential for commercial quantities of base and precious metals. Additional exploration work is warranted to test the area.

The following program is recommended:

1. Trench geochemical anomalies to expose bedrock.

2. Test for an extension of mineralization interpolated from the Texas Gulf Sulphur property by trenching and diamond drilling.

3. Where warranted, diamond drill to establish extent of mineralization found from previous work.

BUDGET

(Estimated Costs)

1.	Diamond drilling	$50,000.00
2.	Bulldozer trenching	30,000.00
3.	Geology and engineering	20,000.00
	TOTAL	$100,000.00

CERTIFICATION

I, RONALD B. STOKES, do hereby certify that:

1. I am a practicing Professional Mining Engineer with offices at Suite 209 - 678 Howe Street, Vancouver 1, British Columbia and resident of Vancouver.

2. I am a graduate of the Camborne School of Mines, Cornwall, England, 1952.

3. I have practised Mining Engineering and Mining Exploration for eighteen years, fifteen of which were based in British Columbia.

4. I am a Member, in good standing, of the Association of Professional Engineers of the Province of British Columbia.

5. I am a Member of the Canadian Institute of Mining and Metallurgy and Associate Member of the Institution of Mining and Metallurgy, England, and the Australasian Institute of Mining and Metallurgy.

6. I am President of Stokes Exploration Management Co. Ltd. which carried out the program of exploration.

   This report is based on study and interpretation of data assembled by D.G.Leighton, Geologist and Phillip Anderson by personal examination on the property and work carried out under my supervision.

7. I have no direct, indirect or anticipated interest in the property or Whipsaw Mines Ltd, (NPL).

R B Stokes

R.B.Stokes, P.Eng.

July 15, 1970.

Respectfully submitted:

R. B. Stokes, P.Eng.

D. G. Leighton,
Geologist/Geophysicist

Phillip Anderson
Geologist

STOKES EXPLORATION
MANAGEMENT CO. LTD.

July 15, 1970.

REFERENCES

1. Annual Reports, Minister of Mines, B.C.: 1915, pp. 245, 346: 1920, p. 160: 1927, pp. 251-253: 1928 p. 264: 1929, p. 276: 1930 p. 214.

2. Annual Reports, Minister of Mines, B.C.: 1931 - 1968

3. Cairns, C.E. (1923): Geological Exploration in Yale & Similkameen Mining Division, Southern B.C.: G.S.C., Summary Report, 1922, Pt. A.

4. Rice, H.R. (1947): Geology and Mineral Deposits of the Princeton Map - Area, B.C. G.S.C. Memoir #243.

5. Schau, M.P. (1964): Geology of the Upper Triassic Nicola Group in South Central British Columbia, unpublished Ph.D. thesis, U.B.C.

6. Stokes, R.B. and Leighton, D.G. (1969): Report on the 'M.J.' Claim Group, Princeton Area, B.C.

APPENDIX 1

CLAIMS LIST

SIMILKAMEEN MINING DIVISION

CLAIM NAME		RECORD NOS.	RECORD DATE	YEARS PER CLAIM	TOTAL YEARS
Mae	1-3	20532-34	27th June, 1967	2	6
Mae	4	20535	"	"	2
Mae	5	20536	"	"	2
Mae	6	20537	"	"	2
Mae	7	20538	"	"	2
Mae	8	20539	"	"	2
Mae	9	20540	"	"	2
Mae	10-16	20541-47	"	"	14
Mae	17	20548	"	"	2
Mae	18	20549	"	"	2
Mae	19	20550	"	"	2
Mae	20-21	20551-52	"	"	4
Mae	25-35	20556-66	"	"	22
Mae	36-47	20567-78	"	"	24
Kerry	3-4	21673-74	22nd Dec., 1966	2	4
Kerry	5-10	19680-85	"	"	12
Kerry	11-21	21643-53	21st Dec., 1967	"	22
Kerry	22-24	21654-56	"	"	6
Kerry	37-50	27611-24	19th June, 1970	"	28
Kerry	429-434	27631-36	17th June, 1970	"	12
Pat	1-8	19686-93	22nd Dec., 1966	"	16
Pat	9-24	19226-41	24th Jan., 1967	"	32
Mike	1-2	17066-67	27th Apr., 1966	"	4
			Certificates of Work		224

APPENDIX II

(a) THIN SECTION 15

Porphroblastic Ferroactinolite Schist

Minerals

Ferroactinolite	-	green patchy pleochroism. Is porphblastic and forms matrix	80%
Feldspar	-	very fine grained anhedral	13%
Pyrite and sphalerite	-	pyrite surrounded by sphalerite	3%
Nondescript alteration	-	clays (?)	4%

Textures and Structures

Ferroactinolite porphrolblasts in a ferroactinolite matrix. Hence porphroblastic to felted texture-fibrous foliated mass. Crumpled schistosity.

