AFFIDAVIT OF EXPENSES

The soil and silt sampling and the geological mapping and research were carried out on the Swing Group and the Peak Group of Claims within the Tahtsa Reach area of the Omineca Mining Division, British Columbia, to the value of the following:

FIELD: (July 31 to September 7, 1981)

Geological Engineer (Goldsmith), 4 days at $320/day	$ 1,280
Geologist (Kallock), 40.5 days at $270/day	10,935
2 assistants, 39 days at $120/day	4,680
4-wheel drive truck rental, 39 days at $80/day	3,120
2-wheel drive truck rental, 39 days at $50/day	1,950
Helicopter	1,338
Mob and demob for Kallock	420
Boat, 39 days at $40/day	1,560
Airfare and taxi (Goldsmith)	360
Room and board, 162 days at $50/day	8,100
Tatsa Supervisor, 1 1/3 months at $2,500/month	3,333
Float plane services	793
Miscellaneous expenses	1,950
	$39,819

Laboratory:

Rock assaying, soil testing and silt testing	$ 4,253

Office: (September 14, 1981 to March 4, 1982)

Geological Engineer (Goldsmith) 10.5 days at $320/day	3,360
Geologist (Kallock), 17.5 days at $270/day	4,725
Drafting and printing	3,625
Air photo work	1,264
Report typing, photocopying and compilation	891
	$13,865
Grand Total	$57,937

70% prorated to Swing Group of Claims - $40,556
30% prorated to Peak Group of CLaims - $17,381

Respectfully submitted,
TAHTSA MINES LTD.

David G. Mark,
President

PART 2 of 2

GEOLOGICAL INVESTIGATION

OF THE

SAM, SWING, ET AL. MINERAL CLAIMS

TAHTSA LAKE AREA, B. C.

OMINECA MINING DIVISION

93 E/11 W

Prepared for

Tahtsa Mines Ltd.

Arctex Engineering Services

L. B. Goldsmith, P.Eng.
Consulting Geologist

Paul Kallock
Geologist

November 1981

TABLE OF CONTENTS

SUMMARY.. iii

INTRODUCTION... 1

HISTORY.. 1

LOCATION MAP... 2

CLAIM STATUS... 3

REGIONAL GEOLOGICAL SETTING.......................... 3

ROCK UNITS ON THE PROPERTY........................... 4

- Hazelton Group..................................... 4
- Skeena Group....................................... 4
- Kasalka Group...................................... 5
- Intrusives... 6

STRATIGRAPHY... 7

STRUCTURE.. 7

MINERALIZATION....................................... 8

ASSAYS AND GEOCHEMISTRY.............................. 10

GEOPHYSICS... 12

CONCLUSIONS.. 12

RECOMMENDATIONS...................................... 13

COST ESTIMATE.. 14

GEOLOGIST'S CERTIFICATE.............................. 16

ENGINEER'S CERTIFICATE............................... 17

REFERENCES... 18

APPENDIX: ASSAYS AND GEOCHEMISTRY

PETROGRAPHIC DESCRIPTIONS

LOGS OF OLD DIAMOND DRILL CORE

MAPS: 1:10,000 Scale Geology and Claim Map
1:5,000 Scale Geology
1:5,000 Scale Alteration and Mineralization
Upper Adit: Geology
Assay Plan
Lower Adit: Geology
Assay Plan
Vertical Longitudinal Section of the Captain Vein
#2 Vein, Geology and Assays (Pocket Inside Back Cover)

SUMMARY

The Tahtsa Mines Ltd. property is located in west-central British Columbia, 182 km south of Houston, B. C. Approximately 39 square kilometres comprise the contiguous claims which lie on the south side of Tahtsa Reach, a part of the Nechako Reservoir. Geological mapping and soil and stream sediment sampling were conducted during the 1981 field season. Sedimentary rocks of the Lower Cretaceous Skeena Group are overlain by a volcanic pile of andesitic to rhyolitic composition belonging to the Upper Cretaceous Kasalka Group. Hypabyssal (or exhalative) andesite-diorite appears to intrude these volcanics and sediments in the vicinity of two exploration adits. These drifts have been driven along sulfide veins coincident with a north-trending shear zone. Lenses or pods of galena within the vein structures contain up to 8.4 ounces Ag per ton, 2.62% lead and 1.26% zinc in widths up to 0.9 metres. The east half of the property is underlain by volcanic and sedimentary rocks of the Hazelton Group of Lower Jurassic age. Exploration in this area has been initiated. A zone of weak pyrite stockwork veining was discovered in the northern outcrop area which is coincident with an area of anomalous zinc in soil and stream sediment samples. Additional mapping and a grid layout for sampling are recommended for this area.

INTRODUCTION

The "Sam" claims, owned by Tahtsa Mines Ltd., are located in the Tahtsa Lake area of the Omineca Mining Division, B. C. The property straddles the east end of the Kasalka Range, bordered on the north by Tahtsa Reach, which is part of the Nechako Reservoir.

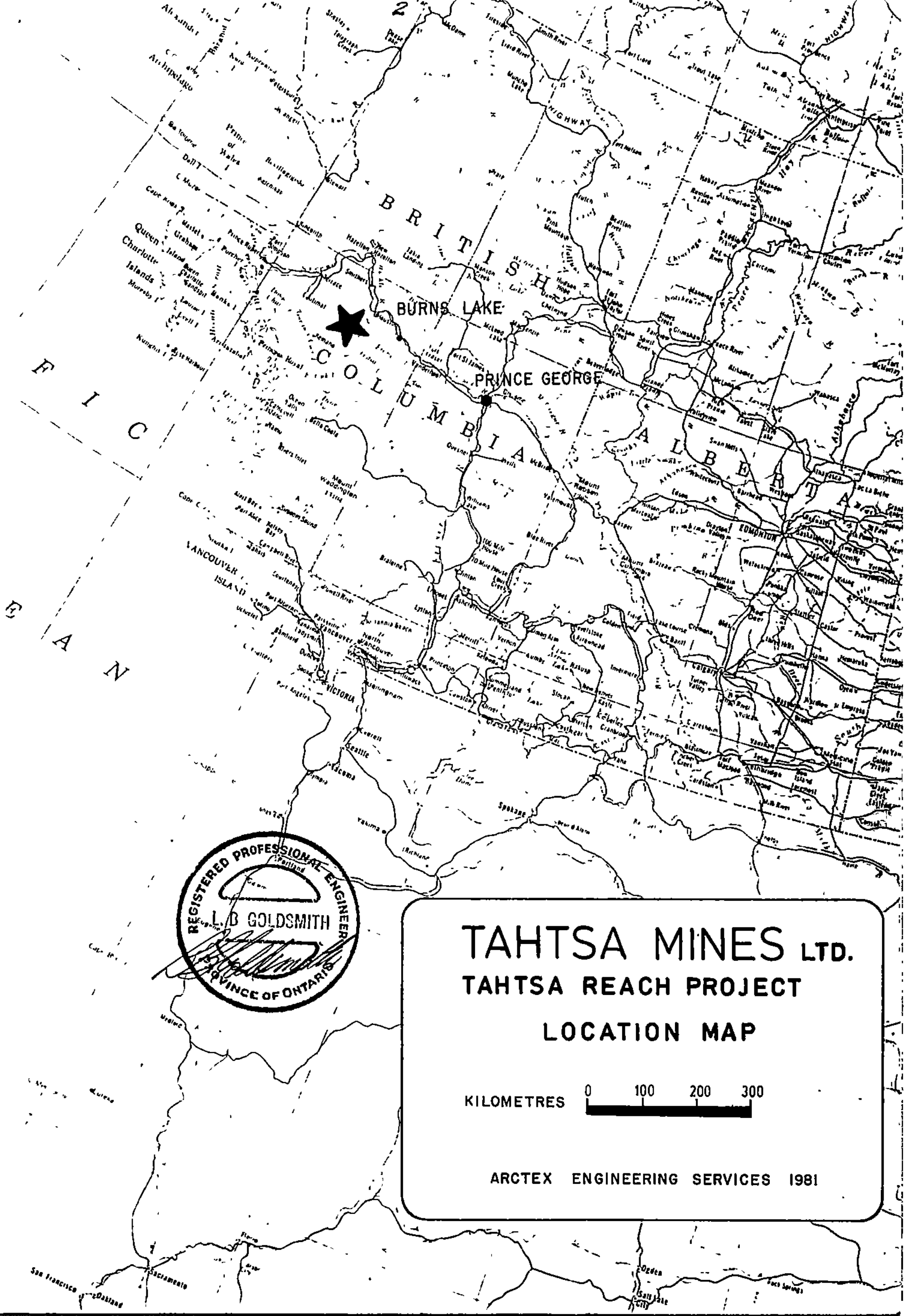
A gravel road connects the north shore of Tahtsa Reach with Burns Lake, B. C., 182 km to the northeast,or Houston, B. C., 110 km to the north. A short crossing of the Reach by launch or raft is required to arrive at the camp which is located near the north boundary of the property. The 1:10,000 geology map shows the geographic setting of the property.

During the 1981 field season a substantial amount of property was added to "Sam" claims of Tahtsa Mines Ltd. Four large claims and two fractions were added to the existing claims, bringing the total to approximately 39 square kilometres.

Between July 30 and September 7, 1981, Arctex Engineering Services conducted a geological survey of the property. The two existing adits were examined and sampled, and a geological map of the property was prepared. Recommendations regarding future exploration for lead-zinc-silver veins, large tonnage-low grade gold deposits, and copper-molybdenum "porphyry" targets are herein stated.

HISTORY

Early work on the property was carried out by George Seel and the Tahtsa Mining Company during the late 1920's. The upper tunnel was driven along what is now called the Captain Vein. Since 1938, Clifford "Cap" McNeil has prospected the Swing Peak area, and is still involved in exploration at the former "Swanell Group" of claims. A limited amount of diamond drilling has been conducted from surface on the Captain Vein. Evidently, Tom McQuillum directed four short core holes totalling <120 metres during the 1962 field season.


BRITISH COLUMBIA
ALBERTA
BURNS LAKE
PRINCE GEORGE
VANCOUVER ISLAND
VICTORIA
EDMONTON
REGISTERED PROFESSIONAL ENGINEER
L. B. GOLDSMITH
PROVINCE OF ONTARIO
TAHTSA MINES LTD.
TAHTSA REACH PROJECT
LOCATION MAP
KILOMETRES 0 100 200 300
ARCTEX ENGINEERING SERVICES 1981

Improvements to the property include the upper (circa 1928) adit which is 115 m (376') long; the lower (circa 1980) adit and raise which is 27 m in horizontal length and 24 m vertical; a landing at both sides of Tahtsa Reach; a camp consisting of 4 cabins, mess hall, drying and laundry building, and a machine shop-generator shed, all located on the south shore of Tahtsa Reach. A four-wheel drive road has also been constructed from camp to the lower adit, a distance of 4.3 km with a vertical gain of 550 m (1800').

CLAIM STATUS

The accompanying map at 1:10,000 scale shows the "Sam 1" and "Sam 2" claims which cover the original prospect area and the new claims staked during 1981.

The "Swing" 1 through 4, "Long", "Short", and "Deuce" 1 and 2 were staked in 1981. Total acreage held by Tahtsa Mines Ltd. is approximately 3900 hectares.

REGIONAL GEOLOGICAL SETTING

The "Sam" and other claims of Tahtsa Mines Ltd. lie on the eastern flank of the Coast Range Plutonic Complex approximately 25 km east of the main granitic masses of the range. The area near the property is underlain by sedimentary and volcanic rocks of the Middle Jurassic Hazelton Group. Overlying or in fault contact with Hazelton rocks are Lower to Upper Cretaceous sedimentary and volcanic rocks of the Skeena and Kasalka Groups. They form the basement and main volcanic assemblages of the Tahtsa property.

Intrusive rocks near the map area range in age from Late Cretaceous to Eocene and vary in composition between diorite, quartz diorite, granite, and feldspar porphyries. Although only one stock of dioritic composition intrudes the property at Kasalka Butte, dikes of basaltic to rhyolitic composition are common.

ROCK UNITS ON THE PROPERTY

Hazelton Group - Lower Jurassic

In the eastern part of the property ("Long" and "Short" claims) sedimentary and volcanic rocks have been assigned to the Telkwa Formation of the Hazelton Group. A traverse along the eastern flank of Kasalka Butte releaved abundant exposures of reddish-brown to dark green andesite and andesite tuff which contained occasional calcite amygdules and locally intense quartz, epidote and hematite. Along the south shore of Tahtsa Reach, north of Kasalka Butte, conglomerate, composed predominantly of red to green volcanic clasts and a greenstone with weak irregular calcite veins, are exposed. Slightly to the west black, cherty shales strike northerly and dip nearly vertical near a fault contact with pale green tuffaceous rocks.

Other sedimentary and volcanic rocks have been mapped in the "Long" claim but none contained significant mineralization.

As can be seen from the accompanying 1:10,000 scale claim and geology map, a major fault has been mapped by Woodsworth (1980), which forms the western boundary of the Hazelton rocks.

Skeena Group - Lower or Middle Cretaceous (Albian)

West of the north-trending fault that bisects the "Deuce" 1 and 2 claims, abundant exposures of black fissile shale and siltstone can be seen in the first major stream east of Swing Creek. They commonly display carbonaceous partings, traces of pyrite and calcite veinlets. Ammonoid fossils are also common.

Within the area of the 1:5000 scale geology map the dark sedimentary rocks of the Skeena Group appear to form a basement for overlying volcanics. Black shale, grey siltstone and grey-brown sandstone are exposed sporadically along the lower slopes of the two prominent east-west trending ridges within the "Sam" and "Swing" claims, and also along a large portion of Swing Creek below 1220 m (4000 feet) elevation. Bedding attitudes are commonly oriented east-west and dip from 10 to 35 degrees to the south. Near faults and dikes, attitudes are more contorted. Thickness of the unit may exceed 300 m (1000 feet) as approximated from the Swing Creek exposures.

Kasalka Group - Upper Cretaceous

During mapping at the Tahtsa property, a crude subdivision evolved within the volcanic pile of the Kasalka Group. Although it is far from complete, it does help to visualize the stratigraphy.

At the base of the Group, a volcanic conglomerate composed of dark reddish-brown to dark grey-green clasts of andesite, basalt and minor red to green chert appears to lie conformably upon the Skeena Group. This is especially true in the upper reaches of Swing Creek and vaguely so on the north side of the north ridge in the "Swing 2" claim.

Above the conglomerate is the main volcanic complex which includes andesite, andesite tuff breccia, dacite, dacite porphyry, rhyolite and rhyolite breccia. Contacts between the units are difficult to distinguish; no doubt many gradational zones exist. Alteration, particularly the abundant limonite oxidation of pyrite and pyrrhotite, masks the inherent texture of the rock. The geology map (1:5000) depicts some of the more readily distinguishable units. Petrographic samples collected in the vicinity of the Captain Vein reveal a more intrusive texture to the rocks. Porphyritic dacite, which could be a near-surface intrusive or extrusive igneous rock proximal to its vent has been grouped within the map-unit termed Andesite-Diorite. Previous Geological Survey maps (Duffell, 1959) indicate a light coloured, porphyritic, plutonic rock as outcropping near the upper adit and extending southerly across the peak (formerly called Swing Peak). This unit was not identified but it may be part of the andesite-diorite of the current study.

Most of the mineralized shear zones which have been targets of silver and lead exploration transect the volcanic (and intrusive?) complex in a northerly direction and are located on the north slope of the south ridge ("Sam" 1 and 2 claims). At about 1830 m (6000') elevation on this ridge a gently-dipping sedimentary unit is encountered. It nearly circumvents the south ridge and is less than 35 metres thick. Typically the sediments are well-indurated, finely-banded siliceous shales, chert or grey siltstone. However, in the west-central portion of the "Sam 1" claim on the north side of the south ridge below the icefield, a dark grey to black conglomerate with strong chlorite is exposed. It is at the same general horizon as the other finer-grained sediments to the east and southeast.

Above the sedimentary unit are more volcanics of intermediate to felsic composition. They are less iron-stained and of a fresher nature on the south ridge and along the west margin of the Tahtsa property. A large proportion of this unit is composed of grey porphyritic andesite or dacite conglomerate or breccia with clasts of angular to well-rounded lighter-coloured porphyry. Near-horizontal bedding attitudes are visible in the flows and beds in the cliffs above the westernmost glaciers.

No bedded sedimentary unit was found within the volcanic complex in the north ridge ("Swing" 1 and 2 claims) as was seen on the south ridge, therefore a stratigraphic section above the Skeena Group basement is much more questionable. Most of the north side of the ridge is similar to the previouly described porphyritic andesite or dacite conglomerate or breccia. Rhyolite or rhyolite breccia is commonly associated with intense argillic altered areas and gossanous or ferricrete zones.

Intrusives

Only one large intrusive body, other than the previously described high-level andesite-diorite, was seen on the property. In the west-central part of the "Long" claim a northeast-trending ridge almost 1 km long shows a fine-grained diorite with weak chloritic alteration and traces of disseminated pyrite.

Dikes of basaltic to rhyolitic composition ranging in size from a few centimetres to 10 metres in width are common throughout the property. They appear to bisect all rock units. Therefore, at least some of them may be the youngest rock types in the area. Andesite and basalt are the most common dike lithologies. Occasionally they are amygdaloidal with calcite or quartz fillings. Dacite is also common; latite porphyry and rhyolite are infrequent. Felsite dikes also fall into the light cream-coloured category.

In the 1:5000 geology map area most dikes can be seen to trend in a northerly direction, parallel to the predominant shear and fracture zones. Length of the dikes is certainly variable and continuous exposures are not seen. Nevertheless, some are known to exceed at least 1 km.

Of special note is a fine-grained diorite dike on the north side of the north ridge in the "Swing 4" claim. It has moderate chlorite alteration of mafic minerals, traces to 1% pyrite, and is moderately magnetic. It outcrops in a stream bed which also shows weak stockwork pyrite veining in fine-grained sediments and/or volcanics. The dike continues to the northwest to an area of moderately high values of zinc in soils.

In the south-central part of the "Sam 2" claim a small outcrop of argillic to weak sericitic-altered granitic rock with a trace of disseminated chalcopyrite was found. It may have been a small dike although exposures in adjacent outcrops were not found.

South of the "Sam 1" claim numerous boulders of talus were found which have fallen from the very steep slopes in the southwest part of that claim; these are of medium-grained, unaltered granodiorite.

STRATIGRAPHY

The oldest rocks on the property are the Hazelton Group sedimentary and volcanic rocks in the eastern third of the claim area. Survey maps show them as belonging to the Telkwa Formation of Lower Jurassic (Sinemurian?) age. Although the Hazelton Group may exceed 3,000 metres in thickness, the thickness of the Telkwa Formation is not known.

In fault contact with the Telkwa Formation on the west is the Skeena Group of Lower to Middle Cretaceous age (Middle Albian). It is primarily dark, fine-grained sedimentary rock and may exceed 300 metres.

Lying conformably above the Skeena Group is the volcanic complex of the Kasalka Group. Numerous flows, several sedimentary units and one or more closely related hypabyssal intrusives are included in this group. The thickness of this volcanic pile could be as much as 900 metres in the claim area.

In addition to numerous dikes of a wide composition outcropping throughout the property, a stock of fine-grained diorite intrudes the "Long" claim. It has been related to the Kasalka Intrusions (Woodsworth, 1980) and may be of Late Cretaceous or Early Tertiary age.

STRUCTURE

Fault zones from a fraction of a metre to several metres in thickness are very common in the "Sam 1" and "Sam 2" claims. Their trend is generally 335° to 025° and dip near vertical. In many of these shears, carbonate or sulfides have formed in or near the ubiquitous clay. Topographically these shear zones have been accentuated and form the strong network of subparallel drainages on either side of Swing Creek. On the south side of the south ridge these fracture zones reappear and host sporadic sulfide mineralization.

Toward the head of Swing Creek near the northwest corner of "Sam 1" claim, a very strong east-to-west trending fault zone displays abundant clay and broken rock cemented by limonite and/or silica. Although not seen farther to the east it may contribute to the location of Swing Creek itself and perhaps could be related to the clay and ferricrete deposits just north and parallel to Swing Creek.

East-west trending faults were also found in the north side of the north ridges. In addition, several strong topographic linear features which are parallel to these faults are present on the top of the north ridge.

As previously mentioned a strong fault contact appears to have brought Hazelton Group rock in contact with the Skeena Group at the west side of the "Long" claim. A diorite stock has also been intruded along this fracture zone.

A joint system, forming tabular rock outcrops parallels the north-trending shear system. This is clearly apparent in the cliff faces above the icefield, just west of the Bennett Lead in the central part of the "Sam 1" claim.

Folding on a small scale can be seen in the Skeena Group near faults or dikes, particularly in Swing Creek below the road crossing. Larger scale folding was not seen but regional dips of the Skeena Group show a east-west trend with southerly dip underlying the north ridge. At the south ridge dips on overlying (?) beds indicate a more northerly inclination. Perhaps a synclinal axis coincides with Swing Creek.

MINERALIZATION

As can be seen from the mineralization and alteration map, limonite and iron stain resulting from the oxidation of pyrite, pyrrhotite and to a lesser extent from mafic rock-forming minerals is abundant on the property. The rusty hills and mountainsides of the Tahtsa property are distinctive and can be seen from many kilometres distant.

Much of this iron can be attributed to the original composition of the volcanic rocks. Mapping has shown that a band of iron stain immediately below the upper sedimentary unit on the south ridge appears to circumscribe the mountain just as do the shales. Strong limonite on the north ridge appears to follow certain conglomerate or breccia "tongues" or flow features.

Pyrite and limonite also coincide with shear or fault zones. Often brecciation has taken place and surficial oxidation has left gossanous limonite encrustations. In several of these shears, particularly the north-trending shears, galena, sphalerite, chalcopyrite and more rarely tetrahedrite and jamisonite ($Pb_4Fe\ Sb_6S_{14}$) have formed. Manganese is common at the surface where shears contain polymetallics. Calcite or a carbonate breccia is also common in many of the shear zones.

Geology and assay location maps have been drawn of the upper and lower adits which are located on the Captain Vein. The lower adit and raise are partially blocked with debris and do not permit a good examination of the vein and shear zone. Only the surface opening of the raise revealed galena mineralization. The majority of the raise had been filled with surficial debris.

The upper adit or drift follows the shear zone and associated sulfide mineralization for 87 or its 114.6 metres. Galena, sphalerite, pyrite, and rarely tetrahedrite occur as stringers or veins up to 5 cm within the shear zone, most commonly on the east wall. Although shears or leads are continuous, sulfide mineralization is intermittent. Most sulfide veins pinch out within 5 to 10 metres of length.

At 1768 m (5800') elevation, 320 metres south and on strike with the Captain Vein is the Captain Vein Extension. It trends N10E. Its orientation suggests that the two veins may be continuous beneath the talus cover. However, epidote and sphalerite content are much higher and brecciation is more pronounced than in the Captain Vein. A diamond drill hole had been cored to intersect this vein at a shallow depth. Unfortunately the core was scattered and incomplete. It evidently was drilled during the early 1960's when other holes were cored on the Captain Vein. No mineralization was observed in the remaining core.

The #2 vein outcrops near a major north-trending stream, 200 metres east of the Captain Vein. The vein or veins are exposed sporadically along 150 m of strike length and 100 m of vertical relief. Galena, sphalerite and pyrite with strong manganese oxide resemble the Captain Vein very closely. The main shear zone strikes N20E and as with the Captain Vein sulfides also occur in fissures oriented at an oblique angle to the main shear.

The Bennett Lead is another vein-shear zone located 300 metres southwest of the upper adit at an elevation of 1677 m (5500'). Only the lower of 4 or 5 trenches is still free of debris. Here, traces of galena and sphalerite are visible in two small parallel shears. In float above this trench a boulder of massive galena was found which must have come from a vein at least 15 cm thick. The zone trends N20E and is at least 35 metres long.

At least three other sulfide veins in shear zones are present on the property and are shown on the 1:5000 mineralization map. One of these veins is in the southwest corner of the "Swing 4" claim. It trends to the northwest and contains abundant carbonate and up to 4% zinc. Exposed along the creek bed where this vein is located is a pervasive, weak stockwork of pyrite veinlets which continue for at least 400 metres. The north end of this zone of moderately silicified and alteration appears to decrease in exposures to the north. However, the presence of a diorite dike and anomalous zinc geochemistry to the northwest may indicate additional mineralization in that area.

Several zones of silicification and argillization may be questionably attributed to hydrothermal alteration. The areas mapped as rhyolite contain abundant silica and occasionally a few feldspar phenocrysts. Some of the silica may have been introduced subsequent to rhyolite deposition, especially in those areas closely associated with intense clay and/or ferricrete formation. For example, near Swing Creek in the south side of the north ridge and in the northwest side of the north ridge, siliceous rhyolite (?), clay, and ferricrete (limonite cemented rock fragments) are closely associated.

There are also several patches on the north side of the south ridge which have intense silicification, and pyritization. However, metallic mineralization other than iron is not present.

ASSAYS AND GEOCHEMISTRY

All rock, soil and stream sediment samples collected for analysis are listed in the Appendix. A brief description of the important results is as follows.

The upper adit was sampled along the shear zone at 3-metre intervals across the back of the drift. Of 39 channel samples collected, the highest sample assayed 8.44 ounces silver per ton, 2.62% lead, 1.26% zinc, and 0.09% copper across 0.9 metres. The average of samples contained less than 1 ounce silver per ton and less than 1% combined lead and zinc. As an indicator of high-grade values, a sample of a 5 cm galena vein assayed 56.34 ounces silver per ton, 46.6% lead, 0.08% zinc, 0.1% ~~gold~~ copper and 0.006 ounces gold per ton.

The lower adit was also sampled on 3-metre intervals over widths of approximately 2.5 metres. Minor lead and zinc and a high value of 0.44 ounces silver per ton were obtained.

As can be seen from the assay maps other vein-shear zones on the property contain significant amounts of lead, zinc and/or silver. Of note are the Bennett Lead which contains up to 103 ounces silver per ton in high-grade samples, the Captain Vein Extension with greater than 10% sphalerite, the #2 vein with up to 11.72 ounces silver/ton, and on the north side of the north ridge where a sphalerite-carbonate vein assays 4.5% zinc.

In at least 3 stream drainages on the slopes of the north ridge, a white precipitate is currently being deposited on stream detritus in a restricted slope length of up to 200 metres in the channels. A geochemical sample of a small bag of heavily coated pebbles contained 1300 ppm lead, 135 ppm zinc, and 6.5 ppm silver. These values are unexpectedly high. The source of metals is unknown and should be sought.

A combined soil and stream sediment sampling survey was conducted along the north slopes of the property. Seventy-one samples were collected and analyzed for copper, lead, zinc, silver, molybdenum and gold. Locations and values are plotted on the 1:10,000 map.

A probability plot was constructed of the stream sediment and soil sample geochemical abundances of zinc, where n = 71. A threshold of 170 to 214 ppm and an anomalous value of greater than 214 ppm were determined. Only two values occur in the high population, these being 385 and 390 ppm zinc. Along with 4 of the 7 samples of threshold value the anomalous values are grouped in the area below and to the west of the weak stockwork pyrite zone in the southeast corner of "Swing 4" claim.

Copper, molybdenum and gold did not display two populations or anomalous geochemical patterns. Lead values are slightly elevated in the same locations as the zinc values. Silver appears to confirm the zinc anomaly with values of 3 to 7 times background. Probability plots were only constructed for zinc, as the other elements did not display a wide enough range to suggest useful analysis of data.

Fourteen stream sediment samples were collected on the south side of the north ridge from drainages which empty into Swing Creek. Two of the samples were anomalous in zinc, with 258 and 310 ppm values.

GEOPHYSICS

Magnetometer and VLF-EM surveys were completed in the vicinity of the Captain Vein. The grid is shown on the 1:5000 scale geology map. Linear VLF-EM responses correspond to the trench of shear zones which host silver-lead-zinc mineralization. A separate report of the geophysical interpretations is being prepared.

CONCLUSIONS

During the 1981 field season geological mapping was concentrated in the area of the adits and the north and south ridges. Mineralization had previously been known in the Captain Vein and its extension and several other similar shear zones on the north side of the south ridge within the "Sam" 1 and 2 claims. Shear and vein zones were also discovered on the south side of the north ridge suggesting throughgoing mineralized structures which may transect the south ridge. Silver, lead and zinc mineralization is limited to these shear zones. Width of sulfide veins seldom exceeds 5 cm; rare pods may be found which approach 15 to 20 cm in width. Strike continuity of sulfide veins within shear zones seldom exceeds 10 metres.

As evidenced by the amount of shearing and alteration (including argillic, silicic and carbonate) in the Captain Vein-Shear Zone, a potential was thought to exist for wide zones (10 to 15 metres) of low-grade silver mineralization. However, geochemical results did not support this concept.

Exploration for veins, pods or low-grade zones of silver, lead and zinc would be costly and the probability of encountering larger zones of richer ore than is exposed near or in the adits of the Captain Vein is not encouraging.

Zones of intense silicification or argillic alteration were mapped and sampled as were ferricrete or intensely limonitized zones. No significant base of precious metal values was encountered.

A zone at least 400 metres in one dimension was discovered on the north side of the north ridge (southeast corner of "Swing 4" claim) which contains a weak pyritized stockwork of veins and fractures. This zone presents the possibility of a sulfide halo near a copper or molybdenum porphyry. Rock geochemistry of this zone (samples collected at 50-metre spacing) did not contain significant metallic values. Nevertheless, there is some encouragement from zinc and silver values in soil and stream sediment geochemistry from this general area. Values up to 390 ppm zinc and 1.5 ppm silver were detected.

A curious and as yet unexplained high geochemical value has been detected in what is apparently a white encrustation or precipitate on detritus of several streams on the north ridge. Evidently the hydrological regime and the change in the chemical balance of the water is depositing base metal ions. Further investigation of this curiosity is required before any conclusions can be drawn.

Exploration of the "Long" and "Short" claims, which are underlain by Hazelton Group rocks and at least one large diorite intrusive, has only begun. Massive sulfide or porphyry deposits are realistic targets in this area, but initial mapping, prospecting, and geochemistry did not indicate zones of mineralization.

RECOMMENDATIONS

Anomalous zinc values in soil and stream sediments and less anomalous but significant silver values in the southern part of the "Swing 3" and "Swing 4" claims should be investigated. These samples are in the general vicinity of the weak stockwork of pyrite veins and a shear zone containing 4% zinc. A grid with 100-metre spacings should be planned and enough samples collected on the lower slopes of the north ridge to delineate the anomaly. Additional geological mapping should be undertaken in this area. If this phase of exploration is encouraging a programme of I.P. (induced polarization) geophysics is recommended to explore for sulfides.

During additional geological mapping, a brief investigation should be made of the white precipitate currently being deposited on the gravels. Additional samples would help to clarify its importance.

The "Long" and "Short" claims were examined only in a cursory manner. Several days of prospecting, sampling and mapping on these claims are warranted.

COST ESTIMATE

Phase I

Geological mapping, grid layout and sampling of 1 square kilometre above zinc anomalies. General prospecting on other portions of the claim group.

Geological mapping, sampling and grid layout		$15,000	
Prospecting		8,000	
Geochemistry and assays		2,000	
Camp supplies		5,000	
Camp maintenance		10,000	
Travel, accommodation, vehicles		4,000	
Supervision		4,000	
Reporting		6,000	
		$54,000	
Contingencies @ 10%		5,400	
	Total Phase I	$59,400	$ 59,400

Phase II

Geophysics: I.P. on delineated soil geochemical target.

I.P. survey on approx. 1 sq km using 100-m line spacings - 11 km @ $1500/km	$16,500	
Camp maintenance, cook	5,000	
Camp supplies	5,000	
Travel and accommodation	5,000	
Supervision	5,000	
Reporting	6,000	
	$42,500	
Contingencies @ 20%	8,500	
Total Phase II	$51,000	$ 51,000
TOTAL		$110,400

All of which is respectfully submitted,

REGISTERED PROFESSIONAL ENGINEER
L. B. GOLDSMITH
PROVINCE OF ONTARIO

Locke B. Goldsmith, P.Eng.
Consulting Geologist

Paul Kallock
Geologist

Vancouver, B. C.

November 10, 1981

GEOLOGIST'S CERTIFICATE

I, Paul Kallock, do state: that I am a geologist to Arctex Engineering Services, 301-1855 Balsam Street, Vancouver, B. C.

