GEOLOGICAL REPORT
ON
THE LOGAN CLAIM GROUP
NORRISH CREEK, NEW WESTMINSTER M.D., B.C.

Lat. 49° 15'
Long. 122° 02'
NTS. 92G/8E

for

SECRETARIAT RESOURCES INCORPORATED

by

STANLEY B. REAMSBOTTOM Ph. D., P. Eng.

KYLE CONSULTANTS
Jan. 1977
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- GEOLOGY MAP
- ALTERATION MAP
PART A

SUMMARY

The Logan Claim is situated 16 miles north of Dewdney near the headwaters of Norrish Creek in the New Westminster Mining Division of British Columbia.

Copper mineralization was discovered on the property in 1969 and limited trenching, geophysical and geochemical surveys have been carried out between 1969 and 1974. Inconclusive diamond drilling was done in 1971.

A sequence of volcanic flow and pyroclastic rocks correlated with the mid-Jurassic Harrison Lake formation were mapped in some detail and form the subject of this report.

Widespread sulphide and oxide mineralization, associated with quartz-vein stockworks, which cut intermediate to acidic flows and tuffs, is composed of pyrite, pyrrhotite, chalcopyrite, sphalerite, and native bismuth.

CONCLUSIONS

1) A faulted sequence of intermediate to rhyo-dacitic, calc-alkaline, volcanic flows and pyroclastics forms a roof pendant within granodiorite and quartz-diorite of the Southern Coast Crystalline Complex. The sequence is correlated with the mid-Jurassic Harrison Lake formation.
2) Mapped zones of alteration vary in intensity from weak epidote-albite-chlorite through chlorite-sericite, chlorite-sericite-pyrite, to strong quartz-sericite-pyrite-magnetite.

3) The sulphide mineralization is generally concentrated within quartz-vein stockworks in the more intensely altered rhyolitic rocks.

4) The rock-sequence is similar to the rhyo-dacitic host rocks of the polymetallic sulphide-sulphate Kuroko deposits of Japan. Defined mineralization is similar to that found in network-type Kuroko deposits.

5) The possibility exists that massive sulphide stratiform-type Kuroko deposits may exist on the property, though to date no massive-sulphide mineralization has been found.

6) Future exploration should be concentrated in horizons of rhyolitic crystal, lithic and welded tuffs and breccias which have associated geophysical and geochemical anomalies. The program should test whether a network-type deposit is economic and prove or disprove the presence of massive-stratiform Kuroko deposits.

RECOMMENDATIONS

A program of trenching, rotary-percussion and/or diamond drilling should be initiated. Cost estimate of this program is in the order of $35,500.

Respectfully submitted,

Stanley B. Reamsbottom Ph. D, P. Eng.
PART B

INTRODUCTION:

The following geological report, prepared at the request of Mr. M. Bertram, Secretariat Resources Incorporated, is the result of eight days field-mapping of volcanic and granitic rocks which underly the Logan Group, Norrish Creek, New Westminster Mining district, B.C. The mapping was undertaken to better understand the geological environment of several copper showings located on the property, and to facilitate decision-making for future exploration in light of our understanding of volcanogenic sulphide deposits of the Kuroko-type.

PROPERTY

The property consists of the twelve-unit Logan Claim which is recorded in the New Westminster Mining District, B.C.

<table>
<thead>
<tr>
<th>CLAIM NAME</th>
<th>RECORD NUMBER</th>
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<tr>
<td>LOGAN</td>
<td>132</td>
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OWNERSHIP

The claim is owned by Cleveland S. Lowry and is held under option by Secretariat Resources Incorporated of Vancouver, British Columbia.

LOCATION AND ACCESS (49'15', 122'02')

The claim is located at the headwaters of Norrish Creek, and is easily reached by travelling 16 miles on the Canadian Forest Products logging road which extends from Dewdney...
on Highway 17, in Southwestern British Columbia. (Fig A,B)

TOPOGRAPHY and CLIMATE

The claim covers an area of steep terrain with elevation varying between 2200 and 3600 feet. Part of the claim group has been logged but good stands of Douglas Fir still remain. Precipitation in the Southern Coast Mountains is heavy so that water supply from Norrish Creek for future exploration-drilling or development is plentiful.