History

Originally an augite pheocryst basalt. Now metamorphosed to upper green schist to lower amphibolite (abukuma) grade. No observable retrograde reactions. Disseminated mineralization.

(b) THIN SECTION 6

Altered limy ferro-actinolite schist

Minerals

Ferroactinolite	-	comprises most of rock; very well foliated	60%
Biotite	-	long schistose flakes, brown pleochroic	10%
Epidote	-	yellow disseminated grains through matrix	5%
Calcite	-	in lenses and interstitial patches	19%

Thin Section 6 (Cont'd)

Feldspar	-	minor constituents strongly recrystallized	5%
Pyrite and sphalerite	-	pyrite rimmed by sphalerite	1%

Textures and Structures

Strongly foliated schistose actinolite which is slightly porphroblastic; lenses of calcite. Broad banding of feldspar and no feldspar.

History

Originally a lime rich argillite or tuffaceous volcanic. Metamorphosed to abukuma green schist grade or is possibly a hydrothermal retrograde reaction.

(c) THIN SECTION 13

Hornblende Augite fine banded gneiss

Minerals

Hornblende	-	fine to coarse grained, strongly foliated segregated into bands	28%
Augite	-	fine subhedral granular, segregated into bands, uralite alteration	25%
Plagioclase (Andesine)	-	anhedral elongate re-crystallized grains	27%
Quartz	-	anhedral, recrystallized, optically aligned	10%
Sericite (+ Tremolite-Actinolite)	-	as hydrothermal alteration of feldspar and augite	10%

Appendix II

Thin Section 13 (Cont'd)

Textures and Structures

Well foliated, finely banded, fine grained gneiss. Crosscutting fractures and quartz-sericite veins.

History

Metamorphism under high pressure perpendicular to bedding giving strong foliation. Minor movement after recrystallization accompanied by fracturing, quartz-sericite veining and hydrothermal alteration.

(d) THIN SECTION 2

Mineralized, Silicified and Sericitized Breccia

Minerals

Quartz	-	as silicification of fragments and forms the cement	50%
Sericite	-	associated with quartz	30%
		(fragments 55%) (cement 25%)	
Epidote	-	in rock fragments, not cement	½%
Chalcopyrite	-	with pyrite on borders	½%
Pyrite	-	mainly in cement - anhedral blobs	13%
Sphalerite	-	mantling pyrite and separate	6%

Textures and Structures

Fragments show replacement silicification throughout and sericitization with coarser quartz and sericite in cement. Pyrite concentrated in cement. Sphalerite concentrated in a basic fragment. Later cross cutting fractures remain open.

Appendix II

Thin Section 2 (Cont'd)

History

Most likely that silification, cementation and mineralization were all one event. Hence brecciation; silification, cementation and mineralization. Rebrecciation.

(e) THIN SECTION 3

Calcite gangued, Silicified Mineralized Breccia

Minerals

Quartz	-	silicification of breccia fragment and a mantling of quartz crystals	20%
Calcite	-	gangue for quartz crystals, colloform banding and vein filling	54%
Sericite and other	-	alteration of breccia fragments	10%
Sphalerite	-	in breccia fragment. mixed and rimming pyrite and separate	6%
Pyrite	-	in breccia fragments. mixed with sphalerite and separate	10%
Magnetite	-	trace.	
Malachite	-	trace.	

Textures' and Structures

Silicification mineralization of rock. Calcite filling with quartz crystals. Calcite colloform banding and calcite vein filling. Sulphides show intergrowth.

History

Rock brecciated. Simultaneously silicified, sericitized

Appendix II

Thin Section 3 (Cont'd)

and mineralized. Fragments rebrecciated and calcite cemented (likely continual vein filling). Calcite (fibrous) colloform rimming of remaining open vein. Massive calcite filling of open vein.

APPENDIX III

SAMPLE PREPARATION AND ANALYSIS

Water is removed for the sample by means of specially designed drying ovens. Following this, the sample material is sieved in a -80 mesh nylon screen to remove larger fragments and the sample more homogeneous.