I Further State That:

1. I have a B.Sc. degree in Geology from Washington State University, 1970.
2. I have engaged in mineral exploration since 1970, both for major mining and exploration companies and as an independent geologist.
3. I have co-authored the report entitled, "Geological Investigation of the Sam, Swing, et al. Mineral Claims, Tahtsa Lake Area, B. C." The report is based on my fieldwork carried out on the property and from previously accumulated geologic data.
4. I have no direct or indirect interest in any manner in either the property or securities of Tahtsa Mines Ltd., or its affiliates, nor do I anticipate to receive any such interest.
5. I consent to the use of this report in a prospectus or in a statement of material facts related to the raising of funds.

Paul Kallock,
Geologist

Vancouver, B. C.

November 10, 1981

ENGINEER'S CERTIFICATE

LOCKE B. GOLDSMITH

1. I, Locke B. Goldsmith, am a Registered Professional Engineer in the Province of Ontario and a Registered Professional Geologist in the State of Oregon. My address is 301, 1855 Balsam Street, Vancouver, B. C.
2. I have a B.Sc. (Honours) degree from Michigan Technological University and have done postgraduate study in Geology at Michigan Tech, University of Nevada and the University of British Columbia. I am a graduate of the Haileybury School of Mines and am a Certified Mining Technician. I am a member of the Society of Economic Geologists, the AIME, and the Australasian Institute of Mining and Metallurgy, and a Fellow of the Geological Association of Canada.
3. I have been engaged in mining exploration for the past 22 years.
4. I have co-authored the report entitled, "Geological Investigation of the Sam, Swing, *et al*. Mineral Claims, Tahtsa Lake Area, B. C." dated November 10, 1981. The report is based upon fieldwork and research supervised by the author.
5. I have no ownership in the property, nor in the stocks of Tahtsa Mines Ltd.
6. I consent to the use of this report in a prospectus or in a statement of material facts related to the raising of funds.

Respectfully submitted,

Locke B. Goldsmith, P.Eng.
Consulting Geologist

REGISTERED PROFESSIONAL ENGINEER
L. B. GOLDSMITH
PROVINCE OF ONTARIO

Vancouver, B. C.
November 10, 1981

REFERENCES

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Woodsworth, G. J. (1980) Geology of the Whitesail Lake Map-Area 93 E B.C. GSC OF 708.

APPENDIX

CHEMEX LABS LTD.

[illegible] NORTH VANCOUVER B.C.
CANADA V7J 2C1
TELEPHONE (604)984-02[illegible]
TELEX 043-5259

• ANALYTICAL CHEMISTS • GEOCHEMISTS • REGISTERED ASSAYERS

CERTIFICATE OF ASSAY

TO : TAHTSA MINES LTD.
403-705 WEST PENDER
VANCOUVER B.C.
V6C 2T7

CERT. # : A8113063-001-A
INVOICE # : I8113063
DATE : 01-SEP-81
P.O. # : NONE
TAHTSA MINES

CC PAUL KALLOCK, ARCTEX ENG. SERVICES

Sample description	Prep code	Cu percent	Pb percent	Zn percent	Ag (FA) oz/t	Au (FA) oz/t	
8181	207	<0.01	0.17	0.47	0.06	<0.003	--
8182	207	<0.01	0.05	0.19	0.06	<0.003	--
8183	207	0.09	7.73	3.47	17.26	<0.003	--
8184	207	<0.01	0.39	0.68	0.62	<0.003	--
8185	207	0.06	1.75	1.24	2.82	0.006	--
8186	207	0.44	61.10	0.33	103.60	0.026	--
8187	207	0.01	1.72	0.40	2.66	<0.003	--
8188	207	<0.01	0.19	0.04	0.44	<0.003	--
8189	207	<0.01	0.08	0.29	0.04	<0.003	--
8190	207	<0.01	0.02	0.02	0.02	<0.003	--
8191	207	<0.01	0.01	0.01	0.02	<0.003	--
8192	207	<0.01	0.01	0.05	0.01	<0.003	--
8193	207	<0.01	0.04	0.06	0.02	<0.003	--
8194	207	<0.01	<0.01	0.03	0.02	<0.003	--

Registered Assayer, Province of British Columbia

MEMBER CANADIAN TESTING ASSOCIATION

CHEMEX LABS LTD.

[illegible] BROOKSBANK AVE
NORTH VANCOUVER B.C.
CANADA V7J 2C1
TELEPHONE (604)984-0221
TELEX 043-52597

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CERTIFICATE OF ASSAY

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VANCOUVER B.C.
V6C 2T7

CERT. # : A8113509-001-A
INVOICE # : I8113509
DATE : 16-SEP-81
P.O. # : NONE
TAHTSA PROJ.

CC PAUL KALLOCK CC ARCTEX ENGINEERING(TAHTSA PROJECT)

Sample description	Prep code	Cu percent	Mo percent	Pb percent	Zn percent	Ag (FA) oz/t	Au (FA) oz/t
23601	207	0.05	--	0.39	1.26	3.26	<0.003
23602	207	<0.01	--	0.11	0.22	3.13	<0.003
23603	207	<0.01	--	0.14	0.23	3.14	<0.003
23604	207	<0.01	--	0.15	0.32	0.20	<0.003
23605	207	<0.01	--	0.12	0.27	0.26	<0.003
23606	207	0.01	--	0.31	1.20	0.74	0.005
23607	207	<0.01	--	0.11	0.27	0.04	<0.003
23608	207	<0.01	--	0.38	0.69	0.20	<0.003
23609	207	<0.01	--	0.14	0.23	0.10	<0.003
23610	207	<0.01	--	0.17	0.22	0.44	0.005
23611	207	<0.01	--	0.06	0.13	0.02	<0.003
23612	207	<0.01	--	0.17	0.22	0.14	<0.003
23613	207	0.01	--	4.24	0.26	3.86	<0.003
23614	207	<0.01	--	4.74	0.12	5.72	<0.003
23615	207	0.09	--	2.62	1.26	3.44	0.006
23616	207	<0.01	--	0.14	0.23	0.36	<0.003
23617	207	<0.01	--	2.84	0.67	3.08	<0.003
23618	207	<0.01	--	0.05	0.09	0.01	0.004
23619	207	<0.01	--	0.45	0.54	[illegible]	<0.003
23620	207	<0.01	--	1.54	0.26	1.09	<0.003
23621	207	<0.01	--	1.34	0.43	2.16	<0.003
23622	207	<0.01	--	0.15	0.13	0.16	<0.003
23623	207	<0.01	--	0.23	0.34	0.04	<0.003
23624	207	<0.01	--	0.06	0.04	0.01	<0.003
23625	207	<0.01	--	0.26	0.26	0.16	<0.003
23626	207	<0.01	--	0.04	0.10	0.04	<0.003
23627	207	<0.01	--	0.04	0.07	0.01	<0.003
23628	207	<0.01	--	<0.01	0.01	0.01	<0.003
23629	207	<0.01	--	0.01	0.03	0.01	<0.003
23630	207	<0.01	--	0.01	0.02	0.01	<0.003
23631	207	<0.01	--	0.03	0.05	0.02	<0.003
23632	207	<0.01	--	0.28	0.89	1.40	<0.003
23633	207	<0.01	--	0.63	0.92	0.22	<0.003
23634	207	<0.01	--	0.40	0.76	0.26	<0.003
23635	207	<0.01	--	0.54	1.00	0.54	<0.003
23636	207	<0.01	--	0.28	0.69	0.66	<0.003
23637	207	<0.01	--	0.20	0.65	0.62	<0.003
23638	207	<0.01	--	0.08	0.43	0.60	<0.003
23639	207	<0.01	--	0.21	1.04	0.96	<0.003
23640	207	<0.01	<0.001	<0.01	0.03	0.40	<0.003

....
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CHEMEX LABS LTD.

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CANADA V7J 2C1
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TELEX 043-52597

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VANCOUVER B.C.
V6C 2T7

CERT. # : A8113509-002-A
INVOICE # : I8113509
DATE : 16-SEP-81
P.O. # : NONE
TAHTSA PROJ.

CC PAUL KALLOCK CC ARCTEX ENGINEERING(TAHTSA PROJECT)

Sample description	Prep code	Cu percent	Mo percent	Pb percent	Zn percent	Ag (FA) oz/t	Au (FA) oz/t
23641	207	<0.01	<0.001	<0.01	0.05	0.38	<0.003
23642	207	<0.01	<0.001	<0.01	0.01	0.40	<0.003
23643	207	0.01	<0.001	<0.01	0.01	0.01	<0.003
23644	207	<0.01	<0.001	<0.01	0.01	0.01	<0.003
23645	207	<0.01	<0.001	<0.01	0.01	0.01	<0.003
23646	207	<0.01	<0.001	<0.01	0.01	0.01	<0.003
23647	207	<0.01	<0.001	<0.01	0.01	0.01	<0.003
8195	207	<0.01	--	0.01	0.03	0.01	<0.003
8196	207	<0.01	--	0.12	0.41	0.20	0.006
8197	207	<0.01	--	0.07	0.33	0.01	<0.003
8198	207	<0.01	--	0.23	0.67	0.14	<0.003
8199	207	<0.01	--	0.02	0.04	0.01	<0.003
8200	207	<0.01	--	0.05	0.10	0.01	<0.003
8201	207	0.04	--	9.96	1.22	9.80	<0.003
8202	207	<0.01	--	0.20	0.20	0.26	<0.003
8203	207	<0.01	--	0.04	0.08	0.01	<0.003
8204	207	<0.01	--	0.04	0.06	0.01	<0.003
8205	207	0.01	--	2.10	0.85	2.16	0.005
8206	207	<0.01	--	0.05	0.02	0.04	<0.003
8207	207	<0.01	--	0.01	<0.01	0.02	<0.003
8208	207	<0.01	--	0.01	<0.01	0.02	<0.003
8209	207	0.02	--	1.51	2.12	1.74	0.066
8210	207	<0.01	--	0.02	0.02	0.01	<0.003
8211	207	<0.01	--	0.01	0.01	0.02	<0.003
23653	207	0.01	<0.001	0.02	0.03	0.04	<0.003
23654	207	0.01	<0.001	0.39	4.52	0.39	<0.003
23655	207	<0.01	<0.001	0.02	0.05	0.01	<0.003
23656	207	<0.01	<0.001	0.01	0.01	0.01	<0.003

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TABLE 2

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CERTIFICATE OF ANALYSIS

TAHTSA MINES LTD.
403-705 WEST PENDER
VANCOUVER B.C.
V6C 2T7

CERT. # : A8114023-001-A
INVOICE # : I8114023
DATE : 29-SEP-81
P.O. # : NONE
TAHTSA

CC: PAUL KALLOCK

Sample description	Prep code	Cu ppm	Mo ppm	Pb ppm	Zn ppm	Ag ppm	AU-AA ppb
23657	205	550	15	--	--	1.3	<10
3658	205	570	130	--	--	0.9	120
3659	205	310	16	--	--	0.7	10
23660	205	60	4	--	--	0.8	<10
23661	205	39	3	--	--	0.4	<10
3662	205	27	2	--	--	1.9	<10
23674	205	42	--	200	1950	1.3	<10
23675	205	50	--	535	2200	3.0	<10
3676	205	42	--	100	810	1.0	<10
23677	205	57	--	300	360	1.7	<10
23678	205	20	--	21	65	0.1	<10
3679	205	--	--	--	>10000	--	--
3680	205	27	--	1300	735	6.5	10
23681	205	11	--	260	230	2.5	10
23682	205	30	--	27	100	1.3	<10
3687	205	5	--	45	16	1.5	<10
23688	205	32	--	10	70	0.4	<10
23689	205	22	--	22	80	0.1	<10
23690	205	66	--	9	141	0.9	<10

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CERT. # : A8114126-001-A
INVOICE # : I8114126
DATE : 05-OCT-81
P.O. # : NONE
TAHTSA PROJ.

CC:PAUL KALLOCK & ARCTEX ENG.

Sample description	Prep code	Cu ppm	Mo ppm	Pb ppm	Zn ppm		
23640	214	107	1	50	340	--	--
23641	214	55	1	108	455	--	--
23642	214	24	1	15	147	--	--
23643	214	134	1	26	145	--	--
23644	214	40	1	21	100	--	--
23645	214	39	1	15	90	--	--
23646	214	35	1	28	120	--	--
23647	214	34	1	19	95	--	--

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CANADA
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VANCOUVER B.C.
V6C 2T7

CERT. # : A8114023-001-B
INVOICE # : I8114023
DATE : 29-SEP-81
P.O. # : NONE
TAHTSA

CC: PAUL KALLOCK

Sample description	Prep code	W ppm	Bi ppm				
23657	205	300	2.6	--	--	--	--
23658	205	250	44.0	--	--	--	--
23659	205	500	3.0	--	--	--	--
23660	205	85	1.0	--	--	--	--
23661	205	90	0.6	--	--	--	--
23602	205	8	0.2	--	--	--	--
23674	205	--	--	--	--	--	--
23675	205	--	--	--	--	--	--
23676	205	--	--	--	--	--	--
23677	205	--	--	--	--	--	--
23678	205	--	--	--	--	--	--
23679	205	--	--	--	--	--	--
23680	205	--	--	--	--	--	--
23681	205	--	--	--	--	--	--
23682	205	--	--	--	--	--	--
23687	205	--	--	--	--	--	--
23689	205	--	--	--	--	--	--
23689	205	--	--	--	--	--	--
23690	205	--	--	--	--	--	--

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CERT. # : A8114024-001-A
INVOICE # : I8114024
DATE : 06-OCT-81
P.O. # : NONE
THATSA

CC: PAUL KALLOCK

Sample description	Prep code	Cu %	Pb %	Zn %	Ag FA oz/T	Au FA oz/t	
23663	207	0.05	4.20	1.84	12.60	<0.003	--
23664	207	<0.01	0.35	1.18	0.90	<0.003	--
23665	207	<0.01	0.18	0.23	0.32	<0.003	--
23666	207	<0.01	0.04	0.08	0.36	<0.003	--
23667	207	<0.01	0.14	0.12	0.40	<0.003	--
23668	207	0.04	1.22	3.97	11.72	<0.003	--
23669	207	<0.01	0.61	1.70	1.02	<0.003	--
23670	207	<0.01	0.32	1.03	1.04	<0.003	--
23671	207	<0.01	0.04	0.09	0.16	<0.003	--
23672	207	<0.01	0.07	0.31	0.34	<0.003	--
23673	207	<0.01	0.51	1.08	0.68	<0.003	--
23683	207	<0.01	0.05	0.15	0.14	<0.003	--
23684	207	<0.01	<0.01	0.03	0.02	<0.003	--
23685	207	0.95	10.50	4.78	63.42	0.008	--
23686	207	0.10	46.60	0.08	56.34	0.006	--

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[illegible] BROOKSBANK AV[illegible]
NORTH VANCOUVER [illegible]
CANADA [illegible]
TELEPHONE (604)98[illegible]
TELEX [illegible]

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403-705 WEST PENDER
VANCOUVER B.C.
V6C 2T7

CERT. # : A8114025-001-A
INVOICE # : I8114025
DATE : 29-SEP-81
P.O. # : NONE
TAHTSA

CC: PAUL WALLOCK

Sample description	Prep code	Cu ppm	Mo ppm	Pb ppm	Zn ppm	Ag ppm	AU-AA ppb
RLI-01	201	18	1	11	66	0.1	<10
RLI-02	201	9	2	4	44	0.3	<10
RLI-03	201	14	1	7	40	0.2	<10
RLI-04	201	18	2	7	186	0.2	<10
RLI-05	201	19	1	5	155	0.1	<10
RLI-06	201	84	3	13	75	1.2	<10
RLI-07	201	34	4	8	72	0.6	<10
RLI-08	201	26	2	4	65	0.1	<10
RLI-09	201	17	3	5	50	0.1	<10
RLI-10	201	29	1	8	175	0.1	10
RLI-11	201	23	2	20	143	0.3	<10
RLI-12	201	24	1	15	90	0.1	<10
RLI-13	201	73	1	45	385	1.5	<10
RLI-14	201	27	1	66	210	0.6	<10
RLI-15	201	[illegible]8	2	38	200	1.4	<10
RLI-16	201	49	1	27	390	0.3	<10
RLI-17	201	23	1	8	80	0.2	<10
RLI-18	201	15	1	14	88	0.3	<10
RLI-19	201	12	2	7	72	0.1	<10
RLI-20	201	33	2	16	190	0.1	<10
RLI-21	201	12	1	10	56	0.5	<10
RLI-22	201	25	1	12	62	0.2	<10
RLI-23	201	39	1	14	85	0.5	<10
RLI-24	201	35	1	14	47	0.2	<10
RLI-25	201	13	1	13	50	0.1	<10
RL2-01	201	14	1	8	88	0.1	<10
RL2-02	201	18	1	10	74	0.1	<10
RL2-03	201	17	1	8	88	0.1	<10
RL2-04	201	28	1	22	190	0.1	<10
RL2-05	201	17	1	11	90	0.1	10
RL2-06	201	22	1	10	64	0.1	<10
RL2-07	201	18	1	10	95	0.1	<10
RL2-08	201	38	1	7	72	0.1	<10
RL2-09	201	22	1	8	64	0.1	<10
RL2-10	201	13	1	9	100	0.1	<10
RL2-11	201	36	1	7	70	0.2	10
RL2-12	201	20	1	7	62	0.1	<10
RL2-13	201	24	1	10	112	0.1	<10
RL2-14	201	24	1	14	178	0.1	20
RL2-15	201	30	1	11	93	0.1	<10

Certified by ....

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CANADIAN TESTING
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[illegible]
NORTH VANCOUVER B.C.
CANADA V7J 2C1
TELEPHONE (604) 984-0221
TELEX 043-52597

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CERTIFICATE OF ANALYSIS

TO : TAHTSA MINES LTD.
403-705 WEST PENDER
VANCOUVER B.C.
V6C 2T7

CC: PAUL WALLOCK

CERT. # : A8114025-002-A
INVOICE # : I8114025
DATE : 29-SEP-81
P.O. # : NONE
TAHTSA

Sample description	Prep code	Cu ppm	Mo ppm	Pb ppm	Zn ppm	Ag ppm	AU-AA ppb
RL2-16	201	86	1	15	210	0.6	10
RL2-17	201	31	1	12	166	0.1	10
RL2-18	201	34	1	9	76	0.1	<10
RL2-19	201	70	1	11	68	0.1	10
RL2-20	201	33	1	9	100	0.1	<10
RL2-21	201	28	1	7	80	0.2	10
RL2-22	201	30	1	9	90	0.5	<10
RL2-23	201	22	1	7	75	0.1	<10
RL2-24	201	24	1	1	75	0.1	10
RL2-25	201	22	1	10	92	0.1	<10
RL2-26	201	12	1	7	46	0.1	10
RL2-27	201	11	1	10	130	0.1	10
RL2-28	201	20	1	11	85	0.1	10
RL2-29	201	29	1	15	75	0.1	<10
RL2-30	201	17	1	14	50	0.1	<10
RL2-31	201	20	1	8	143	0.1	<10
RL2-32	201	22	1	11	83	0.1	<10
RL2-33	201	20	1	11	130	0.2	10
RL2-34	201	13	1	8	43	0.1	<10
RL2-35	201	19	1	30	120	0.1	40
RL2-36	201	18	1	40	103	0.1	10
RL2-37	201	20	1	45	115	0.1	20
RL2-38	201	22	1	46	110	0.1	<10
RL2-39	201	[illegible]	1	20	53	0.1	<10
RL2-40	201	7	1	5	35	0.1	<10
RL2-41	201	4	1	10	16	0.1	20
RL2-42	201	7	1	5	25	0.1	<10
RL2-43	201	12	1	8	36	0.1	10
RL2-44	201	11	1	8	40	0.1	10
RL2-45	201	24	1	10	70	0.1	<10
SC-01	201	23	1	10	90	0.2	<10
SC-02	201	39	1	7	95	0.2	10
SC-03	201	14	2	7	113	0.1	10
SC-04	201	24	1	6	253	0.2	10
SC-05	201	21	1	13	90	0.2	20
SC-06	201	22	1	8	118	0.1	10
SC-07	201	32	1	13	182	0.1	20
SC-08	201	26	1	5	97	0.1	10
SC-09	201	26	1	9	38	0.1	<10
SC-10	201	18	1	7	94	0.1	<10

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CHEMEX LABS LTD.

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NORTH VANCOUVER [illegible]
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TELEPHONE (604)984-[illegible]
TELEX 043-5259[illegible]

• ANALYTICAL CHEMISTS • GEOCHEMISTS • REGISTERED ASSAYERS

CERTIFICATE OF ANALYSIS

: TAHTSA MINES LTD.
403-705 WEST PENDER
VANCOUVER B.C.
V6C 2T7

CERT. # : A8114025-003-A
INVOICE # : I8114025
DATE : 29-SEP-81
P.O. # : NONE
TAHTSA

CC: PAUL WALLOCK

Sample description	Prep code	Cu ppm	Mo ppm	Pb ppm	Zn ppm	Ag ppm	AU-AA ppb
SC-11	201	25	1	7	115	0.1	20
SC-12	201	39	1	16	310	0.1	<10
SC-13	201	16	1	8	74	0.1	<10
SC-14	201	18	1	10	62	0.1	<10
RLI-00	201	20	1	6	99	0.1	<10

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PETROGRAPHIC SAMPLES

#1 Core from 1958, DDH, halfway between old and new tunnel; 27 feet deep, greenish, clearly an andesite tuff breccia, porphyritic with whitish feldspars, greenish fine-grained matrix, fragments to ½" (1" diameter core) of darker andesite (?), flow texture is apparent 0.5% f.g. diss. sulfides.

#2 Same DDH, 64.5' of depth, porphyritic but with less breccia appearances, darker green. 5% diss. epidote alteration.

#3 Same DDH, 65.5' of depth, light tan coloured, more clay, sericite (?), clearly altered traces diss. py.

#4 300 feet west of old adit; propylitic altered f.g. diorite, strong chlorite, weak to moderate epidote (could be andesite tuff?).

#5 New adit west wall, 16 feet from portal near major fault zone. Breccia, quarta-sericite-clay alteration strong. 1% diss. pyrite. Traces diss. green stained feldspar (?).

Vancouver Petrographics Ltd.

JAMES VINNELL, Manager
JOHN G. PAYNE, Ph.D. Geologist

P.O BOX 39
8887 NASH STREET
FORT LANGLEY, B.C.
VOX 1JO

PHONE (604) 888-1323

9 Sept 1981

Paul Kallock
Locke Goldsmith
Arctex Engineering Services
301 - 1855 Balsam Street
Vancouver, B.C.

Dear Paul and Locke:

Enclosed please find descriptions for the five Tahtsa Project samples. They are all prophyritic dacites, probably high-level intrusive rocks. Alteration phases include carbonate, chlorite, epidote, sericite, clay, and quartz. These fit best into the propylitic alteration assemblage. One of the xenocrysts in Arc-1 may have been affected by phyllic alteration prior to its incorporation in the present matrix.

I hope that this information is useful to you. Please don't hesitate to ask questions.

Sincerely yours,

JoAnne Nelson
224-6338

Arc-1 Altered porphyritic dacite

The original igneous texture in this sample is of fairly large phenocrysts (2-3 mm) of plagioclase, hornblende and quartz dispersed in a very fine grained matrix - plagioclase microlites less than .05 mm long and nearly cryptocrystalline material. Several xenoliths are present. One of them is porphyritic like the host rock, but with more large plagioclase phenocrysts. Another seems to have had an original plutonic texture. This is now partly mimicked by large white mica plates.

The alteration assemblage includes carbonate, chlorite and epidote. This is typical of propylitic alteration. The large white micas in the xenolith may be a remnant of phyllic alteration occurring lower down in the system.

Mode

70	plagioclase
8	carbonate
7	Ti-oxide
5	chlorite
5	opaques
4	sericite
1	quartz
tr	epidote

Although the plagioclase phenocrysts are heavily altered, the microlites in the matrix are still intact. Very fine grained anhedral plagioclase is also abundant in the matrix.

Carbonate grows parallel to the crystal structure in hornblende pseudomorphs. Ragged carbonate patches also occur in the matrix and in plagioclase phenocrysts.

Abundant Ti-oxide speckles occur in the matrix.

Chlorite replaces hornblende along with carbonate. Fine grained chlorite fills "corrosion holes" in plagioclase phenocrysts.

The opaques in this rock vary from cubic (pyrite) to anhedral to bladed in clumps. Some occur within plagioclase phenocrysts.

Sericite is most important in the xenoliths. It forms large plates in the plutonic xenolith, and coarse interstitial growths in the porphyritic one. Fine grained sericite dusts the plagioclase phenocrysts.

A few rounded quartz phenocrysts are present.

Small euhedral epidote grains occur in hornblende pseudomorphs.

Arc-2 Altered porphyritic dacite cut by breccia zone

This was originally a porphyritic dacite with plagioclase, hornblende, biotite and quartz phenocrysts. Alteration has affected mpst of the phrnocrysts, except for the quartz and some of the plagioclase. The breccia zone varies from 1 to 10 mm in width, with partly sharp and partly diffuse contacts. It contains fresh, broken plagioclase crystals.

Alteration includes carbonate, chlorite, epidote and sericite.

Mode

57 plagioclase
20 carbonate
10 sericite
5 epidote
5 Ti-oxides
3 chlorite
tr quartz

Anhedral plagioclase dominates the matrix. This, as in the first sample, is extremely fine grained. Some of the original plagioclase phenocrysts are still intact, with heavy clay-altered rims. Others have been converted to clusters of epidote prisms and interstitial carbonate and chlorite.

Carbonate forms abundant lichen-like ragged patches in the matrix. It pseudomorphs biotites. The original crystal structure in these is shown by lines of Ti-oxide.

Sericite blobs with ragged edges accompany carbonate in the matrix. Veinlets run off from the edges of the breccia zone.

Well-formed epidote prisms grow in patches after plagioclase.

Fine Ti-oxides speckle the matrix.

Chlorite occurs interstitial to epidote in plagioclase pseudomorphs.

Sparse rounded quartz phenocrysts are present. A few fine grained quartz aggregates represent minor silicic alteration near the breccia.

Arc-3 Carbonate-chlorite altered porphyritic dacite

The original identity of this rock is derived from its association with rocks like Arc-1 and 2. Rounded, euhedral and embayed quartz phenocrysts are still apparent, as is some of the plagioclase matrix. Otherwise alteration minerals dominate the texture.

Mode

45	carbonate
35	plagioclase
10	quartz
5	chlorite
5	Ti-Fe oxides
tr	white mica
tr	apatite

Fine grained carbonate is very abundant in the matrix. Somewhat coarser patches occur in pseudomorphed phencrysts. Fine carbonate veinlets are scattered in the rock.

Very fine grained, anhedral plagioclase forms the original matrix.

Quartz phenocrysts are unaltered. In addition, very fine grained quartz aggregates replace parts of some phenocrysts (plagioclase?) and occur sporadically in the matrix.

Extremely fine grained chlorite is intermixed with carbonate, particularily in the phenocrysts. Larger chlorite plates may be after biotite.

Small brownish to nearly opaque grains of Ti+Fe-oxides are abundant in the matrix and in some phenocrysts.

A few white mica aggregates with overall vaguely prismatic outlines may be hornblende pseudomorphs.

A few dusty euhedral apatite crystals are present. Some of them occur inside altered phenocrysts, probably hornblende.

Arc-4 Andesitic dacite porphyry?

Staining on the reject block for this sample seems to indicate abundant Kspar; however none, either of primary or secondary texture, can be recognized in thin section. The higher mafic content of the rock in contrast to others in the suite leads to the addition of "andesitic" to its name. Quartz phenocrysts suggest that it is a dacite. Alteration resembles the other samples in the suite.

Mode

67	plagioclase (+ clay)
10	epidote
10	carbonate
7	chlorite
6	Ti-oxide
tr	quartz
tr	apatite

Plagioclase phenocrysts are commonly well-altered to clay: this may account for the yellow staining. Minor chlorite and epidote occur in the phenocrysts. Dusty plagioclase microlites and fine grained anhedral aggregates dominate the matrix.

Some of the plagioclase phenocrysts have been almost completely replaced by aggregates of epidote prisms, as in Arc-2. Small areas of the host crystal remain.

Ragged carbonate-chlorite intergrowths replace hornblende phenocrysts. Scattered chlorite patches occur in the matrix.

Ti-oxides speckle the matrix.

A few rounded quartz phenocrysts are present.

Dusky euhedral apatite grains are seen inside some of the horpblende pseudomorphs.

Arc-5 Silica-carbonate altered, brecciated porphyritic dacite

This rock is classified as a porphyritic dacite based on the presence of a few quartz phenocrysts and on its association with other dacites. The textures and minerology are nearly all secondary. It has a very patchy, inhomogeneous texture that suggests brecciation, although clear clast-matrix distinctions are not seen in all cases. The green mineral may be a white mica. No malachite was seen in thin section, but a number of white mica patches are present. Some chrome mica, which I have seen not only in ultramafic associations but also on fractures in metamorphosed limestones, closely resembles malachite.

Mode

47	quartz
40	carbonate
7	white mica
4	Ti-oxide
2	opaques

The few relict quartz phenocrysts are rounded and embayed. Very fine grained to extremely fine grained quartz aggregates occur as part of the secondary assemblage. Transitions in quartz grain size mark some of the clast-matrix boundaries.

The carbonate in this rock has very high relief. It may be siderite. It occurs in dispersed to cloalesced equant patches. Changes in carbonate abundance define some of the clasts. A few lath-shaped carbonate patches may be after plagioclase microlites.

Scattered large white mica plates may be after plagioclase or hornblende phenocrysts. In one area between clasts, abundant white mica plates with interleaved carbonate are distorted by the edges of the clasts. White mica forms parallel growths with opaques, in what may be pseudomorphs.

Ti-oxide grains are scattered in the rock. They form beaded chains in some of the white micas.

Patchy opaques intergrow with fine, parallel white mica platelets.

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LOGS OF OLD DIAMOND DRILL CORE

Core: Located between old adit (circa 1929) and new adit (1980), late 1950's, 5 box ∿105', 45°. Hole number unknown.

0-65 feet	Andesite tuff (?) breccia, grey with hues of purple and green, angular to subrounded clasts and fluid (?) clasts generally <1", also local porphyritic texture of altered (argillic) feldspar phenocrysts. Occasional clast (?) to 6" of diorite (?) porphyry with up to ¼" feldspar phenocrysts. Pyrrhotite up to 3% and pyrite <1% and traces of chalcopyrite are disseminated throughout the core. Most alteration is classed as phyllic (py-pyrrh/chlorite minor clay, weak pervasive silicification). Local zones of stronger bleaching and more clay, i.e. 9-16'.
65-67 feet	Orange-stained limonite of similar although finer-grained volcanic (?). 65: 30° contact in colour (and alt., more argillic, pick up green speck (Ag?). The limonite is 1/16"-1/8" thick and oxidized since drilling. Epidote is first noticeable at 57' along with calcite veinlets.
67-72 feet	Light tan to white altered andesite tuff (?), strong argillic, numerous clay gouge zones, abundant calcite veins. Traces cpy. galena and py. Disseminated sulfide content is low.
72-74 feet	Uniformly altered silic-carbonate <1% sulfides, light colour. At alt./non-alt. contact local pyrite veins up to 5%.
74-79 feet	Moderately fractured, weak pyrite carbonate veinlet, andesite tuff bx dark grey.
79-103 feet	Epidote shows up as alt. phenocrysts. 1-3% pyrite/carbonate veinlets decrease after 85'.
103 feet	End of hole in andesite tuff breccia.

Diamond Drill Hole #2 (circa 1962). Oriented N85°W, -45° to the west.
Located 40 m northeast of lower adit.

3 boxes - the first is destroyed;
#2 Box from ∿30'-60' is complete;
#3 Box from ∿60'-90' is half destroyed.

30-36 feet	Andesite and andesite tuff breccia fragments up to 6" of porphyry (DT?), generally irregular fragments of ½", pale greenish blue silicified with 3% diss. pyrrhotite moderately magnetic.
36-43 feet	Fract., broken abundant clay-shear zone, 50% recovery.
43-57 feet	Tuff breccia grey-green locally porphyritic, <1% pyrrhotite, some sericite.
57-73 feet	Strong reddish-brown oxidizing, andesite breccia, strong fract. carbonate-py alt., could carry some veins.
73-81 feet	Strongly broken, sheared, carbonate (oxidized black) veins, clay, probably vein zone. Terminating in 5% diss. pyrite.
81-? feed	To at least 90'. Largely destroyed.