HISTORY

High grade massive sulphide float was first discovered in 1920 on the Seneca Property of Zenith Mining Corporation Ltd. which is located 5 miles to the east in the valley of the Chehalis River. This property has been intermittently worked over the years and is at present under exploration by Cominco Ltd. In 1962 crude ore containing 17 ounces of gold, 959 ounces of silver, 7,118 pounds of copper and 40,657 pounds of zinc was shipped to the Britannia Concentrator. (B.C. Minister of Mines, Ann. Rept. 1962). Recognition that the Seneca deposit is similar to the stratabound, polymetallic (Cu, Pb, Zn, Ag, Au) sulphide-sulphate Kuroko deposits of Japan has proven to be a great stimulus to exploration in this part of the Southern Coast Mountains.

Copper was first discovered on the Logan Claim in 1969. In 1970 Harrison Copper Mines Ltd. staked adjoining mineral claims and acquired an option on mineral claims staked in 1969.
Subsequent exploration to 1971 reported on by Stevenson (1971) included airborne and ground magnetic surveys, VLF-electromagnetic survey, soil geochemistry and three diamond drill holes totalling 915 feet. Locations of these drill holes are unknown to the writer but DDE-2 intersected 0.53% Cu between 98 and 113.5 feet.

In 1974 Geotronics Surveys Ltd. carried out combined VLF-EM, magnetometer and soil geochemical surveys (Cu, Zn, Bi, Ag) and located coincident electromagnetic and copper-zinc geochemical anomalies. (MARK, 1974)

The property was restaked in its present form in July 1976.

GEOLOGY

General:

The volcanic rocks which underlie part of the Logan Claim were not recognised when the area was first mapped by the Geological Survey of Canada (Roddick, 1965). These rocks form a roof pendant within the "granitic" rocks of the southern Coast Crystalline Complex which was emplaced from early to mid-Late Cretaceous. No fossils have been found in the rocks but they are lithologically similar to intermediate to acidic flows and pyroclastics of the Middle Jurassic, Harrison Lake Formation which is the host rock of the Seneca deposit. This correlation was first made by Stevenson (1971).

Property:

The grid was extended to east and west and mapped at a
The property is heavily treed to the south and west and is covered by shallow overburden. Outcrops are afforded by logging road cuts, blast-pits, creek beds, and steep bluffs to the north. Outcrop distribution is shown in Map 1 and units were recognised by field identification and thin-section study of selected type-specimens.

A brief description of the volcanic and pyroclastic rock-units follows. A more detailed description is given in Appendix 1.

**Unit 1- ALTERED DACITE**

Pale to dark green, fine to medium grained, porphyritic volcanic. Phenocrysts (2-5mm) of tabular feldspar completely altered to sericite, rounded embayed quartz, and chlorite-epidote knots after tabular hornblende?, set in a microcrystalline groundmass of chlorite (after biotite?) quartz and sericite. Disseminated grains of pyrite and magnetite occur throughout. The unit is cut by a stockwork of thin (2-4mm) quartz veins which contain crystals of magnetite oxidized to hematite.

**Unit 2- INTERMEDIATE TUFF**

Green, fine-grained tuff composed of microcrystalline aggregate of quartz, pervasive pale-green chlorite (after biotite, amphibole?) with disseminated euhedral pyrite cubes (1-4mm) and lesser tiny grains of magnetite-hematite. Unit is cut by magnetite (hematite) bearing quartz veins. (0.5-2 cm thick)

**Unit 3- TRACHY-ANDESITE**

Rusty weathering, pale grey-green fine to medium grained
volcanic with phenocrysts of andesine (An\textsubscript{32}) irregular sericite pseudomorphs of Kspar? and accessory sphene, set in a trachytic-textured groundmass of andesine and quartz. Disseminated euhedral pyrite cubes.