Samples are then digested with hot Aqua Regia. Copper content is then determined by an Atomic Absorption analysis.

All sample preparation and analysis was done by Bondar-Clegg & Company Ltd., 1500 Pemberton Avenue, North Vancouver, B.C.

APPENDIX

IV

STRATIGRAPHIC TYPE SECTION

APPENDIX

V

BREAKDOWN OF COSTS

FOR

ASSESSMENT PURPOSES

DOMINION OF CANADA:
PROVINCE OF BRITISH COLUMBIA.
TO WIT:

In the Matter of Application for Certificates of Work on the Mae, Kerry, Pat and Mike Mineral Claims, Whipsaw Creek area, Similkameen Mining Division.

I, D. G. Leighton

of #209 - 678 Howe Street, Vancouver 1, B.C.

in the Province of British Columbia, do solemnly declare that the underlisted expenditures were made on behalf of Whipsaw Mines Ltd. (NPL) on exploration of the Kerry, Mae, Pat and Mike Mineral Claims:

Bondar-Clegg - assaying	$2,186.80	
Drafting and air photos	656.68	
Thin Section - G. Coots	45.00	
Long distance calls	20.20	
Secretarial services	310.00	
Field equipment	112.00	
Camp expenses, including travel, meals, etc.	1,827.17	
Handling costs	627.47	
		$5,785.32
Truck, camp and power saw rentals		1,246.45
Wages	6,649.75	
WCB, CPP, UIC, fringe benefits, engineering fees and insurance costs	4,387.43	
		11,037.18
D.G.Leighton, Geologist		4,080.00
R.B.Stokes, P.Eng.		295.00
TOTAL		$22,443.95

And I make this solemn declaration conscientiously believing it to be true, and knowing that it is of the same force and effect as if made under oath and by virtue of the "Canada Evidence Act."

Declared before me at the City of Vancouver, in the Province of British Columbia, this 7th day of January 1971, A.D.

D.G. Leighton

S. Phillips

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

Sub-mining Recorder

WHIPSAW MINES LTD. (NPL)
RE: PRINCETON AREA

PAYROLL BREAKDOWN

Name	Period Worked	Rate of Pay	No. of Days	Amount
Anderson, P.	June 4-15	25.00	12	300.00
	June 16 - Oct 31	30.00	107	3,210.00
Elson, M.	June 2 - 21	30.00	20	600.00
Gallagher, R.	Aug 1 - Sep 15	22.50	$28\frac{1}{2}$	641.25
Lang, C.	June 4 - 21	25.00	$17\frac{1}{2}$	437.50
Martin, M.	Aug 1 - 26	12.00	28	336.00
Watkins, A.	June 4 - Aug 8	25.00	45	1,125.00
Leighton, D.G. (Geologist)	June 7 - Nov 30	80.00	51	4,080.00
Stokes, R.B. (P.Eng.)	July 16-Nov 30	125.00	3	295.00

Declared before me at the City of Vancouver, in the Province of British Columbia, this 7th day of January 1971, A.D.

D.G. Leighton

G.P. [signature]
A Commissioner for taking Affidavits within British Columbia or
A Notary Public in and for the Province of British Columbia.

Sub-mining Recorder

Thicknesses True SCALE: 1 inch = 100 feet

LEGEND

- biotite Granodiorite
- Porphyry sills
- hornblende Gneiss (banded)
- hornblende Schist
- hornblende Quartzite
- Limestone
- "Volcanic" hornblende schist
- Porphroblastic hornblende schist
- possible flow top breccia
- Pegmatite
- Aplite
- Quartz-sericite vein
- folding (minor)
- Unconformity
- minor unconformity
- fractures
- mineralization
- Unit boundaries