Diamond Drill Hole #3: Located on Captina Vein Extension, elevation 1586 m (5200 feet), oriented 280°, -36° to west.

Note: Host is andesite tuff breccia (?) and/or andesite-diorite, locally porphyritic.

Only 2 of the 3 core boxes were partially intact.

COMPARISON OF TAHTSA PROJECT GEOLOGY
WITH THE BERG COPPER-MOLYBDENUM PORPHYRY
AND
REVIEW OF 1981 GEOPHYSICS

#1 ADDENDUM TO

GEOLOGICAL INVESTIGATION
OF THE SAM, SWING, ET AL. MINERAL CLAIMS
TAHTSA LAKE AREA, B. C.
OMINECA MINING DIVISION
93 E/11 W

Prepared for

TAHTSA MINES LTD.

ARCTEX ENGINEERING SERVICES

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Consulting Geologist

Paul Kallock
Geologist

January, 1982

TABLE OF CONTENTS

SUMMARY 1
INTRODUCTION 2
GEOLOGY OF THE BERG DEPOSIT 2
COMPARISON OF BERG WITH TAHTSA GEOLOGY 5
TAHTSA GEOPHYSICS AND GEOLOGICAL RELATIONSHIPS 7
- Magnetic Responses 7
- VLF-EM Responses 9

CONCLUSIONS 10
RECOMMENDATIONS 11
COST ESTIMATE 11
ENGINEER'S CERTIFICATE 12
GEOLOGIST'S CERTIFICATE 13
REFERENCES 14

COMPARISON OF TAHTSA PROJECT GEOLOGY WITH THE BERG COPPER-MOLYBDENUM PORPHYRY AND REVIEW OF 1981 GEOPHYSICS

SUMMARY

Similarities between the Berg deposit and geology of the Tahtsa Project are discussed. A pyrite halo which surrounds Berg copper-molybdenum mineralization may be analogous to the pyritic stockwork exposed on the north side of the north ridge. Peripheral lead-zinc-silver veins at Berg may have counterparts in the Captain Vein and in the sphalerite veins within the pyritic stockwork at Tahtsa.

Geophysics has defined shear zones near the Captain Vein which should be explored in conjunction with work in the vicinity of the pyritic stockwork.

INTRODUCTION

The Berg deposit is a major copper-molybdenum porphyry deposit with geological reserve estimates of 400 million tonnes containing 0.4% copper and 0.05% molybdenite. The prospect is located 93 km southwest of Houston, B. C., and 18 km north-northwest of the Tahtsa Lake property of Tahtsa Mines Ltd. The geological setting and certain aspects of alteration and mineralization closely resemble features that have been noted at the Tahtsa prospect. A summary of Bulletin 66 of the B. C. Ministry of Energy, Mines and Petroleum Resources by Panteleyev (1981) concerning comparison with the Tahtsa property.

The magnetic and VLF-EM surveys which were completed in the vicinity of the Captain Vein are discussed in relation to geology.

GEOLOGY OF THE BERG DEPOSIT

The Berg deposit is about 12 km east of the Coast Plutonic Complex in a region of bedded volcanic and sedimentary rocks of Jurassic and Cretaceous age. Bedded rocks have been intruded by a number of Jurassic, Cretaceous and Tertiary stocks. The most important of these is a composite quartz monzonite porphyry plug which is less than 640 metres in diameter. Best grades of copper and molybdenum are found in an asymmetrical annular zone of biotitic hornfels surrounding the quartz monzonite stock. Pyrite and chalcopyrite are the most abundant sulphide minerals and occur primarily in fractures, in quartz veins, and as disseminations. Molybdenite is contained mainly in quartz veins.

The mineralized hornfels is part of the Hazelton Group of Middle Jurassic age. Hazelton rocks are green, grey, red, and maroon lithic tuff, tuff breccia and tuffaceous or epiclastic sedimentary rocks. An andesitic pyroclastic assemblage comprises the majority of the 1675 metres of strata exposed in the mineralized area.

Along the ridge above and to the east of Berg deposit, volcanic and sedimentary rocks of the Lower Cretaceous Skeena Group are exposed. A basal volcanic unit consisting predominantly of feldspathic amydaloidal flow rocks of andesitic or basaltic composition is grey to purple and dark green in colour and is a maximum of 600 metres thick. Overlying the volcanics are from 0 to 500 metres of mainly fine-grained, massive, grey to buff-coloured sandstone. A few pebble conglomerate beds, and thinly bedded siltstone and shale layers are also present. The top of the Skeena is marked by 40 metres of flaggy siltstone and dark brown shale beds.

Upper Cretaceous Kasalka Group unconformably overlies Skeena rocks. A basal member of red to maroon conglomerate ("red bed") containing ferruginous sandstone lenses is 5 to 12 metres thick. The conglomerate is composed of pebbles and cobbles of Hazelton and Skeena volcanic rocks. Overlying the conglomerate is up to 190 metres of strongly jointed hornblende feldspar porphyry and a fragmental unit. The porphyry resembles a sill but may, in fact, be an individual flow. Above the porphyry is 10 metres of red to purple conglomerate (lahar?) followed by 90 metres of basalt or andesite breccia. This in turn is overlain by a 75-metre layer of vitric flows. The lower portion of the Kasalka Group has been termed "Swing Peak Formation" by MacIntyre (1976).

The youngest Kasalka rocks range from intermediate to felsic, dark to pale, and fragmental to massive. Pale grey rhyolite flows and breccia are an important part of this mixed volcanic assemblage which may exceed 100 metres.

The largest intrusion in the Berg area is a quartz diorite which is at least 600 metres wide and several kilometres in length. The intrusion is texturally and compositionally zoned ranging from fine-grained, equigranular to locally porphyritic, biotite hornblende quartz diorite or diorite. The intrusive contact is steeply dipping, somewhat serrated in plan, but continuous without known offshoots or projections. It has no inherent mineralization and has recrystallized intruded rock into a purplish brown hornfels commonly 30 metres or less in width. An Eocene or older age has been estimated for the quartz diorite.

The most economically significant intrusive body at the Berg prospect is the small composite stock of quartz monzonite porphyry. It is composed of at least three phases of coarse-grained, biotite quartz feldspar porphyry that are intruded by at least one crosscutting phase of hornblende quartz feldspar porphyry. All phases of the quartz monzonite are hydrothermally altered and mineralized. The main phases of quartz monzonite have not been observed to intrude the previously mentioned quartz diorite stock and are separated from it by a screen of hornfelsed volcanic rocks, on average about 90 metres wide. The portion of quartz diorite close to the quartz monzonite is strongly altered and mineralized.

An intrusive breccia approximately 450 metres southeast of the quartz monzonite intrudes quartz diorite and pyritic volcanics at the outer edge of the zone of mineralization. It is similar to quartz monzonite in composition and alteration. The breccia pipe is 580 metres long and 175 metres wide. It is thought to be explosive in origin and formed by venting of volatiles related to magma intrusion or by phreatic explosion of groundwater. Other breccias observed in drill holes at the property may also be genetically related to the mineralized stock.

Other minor intrusives have been observed at the Berg property: rhyolite dykes related to the Kasalka rocks; feldspar porphyry sills, which may in fact be flows of the Kasalka Group; and Miocene (and younger?) basalt dykes which intrude all major rock units.

Bedded rocks in the Berg area form a gently eastward dipping succession, younger rocks showing gentler dips. Gentle folding of the Hazelton rocks has taken place.

Fracture patterns indicate predominance of east-northeast and north to northeast trends. Displacements of some tens of metres have been measured along northwesterly breaks. Elongated intrusives may have been influenced by structural breaks during emplacement exemplified by the north-south trend of the quartz diorite.

As previously stated disseminations and stockwork veins of chalcopyrite and molybdenite occur near the margin of the quartz monzonite plug. Outward from the contact, pyrite increases to form a pyritic halo around the zone of Cu-Mo mineralization. Sphalerite with pyrite and some tennantite and galena are found in veins within and peripheral to the pyritic halo as well as in small late-forming quartz and quartz carbonate veinlets in the main Cu-Mo zone.

Supergene alteration caused by weathering, oxidation, hydration, hydrolysis, recrystallization, and leaching by acid solutions is extensive and has resulted in a thick leached capping containing mainly quartz, limonite, sericite, chlorite and clay minerals. At Berg, hypogene alteration zones with dominant quartz-orthoclase and quartz-sericite alteration are developed centrally in the weakly-mineralized quartz monzonite stock and are surrounded by alteration aureoles containing first biotitic cupiferous rocks, then pyritic chlorite-calcite-epidote-bearing rocks. Quartz-sericite-pyrite zones occur extensively along the intrusive contact of the quartz monzonite stock and clay-bearing zones are developed locally in positions intermediate between the intrusive core and pyritic periphery.

Distribution of primary minerals is not readily seen in outcrop because of weathering and sulphide leaching. At surface, rocks are bleached, crumbly masses commonly stained and cemented by limonite. Below approximately 38 metres, secondary copper minerals are deposited in a zone of supergene enrichment which begins approximately at the present water table. Below this zone gypsum, which cements all fractures, remains intact and prevents solution movement.

COMPARISON OF BERG WITH TAHTSA GEOLOGY

Several features which occur at Berg have similarities to the Tahtsa geology. Conversely, some of the characteristics of Berg are lacking or are as yet undiscovered at Tahtsa.

The most striking similarity between the two properties is the geological setting. Nearly identical situations exist where the Kasalka volcanics occupy ridges and have at their bases a red bed conglomerate. The shales and siltstone of the Skeena Group are the next underlying bedded sequence. At Tahtsa the Hazelton Group underlies the east half of the property and probably forms the basement beneath the north and south ridges. Near the west-central part of the "Long" claim a 300 x 900 metre dioritic plug is partially exposed. A diorite dyke cutting pyritic hornfels (?) near the north margin of the north ridge and a nearby granitic outcrop are encouraging signs of intrusive activity. A very small granitic exposure at the extreme southeast corner of the "Sam" claim and granodiorite talus along the southwest part of the south ridge (also in the "Sam" claim) lend additional encouragement to the possibility of "porphyry" type plumbing systems existing at the Tahtsa property. Minor felsite, latite and porphyry dykes along with Tertiary (?) basalt and diabase dykes are common at Tahtsa.

Interestingly, the strongly jointed hornblende-feldspar porphyry which occurs near the base of the Kasalka Group at the Berg property was first thought to be an intrusive sill, but later opinions favour a volcanic flow. At Tahtsa the Unit 3, andesite-diorite, may also be more extrusive than intrusive-related. Other rock units such as the rhyolite breccia and flows and the complex volcanics of the Kasalka Group are also present at Tahtsa.

Two notable geologic units which have not yet been found at Tahtsa are the intrusive breccia pipe and a mineralized and altered plug such as the quartz monzonite.

North-northwest to north-northeast faults are very common at Tahtsa. E-W faults are also present. MacIntyre (1976) suggests that north to northeasterly trends are subsidiary trends within fault blocks bounded by northwesterly faults in the Tahtsa region. Gentle southerly dips of bedded units are common at Tahtsa as opposed to easterly dips at Berg.

At Berg, pyrite content of the quartz monzonite stock is <2%. Pyrite content increases to 6%, 150 metres outward from the contact in the hornfelsic volcanics. A general similarity to this pyrite halo can be seen at Tahtsa, in the weak stockwork pyrite zone on the north side of the north ridge. At higher elevations on the Tahtsa property pyrite may have been significantly leached. At Berg, limonite and goethite display numerous varieties such as granular, coagulate, botryoidal, crusty, etc. and most can be classified as fringing (contiguous) or exotic (transported) types in which a specific source of iron cannot be identified. Many of these criteria fit Tahtsa as does the fact that cellular boxwork or sponge type limonite is rare or absent on the property, and ferricrete is the most abundant accumulation of limonite.

At Berg, distribution of primary minerals is not readily seen at surface due to weathering and leaching but strongly anomalous amounts of copper and molybdenum can be detected by geochemical analyses of the cap rock. Strong copper or molybdenum anomalies have not yet been found at Tahtsa. However, quartz-carbonate-pyrite-sphalerite veins with minor lead and silver occur in the pyritic rocks on the north side of the north ridge as is the case at Berg where pyritic rocks surrounding the stock contain a number of quartz carbonate-pyrite-sphalerite-galena-tetrahedrite veins a few tens of centimetres in width. This type of veining is very similar to the Captain Vein and numerous other occurrences on the "Sam" claim. Also, black amophous iron-manganese oxides that have formed from lead and zinc-bearing carbonate veins have been observed at Berg. This oxide is also common with the main veins at Tahtsa.

At Berg, ore tenor and mineralogy are strongly affected by the downward percolation of acid solutions. Similarly, the present topography also reflects this same leaching system where pyrite has created acid solutions to weather the hydrothermally altered zone along the margin of the stock. At Tahtsa a system similar to this appears to be working. On both sides of the north ridge, deposits of ferric hydroxide which cements detrital material, extremely clay-rich deposits, active precipitation of deposits of limonite and white precipitates (possibly anomalous in zinc), and intensely silicified and leached zones. are present. Anomalous zinc and lesser lead and silver soil and stream sediment geochemistry may also be related to the strongly iron-stained north ridge area. Furthermore, theoretically favourable ground in the flats to the north of the north ridge is largely covered by soil.

TAHTSA GEOPHYSICS AND GEOLOGICAL RELATIONSHIPS

Magnetic Responses

In the vicinity of relatively rapid fluctuations in magnetics on L300S + L400S, near the Bennett area, the character of the andesite-diorite, Unit 3, may be one of the causes. Although much of this area is covered, geologic field notes mention weakly magnetic pyrrhotite at two localities slightly to the north:

1) near 200S 2+50W to 200S 3+00W homogenous andesite-diorite porphyry contains 5% disseminated sulphides, local strong pyrrhotite;
2) near a shear zone at L200S, 1+50W and near or within the shear zone at L150S, 1+00W, there is 2-3% pyrite and 1-2% disseminated pyrrhotite.

Perhaps greater concentrations of pyrrhotite are affecting the magnetics on L300S and L400S.

The origin of Unit 3 is not clear. In the Berg deposit, feldspar porphyry sills which may be similar to the Tahtsa Unit 3, which occur in or near the Kasalka Group, have been redefined as extrusive flows.

Map Unit 3 is probably a mixture of porphyry and breccia and is of a questionable intrusive nature. It should be kept in mind that fairly shallow-dipping sedimentary and volcanic rocks occur above this unit on the south ridge. Also a shallow-dipping basal conglomerate outcrops in Swing Creek below the unit. Therefore, if a planar near-horizontal attitude is applied to rocks in the Bennett Lead area, the general outline of the erratic magnetic signature may be accounted for by the topographic relief along the eroded edge of a volcanic flow.

On the west ends of Lines 300 and 400 S the magnetic signature decreases in intensity. Extensive deposits of glacial debris may be acting in a screening fashion. Similarly, talus shoots and fans may be the cause of erratic jumps in the magnetics near and topographically below the Bennett Lead.

Strong jointing of andesite-diorite and breccia near the Bennett Lead trends N75°E 80°N almost perpendicular to the trend of the vein. This jointing is not apparent on the magnetics.

In the eastern part of the grid, the magnetic anomaly at L400S 7+50E may be related to a strong limonite-altered zone as much or more than to a presumed continuation of a fault on line 300S (which did not exhibit a magnetic high).

The magnetic high at L200S 7+00E appears to be related to a fault which follows a drainage. Several metres across the creek bed and up the banks, soft clay is ubiquitous.

The anomaly at L100S 5+75E coincides with a 28° dip VLF anomaly which probably traces a fault or intersection of faults. The same is true for the magnetic high at L0+00 5+50E.

An anomaly at 100N 4+00E is near the conglomerate/volcanic contact. It is also slightly west of a north-south fault.

The conglomerate/volcanic contact along Line 100N is not clearly defined but it does appear that red bed conglomerate, somewhere east of L1+00N 0+25E has a higher magnetic signature of ∿7600 gammas. Overlying volcanics to the west show 7475-7500 gammas decreasing to 7400 gammas slong Line 100S.

Several mafic dykes were mapped in the northeast quarter of the grid area, some up to several metres wide. Undoubtedly more of these features were unmapped and may have caused magnetic highs.

East of the break at L200S 2+00E magnetic signature is generally higher than the area west of the break. A strong fault follows this break. Similar faults and magnetic changes at L200S 0+50E (Captain Vein), L200S 4+25E and L200S 7+00E may be the northerly-trending block faults referred to by MacIntyre (1976) in the Berg report. Furthermore, a N-S cross-section drawn across the claims in this area shows the basal conglomerate at lower elevations in the east while the dip of these beds is toward the west. N-S block faulting with down-dropping steps on the east would account for the conglomerate position.

VLF-EM Responses

Anomaly (a) at L100S 2+50E is coincident with galena and sphalerite veins in a broad shear zone. The anomaly crosses the creek diagonally toward the north. Outcrops in this area did not contain vein material or obvious shears. Diligent search for vein material on the west side of the creek was not successful. As stated by Anderson in the Geotronics report the anomaly can probably be connected to the 8 degree response found on L400S 2+00E. This zone contains alteration and lead-zinc-silver mineralization which is very similar to the Captain Vein. It has a stronger VLF signature than the Captain Vein, therefore shearing with incipient clay gouge and/or greater sulphide content is indicated.

The 32^{o} anomaly (b) at L100S 4+75E is probably fault controlled, possibly at the intersection of two or more faults. A steeply dipping latite dyke and the trend of a felsite dyke are nearly coincident with this anomaly. The north-south fault touching the northwest side of this anomaly is strong and probably continues northward to the fault on the north side of Swing Creek.

In the fault zone at L300S 3+75E, which trends northeast toward VLF anomaly (b), is contained up to 1 metre of fault-clay gouge in a 2-metre-wide shear zone, also with local concentrations of 3-5% pyrite. Several areas show manganese oxides typical of Pb-Zn carbonate vein zones. A fine-grained felsite dyke may parallel this zone. Two small pods, <1 metre wide, of massive felty biotite, were also seen near the creek bed. Near the southern tip of anomaly (b) a small outcrop of andesite-diorite was mapped which contains up to 5% disseminated pyrite. In addition, a few small cobbles or pebbles of manganese-stained volcanics (?) were seen on the debris-covered slopes less than 25 metres east of the centre of anomaly (b).

Anomaly (c) at L100S 5+75E is slightly west (about 25 metres) of outcrops of intensely silicified breccia (as shown on the geology map), which may have contained up to 20% pyrite (and other sulphides?). Faults which are parallel to the trend of anomaly (c) have been noted to the east and south of the anomaly. Perhaps a similar shear zone is responsible for part of the VLF signature.

Approximately 100 metres east of anomaly (c) another weak, linear VLF anomaly was detected. It nearly coincides with a strong fault zone trending north-northwest which contains several metres of clay and gouge.

Most of the other "anomalies" on the VLF grid are less than 10^{o} of dip, which is very weak. They could easily be contoured in other directions across the 100-metre line spacings. Nevertheless, VLF does seem to confirm the geological observations of numerous NNW to NNE trending shear zones in the grid area.

VLF anomalies (a) and (c) are associated with weak magnetic highs. In the general area of the Bennett Lead, VLF anomalies occur at:

L400S 2+25W, L400S 1+00W, L400S 0+00

L300S 1+00W, L300S 0+00

Although weak, they do occur on the west flank of magnetic highs. The VLF anomalies at the Bennett Lead and Captain Veins are associated with fault zones.

It should be noted that some of the geological mapping was done prior to the establishment of the grid, hence there is some discrepancy between geophysical stations and geological locations.

There appears to be a slight error in the location of the lower adit on the alteration map. The location on the geology is more correct. Therefore the coincident VLF anomaly is nearly exactly over the vein.

CONCLUSIONS

Important geologic and metallogenic events associated with the Berg deposit are present or are suggested on the property of Tahtsa Mines Ltd. Exploration for disseminated mineralization should proceed with parameters from Berg to be used as a working model which should be refined as data are collected.

VLF anomaly (a) defines a lead-zinc-silver-bearing fault zone, probably greater than 500 metres long, which has greater conductivity than the similar appearing Captain Vein. Carbonate-sulphide veins and shears occur on strike with anomaly (b). Although only slightly over 200 metres in length, its signature is 32^{o} dip, which is the strongest encountered on the grid. Anomaly (c) is largely covered by overburden but adjacent parallel shears indicate that faulting also underlies this anomaly. A limited amount of exploration should be completed near these anomalies in the event that high-grade direct-shipping mineralization may be present beneath soil cover.

RECOMMENDATIONS

1. Earlier recommendations (2) concerning concentrated exploration in the vicinity of the pyritic stockwork on the north side of the north ridge are supported by analogy to the Berg deposit. Thin sections of several of the rock specimens which were collected in this area during the 1981 programme will be prepared for petrographic descriptions.

2. (i) Fill-in geophysics on 50-metre-spaced grid lines should be completed in the vicinity of anomalies (a), (b), and (c). Surveys should be extended to the north and south as topography permits until the responses are closed off on both ends.

(ii) Dozer trenches should be cut on anomalies (a), (b), and (c) where feasible.

(iii) Following (i) and (ii), the new grid should be mapped on the same scale (1:2000) as the geophysical coverage.

COST ESTIMATE

To complete part 2 of the recommendations if undertaken as part of the programme which was outlined previously:

Magnetics and VLF-EM with grid preparation and report	$ 8,000
Dozer trenching	5,000
Geological mapping, sampling, reporting	4,000
Assays, analyses	500
Supervision	1,000
Camp supplies	1,500
Camp maintenance	1,500
	$21,500
Contingencies @ 10%	2,100
TOTAL	$23,600

REGISTERED PROFESSIONAL ENGINEER L. B. GOLDSMITH PROVINCE OF ONTARIO

Respectfully submitted,

Locke B. Goldsmith, P.Eng.
Consulting Geologist

Paul Kallock
Geologist

Vancouver, B. C.

January 7, 1982

ENGINEER'S CERTIFICATE

LOCKE B. GOLDSMITH

1. I, Locke B. Goldsmith, am a Registered Professional Engineer in the Province of Ontario and a Registered Professional Geologist in the State of Oregon. My address is 301, 1855 Balsam Street, Vancouver, B. C.
2. I have a B.Sc. (Honours) degree from Michigan Technological University and have done postgraduate study in Geology at Michigan Tech, University of Nevada and the University of British Columbia. I am a graduate of the Haileybury School of Mines and am a Certified Mining Technician. I am a member of the Society of Economic Geologists, the AIME, and the Australasian Institute of Mining and Metallurgy, and a Fellow of the Geological Association of Canada.
3. I have been engaged in mining exploration for the past 23 years.
4. I have co-authored the report entitled, "Comparison of Tahtsa Project Geology with the Berg Copper-Molybdenum Prophyry and Review of 1981 Geophysics," dated January 1982. The report is based upon fieldwork and research supervised by the author.
5. I have no ownership in the property, nor in the stocks of Tahtsa Mines Ltd.
6. I consent to the use of this report in a prospectus or in a statement of material facts related to the raising of funds.

REGISTERED PROFESSIONAL ENGINEER L. B. GOLDSMITH PROVINCE OF ONTARIO

Respectfully submitted,

Locke B. Goldsmith, P.Eng.
Consulting Geologist

Vancouver, B. C.

January 7, 1982

GEOLOGIST'S CERTIFICATE

I, Paul Kallock, do state: that I am a geologist to Arctex Engineering Services, 301-1855 Balsam Street, Vancouver, B. C.

I Further State That:

1. I have a B.Sc. degree in Geology from Washington State University, 1970.
2. I have engaged in mineral exploration since 1970, both for major mining and exploration companies and as an independent geologist.
3. I have co-authored the report entitled, "Comparison of Tahtsa Project Geology with the Berg Copper-Molybdenum Prophyry and Review of 1981 Geophysics." The report is based on my fieldwork carried out on the property and from previously accumulated geologic data.
4. I have no direct or indirect interest in any manner in either the property or securities of Tahtsa Mines Ltd., or its affiliates, nor do I anticipate to receive any such interest.
5. I consent to the use of this report in a prospectus or in a statement of material facts related to the raising of funds.

Paul Kallock
Geologist

Vancouver, B. C.
January 7, 1982

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INFERRED CALDERA AT TAHTSA LAKE
WITH IMPLICATIONS FOR PORPHYRY
AND EPITHERMAL VEIN MINERALIZATION

ADDENDUM TO
GEOLOGICAL INVESTIGATION OF THE SAM,
SWING ET AL. MINERAL CLAIMS
TAHTSA LAKE AREA, B. C.
OMINECA MINING DIVISION
93E 11W

Prepared for

TAHTSA MINES LTD.

ARCTEX ENGINEERING SERVICES

L. B. Goldsmith, P.Eng.
Consulting Geologist

Paul Kallock
Geologist

March 1982

TABLE OF CONTENTS

SUMMARY.. 1
INTRODUCTION... 2
CALDERA AT TAHTSA LAKE..................................... 2
FIG. 1. GENERAL GEOLOGY OF THE TAHTSA LAKE DISTRICT, B.C.
(HODDER AND MACINTYRE, 1979)............................... 3
PLUTONIC ROCKS... 5
Kasalka Intrusions... 5
Bulkley Intrusions... 5
Coast Intrusions... 6
Nanika Intrusions.. 7
PETROGRAPHIC STUDY OF INTRUSIVE ROCKS FROM THE NORTH RIDGE. 7
OTHER INTRUSIVES AT THE TAHTSA PROPERTY.................... 8
OTHER MINERALIZED NORTH AMERICAN CALDERAS.................. 9
Lake City, Colorado, Caldera............................... 9
Silverton Caldera, Southwest Colorado...................... 10
Creede Caldera, Southern Colorado.......................... 10
Rytuba's Caldera Divisions................................. 10
FIG. 2. GENETIC MODEL, EPITHERMAL VEIN SYSTEM
(AFTER BUCHANNAN, 1981).................................... 11
EPITHERMAL VEIN MODEL...................................... 12
DISCUSSION... 12
RECOMMENDATIONS.. 14
COST ESTIMATE.. 14
ENGINEER'S CERTIFICATE..................................... 15
GEOLOGIST'S CERTIFICATE.................................... 16
REFERENCES... 17

APPENDIX 1. PETROGRAPHIC STUDY

APPENDIX 2. HAND SAMPLE DESCRIPTION OF PETROGRAPHIC SAMPLES

APPENDIX 3. PLACE AND TIME OF PORPHYRY-TYPE COPPER-MOLYBDENUM MINERALIZATION IN UPPER CRETACEOUS CALDERA DEVELOPMENT, TAHTSA LAKE, B. C. (HODDER AND MACINTYRE, 1979)

GEOLOGY MAP, 1:5000, WITH LOCATION OF SECTION A-B, AMENDED MARCH, 1982 (Pocket inside back cover)

ALTERATION MAP, 1:5000, WITH LOCATION OF PETROGRAPHIC SAMPLES, AMENDED MARCH, 1982 (Pocket inside back cover)

SECTION A-B, 1:5000 (Pocket inside back cover)

INFERRED CALDERA AT TAHTSA LAKE WITH IMPLICATIONS FOR PORPHYRY AND EPITHERMAL VEIN MINERALIZATION 93E 11W

SUMMARY

Petrographic studies of samples from the north side of the north ridge of the Tahtsa property confirm the presence of propylitization and sulphide enrichment. Dyke-like granodiorite within fine-grained sedimentary rocks in this area is akin to Bulkley intrusions which elsewhere in the Tahtsa Lake region contain Cu-Mo.

Recent studies by Hodder and MacIntyre (1979) indicate the presence of a 25-km-wide caldera at Tahtsa Lake. Studies of calderas in the western U.S. show close association of epithermal Pb-Zn-Ag-Au-Cu veins with caldera faulting or subsequent intrusive activity. Copper-molybdenum porphyrys such as Ox Lake and Huckleberry may be related to ring and radial faulting associated with the caldera at Tahtsa.

Investigation of nearby mineral deposits such as the Emerald Glacier lead-zinc-silver veins and porphyry deposits such as Coles Creek will help to guide meaningful exploration on the Tahtsa claims of Tahtsa Mines Ltd.

INTRODUCTION

Since the writing of the geological report concerning 1981 field work at Tahtsa Lake, additional literature search and rock specimen analysis has necessitated this second addendum.

Petrographic analyses of five rock samples collected from the north side of the north ridge confirm the presence of a propylitic alteration zone. The suite contains three igneous rocks which intrude an argillite or mudstone sedimentary sequence.

Gleaning of the literature has provided a regional model for Tahtsa geology. Hodder and MacIntyre (1979) have suggested that the Kasalka volcanics and many of the nearby porphyry Cu-Mo deposits (i.e. Huckleberry, Ox Lake, etc.) are related to the formation of a 25-km-wide caldera. The Tahtsa Lake property of Tahtsa Mines Ltd. is located on the eastern edge of the inferred caldera and, in fact, straddles the eastern ring-fault zone.

Summation of several other articles regarding mineralized calderas in North America is included in this addendum. Also, the Troitsa porphyry occurrence 15 km south of Tahtsa is reviewed. It has several features that should be kept in mind during exploration at the Tahtsa property.

Finally, a north-south cross-sectional sketch of the Tahtsa property is included as a first estimate of the stratigraphic relations of the Kasalka and Skeena Groups.

CALDERA AT TAHTSA LAKE

By definition, a caldera is "a large basin-shaped volcanic depression, more or less circular or cirquelike in form, the diameter of which is many times greater than that of the included volcanic vent or vents, no matter what the steepness of the walls or form of the floor..." A "...caldera complex is ...the diverse rock assemblage underlying a caldera comprising dikes, sills, stocks and vent breccias; craterfills of lava; talus beds of tuff, cinder, and agglomerate; fault gouge and fault breccias; talus fans along fault escarpments; cinder cones; and other products laid down in a caldera" (1).

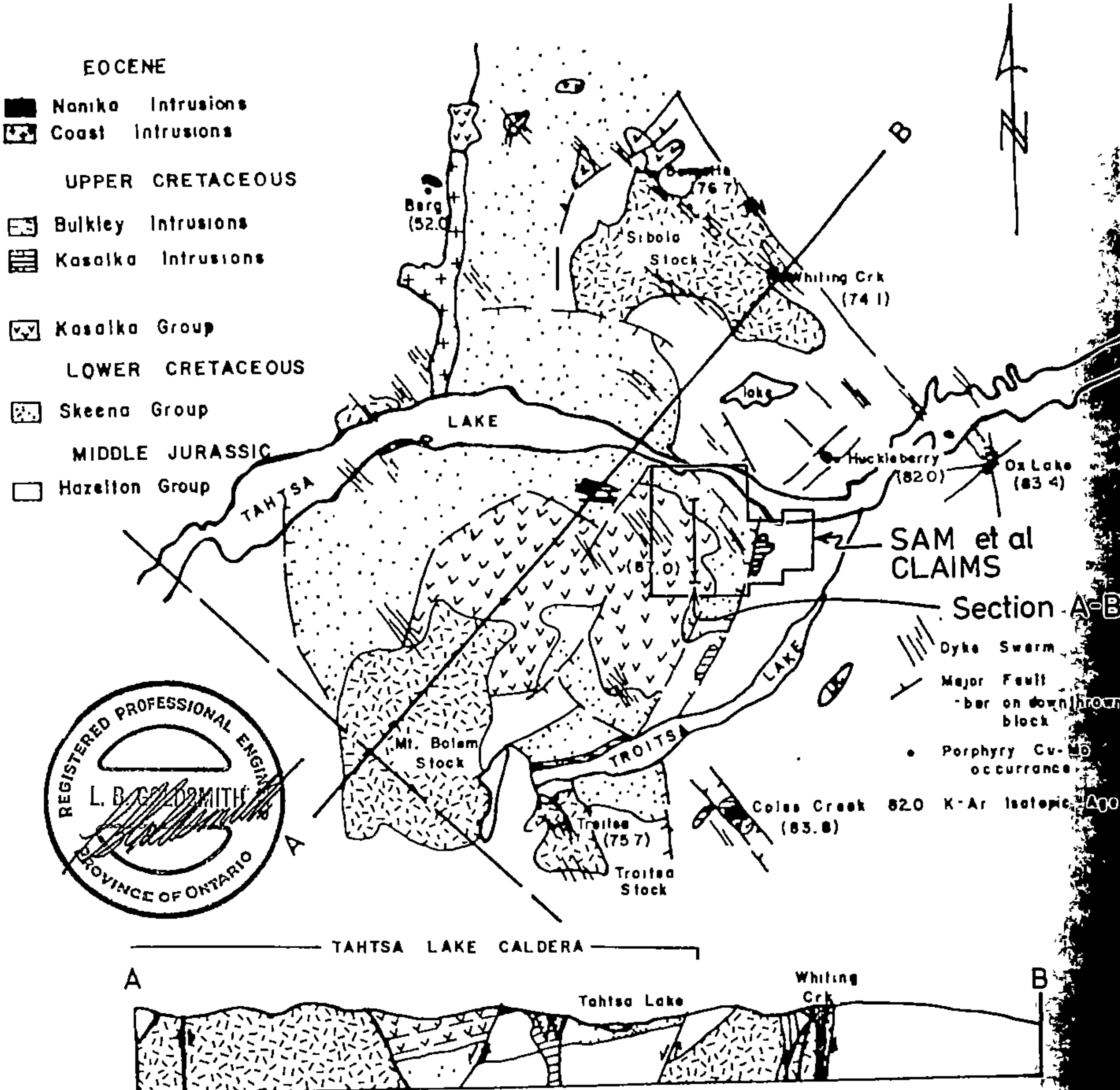

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FIG. 1

GENERAL GEOLOGY of the TAHTSA LAKE DISTRICT, B.C.