Unit 4- **WATER-LAIN FELSIC TUFF.**

Sequence of graded-bedded, grey-green, crystal tuffs. Coarser fragments (2-5mm) of quartz and andesine (An\textsubscript{33-38}) grade upwards within each graded unit (1-2cm) to fine grained, thinly laminated cryptocrystalline quartz beds (ash?). Weak sericite chlorite alteration minerals.

Unit 5- **ANDESITIC TUFF-BRECCIA**

Dark green, volcanic breccia with angular fragments (1-3cm) of medium grained dacite, fine grained trachytic-textured andesite, and fine sugary textured rhyolite tuff which is cut by a stockwork of quartz veins. Rock is strongly pyritized and altered to chlorite and sericite.

Unit 6- **RHYOLITIC LITHIC AND CRYSTAL TUFF**

Sequence of altered, white to grey-green, fine to medium grained crystal and lithic tuffs. Tuffs contain angular fragments of shattered quartz (1-2mm); tabular sericitized feldspar (1-3mm); lithic fragments of cream rhyolitic crystal-tuff and grey cryptocrystalline rhyolite. The unit has been altered by influx of silica, pyrite and is peppered through with tiny magnetite crystals. A stockwork of late white quartz veins cuts the tuffs.
Unit 7- WELDED TUFF

Fine-grained, pale grey-green, mottled streaky chlorite quartz rock with undulous thin laminations.

Rock contains streaked-out shattered fragments of quartz (1-4mm) and cream shard-like objects altered to sericite, set in a cryptocrystalline groundmass of quartz, chlorite and sericite.

Unit 8- RHYOLITE

Rusty weathering, fine grained, white rhyolite. Rock is extremely fine grained and may be tuffaceous in part.

Unit 9- DACITE

Grey-green porphyritic volcanic with phenocrysts (3mm) of rounded embayed quartz and euhedral dusty-brown andesine (An$_{45}$) set in a microcrystalline, spherulitic groundmass of quartz and feldspar. Feldspars are saussuritized (altered to albite & epidote).

Unit 10- GRANODIORITE AND QUARTZ-DIORITE

Medium grained, grey to pinkish granodiorite and quartz-diorite. Mafic content 25 per cent with hornblende equal to biotite. Pinkish orthoclase in granodiorite. Note the portion of the granitoid rock mapped has a more basic selvedge of quartz diorite, with granodiorite confined to the "Core". This is a common phenomenon in Coast Crystalline granitoid rocks.

Alteration

Alteration mineral-facies noted in the rocks are described in Appendix 1.

An attempt has been made to map alteration "zones" and is
presented in the Alteration Map (in pocket). The zones have been defined by alteration of phenocryst and groundmass minerals in the volcanic rocks.

Sericite commonly completely replaces plagioclase feldspar and occurs as disseminations in rock groundmass. Chlorite replaces mafic phenocrysts and pervasively replaces groundmass mafics (biotite, hornblende?) in volcanic and tuffaceous rocks.

Pyrite is treated as an alteration mineral and also quartz, where groundmass has been extensively silicified. The quartz vein stockworks are probably related to hydrothermal alteration activity.

Magnetite is disseminated throughout the groundmass of intensely altered rhyolitic tuffs (Unit 6; 2E, 2-6S).

Weaker alteration is mainly saussuritization of feldspars in dacites of Unit 9.

Facies listed in order of increasing hydrothermal alteration are a) Epidote-albite-chlorite b) Chlorite-Sericite c) Chlorite-sericite-pyrite (quartz stockwork) and d) Quartz-sericite-pyrite-magnetite. (Alteration map)

Intensity of sulphide mineralization to date, generally is highest in zones of maximum alteration and quartz-vein stockwork.

Structure:

Bedding is rare in the units mapped and is found only in graded-bedded felsic tuffs. (Unit 4).
Bedding planes strike easterly and dip to the South between 20 and 35 degrees.

Northerly-trending faults mapped are inferred from lack of on-strike continuity of rock-units; they are therefore highly interpretive. East-west trending faults are well exposed on the road section (8E-6N). These are close to bedding-plane faults and throw on these is probably limited. Abundant mini-fracture systems are common in mineralized, stockwork zones for example L2E-4S.