WEST

feet	UNIT	ZONE	DESCRIPTION	ORIGINAL LITHOLOGY
0	EAGLE GRANODIORITE	Homogeneous Zone	Medium grained biotite grndi well foliated parallel to regional bedding. Extends several miles to the west. Some relicts of gneiss.	feldspathic arenite?
100		Inhomogeneous Zone	Mafic and felsic banding in gneiss. Partial assimilation by differential melting and softening.	
200	MIGMATITE	Assimilation Zone	Foliated bigrndi and highly folded partly assimilated gneisses and schists. Injected grndi, aplite and qtz veins (boudinaged). Mafic, gneissic bnd. Highly similarly folded.	feldspathic wacke?
300				
		Limestone Member	Pure marble beds in a garnet epidote diopside skarn (limy). Injected qtz veins bearing pyr.sp. chpyr.& gl. Some schist.	Limestone
400	plag porphyry sill, dissem pyr.	Granodiorite Section	Foliated rusty bi.grndi. Minor granular gneiss. Lows dipping faults & qtz veins bearing pyr. sp. Gl.chpy. & ep.	feldspathic arenite
500				
600	ms peg.	Injection Zone	Banded qtz.hbde gneisses with regular injections of bi.grndi.& qtz.veins. Metasediments are f. qtz.bnd. bi-hbde gneiss & schist, acic.hbde.gneiss & schist, and crumpled flaky hbde schists (amphibolite). Slightly limy, dissem.ep. Minor faults & qtz. sericite veins with pyr.sp.gl. & chpyr. Graphic peg.intruding grndi, which is pyrtz & eptz.	feldspathic wacke to sub-graywacke
700	porphyry vesicular, foliated, eptz., pyr, sp.		Concentric folding of schistose sections. Qtz. bnd. throughout.	
800				
900	muscovite granite - partly crosscutting, somewhat foliated. Possibly a reaction border. Garnetiferous. Some saussuritization. Albitization?			sodic sediment (arenite)
1000	ACICULAR HORNBLENDE SCHIST (SEDIMENTARY) pure white ms. qtzte. plag + or.porphyry, highly eptz.	White Quartzite Zone	Charaterized by finely laminated qtz-acic. hbde. gneiss & schist grading to qtzte. Distinctive white qtzte. marker bed	qtz-wacke
1100		Black Gneiss Section	Uniformly black qtz-hbde gneiss to hbde qtzte. A marker.	
1200		Ms. quartzite Zone	Dominantly ms.qtz.hbde. schists and ms.qtztes. Fine bedding & laminations throughout. Sandy qtzte, minor granular gneiss. Persistent cross fractures (080°)	quartz arenite
1300				
1400		Quartzose gneiss Section	Acic.hbde.gneiss to quartzite strongly colour bnd. throughout & very qtz. rich. Concentric minor folding: faulting & qtz veins bearing pyr.sp.gl.chpyr. Characteristic ribbed weathering. Resistant marker unit.	qtz.wacke to argillaceous siltstone
1500				
1600	rhomb feldspar porphyry, vesicular, eptz.	Sandy Quarzite Zone	Very well banded ms.bi.hbde. quartzites throughout. Well foliated Distinct light brown sandy qtzte bed. In lower section, delicate siliceous banding suggesting tuffaceous origin. Highly folded amphibolite sections between competent qtzte beds.	quartz wacke; tuffaceous qtz wacke siltstones
1700				
1800				
1900	vesicular foliated, eptz.porphyry.	Colour Banded Gneiss Zone	Extremely well banded, finely laminated acic. hbde.qtzte and qtz-hbde schists. Contains several small angular unconformities. Lower section laminated, colour bnd., ribbed qtz-hbde gneiss.	siltstones to shales (tuffaceous)
2000				
2100	OSCILLATORY UNIT	Siliceous Section	Regular interbedding of fine black qtzose hbde.schists with hornblende gneiss (metavolcanic). well banded within beds. Resistant siliceous bands - recessive hbde schist. More sedimentary than volcanic. Feldspar greater than qtz.	tuffaceous volcanics, volcanic flows shales and siltstones
2200				
2300		Volcanic Section	Interbedding of volcanic hbde schists & gneisses with some resistant feldspathic hbde.gneisses & schists. Unit dominantly volcanic origin	volcanic flows to tuffs.
2400				
2500				
2600	VOLCANIC FLOW UNIT (NICOLA)	Porphroblastic Flows	Med. gr. porphroblastic hbde. schists (volcanic flows) interlayered with finer "volcanic" hbde schists. Blocky fracturing, resistant unit. Possible flow tops. Unit continues several miles to east as interbedded metavolcanic & porphroblastic flows.	volcanic flows
2700				