REPRODUCED FROM HODDER-MacINTYRE — PORPHYRY Cu-Mo — 1979

TAHTSA MINES LTD. TAHTSA REACH PROJECT

To accompany report by P. KALLOCK & L.B. GOLDSMITH, P. Eng.
ARCTEX ENGINEERING SERVICES MARCH 1982

Included in Appendix 3 is an article by Hodder and MacIntyre (1979) entitled "Place and Time of Porphyry-Type Copper-Molybdenum Mineralization in Upper Cretaceous Caldera Development, Tahtsa Lake, British Columbia." Figure 1 is a copy of their geology map of the Tahtsa region with an outline of the approximate location of the Tahtsa Mines Ltd. claim block.

In summary, this article proposes that the Skeena and Kasalka Group sedimentary and volcanic rocks are part of a caldera which formed during the late Cretaceous. While volcanic tuffs and flows were extruded subsidence of a large circular area with a protrusion to the north took place. Extrusion of Kasalka volcanic rock continued and emplacement of closely-related Kasalka intrusions within and peripheral to the caldera occurred.

After a relatively brief period of inactivity a magmatic resurgence led to the intrusion of Cu-Mo-bearing porphyritic granodiorite stocks localized near caldera-related faults. These have been termed Bulkley Intrusions, of which there are two varieties. Somewhat later, dyke swarms also dissected caldera rock units.

From his previous work in the area, MacIntyre has divided the Kasalka Group into 4 or 5 units, several of which appear to occur at the Tahtsa Lake property. The Group begins with the basal "red"-bed pebble conglomerate which is exposed in Swing Creek below the lower adit. Overlying the conglomerate is a generally felsic volcanic unit of flows, tuff and breccia which is 250-300 m thick. In a crude fashion, ignoring complicating faults, it appears that the entire north ridge and the area up to the vicinity of the upper adit on the south ridge may be part of this fragmental unit. Several rhyolitic breccias were mapped which confirm its felsic nature.

Above the felsic unit MacIntyre depicts 200 to 300 metres of massive porphyritic latite-andesite flows. The magnetometer and VLF-EM signatures and mapping by Arctex Engineering Services on the slopes above the adit corroborate this transition into another fairly flat-lying unit.

Stratified volcanics, lahars and sandstones from 800 m to 1000 m thick overlie the andesite flows. The sedimentary unit mapped on the upper slopes of the south ridge may mark the base of this unit.

PLUTONIC ROCKS

According to Hodder and MacIntyre (1979) there are four types of plutonic rocks in the Tahtsa region which occur in or displace concentric and radial faults of the caldera and hence were intruded after initial subsidence.

Kasalka Intrusions

The oldest of the four types are called the Kasalka Intrusives and occur as small stocks, dykes and sills within and peripheral to the caldera. They are diorite to quartz diorite and rhyodacite in composition and fine- to medium-grained. From their close association, similar composition and texture, and their gradational contacts, they can be considered intrusive equivalents to extrusive rocks of the Kasalka Group. Apparently there is but little associated hydrothermal alteration and no mineralization. This may be due to their high level of intrusion with coincident volcanism, rapid cooling, or weak confining pressure. The fine-grained diorite near the west boundary of "Long" claim is a good example of a Kasalka intrusion.

Bulkley Intrusions

There are two types of Bulkley intrusions both of which contain copper-molybdenum mineralization. Of most importance are small isolated stocks peripheral to the caldera which consist of a single phase of porphyritic granodiorite and have the greatest metal concentration. At Ox Lake and Huckleberry this mineralization is chalcopyrite and molybdenite in veinlets, generally less than 1 mm wide, which are concentrated in the potassic-altered zone that lies to one side of the stock. At Coles Creek, MacIntyre (1974) includes in this type the occurrence of bornite and magnetite in veinlets and as disseminations within a porphyritic granodiorite which intrudes Kasalka volcanics and a Kasalka intrusion. The greatest concentration of Cu-Mo is in the potassic-altered zone. There are a few lead, zinc, and silver-bearing veins in the zone of propylitic alteration as much as 1000 metres from the granodiorite intrusion. At Coles Creek the prospect lies between normal faults of a graben that is radial to the caldera.

The second subdivision of Bulkley intrusions occurs as large stocks located at the edge of the caldera and these are generally zoned from cores of quartz monzonite to margins of equigranular diorite and quartz diorite. Local brecciation and alteration of the stock and the presence of dyke swarms of porphyritic granodiorite, quartz diorite or banded rhyodacite which may also be altered and mineralized are typical of the stocks. Examples of copper-molybdenum porphyry occurrences include Whiting Creek and Bergette in the Sibola stock.

The Troitsa stock is also a Bulkley intrusion. A thesis study has been made of this area by Cawthorn (1973; complete text supplied to Tahtsa Mines Ltd.). A stock which is zoned from coarse-grained quartz monzonite in the centre to fine-grained granodiorite at the margin crystallized approximately 75.7 ± 2.3 million years ago. The stock was emplaced in the epizone at a probable depth of 4 kilometres. Thermal metamorphism of the country rock (Hazelton Group) produced hornblende hornfels for up to 400 feet from the contact. Northwest-trending feldspar dykes cross the stock; within these dykes an alteration pattern grades from propylitic near the margin of the stock through quartz-sericite-pyrite and into biotite-orthoclase which contains Cu-Mo sulphides near the centre. Weak propylitic alteration with sulphide mineralization including pyrite, chalcopyrite, molybdenum and galena appears to affect only the centre of the stock itself. The dykes appear to have acted as channelways of hydrothermal fluids.

A flow-banded rhyolite complex, younger than the stock, is shown in the northwest part of Cawthorn's map. It contains disseminated pyrite and secondary marcasite. Little is said about this felsic unit in the thesis. Also of note is the depiction of the Hazelton Group which nearly completely surrounds the stock. Subsequent publication of the Geology of Whitesail Lake (93 E) map by Woodsworth (1980) includes the rhyolite in the Kasalka Group which now appears much more prevalent around the stock than on Cawthorn's map.

Bulkley intrusions, either of the small altered Cu-Mo rich porphyritic granodiorite plugs of the first type or of the altered copper-molybdenum-bearing dykes associated with larger zoned stocks, are potential targets on the Tahtsa Lake property.

<u>Coast Intrusions</u> [Kasalka Intrusions (?)]

The Hodder-MacIntyre (1979) report delineates a dyke-like intrusion south of the Berg deposit as related in age (from isotopic studies) to the intrusions of the Coast Range plutonic complex. In all other respects it is very similar to Kasalka intrusion of quartz diorite. It is unmineralized.

Nanika Intrusions

These intrusions are represented by the small composite stock at Berg deposit. It is granodiorite and quartz monzonite in composition. Besides having an age that is younger than the other plutonic rocks it is slightly more potassic than the Bulkley intrusions. The alteration and mineralization of this Nanika intrusion at Berg has been reviewed in the addendum of January 1982. Caution should be noted that age of this intrusion is questionable; it may in fact be a member of the Bulkley intrusions.

PETROGRAPHIC STUDY OF INTRUSIVE ROCKS FROM THE NORTH RIDGE

One of the areas of interest on the Tahtsa property is located on the north slope of the north ridge. Dykes of intermediate intrusives and fracture-controlled stockwork pyrite veins have been observed in this area. Five rock samples have been thin-sectioned and studied under the petrographic microscope by Joanne Nelson. These descriptions are in Appendix 1, hand sample descriptions are in Appendix 2, and the sample locations are shown on the 1:5000 scale Alteration Map (Amended, March 1982). Propylitic alteration of argillite and mudstone of the Skeena Group (?) by more strongly-altered dykes and/or hypabyssal intrusives of Bulkley and/or Kasalka affinities is demonstrated.

Categorizing the three samples of intrusive rocks is necessarily questionable. Sample #1 is a clay, sericite and carbonate-altered quartz diorite which is probably part of a Kasalka intrusion, either a dyke or a small plug. Abundant rubble of this type was seen on the eastern end of the shallow lake bottom (see Geology and Alteration Maps).

Sample #3 in outcrop appears very light-coloured and bleached and its igneous nature was not readily apparent. Due to the poor exposure of outcrops which are limited to the stream bed, the size or dimensions of this rock type are not easily distinguished. The strong alteration and presence of pyrite and minor chalcopyrite and argentite (?) are not characteristics of Kasalka intrusions. The sample shows more affinity to the second class of Bulkley intrusion and the associated altered and mineralized dykes.

Sample #5 comes from the area which was originally mapped as diorite dykes, located near a strong fault zone containing quartz-carbonate and sphalerite mineralization. Petrographic study reveals a granodiorite composition with moderate alteration to potassium feldspar, sericite, actinolite, chlorite and carbonate. Disseminated pyrite and up to perhaps 0.25% chalcopyrite are also present. This dyke rock or hypabyssal intrusive appears to be similar to the first division of Bulkley intrusions, i.e. those of Ox Lake, Huckleberry, etc. Perhaps the present erosion level has only begun to expose a larger stock or perhaps the large covered areas in the vicinity of the creek exposures are underlain by extensions of similar rock.

OTHER INTRUSIVES AT THE TAHTSA PROPERTY

The location of mineralized dykes and the changes in alteration along strike can be valuable clues that lead to a mineralized stock as at Troitsa. It is also reasonable to visualize a vertical change in alteration in these dykes which may overlie a porphyry stock. At Tahtsa, small isolated intrusive exposures could be used as pathfinders if a change in alteration along strike or dip can be identified.

Several intrusives, most probably dykes, are worth additional examination in the coming field season.

1) On the cross section on the Hodder-MacIntyre (1979) map a small stock of Kasalka (?) intrusive is shown at about mid-point on section A-B. This area is probably west of the Swing claims but the nature of its contacts with the Skeena Group and the eastward extension toward the Swing claims should be traced.

2) A very small outcrop of a leucocratic intrusive was mapped in the extreme southeast part of the Swing claims. Coincidentally, a very small Bulkley intrusion on the Woodsworth (1980) map is also present in that vicinity. Outcrops are sparse and the vegetation is thick but additional mapping should be attempted.

3) At least two dykes of acidic affinity were mapped in the next major stream east of Swing Creek near the Deuce #1 claim. Sulphides are present and considerable exposure of the dykes occurs along the stream tributaries. The north-to-northwest trend of the dykes and their location is nearly coincident with the eastern ring fault of Hodder and MacIntyre's (1979) caldera.

4) Granodiorite talus was seen in the steep south-facing slopes of the southwest corner of the Swing claims. Additional search is warranted.

OTHER MINERALIZED NORTH AMERICAN CALDERAS

The faulting and fracturing which results from subareal vulcanism and subsequent caldera formation provide channelways which are used by various types of intrusions and their associated hydrothermal fluids.

Lake City, Colorado, Caldera

In the San Juan Mountains of southwest Colorado, Slack and Lipman (1979) state that Tertiary volcanic activity has produced multiple hydrothermal systems. Beginning with andesitic stratavolcanos and emplacement of monzonitic intrusions into their cores, through a sequence of additional volcanic extrusions, caldera collapse, resurgent doming, intracaldera intrusions and additional vulcanism, four caldron complexes (the Uncompahgre, San Juan, Silverton and Lake City) were formed. All four have associated alteration but only the youngest, the Lake City caldera, contains significant mineralization.

The major ore deposits of the district are polymetallic (Ag, Pb, Zn, Au, Cu) fissure veins directly associated with the formation of the Lake City caldera. Older igneous activity, including other caldera developments and intracaldera monzonites, produced favourable plumbing systems and widespread hydrothermal alteration but no significant mineralization.

Two vein systems are related to the Lake City caldera. An early quartz-base metal assemblage appears to be related to post-caldera resurgent doming. A second barite-precious metal assemblage formed during late ring-fracture vulcanism. All of the veins occur in an arcuate belt outside the ring fracture of the Lake City caldera and within the moat area of the surrounding Uncompahgre caldera. Veins are 0.5 to 1.5 metres wide and up to 2000 metres long. Wall-rock alteration includes quartz-sericite-pyrite grading laterally outward into regional pre-ore propylitization. The quartz-base metal veins are genetically related to granitic porphyry dykes which fill the northern ring-fault zone of the Lake City caldera. The barite-precious metal veins which display quartz-sericite-alunite wallrock alteration are genetically related to a highly altered quartz-latite lava dome which was emplaced along the eastern ring-fault zone of the Lake City caldera. Post-caldera rhyolitic dykes, plugs and lacoliths intrude the volcanic moat fillings of the Uncompahgre caldera. They contain high concentrations of U, Th, F, Be, Mo, Nb and Sn but veins and hydrothermal alteration are absent.

Silverton Caldera, Southwest Colorado

In contrast to the caldera-related mineralization at Lake City, the majority of ore deposits at the Silverton caldera appear to be genetically unrelated to the evolution of the caldera and its magmatic activity. More likely, the caldera prepared the ground by numerous faults which later (by 5 to 15 million years) became conduits for quartz-bearing intrusions and flows of quartz latite and rhyolite and the main mineralization veins (Lipman and others, 1976).

Creede Caldera, Southern Colorado

Epithermal silver-base metal veins at the Creede caldera in the central San Juan Mountains of Colorado are not unlike those discussed at the Lake City caldera. In a study by Wetlaufer and others (1979) striking similarity between active geothermal systems and the fossil hydrothermal system that deposited the Creede veins is presented.

Most of the metal production at Creede has come from veins bearing native silver, sphalerite, galena, chalcopyrite and tetrahedrite; gangue includes quartz, chlorite, pyrite, barite, sericite, rhodochrosite, siderite, hematite, fluorite and adularia. Zones of intense illitic alteration overlie some of the veins and mark the upper limit of mining. Ore bottoms downward in open, weakly mineralized breccia. Base metals were deposited from recurrent boiling of saline solutions. A few chalcedonic veins at the present surface may be related to a more shallow dilute system. Presently one-half of the 500 metres of overburden originally overlying the Creede deposit has been eroded away and with it the sinter deposits which were associated with hot spring or geyser activity. Exploration for base metal deposits associated with silicic volcanic rock, bonanza Au/Ag veins, and late-stage veins of porphyry-copper deposits should use the context of geothermal systems as guides.

Rytuba's Caldera Divisions

Rytuba (1981) has summarized the sequence of events of caldera development in the San Juan Mountains of Colorado and elsewhere and stresses a division into two groups. Firstly, those formed by the eruption of calc-alkalic rhyolitic ash-flow tuffs related to continental margin subduction, and secondly, those formed by eruption of high-silica rhyolite in extensional tectonic environments.

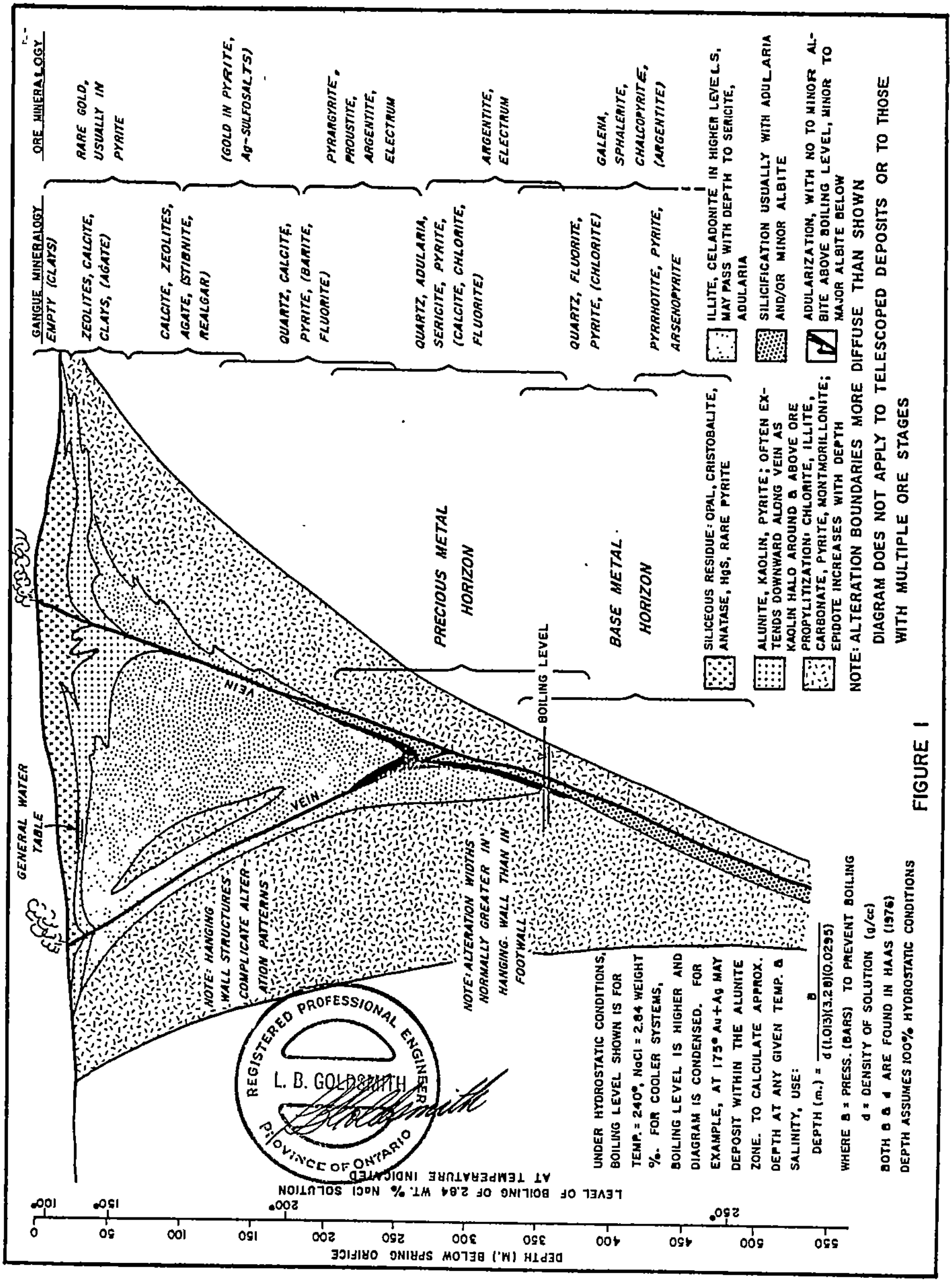

Fig. 2. GENETIC MODEL, EPITHERMAL VEIN SYSTEM (after Buchanan, 1981).

Calc-alkalic-type calderas (such as Tahtsa Lake) may contain base and precious metal deposits which are typically much younger than the caldera-forming vulcanism and not genetically related to it. High-silica rhyolite calderas are generally formed by the eruption of chemically zoned magma and have ash flow tuffs enriched in Be, Cs, Li, Hg, Mo, Sb, Sn, Th, U and W.

EPITHERMAL VEIN MODEL

Buchanan (1981) has synthesized abundant data from many sources to depict a fairly convincing model for epithermal base and precious metal vein genesis. Host rocks are largely Tertiary calc-alkaline extrusions with hypabyssal intrusions. Andesites are the most common host to ore shoots, however most districts have pre-ore felsic tuffs, volcanogenic sediments, dykes, sills and plugs. The vein deposits fill fractures often related to caldera environments. Figure 2 shows Buchanan's model.

Of importance to the explorationist is the low-pH alteration assemblage which is genetically related to the process of ore formation. It extends well above the ore level so that non-outcropping ore shoots can be targeted. The assemblage may contain any or all of the following minerals: alunite, sericite, illite, kaolinite, montmorillonite or any of the kaolin clay minerals. It is often referred to as "bleaching" in the literature, and forms a halo around and a cap above individual ore shoots but is absent below the precious metal horizon. It is believed that the low-pH alteration zone extended to the paleosurface and mixed with siliceous sinter and opal capping.

DISCUSSION

Petrographic analyses of sedimentary and intrusive specimens from the north slope of the north ridge provide strong evidence for propylitic alteration which may be associated with a convective cell of a Bulkley intrusion. The strong pyritic fracture veinlets within the argillite and the disseminated sulphides which include chalcopyrite and argentite (?) in granodiorite and leuco-quartz diorite are targets worth continued investigation.

The Tahtsa Lake property appears to straddle the eastern edge of a wide (25 km) caldera, according to Hodder and MacIntyre (1979). From field work, abundant faulting is known to be present, and volcanics of the Kasalka Group (particularly on the north ridge) are extremely complex. Vent structures in this area are a possibility.

From literature, any caldera-related fault, whether concentric, radial, or ring, is susceptible to localizing intrusive activity. Although all porphyry deposits that have been found in the Tahtsa region are outside the ring-fault, fracture systems within the caldera are also favourable. Note, as shown on the Hodder and MacIntyre map, the concentric, nested ring structure which lies just west of the claims. Undoubtedly other subsidence features exist in the caldera.

A first assumption is to neglect Kasalka intrusions because they have been shown barren, but as can be seen at Coles Creek, a mineralized Bulkely intrusion has been implaced in a Kasalka stock.

According to Hodder and MacIntyre (1979) Kasalka and Bulkley intrusions may penetrate well into the Kasalka Group. At Berg there are Skeena and Kasalka rocks stratigraphically above the deposit. At Coles Creek the porphyry intrudes the Kasalka Group (and a Kasalka intrusion). With this comparison to Tahtsa the presence of an intrusive could be possible anywhere except on the highest peaks of the south ridge.

At the Captain Vein, if an epithermal vein model is applied, the implication of depth to a buried porphyry is greater than 300 or 400 metres. On the lower slopes of the north ridge in the propylitic-altered area, a porphyry stock may be much shallower.

Porphyry Cu-Mo deposits are associated with the Tahtsa caldera, as are epithermal veins. The Emerald Glacier property on Mt. Sweeney, about 7 km north of the Tahtsa property, produced 4,560 tons of lead-zinc-silver ore in 1951 and 1952. It undoubtedly has similarities to the epithermal model of Buchanan. Complicating features such as faulting, overprinting, or leaching of the vein system may prohibit fitting of the Captain Vein at the Tahtsa property into the model. Nevertheless, the presence of quartz, chlorite and pyrite in the gangue, and galena, sphalerite, chalcopyrite and argentite (?) in the mineralization may fit into Buchanan's model at 350 to 450 metre depth. If this is true greater precious metal value may have previously been present above the upper adit. Alteration is not pervasive in wallrocks adjacent to veins in the Captain area, but should be examined in more detail.

RECOMMENDATIONS

Petrographic descriptions from the pyritic stockwork area on the north slope of the north ridge confirm the presence of propylitic alteration and sulphide concentration which warrant further exploration as previously recommended.

Dykes which are coincident with the eastern ring-fault of the caldera near the Deuce #1 claim should be examined with particular attention paid to lateral alteration zoning. Similar examination and mapping should be completed on the western margin of the Swing claims where dyke swarms are shown on the Hodder and MacIntyre map.

In order to further define the epithermal vein potential on the Tahtsa property a careful examination of the area surrounding the Emerald Glacier Pb-Zn-Ag deposit noting vertical alteration changes, would be helpful. This should be done prior to bulldozer trenching and exploration on the veins east of the Captain Vein.

Ferricrete, silica, clay, and pyritic alteration which form a zone around the north ridge should be re-examined as a potential barren capping above an epithermal vein system (Figure 2 and section A-B in pocket).

The Coles Creek porphyry deposit has similarities to Tahtsa geology. Further study of MacIntyre's thesis which details this area should be undertaken.

COST ESTIMATE

The cost of the investigations which are outlined in this report is included in the cost estimate of the previous reports.

Respectfully submitted,

REGISTERED PROFESSIONAL ENGINEER
L. B. GOLDSMITH
PROVINCE OF ONTARIO

Locke B. Goldsmith, P.Eng.
Consulting Geologist

Paul Kallock
Geologist

Vancouver, B. C.
March 4, 1982

ENGINEER'S CERTIFICATE

LOCKE B. GOLDSMITH

1. I, Locke B. Goldsmith, am a Registered Professional Engineer in the Province of Ontario and a Registered Professional Geologist in the State of Oregon. My address is 301, 1855 Balsam Street, Vancouver, B. C.
2. I have a B.Sc. (Honours) degree from Michigan Technological University and have done postgraduate study in Geology at Michigan Tech, University of Nevada and the University of British Columbia. I am a graduate of the Haileybury School of Mines and am a Certified Mining Technician. I am a member of the Society of Economic Geologists, the AIME, and the Australasian Institute of Mining and Metallurgy, and a Fellow of the Geological Association of Canada.
3. I have been engaged in mining exploration for the past 23 years.
4. I have co-authored the report entitled, "Inferred Caldera at Tahtsa Lake with Implications for Porphyry and Epithermal Vein Mineralization", dated March 4, 1982. The report is based upon fieldwork and research supervised by the author.
5. I have no ownership in the property, nor in the stocks of Tahtsa Mines Ltd.
6. I consent to the use of this report in a prospectus or in a statement of material facts related to the raising of funds.

Respectfully submitted,

Locke B. Goldsmith, P.Eng.
Consulting Geologist

Vancouver, B. C.

March 4, 1982

GEOLOGIST'S CERTIFICATE

I, Paul Kallock, do state: that I am a geologist to Arctex Engineering Services, 301-1855 Balsam Street, Vancouver, B. C.

I Further State That:

1. I have a B.Sc. degree in Geology from Washington State University, 1970.
2. I have engaged in mineral exploration since 1970, both for major mining and exploration companies and as an independent geologist.
3. I have co-authored the report entitled, "Inferred Caldera at Tahtsa Lake with Implications for Prophyry and Epithermal Vein Mineralization". The report is based on my fieldwork carried out on the property and from previously accumulated geologic data.
4. I have no direct or indirect interest in any manner in either the property or securities of Tahtsa Mines Ltd., or its affiliates, nor do I anticipate to receive any such interest.
5. I consent to the use of this report in a prospectus or in a statement of material facts related to the raising of funds.

Paul Kallock
Geologist

Vancouver, B. C.
March 4, 1982

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APPENDIX

Feb. 6 1982

Mr. Locke Goldsmith
Arctex Engineering
301 - 1855 Balsam St.
Vancouver, B.C.

Dear Locke:

This letter accompanies the report on the Tahtsa Lake samples which you submitted to us on January 5. They fall into two categories. #1, 3 and 5 are hypabyssal intrusive rocks. #2 and 4 are argillites or mudstones. They have been classified as follows:

1. hypabyssal quartz diorite
2. argillite
3. hypabyssal leuco-quartz diorite or "soda granite"
4. argillite or mudstone
5. hypabyssal granodiorite

The sediments are not significantly metamorphosed, but #2 shows evidence of alteration and possible bleaching, which accompanied the crackling and pyrite introduction.

The hypabyssal rocks have undergone moderate to strong alteration. Common phases include sericite, chlorite, and carbonate. In addition, Ti-oxides are present; #3 may contain secondary quartz; and #5 contains minor epidote. In general, the presence of chlorite and carbonate and the lack of clearly secondary quartz textures (veinlets, stockworks), probably signify that these rocks have undergone propylitic alteration.

#3 contains minor amounts of chalcopyrite and argentite. These phases do not account for the Pb-Zn assays; perhaps grains of other sulfides were omitted in the particular slice sampled. #5 contains perhaps 1/4% chalcopyrite. Pyrite is more abundant than was apparent in hand sample.

These rocks could be from the pyrite halo of a porphyry system. If so, the halo falls in the propylitic zone, just outside of the zone of potassic alteration as is the case at Berg.

Sincerely,

JoAnne

JoAnne

1. Strongly altered hypabyssal quartz diorite

The original phenocrysts in this sample were plagioclase, biotite and hornblende, with plagioclase by for the largest and most abundant. The average grain size in the matrix is about .2 mm. It consists of an aggregate of quartz and plagioclase and secondary minerals.

Alteration has converted all primary biotite to sericite ± clay, Ti-oxide and carbonate. Hornblendes are now chlorite and sericite. The primary plagioclases are pink due to Fe-oxide dust. They are soft from extensive clay-sericite alteration, and contain small carbonate patches. About 40% of the rock is made up of alteration products.

Mode

33	plagioclase (albite)
25	sericite
18	quartz
10	chlorite
3	Fe-oxide
8	pyrite
2	Ti-oxide
tr	apatite
tr	zircon
1	carbonate

Plagioclase phenocrysts are tabular, and range in size from .25 cm down to matrix dimensions. Plagioclase in the matrix is anhedral.

Fine sericite (some of low birefringence is probably clay) flecks the plagioclase phenocrysts. Sericite sprays are common in the matrix. Sericite ± clay pseudomorphs biotite phanocrysts. Sprays have formed in original hornblendes.

Quartz is restricted to the original igneous matrix; it is not seen as phenocrysts or in forms which could be considered secondary.

Very pale green chlorite in dense aggregates replaces hornblende. Sprays of chlorite in the matrix may be after original mafic material.

Fe-oxide occurs as dust in plagioclases. Rims of Fe-oxide are seen on some of the pyrite grains.

Pyrite forms irregular-shaped clumps. They tend to associate with original mafic phenocrysts. They are clearly replacing the matrix. Some have engulfed quartz grains. Scattered small anhedral pyrite grains (.1 mm) are also present.

Ti-oxide needles and fine granular clumps occur in pseudomorphed biotites.

A few prisms (primary) and irregular grains (secondary?) of apatite were seen. The rare zircons are small and euhedral.

Very small carbonate grains fleck plagioclases. In some biotite psuedomorphs, carbonate intergrows with coarse sericite.

2. Argillite with strong argillic alteration ?

This sample is dominated by sericite/clay; however the alteration is obscured because much of the clay is probably primary. Its parent seems to have been an argillite or a clay-rich mudstone. Therefore, although some of the textures seem to be secondary, the amount of mass transport affecting this rock may have been minimal, i.e. its chemical composition did not change appreciably.

Sericite/clay occurs in two forms: extremely fine grained and as aggregates of platelets averaging .03 mm in diameter. The latter appear to be the result of secondary recrystallization.

A partly dismembered bed or clay interclast shows less prominent recrystallization of the phyllosilicates; it consists mostly of dense, nearly cryptocrystalline clay.

The sample has a very high fracture density. These fine fractures are filled with pyrite, which has partly altered to hematite and limonite. Alteration is not noticeably more intense around the fractures than elsewhere. The fracture patterns through the bed/interclast differ from those in the matrix, showing different mechanical character during fracturing. The fractures show a distinct preferred orientation throughout.

Faint grey inhomogeneities are apparent in hand sample: it is mottled on a very fine scale. In thin section, these are small oval areas of slightly coarser sericite than the average, with faint opaque dusting to a greater extent than their surroundings. They may be relict clasts. There are sparse, small quartz clasts , but no secondary quartz.

Mode

85	sericite/clay
7	Fe-oxides
5	pyrite
3	quartz

The birefringence of the phyllosilicates ranges from low to middle first order; a strong clay component is suspected, particularily in the dense, nearly cryptocrystalline material which forms a background for the aggregates of more distinct sericite platelets. These show no preferred orientation. The only directional feature of the rock is in the fractures. Relatively coarse sericite is more abundant near the fractures than elsewhere, but no chemical gradient is apparent.

Pyrite occurs in very fine, multiple veinlets along the fractures, and in patchy grains next to them. Red hematite replaces the pyrite, and orange to yellow limonite staining surrounds the factures.

Quartz clasts are approximately equant and very small.

In this sample, the bleaching of original organic material by hydrothermal fluids cannot be proven but should be suggested by comparison with unaltered fine sedimentary rocks in the area.