Mineralization:

Mineralization on the property is found in zones on intensely altered volcanics and pyroclastics which have been net veined by quartz stockworks. Sulphides and oxides are either disseminated through the host rock groundmass or concentrated in the veins. Mineralization consists of pyrite, pyrrhotite, chalcopyrite, sphalerite, native bismuth, magnetite and hematite. Assayed specimens vary in grade from 0.24 to 3.1% Cu, (Touah 1975) and 0.09 to 3.3 % Cu; 1.39% Zn, 0.03% Bi and minor gold (MARK, 1974). One drill hole of unknown location intersected 15.5 feet of 0.53% Cu between 98 and 113.5 feet (Stevenson, 1971).

DISCUSSION:

The sequence of volcanic and pyroclastic rocks mapped is lithologically similar to the rhyo-dacitic volcanic rocks which host the mid-Miocene Kuroko-type deposits of Japan. (Fig. C) The stockwork system with pyrite-chalcopyrite-quartz mineralization is analogous
Fig. C  Schematic cross section of a typical Kuroko deposit.
to Kuroko-type network deposits. The possibility therefore exists that there may be associated stratiform ore, of the type shown in Fig C., on the flanks of the stockwork system.

This study and previous studies (MARK 1974) show coincident intense alteration, copper-bismuth geochemical anomaly and magnetic anomaly associated with the stockwork system centred on L2E 4S. This area is a prime exploration target. On strike down hill from this, within rhyolitic rocks of Units 7 and 8, coincident VLF-EM and zinc geochemical anomalies occur on L8E-5S. These anomalies conceivably could be the surficial manifestation of buried stratiform Kuroko-type mineralization (Fig C) and are therefore worthy of testing.

EXPLORATION:

A program of trenching, rotary-percussion and diamond drilling within the Cu-Zn anomalous zone which runs south of the baseline between L 0-L10E and 2-8S should be initiated. Emphasis should be given on proving whether the stockwork system centred on L2E-4S is economic, and whether the zinc and electromagnetic anomalies on L10E-5S are associated with Kuroko-type stratiform deposits.
ESTIMATE OF COST OF EXPLORATION PROGRAM

TRENCHING

DRILLING

ROTARY PERCUSSION, 1000 ft. at $3.00/ft.  $3,000.00
DIAMOND  1500 ft. at $15.00/ft.  $22,500.00

SUPERVISION  $4,000.00

CONTINGENCIES  $4,000.00

Total  $35,500.00

The program should be completed in one to two months.

Respectfully submitted,

Stanley B. Reamsbottom  Ph. D., P. Eng.

KYLE CONSULTANTS
References:


CERTIFICATE

I, STANLEY B. REAMSBOTTOM, of Coquitlam in the Province of British Columbia, do hereby certify:

That I am a Consulting Geologist with offices located at #530-701 W. Georgia Street, Vancouver, British Columbia.

I further certify that

1) I am a graduate of the University of Aberdeen, Scotland (1968) and hold a B. Sc. (1st Class Honours) in Geology.

2) I am a graduate of the University of British Columbia and hold M. Sc. (1971) and Ph. D. (1974) degrees in Geology.

3) I am registered with the Association of Professional Engineers of British Columbia.

4) I have been practising my profession for the past 8 years.

5) The information in this report was obtained from private reports and pertinent government publications; from 8 days field mapping on the property, by myself between Nov. 18 and Dec. 20, 1976; and from my personal knowledge and experience in the area.

6) I have no direct or indirect interest whatsoever in the property described herein, nor in the Securities of Secretariat Resources Incorporated and do not expect to receive any interest therein.

Dated at Vancouver, British Columbia this 7th day of January 1977.

STANLEY B. REAMSBOTTOM Ph. D., P. Eng.
Consulting Geologist
Appendix: 1

Microscopic description of selected specimens

a) 2W 2N: Intermediate green tuff.

Macro: Fine grained, green tuff cut by stockwork of magnetite-bearing quartz veins. (0.5 - 2 cm. thick). Euhedral to anhedral fine grained pyrite; chalcopyrite disseminated throughout tuff. Hematite after magnetite.