2802

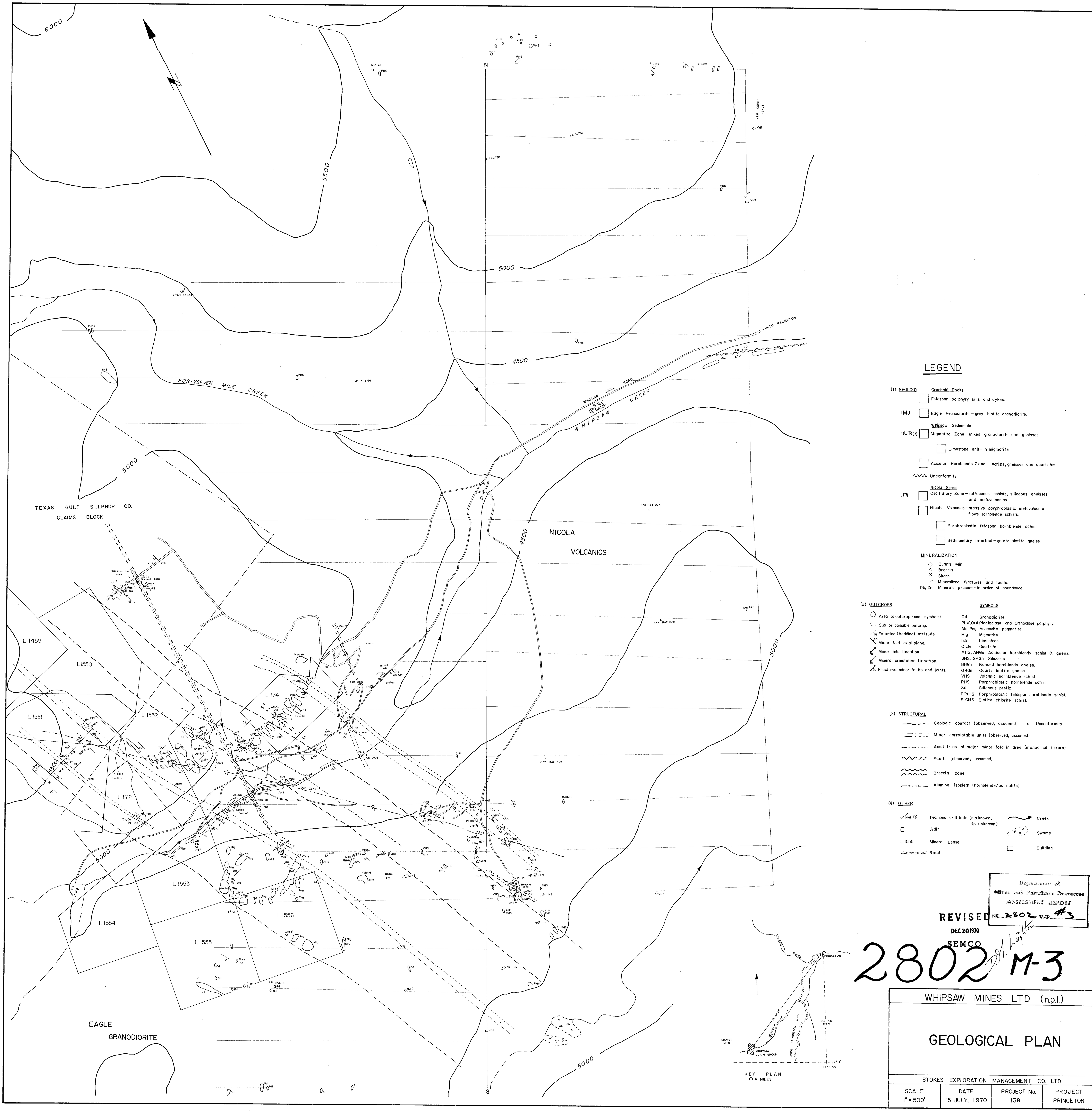
EAST Thicknesses True SCALE: 1 inch = 100 feet