3. Hypabyssal leuco-quartz diorite or "soda granite"

This sample comes from either a dike or a late phase of a quartz diorite (hypabyssal) intrusion. Its original minerology was mostly quartz and plagioclase. The plagioclase has been thoroughly albitized, so that its composition cannot be used in classifying the rock. Plagioclase-quartz rocks, in which the plagioclase is of intermediate composition, commonly form as differentiates of small diorite or quartz diorite plutons.

Alteration of the plagioclase has been fairly strong. Secondary phases include sericite and carbonate and minor chlorite.

Mode

36	plagioclase	1	rutile
20	quartz	tr	chalcopyrite
20	carbonate	tr	argentite
17	sericite		
4	pyrite		
2	chlorite		
tr	apatite		

Plagioclases are subhedral and intergrown, ranging from .1 to 1 mm long. They show no preferred orientation.

Quartz occurs as small, anhedral grains with plagioclase in the matrix. It also occurs in the features which resemble phenocrysts or amygdules in hand sample. In them, it has either crystallized as or recrystallized to vein-like, columnar, in some cases radiating aggregates. They could be either recrystallized phenocrysts or miaroles. Because of the inferred origin of the rock, the latter supposition is attractive. This would mean that the radiating internal structures, some of which have a core of open space filled with pyrite and carbonate, are dictated by the original character of the miarole.

Small to large carbonate patches are abundant within plagioclases. Minor carbonate also occurs in some of the quartz aggregates described above.

Sericite forms evenly-distributed platelets within plagioclases.

Chlorite is very pale green. It occurs mainly in the quartz aggregates.

A few euhedral apatite grains were seen within quartz.

Sheafs of rutile needles grow within either quartz or carbonate grains. These could be relict biotites.

Pyrite patches occur both in the quartz aggregates and in the matrix. They are poikilitic, having developed at the silicates' expense.

A few tiny chalcopyrite beads, and one bead containing chalcopyrite and a soft grey mineral, probably argentite, are enclosed in pyrite.

4. Argillite or mudstone

This rock has a texture like the primary one in (2). It is dominated by extremely fine grained sericite/clay, with scattered slightly larger sericite platelets which may be after clasts of mica; and quartz clasts. No bedding or other directional character is apparent. Secondary carbonate patches are small but abundant.

The leisegang rings are interesting because they occur in two separate sets, which overlap each other. They may be related to two different ages of fracturing.

Mode

82 sericite/clay
10 carbonate
5 Fe-oxide
3 quartz

The clay/sericite matrix is very dense; individual platelets are not common. The general texture is finely granular.

Carbonate forms scattered, ragged patches, most from .05 to .1 mm in diameter but some up to .5 mm. They cluster in places. The parts of the rock which appear Fe-oxide stained contain very dark carbonate patches with abundant included hematite dust; elsewhere the carbonate is clear.

Fe-oxide forms fine strands in the section in two direction. In hand sample these are seen to be two sets of rings. Most of the staining is of the carbonate, although fine dust occurs in the matrix as well.

Quartz forms small, scattered clasts. A few tiny aggregates of relatively coarse grained phyllosilicates may be after feldspar clasts.

5. Hypabyssal granodiorite

This sample is the only intrusive rock in the suite which contains Kspar. It is seriate porphyritic. Alteration has been moderate. It has involved sericite in plagioclase and Kspar, conversion of hornblende to actinolite, and small amounts of chlorite, epidote and carbonate crystallization.

Chalcopyrite is less than 1% of the rock, but is not insignificant. It occurs in scattered grains with identical habits and sizes to pyrite.

Mode

45	plagioclase
13	Kspar
9	quartz
15	sericite
4	pyrite
tr	chalcopyrite
3	chlorite
10	actinolite
1	carbonate
tr	epidote
tr	sphene, ilmenite

Plagioclase grains are euhedral to subhedral, where interference has limited their growth. Some show relict oscillatory zoning with two prominent reversals and a spread in An values giving a difference in extinction angles with the albite twin plane of 35°. Exact An measurements were not possible due to unfavorable crystal orientations. Most plagioclases are albitized.

Kspars are interstitial and anhedral. This can be seen on the stained block as well as in thin section. They are dustier than plagioclases (clay?).

Quartz grains are anhedral and also interstitial, like Kspars.

Sericite forms fine flecks in plagioclases and to a lesser extent in Kspars.

Pyrite grains are blobby. They seem to favor sites interstitial to plagioclase. They also tend to associate with mafic phases. Four chalcopyrite grains were seen in the section. One of them includes a few euhedral hematite spears.

Chlorite may pseudomorph biotite. Growths are somewhat skeletal. It associates with amphibole in many cases.

Amphiboles are still euhedral to subhedral, but they are pale green actinolite.

Carbonate favors quartz grain boundaries and areas near the mafic phases.

A few small epidote grains accompany actinolite and chlorite.

Ti-oxides form parallel growths in chlorite and actinolite, as well as single, regular interstitial grains.

TAHTSA MINES LTD.

HAND SAMPLE DESCRIPTIONS
OF FIVE ROCKS FOR THIN SECTION
FROM NORTH SIDE OF NORTH RIDGE
TAHTSA LAKE PROJECT, B. C.
JANUARY 5, 1982

1. FELDSPAR PORPHYRY - pink potassium feldspars, to 0.25 cm in fine-grained tan to grey matrix of quartz-feldspar. Probably <10% quartz + <10% fine-grained mafics. 1% disseminated pyrite. Non-magnetic.

   Location: In shallow water near eastern shore of small lake, approximately 500 metres west of #23640. Numerous boulders of this rock type present. Definitive bedrock not established. Moderate sericite alteration?

2. BLEACHED HORNFELSIC (?) fragmental sedimentary (?) rock with intense, very fine pyrite as fracture coatings (veinlets) most of which are partially to completely oxidized to limonite (goethite?). Also lesser disseminated pyrite. Non-magnetic. Fragments (pebbles?) up to 2 cm have cloudy, vague outlines.

   Location: 10 metres south of #23655 near northerly-trending shear zone.

3. FINE-GRAINED RHYODACITE (?), strong quartz-sericite alteration (?). 1-2% disseminated pyrite. Pyrite occurs with quartz.

   Location: At sample location #23655 (which carried 0.02% Pb and 0.05% Zn).

4. GRAY, VERY FINE-GRAINED SHALE (?), homogeneous, non-magnetic. Shows prominent limonite banding on weathered surface (leisegang rings?).

   Location: From outcrop in creek bed between #23640 and #23642.

5. FINE-GRAINED DIORITE DYKE, ~10% quartz, 40% mafics, 40% feldspar (mostly plagioclase?), <1% disseminated pyrite. Non-magnetic.

   Location: Near #23656.

NEVADA BUREAU OF MINES AND GEOLOGY, REPORT 33, 1979

PLACE AND TIME OF PORPHYRY-TYPE CU-MO MINERALIZATION IN UPPER CRETACEOUS CALDERA DEVELOPMENT, TAHTSA LAKE, BRITISH COLUMBIA

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ABSTRACT

At Tahtsa Lake, on the east edge of the Coast Plutonic complex in central British Columbia, significant stockwork concentrations of copper and molybdenum occur in and about upper Cretaceous and possibly Eocene stocks of porphyritic granodiorite and quartz monzonite and, dike swarms of porphyritic quartz monzonite. The stocks and dike swarms are peripheral to a fault-bounded circular area 25 km in diameter enclosing a 1.5 km thickness of distinctive, relatively flat-lying volcanic rocks. These volcanic rocks also are upper Cretaceous in age and similar in composition to the stocks and dikes.

The fault-bounded circular area is interpreted as a collapsed caldera. The stocks of porphyritic granodiorite and associated copper and molybdenum were emplaced at intersecting arcuate and radial fractures during a resurgence of magma within the caldera. The dike swarms of porphyritic quartz monzonite, and their attendant copper and molybdenum, were localized in post-resurgence tension fractures.

INTRODUCTION

During the past 15 years, exploration in the Tahtsa Lake district of west central British Columbia has located several concentrations of copper sulfide minerals and molybdenite in stockwork veinlets within (1) small stocks of porphyritic granodiorite of upper Cretaceous age, (2) dikes of porphyritic quartz monzonite within large stocks of granodiorite also of upper Cretaceous age but younger than the small stocks, and (3) a stock of porphyritic quartz monzonite possibly Eocene in age. Recent detailed mapping (MacIntyre, 1976) places these stocks at the edge of, and peripheral to, a fault bounded, nearly circular, area 25 km in diameter and confining a 1.5 km thickness of relatively flat lying pyroclastic, clastic, and flow rocks similar in age and composition to the stocks and dikes and distinctive to the district.

The interpretation is that the circular area is a collapsed caldera and that stocks, dikes, and attendant copper and molybdenum are localized by collapse structures and temporally associated with post-collapse resurgence of magma. The purpose of this paper is to describe the position and age of porphyry-type mineralization in an igneous event that has both volcanic and plutonic environments.

DISTRICT GEOLOGY

The Tahtsa Lake district is in the westernmost part of the Intermontaine Thrust and Fold belt and next to the east edge of the Coast Plutonic complex (Wheeler, et al., 1972) (Fig. 1). The district is underlain by a 3 km thickness of mixed volcanic and sedimentary rocks of early to middle Jurassic age in broad open folds and metamorphosed to greenschist facies. These rocks are part of the Hazelton group of Duffell (1959), and they are overlain unconformably to disconformably by part of the lower Cretaceous Skeena group (Duffell, 1959) of slightly deformed amygdaloidal basalt flows, micaceous lithic wake, and carbonaceous shale with a lower Cretaceous shelly fauna. Although the rocks of the Hazelton group have broad distribution, rocks of the Skeena group occur in a roughly circular area 25 km in diameter with a prong to the north (Fig. 2). More than 1.5 km of nearly flat-lying felsic tuffs, intermediate to felsic flows, and locally derived clastic rocks unconformably overlie the Skeena group in the middle of this circular area and on ridge tops in the prong to the north. These rocks were first mapped as a separate entity by MacIntyre (1976) and are called the Kasalka group. They and their underlying rocks are broken by arcuate and concentric, steep inward-dipping normal faults that have a maximum downthrow of 1 km and that commonly are breccia zones in which clasts, matrix, and wall rocks are hydrothermally altered.

Rocks of the Hazelton, Skeena, and Kasalka groups are intruded by small linear, crescent-shaped, and circular stocks, plus somewhat larger and elongate stocks of diorite to quartz monzonite composition and of 4 apparent ages.

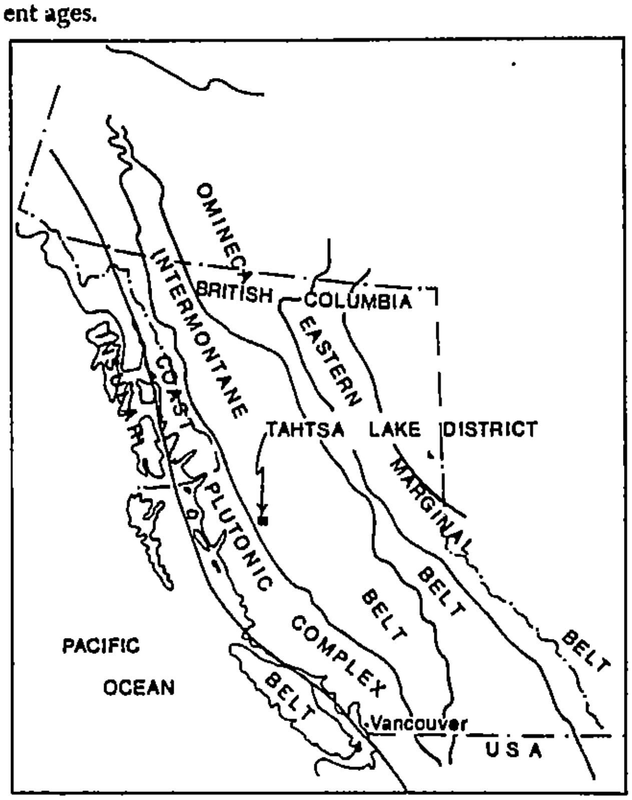


Figure 1. Location and tectonic setting.

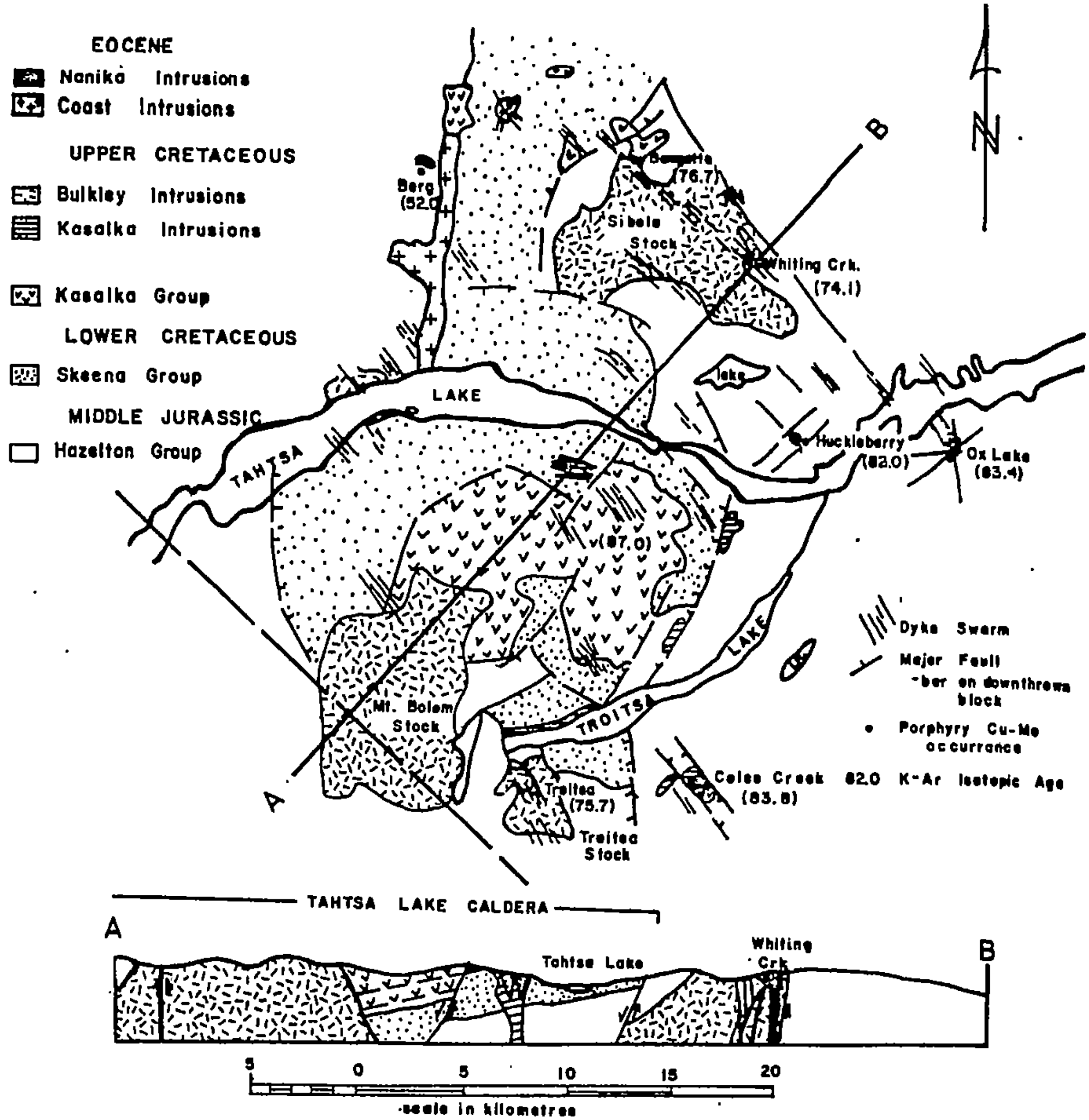


Figure 2. General geology of the Tahtsa Lake district.

In the broad sense, the Tahtsa Lake district is characterized by Jurassic, Cretaceous, and Tertiary volcanic, plutonic, and sedimentary rocks of a continental margin arc-trench system of Andean-type that succeeded a Japanese-type of arc in mid to late Triassic and that became a Californian-type margin in the Cenozoic (Dickinson, 1976). The rocks of the Hazelton group are arc-type volcanic and sedimentary rocks. The Skeena group occupies a successor basin behind the arc, and the Kasalka group is the product of local magmatism within the successor basin before plate motion at the continental margin changed from subduction to transform and strike-slip.

THE KASALKA GROUP

Rocks of the Kasalka group, those lying unconformably on the Skeena group and critical to the interpretation of a caldera in this district, have a base of 5-50 m of red to reddish-brown pebble conglomerate and sandstone (Fig. 3). This is overlain by as much as 300 m of interlayered flows of rhyodacite, ash flow tuff, and lapilli tuff, and minor volcanic breccia and andesite flows. Flows are discontinuous along strike. Fragmental rocks have clasts of various sizes, and eutaxitic texture is common locally, especially in the most siliceous rocks. This in turn is overlain by 200-300 m of massive porphyritic latite-andesite flows that have ubiquitous chlorite, calcite, and primary feldspar (that was converted to pseudomorphous albite) and mafic minerals. The next mappable unit up section is 800-1000 m of irregularly, and in some instances indistinctly, layered lahar with fragments of latite-andesite and other underlying rocks held in a matrix of fine lithic fragments, broken crystals, and clay minerals. Fragments are from a few mm to several m in diameter. There are some intercalated andesite flows and volcanic sandstones. The Kasalka group is topped by at least 300 m of massive latite-andesite flows with prominent columnar jointing.

The Kasalka group is considered late Cretaceous in age (MacIntyre, 1977) because it is unconformable on fossiliferous rocks of the lower Cretaceous Skeena group and because of an age of 87 ± 4 m.y. (Table I) determined by the K/Ar method for a whole-rock sample collected 400 m stratigraphically above the top of the pebble conglomerate. In addition, the layered sequence is tilted and domed by intrusions with isotopically determined late Cretaceous ages.

These rocks are distinctive in composition and age for this area, occupy a circular area bounded by arcuate normal faults, and are for the most part flat-lying except where tilted and domed against younger intrusions. They are considered as an initial ash flow followed by lava flows that evacuated a magma chamber allowing subsidence and infilling by talus, landslide, and mud flow with intermittent flows and finer-grained clastic rocks of lacustrine origin. The circular feature, with its concentric structures and volcanic fill, meets William's (1941) definition of a volcanic caldera, and the presence of the Kasalka group rocks as a coherent crustal block rather than a chaotic jumble, the alteration of the flow rocks, and the post-subsidence uplift about the larger stocks suggests this is a resurgent caldera as described by Smith and Bailey (1968).

PLUTONIC ROCKS

Several stocks and dikes intrude layered rocks of the Hazelton, Skeena, and Kasalka groups within and about the caldera. They occur in or displace concentric and radial faults of the caldera and hence were intruded after initial subsidence. There are 4 divisions on the basis of age and composition: the oldest are the Kasalka intrusions (MacIntyre, 1976), the next oldest are the Bulkley intrusions (Carter, 1974) and these are followed in order by the Coast intrusions (Carter, 1974) and the Nanika intrusions (Carter, 1974).

The Kasalka intrusions are small stocks, dikes, and sills within, and peripheral to, the caldera, and they are diorite to quartz diorite and rhyodacite in composition, and fine- to medium-grained porphyritic with pilotaxitic groundmass. Most intrude into the latite-andesite flows above the felsic tuff unit of the Kasalka group. By composition, texture, gradational contacts, and structural position, they are the intrusive equivalents to extrusive rocks of the Kasalka group. There are no isotopic age determinations for the Kasalka intrusions.

The Bulkley intrusions can be subdivided into:

(1) small isolated stocks peripheral to the caldera and consisting of a single phase of porphyritic granodiorite. They intrude those units of the Kasalka group below the lahar. The examples are intrusions at Huckleberry Mountain (James, 1976), Ox Lake (Richards, 1976) and Coles Creek (MacIntyre, 1974) for which isotopic age determinations by the K/Ar method are respectively 84.4 ± 3.2 m.y., 82.0 ± 3.0 m.y., and 83.8 ± 2.8 m.y. (Table 1).

(2) large stocks at the edge of the caldera and mostly zoned from margins of equigranular diorite and quartz diorite to cores of quartz monzonite as in the Sibola, Troitsa (Cawthorn, 1973), and Mount Bolom stocks. These bodies intrude the lower part of the Kasalka group. The Sibola and Troitsa stocks are traversed by northwest-trending dike swarms of porphyritic granodiorite and quartz diorite, and rhyodacite, so called because it has an aphanitic groundmass and is locally flow banded. Dikes intrude the full stratigraphic thickness of the Kasalka group. Ages determined by the K/Ar method for porphyritic quartz monzonite at Bergette and Whiting Creek in the Sibola stock are, respectively, 76.7 ± 2.5 m.y. and 74.1 ± 2.2 m.y., and for porphyritic granodiorite in the Troitsa stock, 75.7 ± 2.3 m.y. There is no age determination available for the Mount Bolom stock.

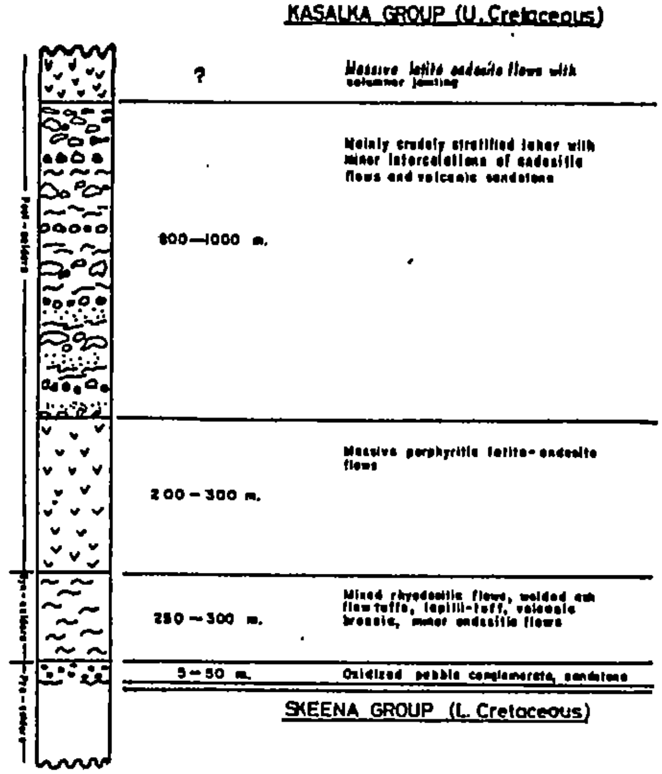


Figure 3. Stratigraphic column for the Kasalka group.

Coast intrusions are represented by a north-trending dike of quartz diorite that supports a ridge west of the Sibola stock and for which ages of 49.9 ± 2.1 m.y. and 46.8 ± 1.5 m.y. have been determined. It occupies the contact between rocks of the Hazelton and Skeena groups and intrudes rocks of the Kasalka group at its north end. Composition and age are similar to plutons of the Coast Plutonic complex just 14 km to the west. Nanika intrusions are represented by one small composite stock at

TABLE I

ISOTOPIC AGE DETERMINATIONS FOR ROCKS OF THE TAHTSA LAKE DISTRICT

	Location	Rock Type	Mineral	Apparent Age (m.y.)	Laboratory	and Reference
Kasalka Group	Swing Peak	porphyritic latite-andesite	whole rock	87.0±4	Teledyne	MacIntyre, 1977
Bulkley Intrusions sub-division 1	Coles Creek	porphyritic granodiorite	biotite	83.8±2.8	UBC	Carter, 1974
	Huckleberry Mountain	porphyritic granodiorite	biotite	83.4±3.2	UBC	Carter, 1974
	Ox Lake	porphyritic granodiorite	biotite	82.0±3.0	UBC	Carter, 1974
Bulkley Intrusions sub-division 2	Bergette	porphyritic quartz monzonite	biotite	76.7±2.5	UBC	Carter, 1974
	Whiting Creek	porphyritic quartz monzonite	biotite	74.1±2.2	UBC	Carter, 1974
	Troitsa	granodiorite	biotite	75.7±2.3	UBC	Cawthorn, 1973
Coast Intrusions	Berg	quartz diorite	biotite	49.9±2.1	UBC	Carter, 1974
	Berg	quartz diorite	biotite	46.8±1.5	UBC	Carter, 1974
Nanika Intrusions	Berg	porphyritic quartz monzonite	biotite	52.0±2.0	UBC	Carter, 1974
	Berg	quartz latite	biotite	47.0±3.0	UBC	Carter, 1974

UBC = University of British Columbia

the Berg prospect immediately west of the aforementioned Coast intrusion of quartz diorite. The Berg stock is granodiorite and quartz monzonite for which ages of 52.0 ± 2.0 m.y. to 46.8 ± 1.5 m.y. have been determined. It intrudes only rocks of the Hazelton Group, but its alteration and mineralization haloes overlap the Coast intrusion immediately to the east.

The Kasalka intrusions are very similar in modal and chemical composition to volcanic rocks of the Kasalka group (Fig. 4a). This supports the contention of their comagmatic relationship. The Bulkley intrusions are generally more siliceous and more potassic than the Kasalka intrusions and can possibly be considered later differentiates of the same parent magma. The Coast intrusion is not chemically distinguishable from the Kasalka intrusions, but the Nanika intrusion at Berg is more potassic than any of the other intrusions (MacIntyre, 1976). All of the upper Cretaceous volcanic and plutonic rocks are calc-alkaline in nature and form a differentiation trend (Fig. 4b) typical of volcanic arcs built on continental margins (Carmichael, et al., 1974).

PORPHYRY-TYPE Cu-Mo OCCURRENCES

Two of the 4 divisions of the plutonic rocks in the Tahtsa Lake district, the Bulkley and the Nanika intrusions, have spatially associated chalcopyrite and molybdenite in stockwork veinlets and as dispersed grains coincident with mineral assemblages attributal to hydrothermal alteration. The sulfide and alteration mineral assemblages are concentrated in annular and crescent-shaped areas at the contact of small stocks of porphyritic granodiorite with rocks of the Hazelton and Kasalka groups or within and at the margins of quartz-monzonite dikes traversing large stocks of granodiorite.

Both subdivisions of the Bulkley intrusions have associated porphyry-type Cu-Mo occurrences. The small, older stocks of porphyritic granodiorite at Huckleberry Mountain, Ox Lake, and Coles Creek (Fig. 5) have the greatest metal concentrations. Huckleberry Mountain has 87 million tons of 0.41% Cu and 0.025% MoS_2 (James, 1976) to a depth of 220 m and within a cut-off of 0.30% Cu. This mineralization is chalcopyrite and molybdenite

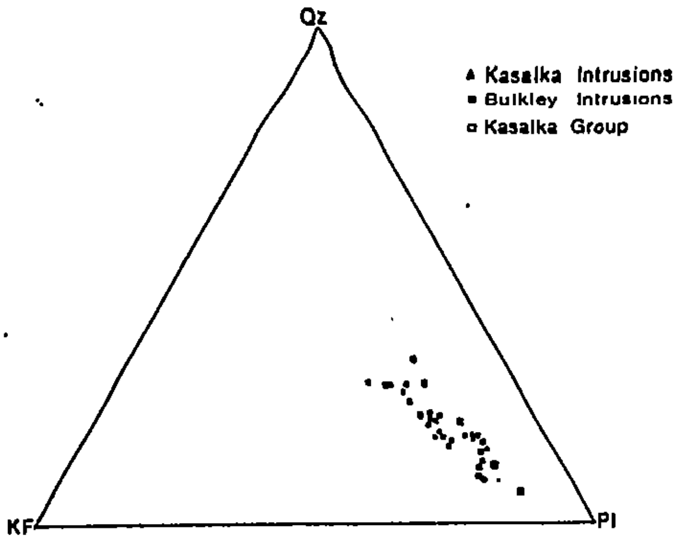


Figure 4a. Qz-Pl-Kf diagram of Kasalka group, Kasalka intrusions, and Bulkley intrusions.

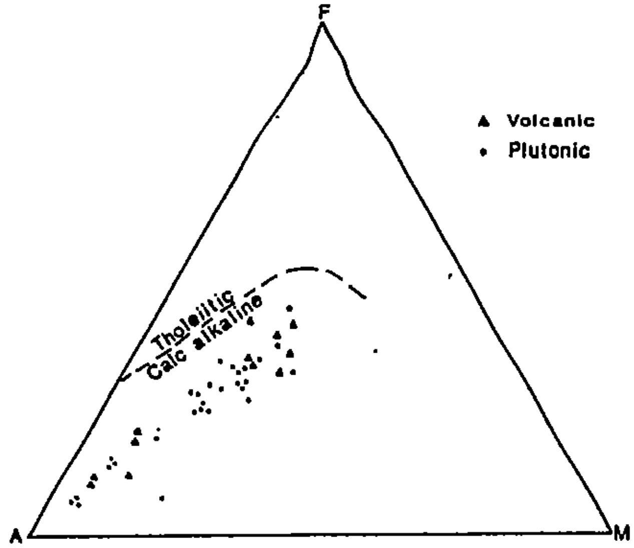


Figure 4b. AFM diagram of volcanic and plutonic rocks of the Tahtsa Lake district.

on veinlets less than 1 mm wide in a crescent-shaped area along the east side of a porphyritic granodiorite stock. Hydrothermal alteration is roughly concentric about the stock with a potassic zone at the stock margin and extending up to 300 m into the wall rock, a phyllic zone at least 190 m wide that extends 3 km east of the stock and is succeeded outward by a propylitic zone. Essentially all of the copper and molybdenum is within the potassic and phyllic zones.

Ox Lake, which is 8 km east of Huckleberry Mountain, has 23.6 million tons of 0.35% Cu equivalent within a cut-off of 0.1% Cu and 0.01% Mo. This mineralization is composed of chalcopyrite and molybdenite in veinlets around a stock of porphyritic granodiorite approximately 450 m in diameter but with greatest concentration in a crescent-shaped area on the west side of the stock. Molybdenite is most abundant next to the stock and its distribution is coincident with the potassic alteration mineral assemblages. Alteration is predominantly fracture controlled rather than pervasive in the wall rocks of the Hazelton group but in general there are concentric zones of potassic through phyllic to propylitic mineral assemblages outward from the stock.

Coles Creek (MacIntyre, 1974) has no stated tonnage and grade. Chalcopyrite, magnetite, and traces of bornite and molybdenite in veinlets and as dispersed grains are confined mostly within the porphyritic granodiorite stock that intrudes volcanic rocks of the Kasalka group and a porphyritic dacite of the Kasalka intrusions (Fig. 5). Hydrothermal alteration centers on the stock of porphyritic granodiorite and includes, from within the stock outward, a potassic zone, a phyllic zone that extends for 450 m from the stock, an argillic and advanced argillic zone that extends for 650 m from the stock, and an even more distal propylitic zone. The greatest abundance of copper and molybdenum is within the potassic zone. There are a few lead, zinc, and silver-bearing veins in the zone of propylitic alteration.

Although the metal content observed at Coles Creek to date is less than that at Huckleberry Mountain and Ox Lake, Coles Creek does have the most complete geologic section including volcanic rocks of the Hazelton and Kasalka groups, plus plutons of the Kasalka and Bulkley intrusions. These rocks are preserved within a graben down dropped between 2 normal faults that are radial to the caldera. The exposed stratigraphic section and plutonic rocks mapped by MacIntyre (1974) support the conclusion that Kasalka group volcanic rocks were deposited unconformably on rocks of the Hazelton group, intruded by Kasalka intrusions of quartz diorite and dacite, down dropped by normal faults, and intruded by the stock of granodiorite. Magmatic fluids generated in part by retrograde boiling of the granodiorite melt caused

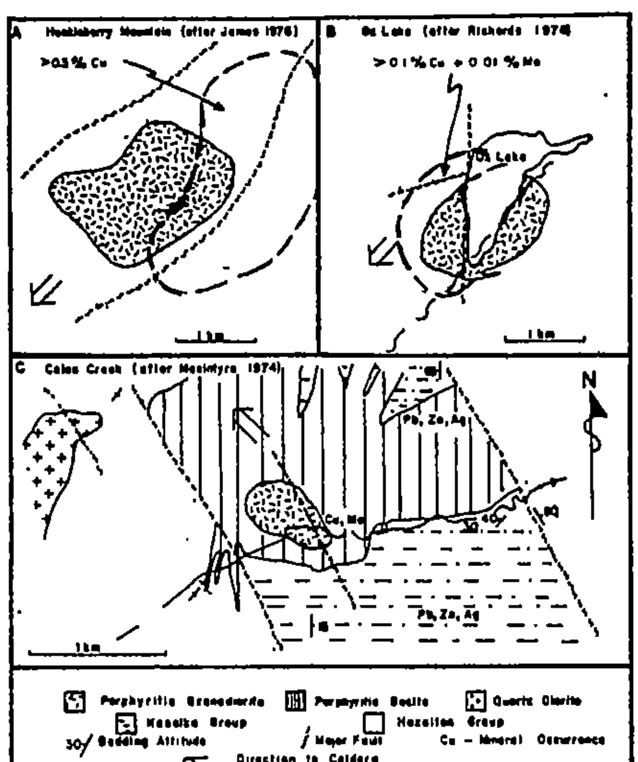


Figure 5. Generalized geology of the porphyry-type Cu-Mo occurrences at Huckleberry Mountain, Ox Lake, and Coles Creek.