Micro: Fine grained, sugary-textured, microcrystalline aggregate of quartz, pale-green chlorite (after biotite?) euhedral cubes of pyrite (1-4 mm) tiny grains of magnetite and hematite and local intergrowths of muscovite with chlorite.

Alteration: Extreme chloritization; quartz; pyrite and possibly magnetite.

b) 2W 5N: Altered green dacite?

Macro: Dark-green porphyritic volcanic rock with phenocrysts of round quartz and euhedral feldspar set in fine-grained green matrix.

Micro: Phenocrysts (2-5 mm) of rounded, embayed quartz, and euhedral, completely sericitized feldspar set in a microcrystalline, sugary textured ground mass of quartz and chlorite (after biotite?). Note chlorite, epidote aggregates after tabular amphibole? Quartz veins (1 - 2 mm). Subhedral pyrite blebs (2-3%), minor magnetite locally altered to hematite.

Alteration: chlorite; sericite; epidote

c) 2E 7N: Altered green dacite?

Macro: Porphyritic, green, fine-grained volcanic. Tabular feldspar phenocrysts (2 mm) set in green chlorite-rich matrix. Thin (2-3 mm) quartz veins with blebs of magnetite altered to hematite.

Micro: Euhedral feldspar phenocrysts completely altered to sericite with minor associated chlorite, and chlorite epidote aggregates after hornblende, set in a microcrystalline groundmass of quartz, chlorite (after biotite?) and sericite. Disseminated magnetite and pyrite blebs. Note tiny rhombs of sphene.
Alteration: Chlorite, sercite, quartz, pyrite, epidote.

d) 2E 3S - 1 Silicified, Lithic to crystal, rhyolitic tuff-breccia.

Macro: Angular pale fragments (1 cm) of fine-grained rhyolite; white fine to medium grained tuff; quartz and feldspar crystals set in fine-grained quartz pyritized matrix. Rock cut by white veins of quartz (0.5-1 cm). Local pyrite cubes with oxide tarnish. Quartz crystals (1-3 mm) in vuggy cavities.

Micro: Angular Fragments

a) Recrystallized quartz aggregate

b) Crystal tuff: Fragments of shattered quartz, and sericite pseudomorphs after feldspar in fine-grained quartzitic matrix

c) Sericitized feldspar crystals.

set in microcrystalline groundmass of quartz, sericite and pyrite disseminations.

Note quartz in late veins exhibits undulous extinctions.

Alteration: quartz, sercite, magnetite, pyrite.

e) 2E 3S - 2: Rhyolitic crystal tuff.

Macro: Rusty weathering, creamy-white fine-grained crystal tuff with disseminated black magnetite. Pyrite in thin fractures.

Micro: Angular fragments (1-2 mm) of shattered quartz; tabular feldspar altered to sericite (1-3 mm) and disseminated octahedra of magnetite (<1 mm) altered to hematite, set in a cryptocrystalline groundmass of quartz (recrystallized ash?) and sericite needles.

Alteration: quartz, sercite, magnetite, pyrite.

f) 2E 3S - 3: Grey-green, fine-grained, rhyolitic, lithic to crystal tuff.

Macro: Grey-green fine-grained tuff with disseminated magnetite and pyrite.

Micro: Angular fragments (1-2 mm) of shattered quartz; euhedral tabular feldspar altered to sericite; cryptocrystalline rhyolite and fine-grained disseminations of magnetite and lesser pyrite set in a cryptocrystalline groundmass of quartz and chlorite. Note minor accessory sphene.
Alteration: sericite, chlorite, magnetite, pyrite, quartz

g) 2E 6S: Green spotted lithic to crystal, rhyolitic tuff.

Macro: Fragments (1-4 mm) of white quartz, feldspar, grey rhyolite set in a fine-grained green groundmass. Pyrite (1%) disseminated throughout.