ABBREVIATIONS

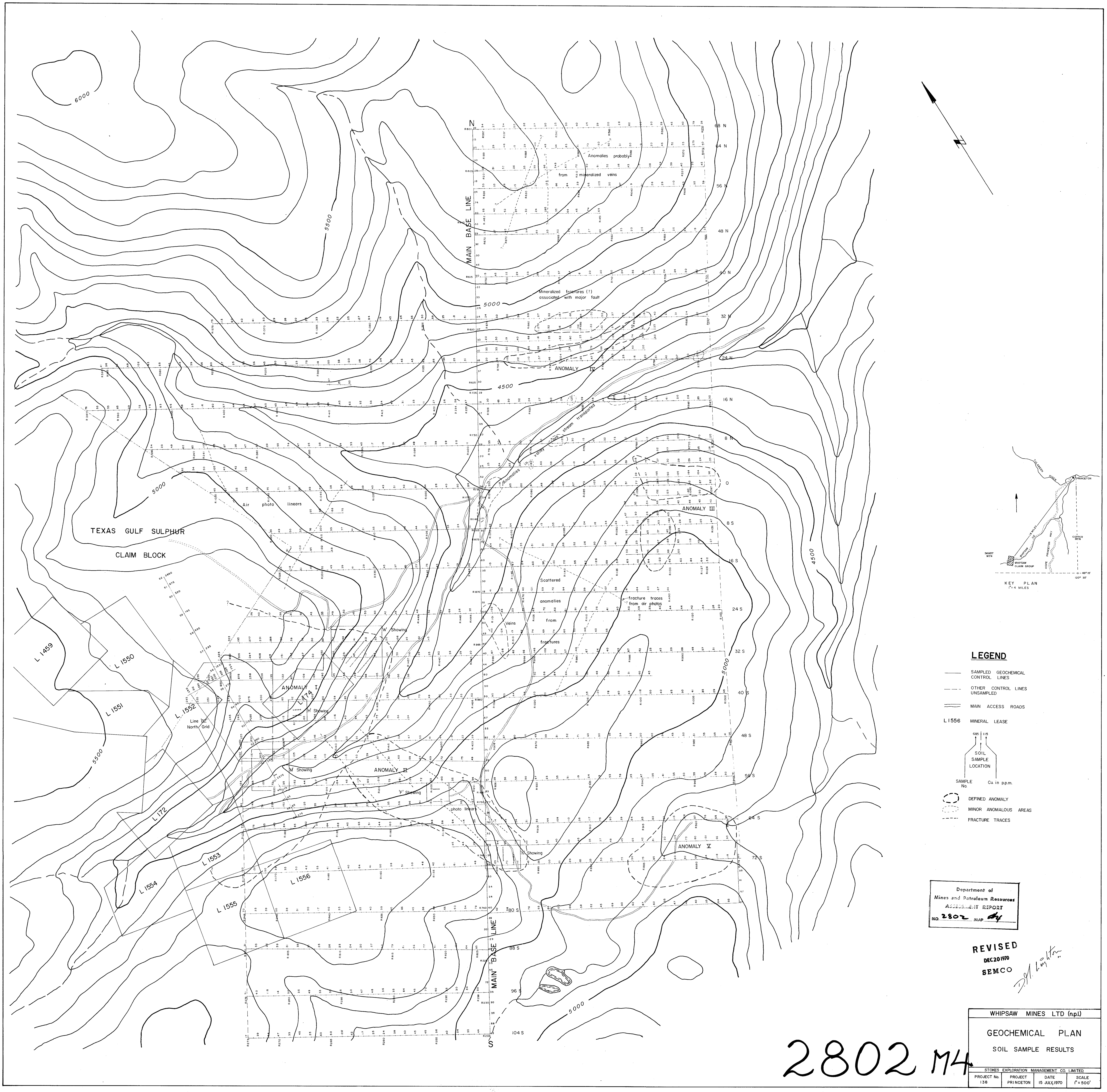
hbde - hornblende	pyr. - pyrite	bnd. - banded	grndi - granodiorite
bi - biotite	sp. - sphalerite	sch. - schistose	qtzte - quartzite
ms - muscovite	gl. - galena	acic. - acicular	peg - pegmatite
qtz. - quartz	chpyr - chalcopyrite	meta - metamorphosed	pyrtz - pyritized
ep - epidote	bn - bornite	f. - fine	eptz - epidotized
plag - plagioclase	min. - mineralized	gr. - grained	dissem- disseminated
or - orthoclase		med.. - medium	