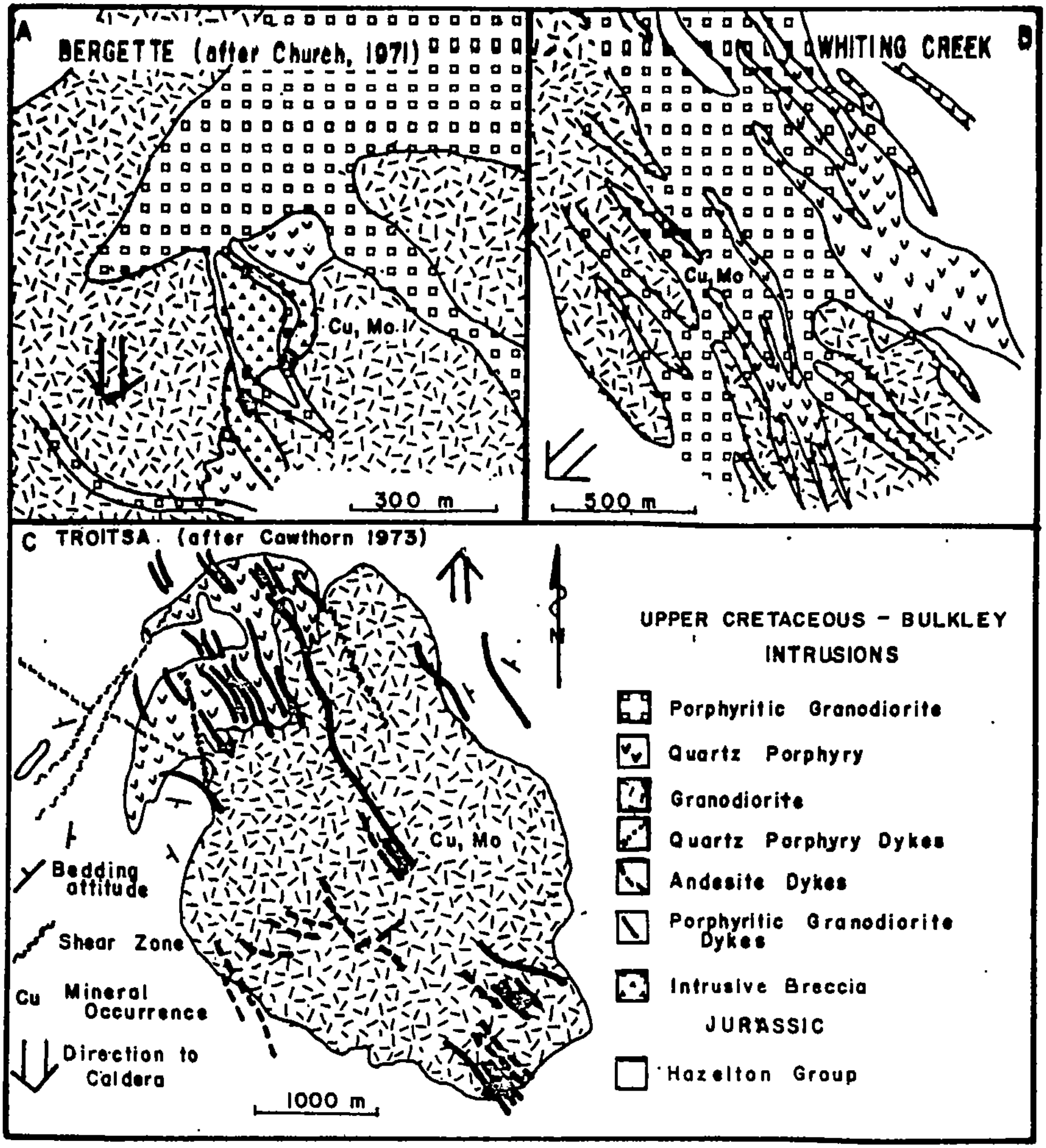


Figure 6. Generalized geology of the porphyry-type Cu-Mo occurrences at Bergette, Whiting Creek, and Troitsa.

potassic alteration and metalization within the stock. Where these fluids ascended and met cold meteoric water they precipitated sulfide minerals and quartz on fractures. Further dilation and cooling took place as mixed fluids continued to rise and thus favoured argillic, advanced argillic, and ultimately propylitic alteration.

The larger, composite, and younger stocks of granodiorite with dike swarms of porphyritic granodiorite and quartz monzonite also have porphyry-type Cu-Mo occurrences as at Bergette (Church, 1971) and Whiting Creek at the east edge of the Sibola stock, and at the Troitsa occurrence within the Troitsa stock (Cawthorn, 1973) (Fig. 6). There are no tonnages and grades stated for these occurrences. Chalcopyrite and molybdenite occur on fractures in zones of brecciation in and about the dike swarms and coincident with pervasive potassic and phyllic alteration.

The Berg stock is the only Nanika intrusion in the

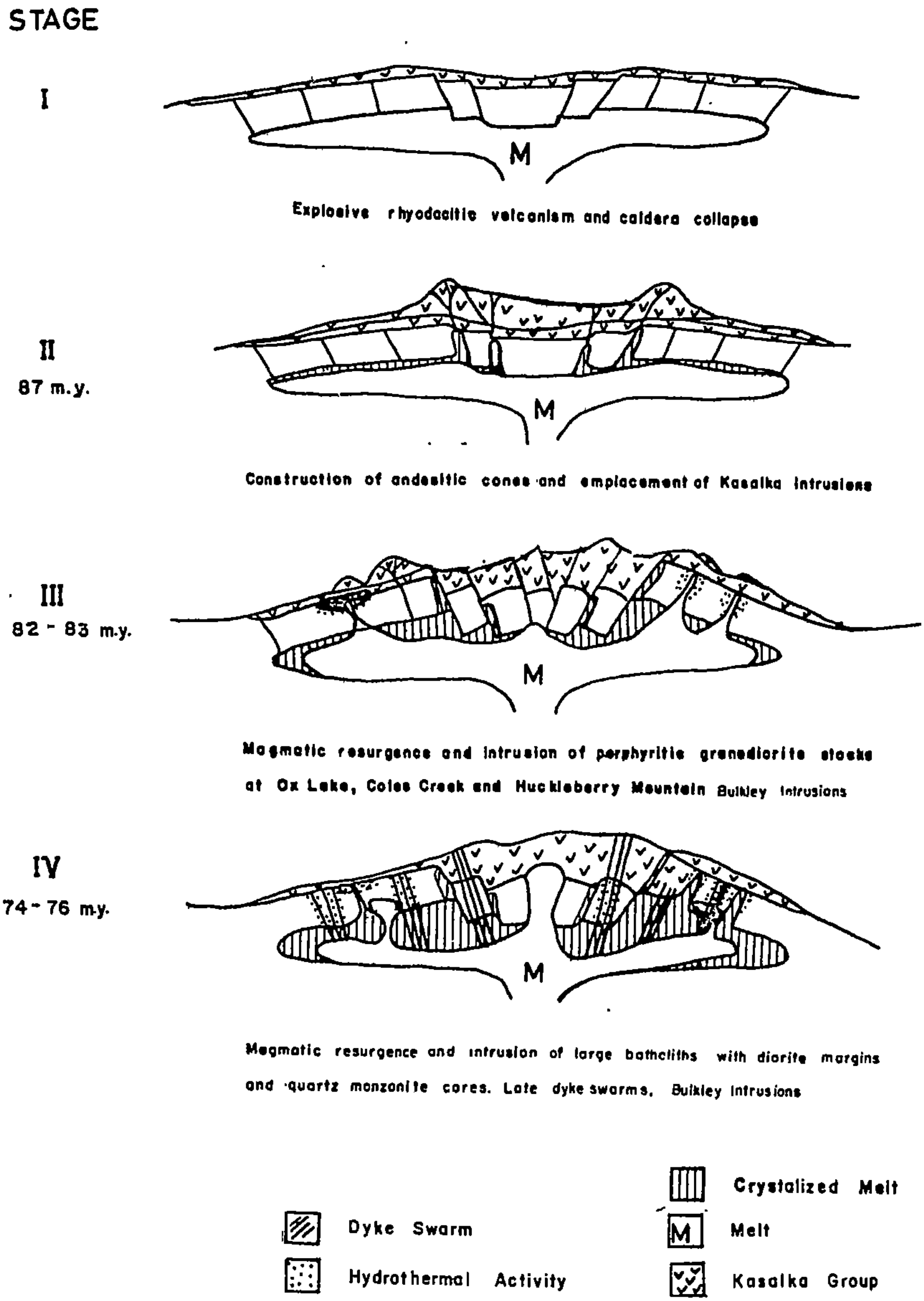


Figure 8. A sequence of events.

Tahtsa Lake district, an assignment based entirely on the isotopic-age determinations for various phases of that composite stock of quartz monzonite to granodiorite. The stock is 600 m in diameter (Fig. 7) and is central to a ring of chalcopyrite and molybdenite in stockwork quartz veinlets distributed both in the stock and the intruded volcanic rocks of the Hazelton group and quartz diorite of the Coast intrusions. Disseminated sulfide minerals are rare. Molybdenite is concentrated mostly within 100-135 m of the stock's margin and is roughly coincident with a potassic alteration. The zone of greatest chalcopyrite content overlaps the contact between the stock and the country rock and extends for more than 260 m from the stock, although the greatest concentration is within 130 m of that contact and near the interface of potassic and phyllic alteration. Pyrite in a phyllic mineral assemblage extends for 700 m beyond the stock. Argentiferous galena, sphalerite, and minor chalcopyrite occur in veins peripheral to the stock and in the hornfelsed and propylitically altered country rock. These veins were staked first in 1929 and have the only recorded production from the district. Tonnage and grade of the porphyry-type occurrence at Berg is 400 million tons of 0.4% Cu, 0.05% MoS_2 using a cut off of 0.25% Cu (Panteleyev, 1976) and as such is the most economically significant occurrence in the Tahtsa Lake district.

A SEQUENCE OF EVENTS

(1) Differentiated volcanic rocks accompanied by clastic and chemical sedimentary rocks were deposited as part of an Andean-type arc-trench complex built on the continental margin during lower to middle Jurassic. These rocks are the Hazelton group.

(2) Sedimentary and volcanic rocks of the Skeena group were deposited unconformably upon rocks of the Hazelton group in successor basins behind the crest of the arc during lower Cretaceous.

(3) Uplift and erosion of rocks of the Hazelton and Skeena groups produced the pebble conglomerate at the base of the Kasalka group in late Cretaceous. This was followed in the Tahtsa Lake district by massive extrusion of felsic fragmental and flow rocks (Fig. 8-I), local extrusion of latite-andesite flows, and abrupt subsidence along arcuate and radial faults of a virtually intact area 25 km in diameter with a prong to the north. The resulting depression was filled by talus and mud flows along with finer waterlain clastic material and intermittent flows (Fig. 8-II). These are the rocks of the Kasalka group and they cooled about 87 m.y. ago. The Kasalka intrusions of diorite to rhyodacite were emplaced along concentric and radial fractures essentially to the level of the latite-andesite flows that overlie the siliceous-tuff and ash-flow unit. These are the first of the caldera related intrusions. They have little associated hydrothermal alteration and no mineralization, perhaps because they are coincident with volcanism, intruded to high levels in open fractures, and cooled quickly.

(4) Magma resurged upward in the magma chamber, domed the floor of the caldera and intruded at intersections of concentric and radial fractures as at Huckleberry Mountain, Ox Lake, and Coles Creek. These are stocks of the first subdivision of the Bulkley intrusions emplaced 82-83 m.y. ago (Fig. 8-III). Heat from these small stocks focused ascent of hot, metal-bearing fluids in a convecting magmatic-meteoric hydrothermal system (Sheppard, 1977) that altered rocks through which they passed and, because of the focused heat, rose almost chemically intact to high levels in the crust to mix with cold, oxygenated meteoric water. With mixing, metal sulfide minerals were deposited on fractures within, and at the margins of, the stocks. Fluids ascending and descending over a broad area and without focus provided by the small stocks produced pervasive propylitic alteration in the lower latite-andesite flows of the caldera fill.

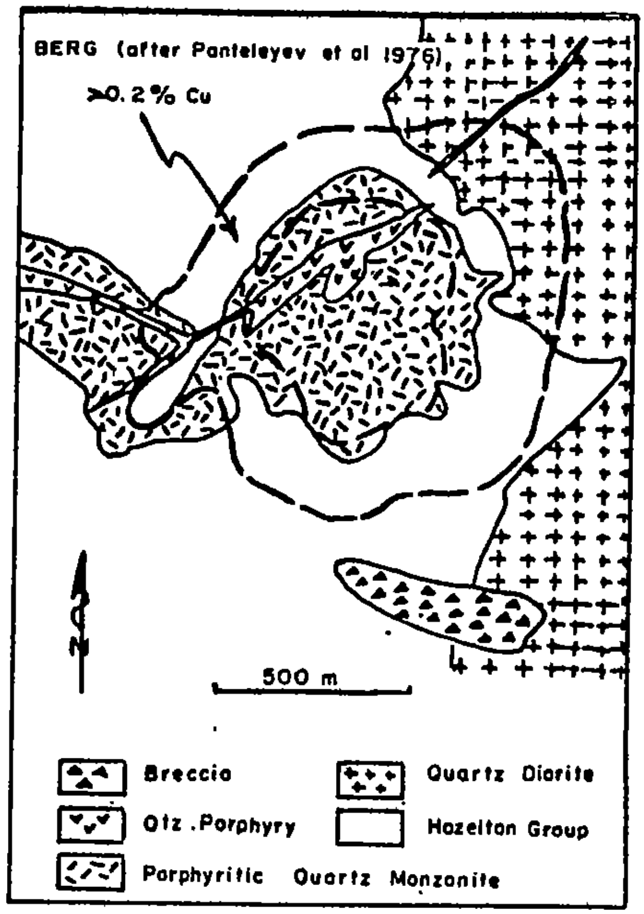
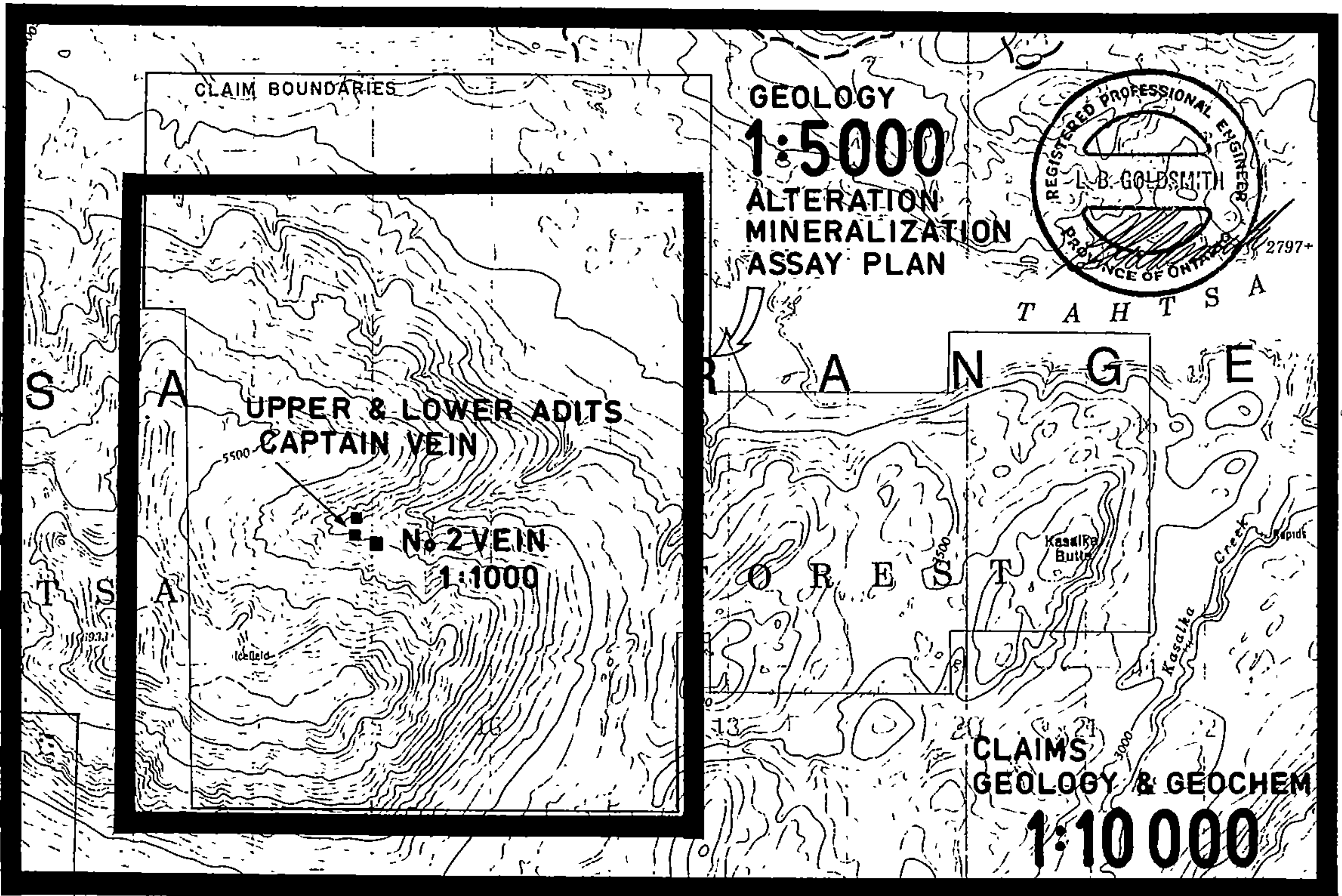


Figure 7. Generalized geology of the porphyry-type Cu-Mo occurrence at Berg.

(5) A second magmatic resurgence emplaced large stocks of the second subdivision of the Bulkley intrusions 74-76 m.y. ago (Fig. 8-IV). These are the Sibola, Troitsa, and Mount Bolom stocks. They domed the caldera floor and rim, reactivating arcuate and linear fractures that controlled their somewhat elongate shape. The dike swarms are late differentiates occupying post-resurgence tension fractures. Concentrations of Cu and Mo are smaller and lower grade than those associated with the first subdivision of the Bulkley intrusions and are spatially and temporally related to dike swarms at the margins of, or within, the larger stocks. The Mount Bolom stock is the largest, most central intrusion and most deformed caldera fill.

(6) The youngest igneous products related to the development of the caldera are Coast and Nanika intrusions in the area of the Berg porphyry-type Cu-Mo oc-



INDEX TO MAPS TAHTSA REACH PROJECT

TAHTSA MINES LIMITED

N.T.S. 93 E / 11 E & W

ARCTEX ENGINEERING SERVICES

NOVEMBER 1981


CLAY
CLAY
FERRICRETE
2% Py
FERRICRETE
SC
5+00 W
4+00 W.
3+00 W.
2+00 W.
1+00 W.
0+00
1+00 E
2+00 E
3+00 E
4+00 E
5+00 E
6+00 E
7+00 E
100 N.
0+00
100 S.
200 S.
300 S.
400 S.
ASSUMED BOUNDARY OF SKEENA GR.
CO_2 with ∠1% SPHALERITE
LOWER ADIT
WEAK EPIDOTE
75
CO_2, TR. ZnS & PbS
CAPTAIN VEIN
∠5 cm. MASSIVE GALENA PODS ALONG SHEAR
UPPER ADIT
∠10 cm. GALENA, SPHALERITE & PYRITE POD ALONG SHEAR ZONE. STRONG MANGANESE
INTENSE LIMONITIZATION
BENNETT LEAD
75
TR. GALENA IN FAULT GOUGE
58
INTENSE LIMONITE IN GOSSANOUS ZONE
STRONG MnO_2, GALENA, SPHALERITE IN PODS ALONG LEAD UP TO 5 cm. WIDE.
75
CAPTAIN EXTENSION
GOUGE, LIMONITE
STRONG EPIDOTE-CO_3 WITH ∠10 % SPHALERITE & ∠3 % GALENA
1372
1219
1524
1676
N
MAGNETIC NORTH
23°
LEGEND
ROAD
CREEK
ANDESITE - DIORITE
ANDESITE OR DACITE BRECCIA
RHYOLITE
CONGLOMERATE
SHEAR ZONE, WITH ATTITUDE.
SURFACE MINERALIZATION
VALUE OF EARTH'S TOTAL MAGNETIC FIELD, IN GAMMAS LESS 50,000γ BACKGROUND
PROFILE OF MAGNETIC VALUES
MINERAL RESOURCES BRANCH
10,261
PART 2 of 2
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TO ACCOMPANY REPORT BY J. M. ANDERSON, GEOPHYSICIST.
GEOTRONICS SURVEYS LTD.
TATSA RESOURCES LTD.
SAM CLAIMS
TAHTSA LAKE AREA, OMINECA M.D., B.C.
MAGNETIC SURVEY DATA AND PROFILES
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DATE: NOV. 1981
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TAHTSA MINES LIMITED

TAHTSA REACH PROJECT

TAHTSA REACH, B.C. OMINECA MINING DIVISION N.T.S. 93 E / 11

VERTICAL LONGITUDINAL SECTION OF THE CAPTAIN VEIN

To accompany report by

P. KALLOCK, GEOLOGIST

L.B. GOLDSMITH, P.Eng.
CONSULTING GEOLOGIST

ARCTEX ENGINEERING SERVICES NOVEMBER 1981

UPPER ADIT
114.6 m.
DRIVEN between 1927 and 1929
ELEVATION 4890'

10261
PART
2 of 2

TAHTSA MINES LIMITED

TAHTSA REACH PROJECT

TAHTSA REACH, B.C. OMINECA MINING DIVISION N.T.S. 93 E / 11

GEOLOGY OF UPPER ADIT

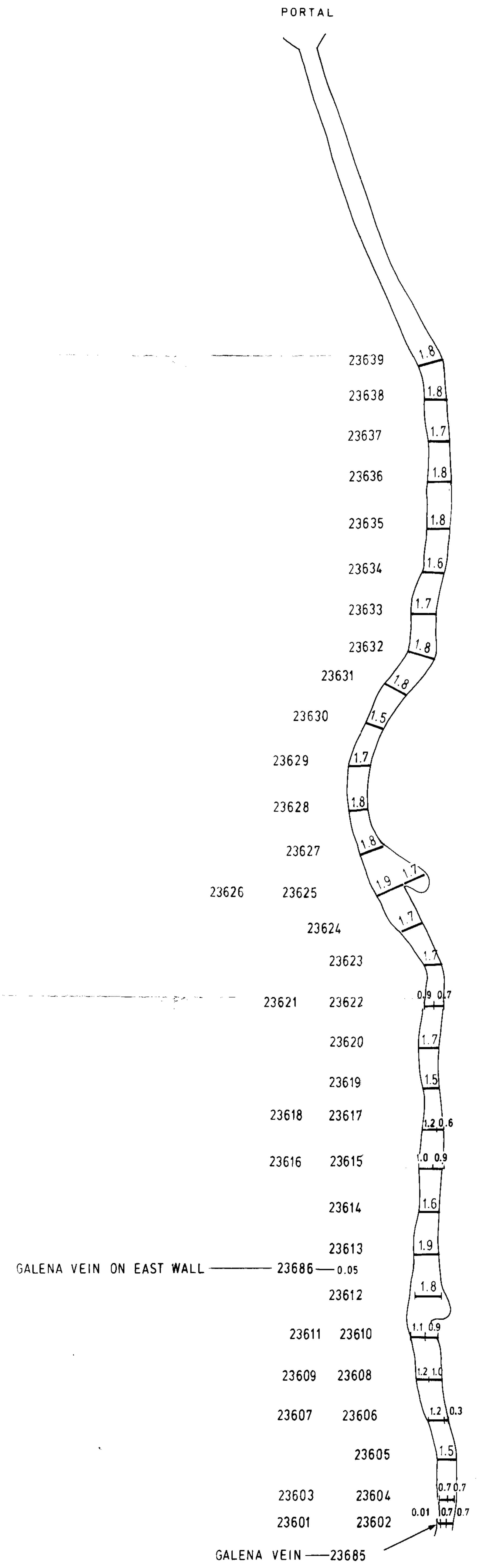
To accompany report by

P. KALLOCK, GEOLOGIST

L.B. GOLDSMITH, P.Eng.
CONSULTING GEOLOGIST

REGISTERED PROFESSIONAL ENGINEER
L. B. GOLDSMITH
PROVINCE OF ONTARIO

ARCTEX ENGINEERING SERVICES NOVEMBER 1981



	%Cu	%Pb	%Zn	oz. ton Ag	oz. ton Au
23639	<0.01	0.21	1.04	0.96	<0.003
23638	<0.01	0.08	0.43	0.60	<0.003
23637	<0.01	0.20	0.65	0.62	<0.003
23636	<0.01	0.28	0.69	0.66	<0.003
23635	<0.01	0.54	1.00	0.84	<0.003
23634	<0.01	0.40	0.76	0.26	<0.003
23633	<0.01	0.63	0.92	0.28	<0.003
23632	<0.01	0.28	0.89	1.40	<0.003
23631	<0.01	0.03	0.08	0.02	<0.003
23630	<0.01	0.01	0.02	0.01	<0.003
23629	<0.01	0.01	0.03	0.01	<0.003
23628	<0.01	<0.01	0.01	0.01	<0.003
23627	<0.01	0.04	0.07	0.01	<0.003
23626	<0.01	0.04	0.10	0.04	<0.003
23625	<0.01	0.26	0.26	0.16	<0.003
23624	<0.01	0.06	0.04	0.01	<0.003
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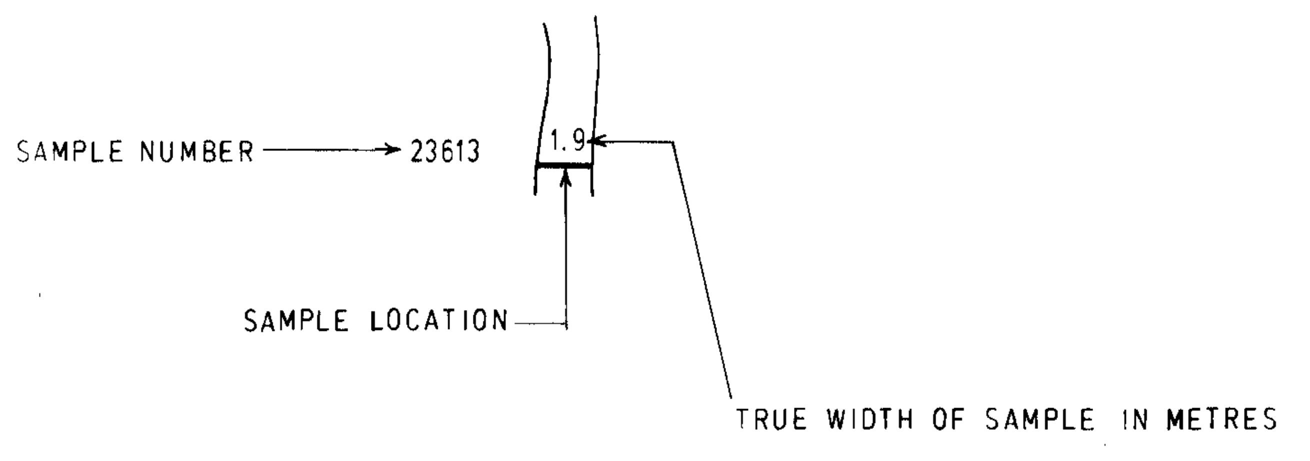
23617	<0.01	2.84	0.67	3.08	<0.003
23616	<0.01	0.14	0.23	0.36	<0.003
23615	0.09	2.62	1.26	8.44	0.006
23614	<0.01	4.74	0.12	5.72	<0.003
23613	0.01	4.24	0.26	3.86	<0.003
23612	<0.01	0.17	0.22	0.14	<0.003
23611	<0.01	0.06	0.13	0.02	<0.003
23610	<0.01	0.17	0.22	0.44	0.005
23609	<0.01	0.14	0.28	0.10	<0.003
23608	<0.01	0.38	0.69	0.20	<0.003
23607	<0.01	0.11	0.27	0.04	<0.003
23606	0.01	0.31	1.20	0.74	0.005
23605	<0.01	0.12	0.27	0.26	<0.003
23604	<0.01	0.15	0.32	0.20	<0.003
23603	<0.01	0.14	0.23	3.14	<0.003
23602	<0.01	0.11	0.22	3.13	<0.003
23601	0.05	0.88	1.26	3.26	<0.003
23685	0.95	10.50	4.78	63.42	0.008
23686	0.10	46.60	0.08	56.34	0.006
	%Cu	%Pb	%Zn	oz/ton Ag	oz/ton Au



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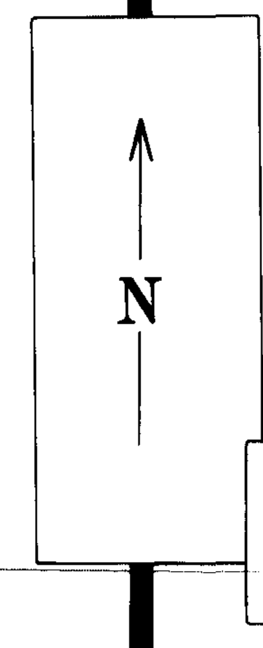

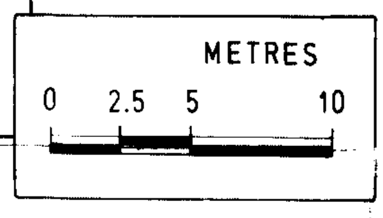

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TAHTSA REACH PROJECT

TAHTSA REACH, B.C. OMINECA MINING DIVISION N.T.S. 93 E / 11

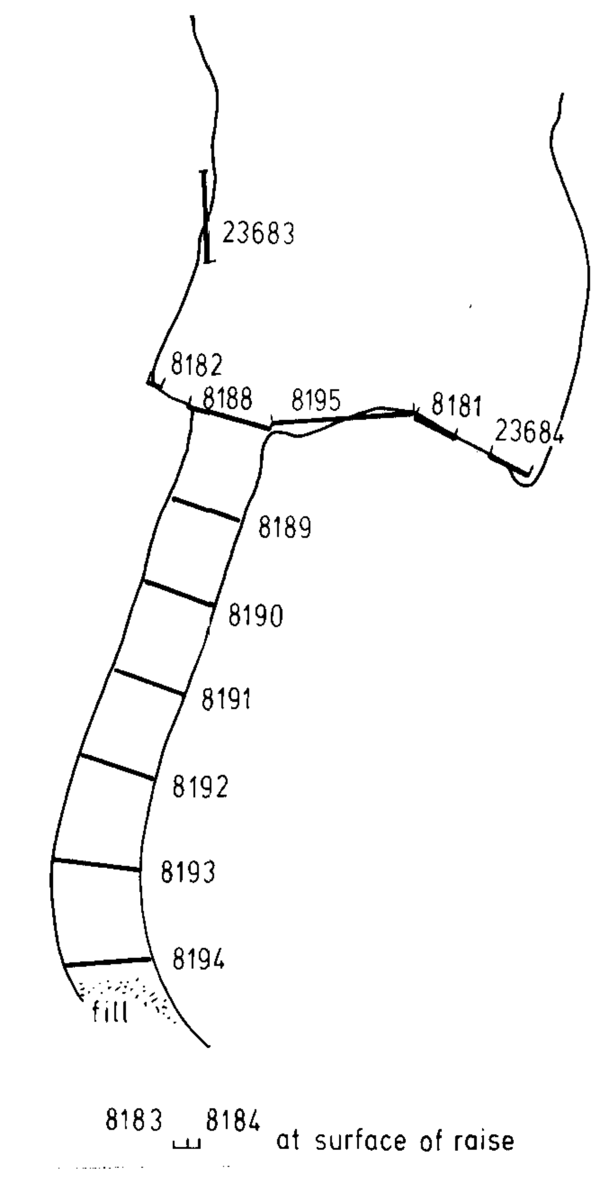
UPPER ADIT SHOWING SAMPLE LOCATIONS AND ASSAY RESULTS

To accompany report by
P. KALLOCK, GEOLOGIST
L.B. GOLDSMITH, P.Eng.
CONSULTING GEOLOGIST