Micro: Fragments (1-4 mm) of angular to rounded shattered quartz; cryptocrystalline rhyolite; sericitized feldspar, and shard-like fragments altered to chlorite and sericite, set in a cryptocrystalline groundmass of quartz and chlorite. Note wispy veins of sericite surrounding crystal fragments.

Alteration: chlorite, sericite

h) 6E 6N: Trachy-andesite

Macro: Rusty weathering, pale grey-green, fine to medium grained, volcanic with phenocrysts of pale plagioclase and clots of pyrite and epidote set in a fine-grained greyish matrix.


Alteration: Weak sericite, epidote, pyrite.

i) 8E 4-5S Rhyolitic welded tuff.

Macro: Pale grey-green, mottled streaky chlorite quartz tuff with undulous layering.

Micro: Fragments (1-4 mm) of shattered quartz, streaked out shard like, sericite pseudomorphs after feldspar and knots of green chlorite and quartz, set in a sugary, cryptocrystalline groundmass of quartz, green chlorite, streaky sericite and sphene. Note vague undulous compositional banding or bedding.

Alteration: chlorite, sericite

j) RS 1: Felsic, waterlain? crystal tuff.

Macro: Grey, fine-grained, thinly laminated, graded bedded, water-lain tuff. Four cycles of coarse to fine fragments each 1 to 1.5 cm. thick.

Micro: Coarse (2-4 mm) fragments of quartz and andesine (An33) grade upwards to fine, almost cryptocrystalline fractions of quartz, feldspar, chlorite, sericite, and euhedral epidote.
Alteration: Weak; chlorite, sericite

k) RS 2: Grey green, waterlain, crystal tuff.

Macro: Grey-green, laminated, graded bedded, felsic tuff with feldspar fragments (3-5 mm) set in fine-grained quartose matrix.

Micro: Fragments (3-5 mm) of rounded quartz, tabular andesine (An38) grade upwards through fine grained quartz, feldspar, chlorite and sericite to cryptocrystalline band of sugary quartz.

Alteration: Weak; sericite, chlorite.

l) RS 3: Green, quartz veined, andesitic, lithic tuff-breccia.

Macro: Dark green, fine to medium-grained, pyritized, quartz veined, fragmental volcanic breccia.

Micro: Fragments of

i: Medium grained dacite with phenocrysts of dusty andesine (An35) and quartz set in finer groundmass of quartz, chlorite, epidote and sericite.


iii: Sugary textured, fine-grained rhyolite tuff. Rock is not veined by quartz, and heavily pyritized.

Alteration: chlorite, quartz, pyrite, sericite.

AR 1: Dacite.

Macro: Grey-green porphyritic volcanic with phenocrysts (3 mm) of feldspar and quartz set in fine-grained matrix.

Micro: Phenocrysts of rounded, embayed quartz (2-3 mm) euhedral, dusty-brown, saussuritized andesine (An45), rounded magnetite, sphene, and apatite, set in a microcrystalline groundmass of quartz, feldspar laths and spherulites with "black cross" extinction. Fine-grained chlorite and epidote peppered throughout groundmass. Note chlorite pseudomorphous after tabular amphibole?

Alteration: Weak: Saussuritized (plag→ epidote + albite), chloritized.
CERTIFICATE OF EXPENSES

I, Stanley B. Reamsbottom, certify geological mapping with minor grid work was carried out on the Lcgan Claim, Record No. 132(7), New Westminster M.D., B.C. to the value of $3,074.00 as detailed below:

**Field Mapping and Line Flagging**
- S. Reamsbottom 8 days @ $200.00 = $1,600.00
- V. Mukans 4 days @ $50.00 = 200.00

**Travel**
- S. Reamsbottom 8 trips @ 110 ml = 880 @ 20¢ = 176.00
- V. Mukans 4 trips @ 50 ml = 200 @ 20¢ = 40.00

**Microscopic Work**
- Report 5 days at $200/day = 1,000.00

**Total**

$3,074.00

Days Worked on property
- S. Reamsbottom Nov 18-21, 25, 26, Dec 19, 20
- V. Mukans Nov 18-21

Certified Correct,

Stanley Reamsbottom, Ph.D. P.Eng.