GEOLOGY STRATIGRAPHIC TYPE SECTION

D. G. Leighton



6000
5500
5000
4500
N
S
FORTYSEVEN MILE CREEK
WHIPSAW CREEK ROAD
BASE CAMP
WHIPSAW CREEK
TO PRINCETON
TEXAS GULF SULPHUR CO.
CLAIMS BLOCK
NICOLA
VOLCANICS
EAGLE
GRANODIORITE
L 1459
L 1550
L 1551
L 1552
L 174
L 172
L 1553
L 1554
L 1555
L 1556
LEGEND
(1) GEOLOGY
Granitoid Rocks
Feldspar porphyry sills and dykes.
IMJ Eagle Granodiorite — gray biotite granodiorite.
Whipsaw Sediments
uUTR(?) Migmatite Zone — mixed granodiorite and gneisses.
Limestone unit- in migmatite.
Acicular Hornblende Zone — schists, gneisses and quartzites.
Unconformity
Nicola Series
UTR Oscillatory Zone — tuffaceous schists, siliceous gneisses and metavolcanics.
Nicola Volcanics — massive porphroblastic metavolcanic flows. Hornblende schists.
Porphroblastic feldspar hornblende schist.
Sedimentary interbed — quartz biotite gneiss.
MINERALIZATION
Quartz vein.
Breccia.
Skarn.
Mineralized fractures and faults.
Pb, Zn Minerals present — in order of abundance.
(2) OUTCROPS
Area of outcrop (see symbols).
Sub or possible outcrop.
Foliation (bedding) attitude.
Minor fold axial plane.
Minor fold lineation.
Mineral orientation lineation.
Fractures, minor faults and joints.
SYMBOLS
Gd Granodiorite.
PLø, Orø Plagioclase and Orthoclase porphyry.
Ms Peg Muscovite pegmatite.
Mig Migmatite.
lstn Limestone.
Qtzte Quartzite.
AHS, AHGn Accicular hornblende schist & gneiss.
SHS, SHGn Siliceous .. ..
BHGn Banded hornblende gneiss.
QBGn Quartz biotite gneiss.
VHS Volcanic hornblende schist.
PHS Porphroblastic hornblende schist.
Sil Siliceous prefix.
PFsHS Porphroblastic feldspar hornblende schist.
BiChlS Biotite chlorite schist.
(3) STRUCTURAL
Geologic contact (observed, assumed) u Unconformity
Minor correlatable units (observed, assumed)
Axial trace of major minor fold in area (monoclinal flexure)
Faults (observed, assumed)
Breccia zone
Alumina isopleth (hornblende/actinolite)
(4) OTHER
Diamond drill hole (dip known, dip unknown)
Adit
L 1555 Mineral Lease
Road
Creek
Swamp
Building
Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 2802 MAP #3
REVISED
DEC 20 1970
SEMCO
2802 M-3
KEY PLAN
1" = 4 MILES
PRINCETON
WHIPSAW CLAIM GROUP
WHIPSAW MINES LTD (n.p.l.)
GEOLOGICAL PLAN
STOKES EXPLORATION MANAGEMENT CO. LTD
SCALE 1" = 500'
DATE 15 JULY, 1970
PROJECT No. 138
PROJECT PRINCETON


MAIN BASE LINE
N
S
68 N
64 N
56 N
48 N
40 N
32 N
24 N
16 N
8 N
0
8 S
16 S
24 S
32 S
40 S
48 S
56 S
64 S
72 S
80 S
88 S
96 S
104 S
6000
5500
5000
4500
Anomalies probably from mineralized veins
Mineralized fractures (?) associated with major fault
ANOMALY IV
Anomalies in valley fill, stream transported
ANOMALY III
Scattered anomalies from fractures
fracture traces from air photos
Veins
Air photo linears
TEXAS GULF SULPHUR
CLAIM BLOCK
'W' Showing
ANOMALY I
'H' Showing
Line 'B' North Grid
M Showing
ANOMALY II
'F' Showing
photo linears
N Showing
ANOMALY V
L 1459
L 1550
L 1551
L 1552
L 174
L 172
L 1553
L 1554
L 1555
L 1556
KEY PLAN
1" = 4 MILES
PRINCETON
WHIPSAW CLAIM GROUP
LEGEND
SAMPLED GEOCHEMICAL CONTROL LINES
OTHER CONTROL LINES UNSAMPLED
MAIN ACCESS ROADS
L1556 MINERAL LEASE
SOIL SAMPLE LOCATION
SAMPLE No.
Cu in p.p.m.
DEFINED ANOMALY
MINOR ANOMALOUS AREAS
FRACTURE TRACES
Department of Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 2802 MAP #4
REVISED
DEC 20 1970
SEMCO
WHIPSAW MINES LTD (n.p.l.)
GEOCHEMICAL PLAN
SOIL SAMPLE RESULTS
STOKES EXPLORATION MANAGEMENT CO. LIMITED
PROJECT No. 138
PROJECT PRINCETON
DATE 15 JULY, 1970
SCALE 1" = 500'
2802 M4