REGISTERED PROFESSIONAL ENGINEER L. B. GOLDSMITH PROVINCE OF ONTARIO

ARCTEX ENGINEERING SERVICES NOVEMBER 1981

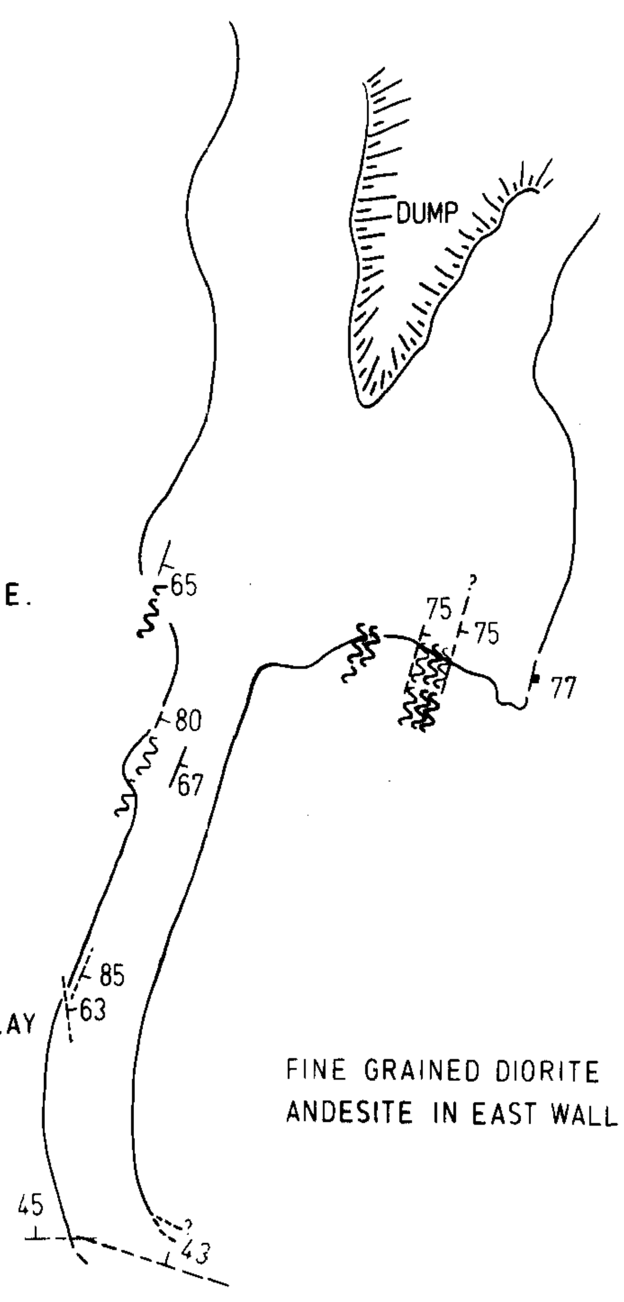
10261
PART 2 of 2



SAMPLE NUMBER	TRUE WIDTH	% Cu	% Pb	% Zn	oz./ton Ag	oz./ton Au
8181	1.5 m.	<0.01	0.17	0.47	0.06	<0.003
8182	0.5 m.	<0.01	0.05	0.19	0.06	<0.003
8183	0.3 m.	0.09	7.73	3.47	17.26	<0.003
8184	0.3 m.	<0.01	0.39	0.68	0.62	<0.003
8188	3.0 m.	<0.01	0.19	0.04	0.44	<0.003
8189	3.0 m.	<0.01	0.08	0.29	0.04	<0.003
8190	2.6 m.	<0.01	0.02	0.02	0.02	<0.003
8191	2.7 m.	<0.01	0.01	0.01	0.02	<0.003
8192	3.0 m.	<0.01	0.01	0.05	0.01	<0.003
8193	2.9 m.	<0.01	0.04	0.06	0.02	<0.003
8194	2.7 m.	<0.01	<0.01	0.03	0.02	<0.003
8195	5.4 m.	<0.01	0.01	0.03	0.01	<0.003
23683	3.0 m.	<0.01	0.05	0.15	0.14	<0.003
23684	3.0 m.	<0.01	<0.01	0.03	0.02	<0.003

77 jointing
85 fracture
65 vein attitude
65 fault

ELEVATION 4600'



7.5-10 cm. CLAY GOUGE IN FOOT & HANGING WALL OF 1.5 m. SHEAR ZONE WHICH CONTAINS MODERATELY SILICEOUS PORPHYRITIC BRECCIA (?). NUMEROUS BLACK SILICA VEINLETS AND TRACES TO 1% PYRITE.

0.6 m. GOUGE IN 1.2 m. SHEAR ZONE. MINOR CO_3, TR. PYRITE.

15+ cm. GOUGE IN FAULT

WALL ROCK HOST IS LIGHT GREY TO CREAM PORPHYRITIC BRECCIA. DARK FRAGMENTS TO 5cm., ALSO LOCALLY PORPHYRITIC. WITH PHENOCRYSTS INTENSELY ALTERED TO CLAY AND/OR SERICITE. WEAK SILICIFICATION ALSO CONTAINS MINUTE DISSEMINATED DARK METALLIC MINERAL.

BRECCIA, BROKEN CLAY & CALCITE VEINS

FINE GRAINED DIORITE OR ANDESITE IN EAST WALL

CALCITE VEIN IN 10 cm. BROKEN ZONE WITH <0.5 % PYRITE, TR. ZnS & PbS

PORTIONS OF THE ADIT NEAR THE PORTAL APPEAR TO BE AN ALTERED TUFF BRECCIA WITH VOLCANIC FRAGMENTS <2 cm.
CHERT FRAGMENTS ARE COMMON.
LOCAL FELDSPAR PHENOCRYSTS.
3% PYRITE DISSEMINATIONS & VEINLETS.
CO_3 COMMON AS VEINLETS.

N

METRES
0 2.5 5 10

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TAHTSA REACH PROJECT

TAHTSA REACH, B.C. OMINECA MINING DIVISION N.T.S. 93 E / 11

LOWER ADIT

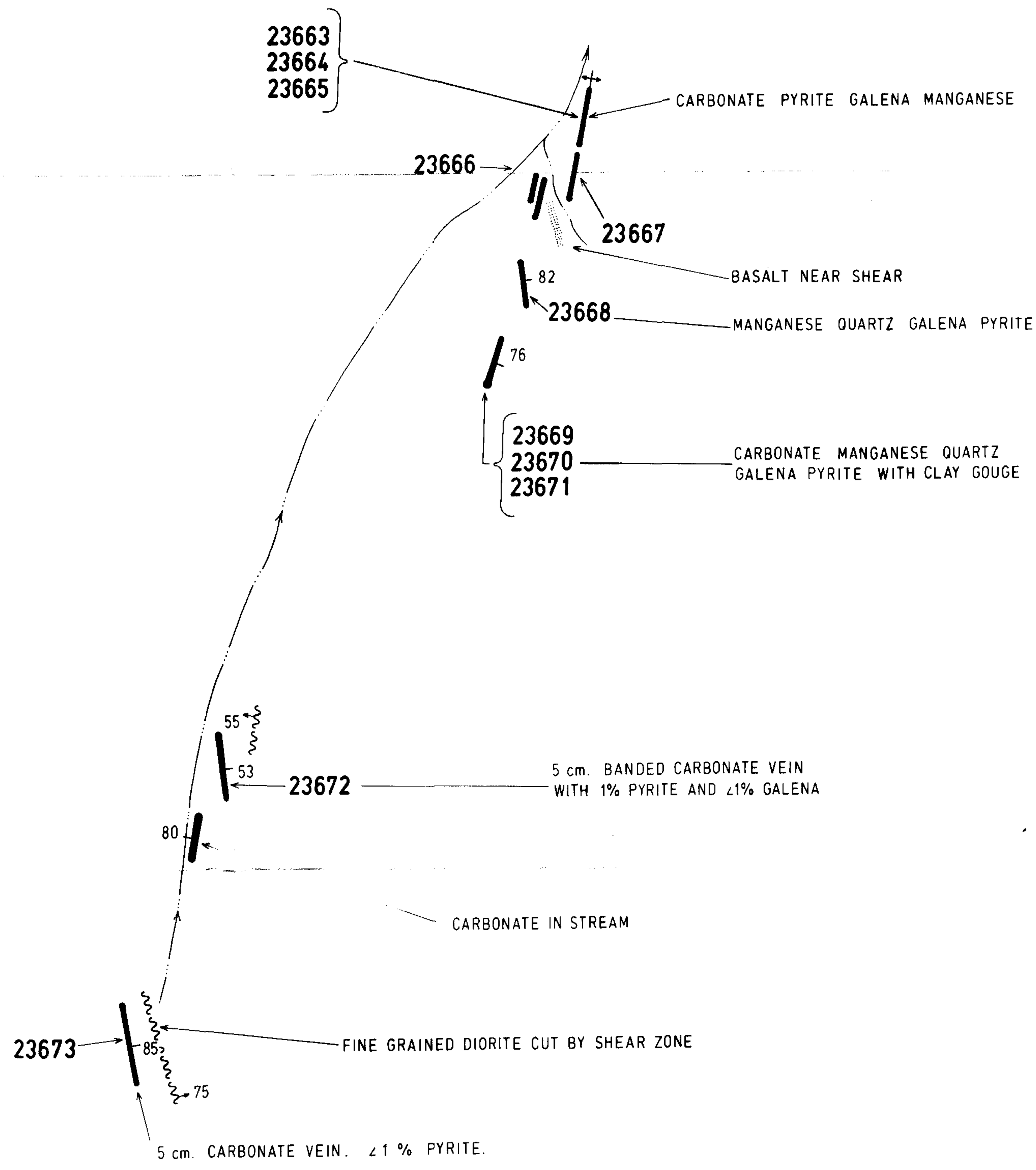
GEOLOGY MAP & ASSAY PLAN

REGISTERED PROFESSIONAL ENGINEER L. B. GOLDSMITH PROVINCE OF ONTARIO

To accompany report by
P. KALLOCK, GEOLOGIST
L. B. GOLDSMITH, P.Eng. CONSULTING GEOLOGIST

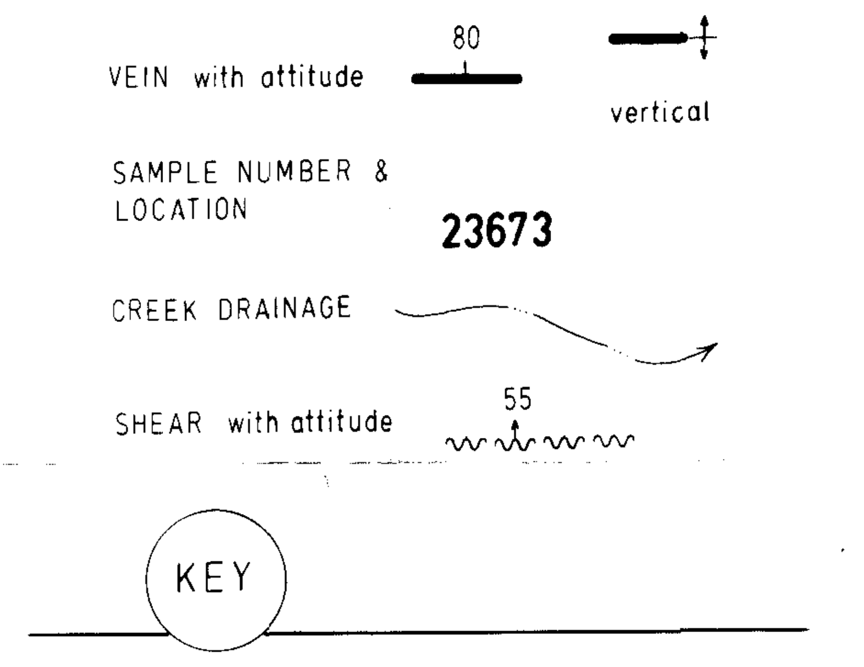
ARCTEX ENGINEERING SERVICES NOVEMBER 1981

10261 Part 2 of 2



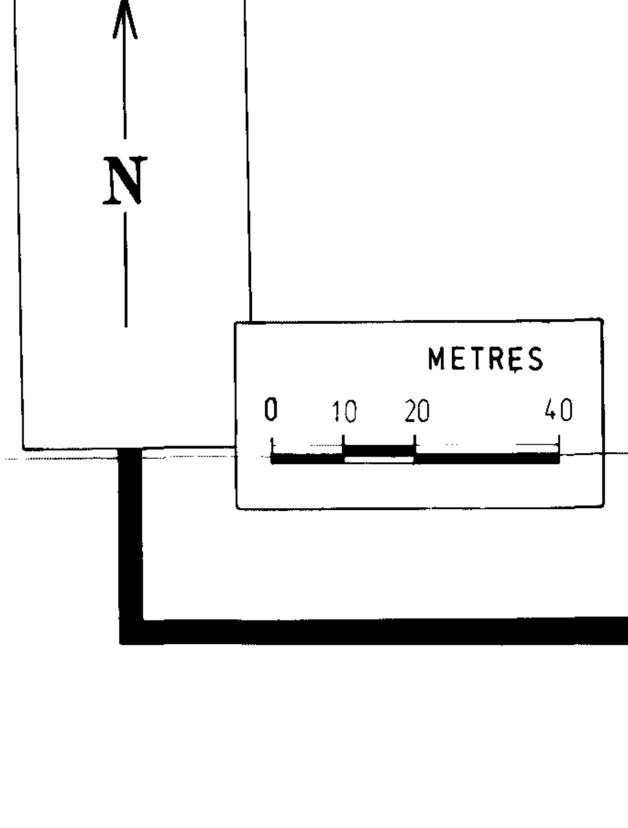
GEOLOGY

AND SAMPLE LOCATIONS



ASSAY RESULTS

TRUE WIDTH OF SAMPLE	SAMPLE NUMBER	% Cu	% Pb	% Zn	oz. ton Ag	oz. ton Au
0.15 m.	23663	0.05	4.20	1.84	12.60	∠0.003
0.60 m.	23664	∠0.01	0.35	1.18	0.90	∠0.003
0.50 m.	23665	∠0.01	0.18	0.23	0.32	∠0.003
1.00 m.	23666	∠0.01	0.04	0.08	0.36	∠0.003
0.75 m.	23667	∠0.01	0.14	0.12	0.40	∠0.003
1.00 m.	23668	0.04	1.22	3.97	11.72	∠0.003
0.20 m.	23669	∠0.01	0.61	1.70	1.02	∠0.003
0.50 m.	23670	∠0.01	0.32	1.03	1.04	∠0.003
0.50 m.	23671	∠0.01	0.04	0.09	0.16	∠0.003
0.50 m.	23672	∠0.01	0.07	0.31	0.34	∠0.003
0.25 m.	23673	∠0.01	0.51	1.08	0.68	∠0.003



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TAHTSA REACH PROJECT

TAHTSA REACH, B.C. OMINECA MINING DIVISION N.T.S. 93 E / 11

Nº 2 VEIN

SHOWING
GEOLOGY,
SAMPLE LOCATIONS
AND ASSAY RESULTS.

To accompany report by
P. KALLOCK, GEOLOGIST
L.B. GOLDSMITH, P.Eng.
CONSULTING GEOLOGIST

L. B. GOLDSMITH

ARCTEX ENGINEERING SERVICES NOVEMBER 1981

10,261
PART
2 of 2

KEY

(wavy lines)	FAULT ZONE
(dots)	BASE METAL VEIN OCCURRENCES
X X X X	STOCKWORK: PYRITE and/or LIMONITE-FERRICRETE
(stipple)	WHITE PRECIPITATE

STRATIGRAPHY

KASALKA GROUP UPPER CRETACEOUS	2b, 2c, 3	MAINLY CRUDELY STRATIFIED LAHAR WITH INTERCALATIONS OF ANDESITIC AND VOLCANIC SANDSTONES.	800 - 1000 m.
	2b, 3	PORPHYRITIC LATITE-ANDESITE FLOWS	200 - 300 m.
	2a, 2b	FELSIC FLOWS, TUFFS AND BRECCIAS; LOCAL RHYOLITE BRECCIA.	250 - 300 m.
	1b	BASAL RED BED CONGLOMERATE	5 - 50 m.
SKEENA GROUP LOWER CRETACEOUS	1a	BLACK SHALE, MUDSTONE, ARGILLITE	

FROM KALLOCK & GOLDSMITH, 1981

AFTER MacINTYRE & HODDER, 1979

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TAHTSA REACH PROJECT:

SAM & SWING CLAIMS TAHTSA REACH B.C. OMINECA MINING DIVISION NTS 93 /11

NORTH-SOUTH CROSS SECTION A-B

KEYED TO GEOLOGY MAP 1 : 5000 (1981)

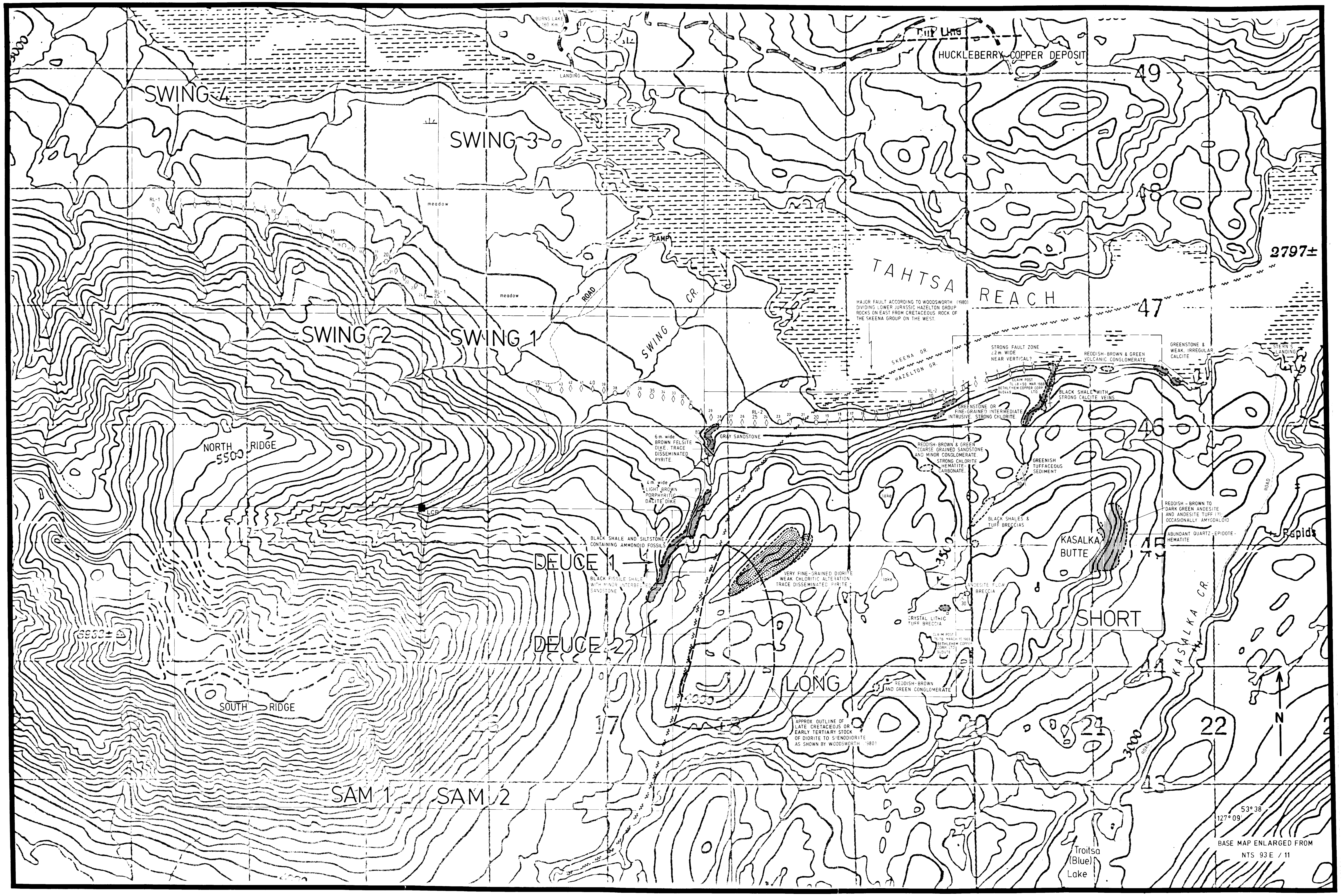
TO ACCOMPANY REPORT BY
P. KALLOCK, GEOLOGIST
&
L.B. GOLDSMITH, P. Eng.
Consulting Geologist

L. B. GOLDSMITH — REGISTERED PROFESSIONAL ENGINEER — PROVINCE OF ONTARIO

10,261

PART 2 of 2

ARCTEX ENGINEERING SERVICES MARCH 1982



FAULT

OUTCROP BOUNDARY

RL-2 20 ◊ 19 ◊ SOIL
21 ○ STREAM SEDIMENT

SAMPLE LOCATIONS

CLAIM BOUNDARIES

45

ATTITUDE OF BEDDING OR DIKE ; VERTICAL

KEY

STRATIGRAPHY

Felsic to dacitic dike
Light brown to tan.

LATE CRETACEOUS OR TERTIARY — KASALKA INTRUSIVE?
Fine-grained diorite

LOWER & MIDDLE CRETACEOUS — SKEENA GROUP
Micaceous sandstone, siltstone, black shale and minor conglomerate

HAZELTON GROUP
TELKWA FORMATION

Predominantly volcanics of andesitic composition

Predominantly sedimentary rocks of clay to conglomerate size

GEOCHEMISTRY

Sample no.	Cu ppm	Mo ppm	Pb ppm	Zn ppm	Ag ppm	Au ppb
RL-1-0	20	1	6	98	0.1	<10
1	18	1	11	68	0.1	<10
2	9	2	4	44	0.3	<10
3	14	1	7	40	0.2	<10
4	18	2	7	186	0.2	<10
5	19	1	5	155	0.1	<10
6	84	3	13	75	1.2	<10
7	34	4	8	72	0.6	<10
8	26	2	4	65	0.1	<10
9	17	3	5	50	0.1	<10
10	29	1	8	175	0.1	10
11	23	2	20	143	0.3	<10
12	24	1	15	90	0.1	<10
13	73	1	45	385	1.5	<10
14	27	1	66	210	0.6	<10
15	98	2	38	200	1.4	<10
16	49	1	27	390	0.3	<10
17	23	1	8	80	0.2	<10
18	15	1	14	88	0.3	<10
19	12	2	7	72	0.1	<10
20	33	2	16	190	0.1	<10
21	12	1	10	56	0.5	<10
22	25	1	12	62	0.2	<10
23	39	1	14	85	0.5	<10
24	35	1	14	47	0.2	<10
25	13	1	13	50	0.1	<10
RL-2-1	14	1	8	88	0.1	<10
2	18	1	10	74	0.1	<10
3	17	1	8	88	0.1	<10
4	28	1	22	190	0.1	<10
5	17	1	11	90	0.1	10
6	22	1	10	64	0.1	<10
7	18	1	10	95	0.1	<10
8	38	1	7	72	0.1	<10
9	22	1	8	64	0.1	<10
10	13	1	9	100	0.1	<10

Sample no.	Cu ppm	Mo ppm	Pb ppm	Zn ppm	Ag ppm	Au ppb
RL-2-11	36	1	7	70	0.2	10
12	20	1	7	62	0.1	<10
13	24	1	10	112	0.1	<10
14	24	1	14	178	0.1	20
15	30	1	11	93	0.1	<10
16	86	1	15	210	0.6	10
17	31	1	12	166	0.1	10
18	34	1	9	76	0.1	<10
19	70	1	11	68	0.1	10
20	33	1	9	100	0.1	<10
21	28	1	7	80	0.2	10
22	30	1	9	90	0.5	<10
23	22	1	7	75	0.1	<10
24	24	1	1	75	0.1	10
25	22	1	10	92	0.1	<10
26	12	1	7	46	0.1	10
27	11	1	10	130	0.1	10
28	20	1	11	85	0.1	10
29	29	1	15	75	0.1	<10
30	17	1	14	50	0.1	<10
31	20	1	8	143	0.1	<10
32	22	1	11	83	0.1	<10
33	20	1	11	130	0.2	10
34	13	1	8	43	0.1	<10
35	19	1	30	120	0.1	40
36	18	1	40	103	0.1	10
37	20	1	45	115	0.1	20
38	22	1	46	110	0.1	<10
39	9	1	20	53	0.1	<10
40	7	1	5	35	0.1	<10
41	[illegible]	1	10	16	0.1	20
42	7	1	5	[illegible]	0.1	<10
43	12	1	8	36	0.1	10
44	11	1	8	40	0.1	10
45	24	1	10	70	0.1	<10

STREAM SEDIMENT SAMPLE

metres 0 50 100 200 300 500 m.

1 cm. = 100 m.

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TAHTSA REACH PROJECT

TAHTSA REACH B.C. OMINECA MINING DIVISION N.T.S. 93 E / 11

GEOLOGY

1:10,000

PART 2 of 2

SHOWING BOUNDARIES OF SWING, SAM, DEUCE, LONG & SHORT MINERAL CLAIM GROUPS

TO ACCOMPANY REPORT BY

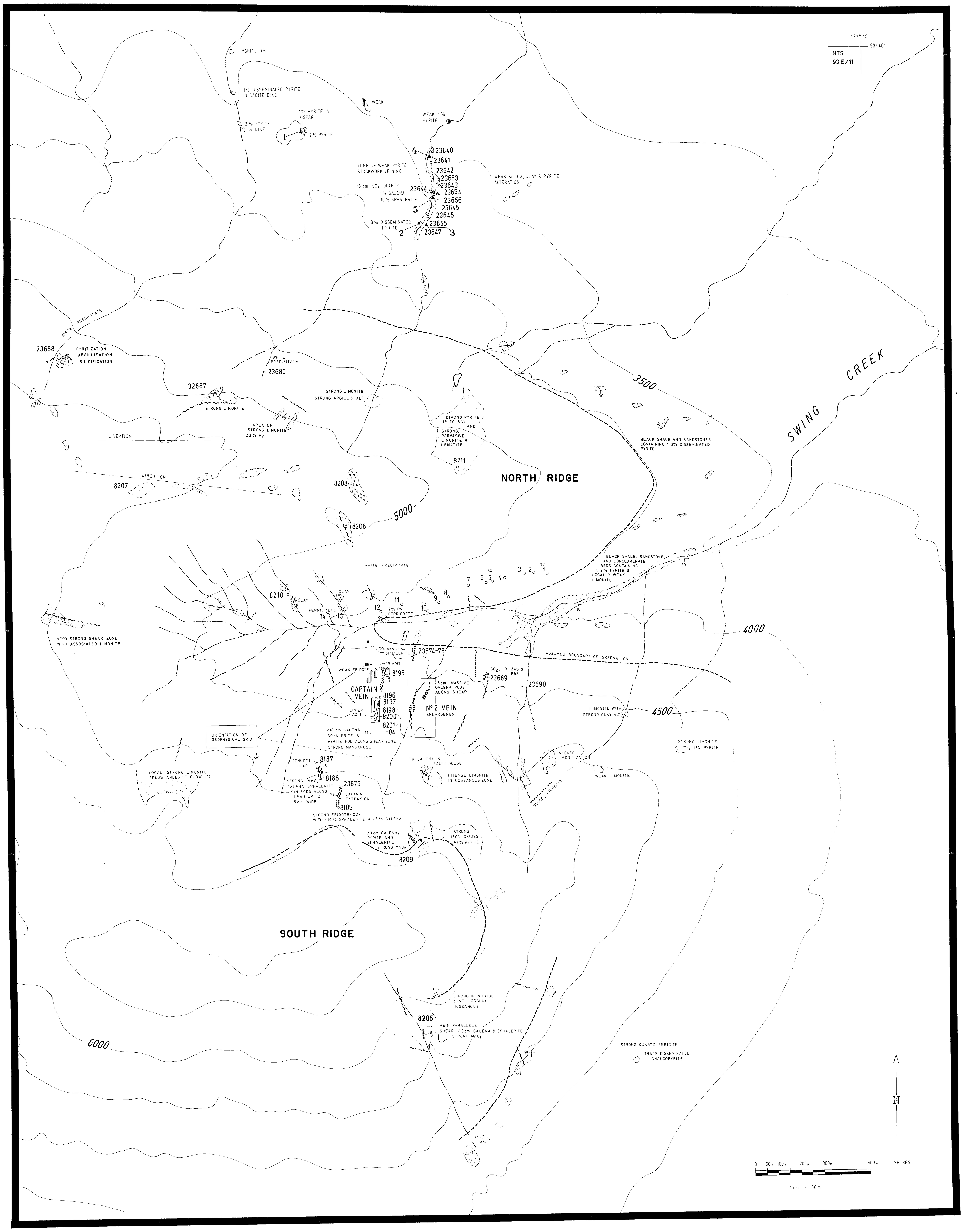
P. KALLOCK

B. GOLDSMITH P. Eng.

REGISTERED PROFESSIONAL ENGINEER

10,261

ARCTEX ENGINEERING SERVICES NOVEMBER 1981



SAMPLE NUMBER	Cu %	Mo %	Pb %	Zn %	Ag oz/ton	Au oz./ton
23640	<0.01	<0.001	<0.01	0.03	0 40	<0.003
23641	<0 01	<0.001	<0 01	0 05	0.38	<0 003
23642	<0.01	<0 001	<0.01	0.01	0.40	<0 003
23643	0.01	<0.001	<0 01	0 01	0 01	<0.003
23644	<0 01	<0 001	<0.01	0.01	0 01	<0 003
23645	<0.01	<0.001	<0.01	0.01	0 01	<0.003
23646	<0 01	<0.001	<0.01	0.01	0.01	<0.003
23647	<0.01	<0 001	<0.01	0.01	0.01	<0.003
23653	0.01	<0.001	0.02	0.03	0.04	<0 003
23654	0.01	<0.001	0.89	4.52	0 38	<0 003
23655	<0 01	<0.001	0 02	0 05	0.01	<0.003
23656	<0.01	<0 001	0.01	0 01	0 01	<0 003
8185 .07m	0 08	---	1.75	1.24	2.82	0.006
8186 GRAB	0.44	---	61.10	0.33	103 60	0.026
8187 1 8 m.	0.01	---	1.72	0.40	2.66	<0.003

SAMPLE NUMBER	Cu %	Mo %	Pb %	Zn %	Ag oz/ton	Au oz./ton
8195 5 4	<0.01	--	0.01	0.03	0.01	<0 003
8196 1.8	<0 01	--	0 12	0.41	0 20	0.006
8197 1.2	<0 01	--	0 07	0.33	0 01	<0.003
8198 1 7	<0.01	--	0.23	0 67	0 14	<0 003
8199 0 6	<0 01	--	0 02	0 04	0 01	<0.003
8200 0 6	<0 01	--	0.05	0.10	0.01	<0.003
8201 0 6	0.04	--	9.96	1 22	9 80	<0.003
8202 1 3	<0.01	--	0.20	0.20	0 20	<0.003
8203 1 4	<0 01	--	0 04	0 08	0 01	<0 003
8204 1.2	<0 01	--	0 04	0 06	0 01	<0.003
8205 0 5	0 01	--	2 10	0 85	2 16	0 005
8206 1 8	<0 01	--	0 05	0.02	0 04	<0.003
8207 7 6	<0 01	--	0.01	<0.01	0.02	<0 003
8208 6.0	<0.01	--	0.01	<0.01	0.02	<0.003
8209 0 6	0.02	--	1.51	2 12	1.74	0 066
8210 1 5	<0 01	--	0 02	0 02	0 01	<0.003
8211 1 5	<0 01	--	0.01	0 01	0.02	<0.003

WIDTH IN METRES

ASSAY RESULTS and GEOCHEMISTRY

SAMPLE NUMBER	Cu ppm	Mo ppm	Pb ppm	Zn ppm	Ag ppm	Au ppb
23640	107	1	50	340	--	--
23641	55	1	108	455	--	--
23642	24	1	15	147	--	--
23643	134	1	26	145	--	--
23644	40	1	21	100	--	--
23645	39	1	15	90	--	--
23646	35	1	28	120	--	--
23647	34	1	19	95	--	--
SC -01	23	1	10	90	0 2	<10
-02	39	1	7	96	0 2	10
-03	14	2	7	113	0.1	10
-04	24	1	6	258	0 2	10
-05	21	1	13	90	0 2	20
-06	22	1	8	118	0.1	10
SC -07	32	1	13	182	0.1	20
-08	26	1	5	97	0 1	10
-09	26	1	9	88	0 1	<10
-10	18	1	7	94	0 1	<10
-11	25	1	7	115	0 1	20
-12	39	1	16	310	0 1	<10
-13	16	1	8	74	0.1	<10
-14	18	1	10	62	0.1	<10
23674	42	-	200	1950	1.3	<10
23675	50	--	535	2200	3.0	<10
23676	42	--	100	810	1.0	<10
23677	57	--	300	360	1.7	<10
23678	20	--	21	65	0.1	<10
23679	--	--	--	>10000	--	--
23680	27	--	1300	735	6.5	10
23687	5	--	45	16	1 5	<10
23688	32	--	10	70	0.4	<10
23689	23	--	28	80	0.1	<10
23690	66		9	141	0.9	<10

10,261
PART
2 of 2

KEY

- SC 5 ○ STREAM SEDIMENT SAMPLE LOCATION
- 8195 ▫ ROCK SAMPLE LOCATION
- ▲ 5 PETROGRAPHIC SAMPLE LOCATION
- 75 SHEAR ZONE with attitude
- SULPHIDE MINERALIZATION
- BOUNDARY OF ALTERATION
- POSSIBLE CONTINUOUS GEOLOGIC CONTACT
- 75 VEIN ATTITUDE & ORIENTATION
- 28 BEDDING ATTITUDE & ORIENTATION
- STREAMS, CREEKS
- ADIT
- DUMP
- OUTLINE OF AREA SHOWN IN SEPARATE SKETCH
- SILICIFICATION
- PROPYLITIC ALTERATION (EPIDOTE and/or CHLORITE and/or CARBONATE)
- ARGILLIC ALTERATION OR CLAY CONCENTRATION
- DISSEMINATED PYRITE OR LIMONITE AFTER PYRITE
- WEAKLY PYRITIZED SHALE SANDSTONE OR CONGLOMERATE

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TAHTSA REACH PROJECT

TAHTSA REACH B.C. OMINECA MINING DIVISION BASE MAP ENLARGED FROM 93E/11

1:5000 MAP SHOWING

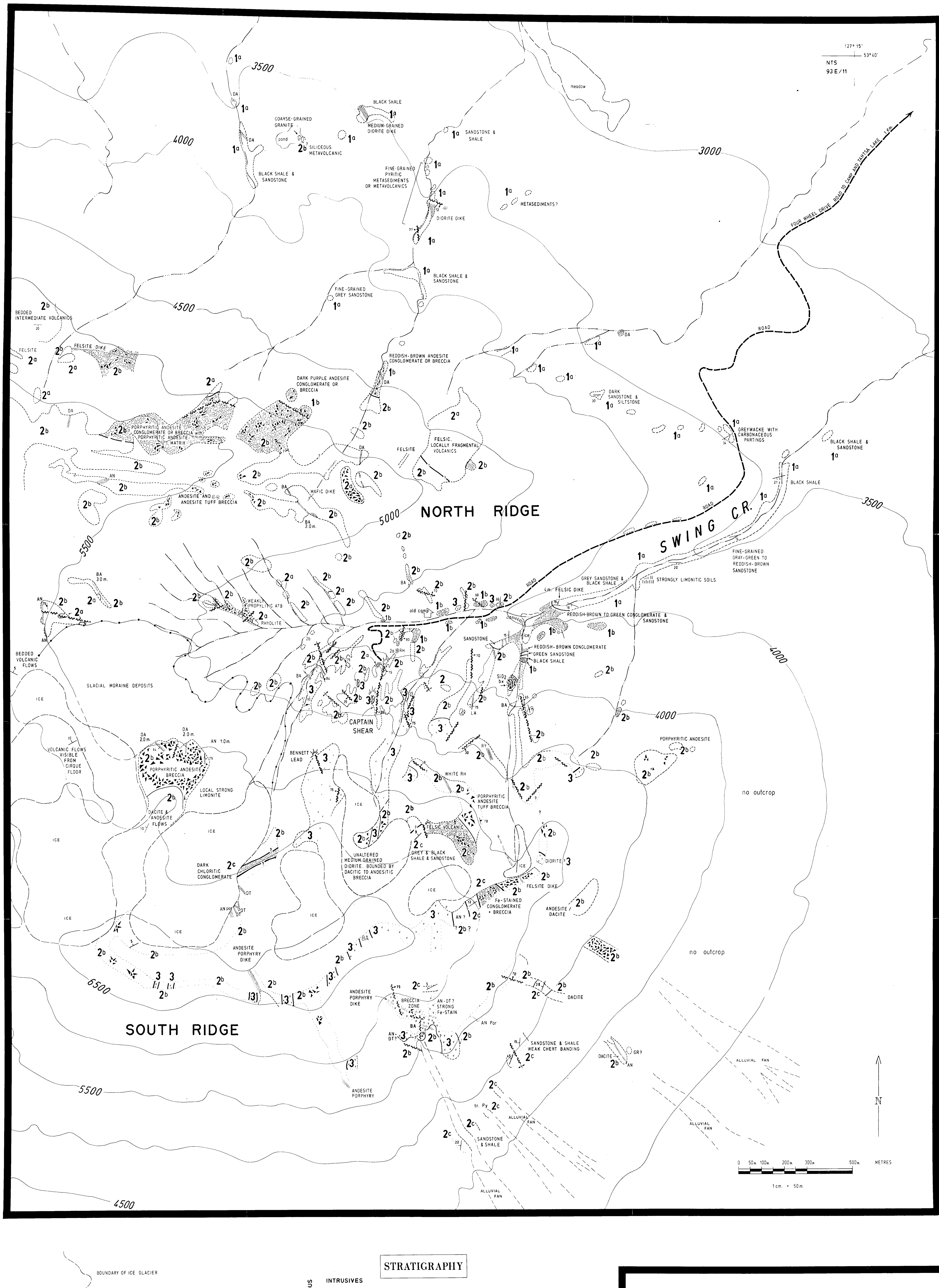
ALTERATION AND MINERALIZATION

SAMPLE LOCATIONS, GEOCHEMISTRY AND ASSAY RESULTS.

TO ACCOMPANY REPORT BY

P. KALLOCK, Geologist
L. B. GOLDSMITH, P. Eng. Consulting geologist
ARCTEX ENGINEERING SERVICES

NOVEMBER 1981
AMENDED MARCH 1982



BOUNDARY OF ICE GLACIER

STREAM DRAINAGE

ROAD

ROCK CONTACT, defined
questionable
probable

SHEAR ZONE with attitude

OUTCROP BOUNDARY
observed
boundaries of [outcrop] areas observed on traverses.

PROMINENT JOINT TREND & ATTITUDE

BEDDING TREND & ATTITUDE OF VOLCANIC & SEDIMENTARY BEDS

ADIT

BRECCIA

CONGLOMERATE

KEY

END MORAINE

DUMP

STRATIGRAPHY

LATE CRETACEOUS

INTRUSIVES

GRANITE DIORITE

DIKES

BA basalt AN andesite DA dacite
RY rhyolite DT diorite GR granite

shown: FELSITE

3 — ANDESITE-DIORITE : NEAR SURFACE INTRUSIVE (?). LOCALLY DACITIC IN COMPOSITION. GENERALLY PORPHYRITIC. ANDESITE, DACITE FLOWS AND BRECCIAS, MINOR BASALT.

UPPER CRETACEOUS

KASALKA GROUP

2 (c) — CHERTY, DARK, HORNFELSIC SHALES, SANDSTONE AND CONGLOMERATE

2 (b) — ANDESITE OR DACITE BRECCIA, TUFF, AND/OR FLOW. ON NORTH RIDGE A PORPHYRITIC VOLCANIC CONGLOMERATE OR BRECCIA

2 (a) — RHYOLITE ; WHITE TO CREAM, STRONGLY SILICEOUS, LOCALLY PORPHYRITIC, OFTEN SPATIALLY ASSOCIATED WITH INTENSE CLAY ALTERATION AND FERRICRETE.

BASAL KASALKA (?) OR SKEENA GROUP (?)

1 (b) — REDDISH-BROWN TO DARK BROWN, BOULDER TO PEBBLE CONGLOMERATE NEAR BASE OF VOLCANICS.

MIDDLE CRETACEOUS

SKEENA GROUP

1 (a) — SANDSTONE SHALE, DARK FINE GRAINED, LOCALLY CARBONIFEROUS, FOSSILIFEROUS. MAY CONTAIN METAVOLCANICS IN NORTH ZONE.

10,261
PART
2 of 2

TAHTSA MINES LTD.

TAHTSA REACH PROJECT

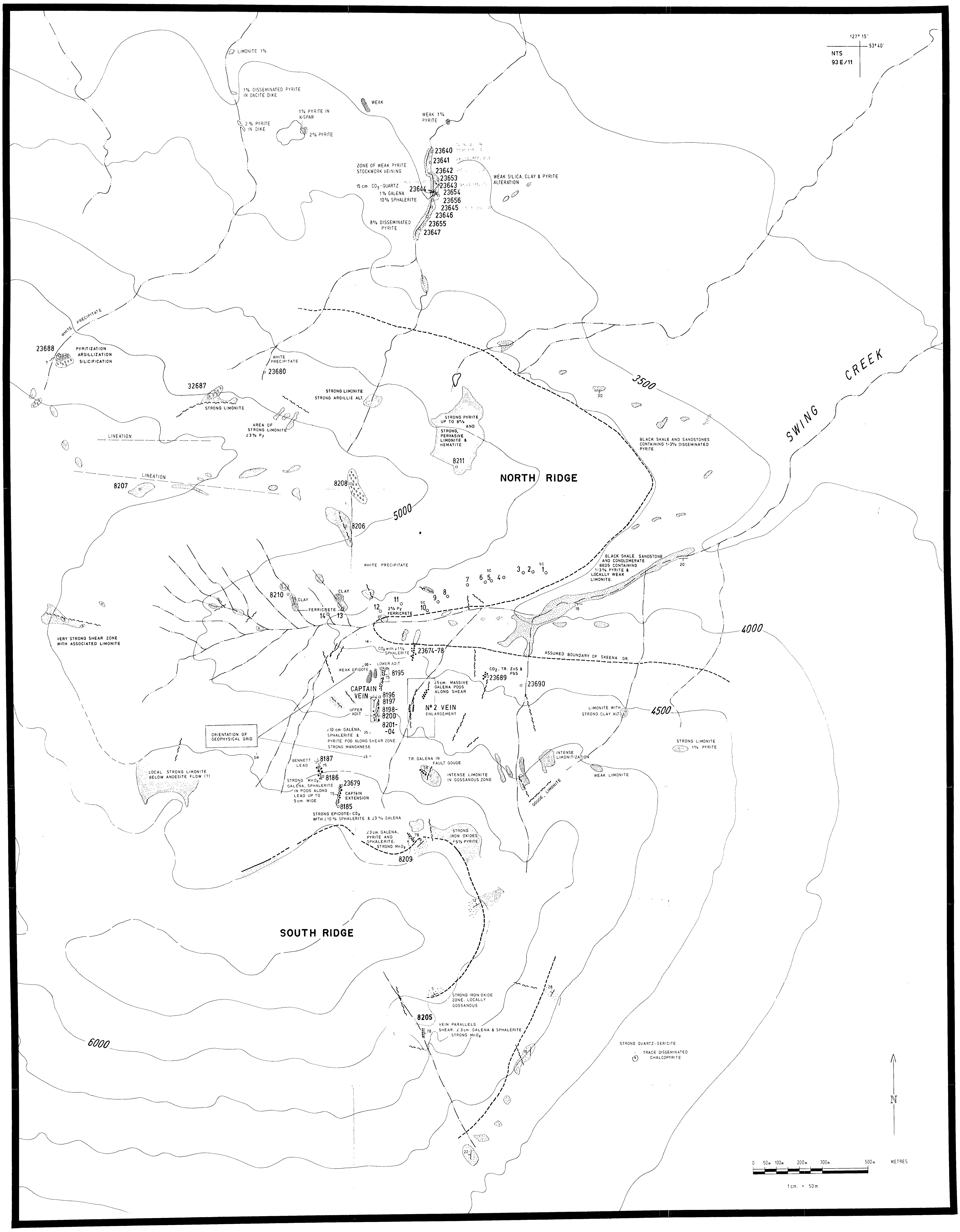
TAHTSA REACH B.C. OMINECA MINING DIVISION 93E / 11

GEOLOGY 1: 5000

TO ACCOMPANY REPORT BY

P. KALLOCK Geologist
L. B. GOLDSMITH, P. Eng.
Consulting geologist

ARCTEX ENGINEERING SERVICES NOVEMBER 1981



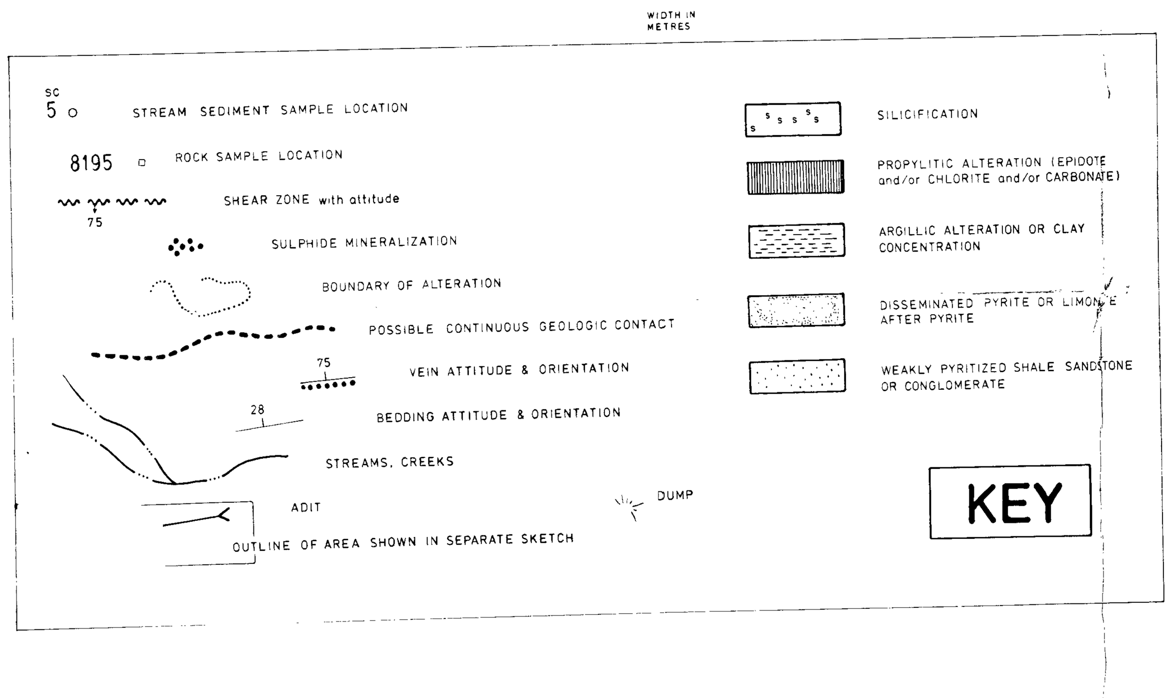
10,261
PART
2 of 2

SAMPLE NUMBER		Cu %	Mo %	Pb %	Zn %	Ag oz/ton	Au oz./ton
23640		<0.01	<0.001	<0.01	0.03	0.40	<0.003
23641		<0.01	<0.001	<0.01	0.05	0.38	<0.003
23642		<0.01	<0.001	<0.01	0.01	0.40	<0.003
23643		0.01	<0.001	<0.01	0.01	0.01	<0.003
23644		<0.01	<0.001	<0.01	0.01	0.01	<0.003
23645		<0.01	<0.001	<0.01	0.01	0.01	<0.003
23646		<0.01	<0.001	<0.01	0.01	0.01	<0.003
23647		<0.01	<0.001	<0.01	0.01	0.01	<0.003
23653		0.01	<0.001	0.02	0.03	0.04	<0.003
23654		0.01	<0.001	0.89	4.52	0.38	<0.003
23655		<0.01	<0.001	0.02	0.05	0.01	<0.003
23656		<0.01	<0.001	0.01	0.01	0.01	<0.003
8185	07m.	0.08	---	1.75	1.24	2.82	0.006
8186	GRAB	0.44	---	61.10	0.33	103.60	0.026
8187	1.8 m.	0.01	---	1.72	0.40	2.66	<0.003

SAMPLE NUMBER	WIDTH IN METRES	Cu %	Mo %	Pb %	Zn %	Ag oz./ton	Au oz./ton
8195	5.4	<0.01	--	0.01	0.03	0.01	<0.003
8196	1.8	<0.01	--	0.12	0.41	0.20	0.005
8197	1.2	<0.01	--	0.07	0.33	0.01	<0.003
8198	1.7	<0.01	--	0.23	0.67	0.14	<0.003
8199	0.6	<0.01	--	0.02	0.04	0.01	<0.003
8200	0.6	<0.01	--	0.05	0.10	0.01	<0.003
8201	0.6	0.04	--	9.96	1.22	9.80	<0.003
8202	1.3	<0.01	--	0.20	0.20	0.20	<0.003
8203	1.4	<0.01	--	0.04	0.08	0.01	<0.003
8204	1.2	<0.01	--	0.04	0.06	0.01	<0.003
8205	0.5	0.01	--	2.10	0.85	2.16	0.005
8206	1.8	<0.01	--	0.05	0.02	0.04	<0.003
8207	7.6	<0.01	--	0.01	<0.01	0.02	<0.003
8208	6.0	<0.01	--	0.01	<0.01	0.02	<0.003
8209	0.6	0.02	--	1.51	2.12	1.74	0.056
8210	1.5	<0.01	--	0.02	0.02	0.01	<0.003
8211	1.5	<0.01	--	0.01	0.01	0.02	<0.003

ASSAY RESULTS and GEOCHEMISTRY

SAMPLE NUMBER	Cu ppm	Mo ppm	Pb ppm	Zn ppm	Ag ppm	Au ppb
23640	107	1	50	340	--	--
23641	55	1	108	455	--	--
23642	24	1	15	147	--	--
23643	134	1	26	145	--	--
23644	40	1	21	100	--	--
23645	39	1	15	90	--	--
23646	35	1	28	120	--	--
23647	34	1	19	95	--	--
SC -01	23	1	10	90	0.2	<10
-02	39	1	7	96	0.2	10
-03	14	2	7	113	0.1	10
-04	24	1	6	258	0.2	10
-05	21	1	13	90	0.2	20
-06	22	1	8	118	0.1	10
SC -07	32	1	13	182	0.1	20
-08	26	1	5	97	0.1	10
-09	26	1	9	88	0.1	<10
-10	18	1	7	94	0.1	<10
-11	25	1	7	115	0.1	20
-12	39	1	16	310	0.1	<10
-13	16	1	8	74	0.1	<10
-14	18	1	10	62	0.1	<10
23674	42	-	200	1950	1.3	<10
23675	50	--	535	2200	3.0	<10
23676	42	--	100	810	1.0	<10
23677	57	--	300	360	1.7	<10
23678	20	--	21	65	0.1	<10
23679	--	--	--	>10000	--	--
23680	27	--	1300	735	6.5	10
23687	5	--	45	16	1.5	<10
23688	32	--	10	70	0.4	<10
23689	23	--	28	80	0.1	<10
23690	66		9	141	0.9	<10



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TAHTSA REACH PROJECT

TAHTSA REACH B.C. OMINECA MINING DIVISION BASE MAP ENLARGED FROM 93E/11

1:5000 MAP SHOWING

ALTERATION AND MINERALIZATION

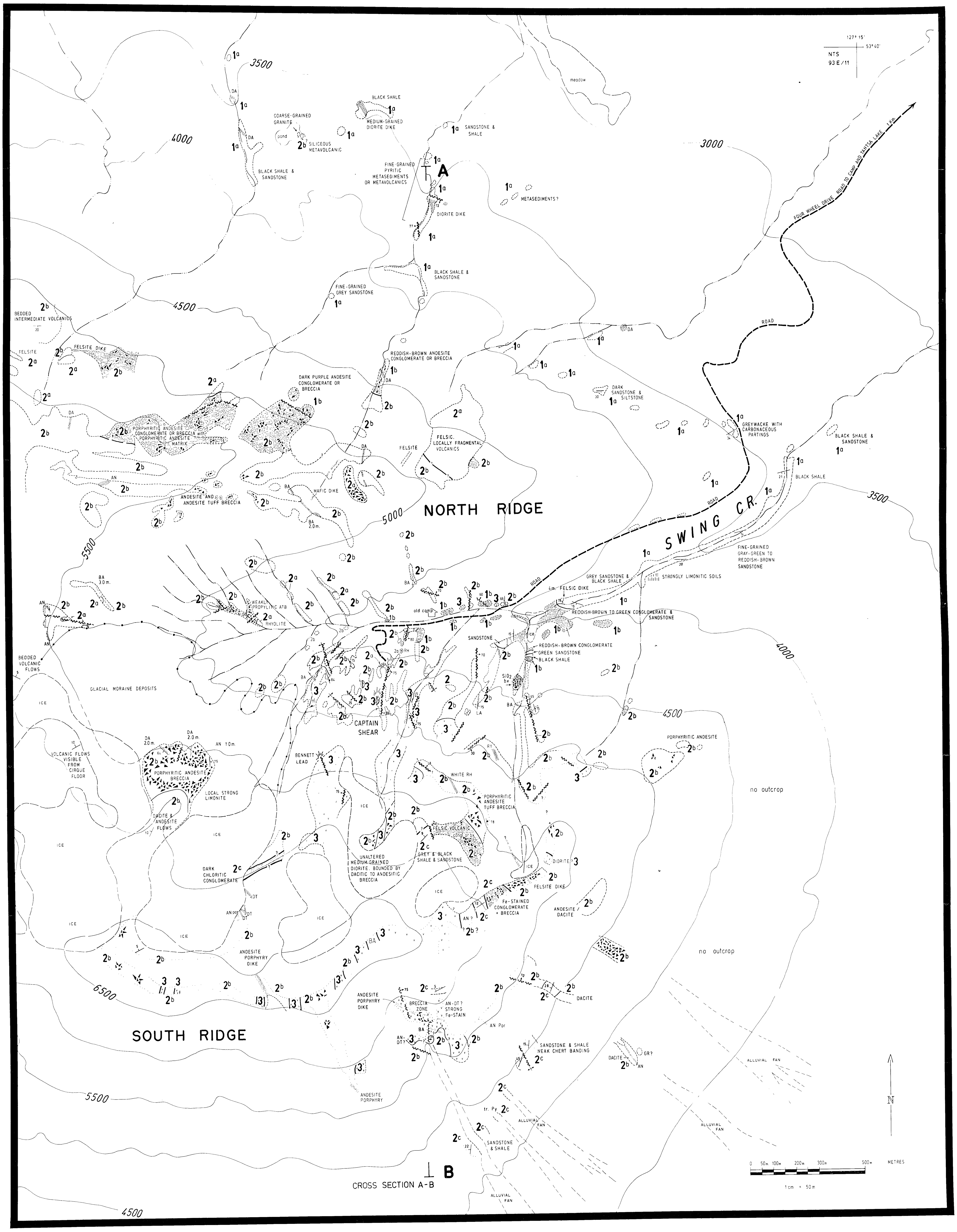
SAMPLE LOCATIONS, GEOCHEMISTRY AND ASSAY RESULTS.

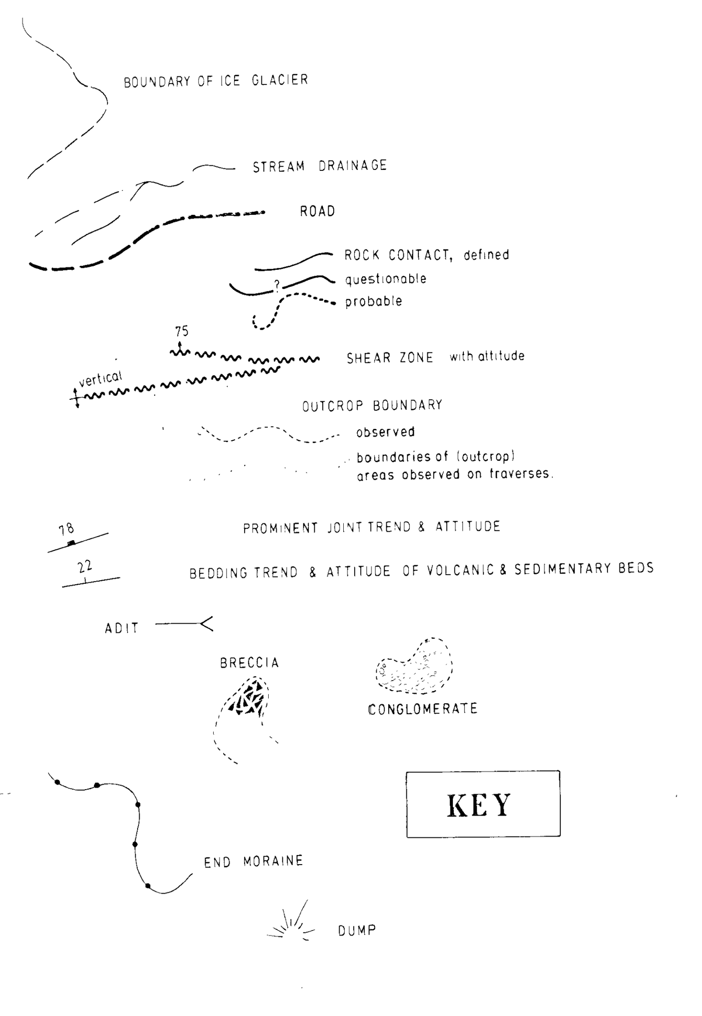
TO ACCOMPANY REPORT BY

P. KALLOCK, Geologist
L. B. GOLDSMITH, P. Eng. Consulting geologist
ARCTEX ENGINEERING SERVICES

NOVEMBER 1981

REGISTERED PROFESSIONAL ENGINEER L. B. GOLDSMITH PROVINCE OF ONTARIO





STRATIGRAPHY

LATE CRETACEOUS

INTRUSIVES

GRANITE DIORITE

DIKES

BA basalt, AN andesite, DA dacite, RY rhyolite, DT diorite, GR granite

shown: FELSITE

3	ANDESITE-DIORITE: NEAR SURFACE INTRUSIVE (?). LOCALLY DACITIC IN COMPOSITION. GENERALLY PORPHYRITIC.

ANDESITE, DACITE FLOWS AND BRECCIAS, MINOR BASALT.

UPPER CRETACEOUS

KASALKA GROUP

2 (c)	CHERTY, DARK, HORNFELSIC SHALES, SANDSTONE AND CONGLOMERATE
2 (b)	ANDESITE OR DACITE BRECCIA, TUFF, AND/OR FLOW, ON NORTH RIDGE A PORPHYRITIC VOLCANIC CONGLOMERATE OR BRECCIA
2 (a)	RHYOLITE; WHITE TO CREAM, STRONGLY SILICEOUS, LOCALLY PORPHYRITIC, OFTEN SPATIALLY ASSOCIATED WITH INTENSE CLAY ALTERATION AND FERRICRETE.

BASAL KASALKA (?) OR SKEENA GROUP (?)

1 (b)	REDDISH-BROWN TO DARK BROWN, BOULDER TO PEBBLE CONGLOMERATE NEAR BASE OF VOLCANICS.

MIDDLE CRETACEOUS

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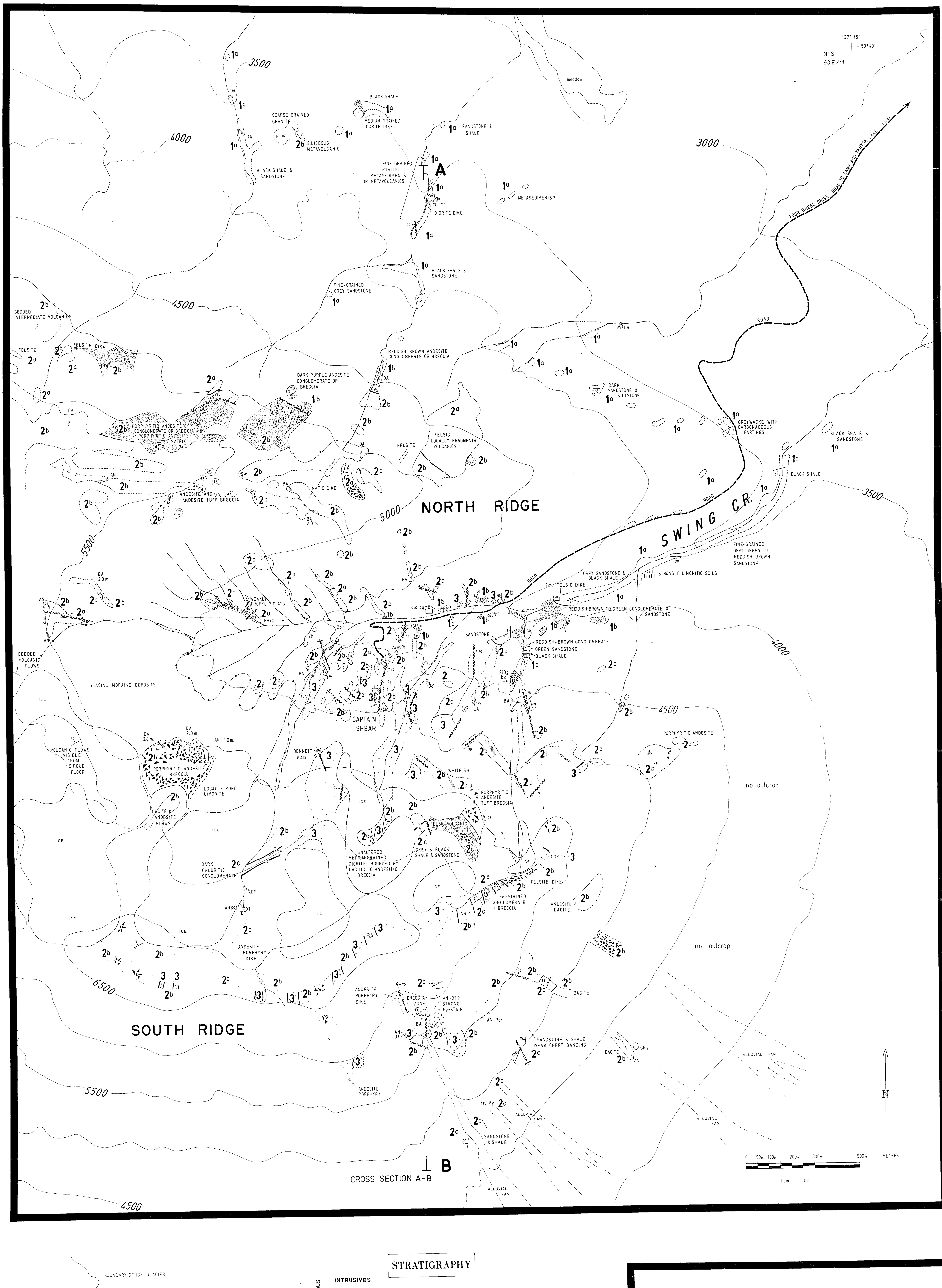

KEY

BOUNDARY OF ICE GLACIER

STREAM DRAINAGE

ROAD

ROCK CONTACT, defined
questionable
probable

SHEAR ZONE with attitude (75; vertical)

OUTCROP BOUNDARY
observed
boundaries of (outcrop) areas observed on traverses.

PROMINENT JOINT TREND & ATTITUDE (78)

BEDDING TREND & ATTITUDE OF VOLCANIC & SEDIMENTARY BEDS (22)

ADIT

BRECCIA

CONGLOMERATE

END MORAINE

DUMP

STRATIGRAPHY

LATE CRETACEOUS — UPPER CRETACEOUS — MIDDLE CRETACEOUS

INTRUSIVES

GRANITE DIORITE

DIKES

BA basalt | AN andesite | DA dacite | shown: FELSITE
RY rhyolite | DT diorite | GR granite

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