

1980 GEOLOGICAL AND GEOCHEMICAL
ASSESSMENT REPORT

TITLE JOHNNY CREEK PROPERTY
CLAIMS SIS 1 - 4
COMMODITY Tungsten
LOCATED 85 km south of Watson Lake, Y.T.
Latitude 59°22' Longitude 128° 50'
Liard Mining Division 104 P 7W
BY M.K. McGill & H.W. Sellmer
FOR AMAX OF CANADA LIMITED
WORK PERIOD Field Work carried out between July 22 - 26
1980
Topographic Mapping
May 1 - 31, 1981

JULY, 1981

AMAX Vancouver Office

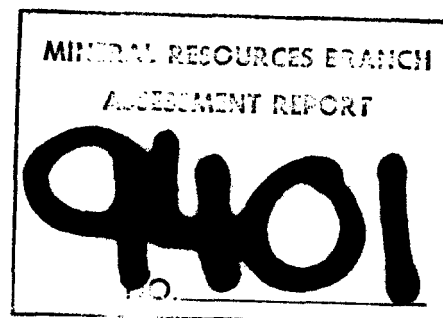


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SUMMARY

The Johnny Creek tungsten prospect was staked as the SIS 1-4 claims totalling 25 MGS units on July 9th and 10th, 1980. They cover a tungsten anomaly and scheelite bearing skarn at the headwaters of Johnny Creek in the central Horseranch Range, 35 miles east of Cassiar in northern British Columbia.

Cambrian and Hadrynian metasediments, locally paragneiss and schist, termed the Horseranch Group form a doubly plunging fault-bounded anticline which underlies the axis of the Horseranch Range. Concordant and discordant pegmatites and a variety of meta-igneous rocks are common. Muscovite from a granite at the north end of the range yielded an age of 57 m.y.

Crystalline limestone and calc-silicate skarn which dip SW at 30° - 50° interlayered with micaceous quartzite and schist/paragneiss units are intruded(?) by granite and pegmatite.

Scheelite occurs in calc silicate units as crystals from 1-3 mm in diameter, up to .5% WO_3 in some samples from mineralized skarn units. Tourmaline is common as vein and dyke selvages, in quartz segregations and in skarned limestone.

Silt, soil and rock chip samples yielded anomalous, W, F, Ag, and Cu values.

CONCLUSIONS

The Johnny Creek property is a raw prospect which contains geology favourable for metasomatic tungsten deposits including the presence of calc-silicate skarn interbedded with non-calcareous metasedimentary rocks, granitic rocks and tourmaline in veins (Dick L. 1979 p. 260 G.S.C. p77-1A). A possible target would be a scheelite-mineralized skarn layer or layers within schist grading better than 0.3% WO₃.

Location and Access

The property is located in alpine terrain at about 7,000 feet elevation in the central Horseranch Range on the McDame map area (NTS 104P 7W). Watson Lake, the nearest supply base, is 85 km north of the prospect, Cassiar is 35 km west and the Stewart-Cassiar highway is 20 km to the west. Johnny Creek empties into the Red River to the east of the claims.

Physiography

Rugged cirques with abundant outcrops coalesce on the property forming a sigmoidal northwesterly trending ridge through its centre. Debris-filled northeast trending valleys to the west are in contrast to transverse ribbed moraine plains to the east (Airphoto BC-5682-141).

Claims

A total of twenty-five M.G.S. units in four adjoining claims (SIS 1-4) are located in the Liard Mining Division of northern British Columbia (Figure 3). Their present expiry date is July 15th, 1981.

| CLAIM NAME | RECORD NO. | EXPIRY DATE |
|-----------------|------------|---------------|
| SIS 1 (6 units) | 14443 | July 15, 1981 |
| SIS 2 (4 units) | 14444 | |
| SIS 3 (6 units) | 14445 | |
| SIS 4 (9 units) | 14446 | |

Discovery

The Johnny Creek tungsten property was staked after scheelite bearing skarn was discovered by prospecting along strike from 20-30 ppm W silt anomalies outlined by a previous G.S.C. geochemical survey.

Previous and Current Work

Geological Survey of Canada mapping of the McDame map area was carried out by L.L. Price in 1949 and H. Gabrielse from 1950 to 1954. British Columbia Department of Mines detected beryllium in samples of pegmatite from the Horseranch Range in 1949. A beryl occurrence was staked in 1955 three kilometres southwest of the SIS claims. Beryl is also found in pegmatites in the northern parts of Horseranch Range. A reconnaissance silt sampling program was conducted over the McDame map area by the Federal and Provincial government as part of Uranium Reconnaissance Project (G.S.C Open File 562) with information released in 1979.

Prospecting in cirques and ridges and sampling of creeks was undertaken. Claims were staked by E.A. Fuller, M. McGill, T. Mongey and P. Harker on July 9th and 10th, 1980 to cover the boulder prospect.

REGIONAL GEOLOGY

The undivided stratigraphy for the claim area is termed the Horseranch Group by Gabrielse (Map 1110A) and is restricted entirely to the Horseranch Range. The Group consists of Cambrian and Hadrynian metamorphosed sedimentary rocks with lesser amounts of coarse-grained igneous rocks. Sedimentary rocks are now represented by migmatitic paragneiss, mica schists, quartzite, crystalline limestone, hornfels and skarn. Coarse-grained dark green pyroxenite appear as boulder accumulations in several areas of the range and outcrop in the northwestern area. Simple pegmatites carrying tourmaline, garnet and beryl cut across stratification in metasedimentary rocks in the central and northern parts of the range. An age date on muscovite of 57 m.y. was obtained from granitic rocks at the north end of the range. Rusty zones visible from the air are caused by pyroxenite and rusty biotite schist.

Structurally, the Horseranch Range is a doubly-plunging fault-bounded anticline and stands out in ERTS imagery as a distinctive topographic feature.

PROPERTY GEOLOGY

The Horseranch Group is represented on the property by quartz-mica schist, hornfels, skarn, crystalline, limestone, and foliated muscovite-garnet granites (Figure 4a). The lithology has been sub-divided into four mappable units briefly described below.

Micaceous Quartzite

Well layered micaceous quartzite rock and quartz-mica schist are exposed in the western part of the property, and do not appear to contain pegmatite. It is composed of from 70-90% quartz with the remainder muscovite and biotite.

Muscovite-Biotite Schist/Paragneiss

The crenulated muscovite-biotite-quartz-feldspar schist is coarse-grained and interbedded with calc-silicate skarn. Quartz veins are conformable to schistosity. In places, the schist is migmatized with medium-grained and pegmatitic granite veins where it becomes a migmatitic paragneiss.

Crystalline Limestone/Calc-Silicate Skarn

Coarse-grained mosaic textured white to buff weathering crystalline limestone layers, from one to two metres in thickness, outcrop as three horizons, interbedded with muscovite-biotite schist in the centre of the claim group.

Calc-silicate occurs as layers and lenses 2-10 feet thick within granite pegmatite but more commonly in biotite-muscovite schist. Garnet is ubiquitous in these calc-silicates, however diopside and vesuvianite content is quite variable. Calcite is almost always present in or near skarns.

A thin section of interlayered skarn and hornfelsed siliceous sediment reveals garnet, diopside, plagioclase and quartz as the dominant minerals with potash feldspar, calcite, biotite, sphene, clinozoisite and opaques making up the remainder of the section. A petrographic report is included as sample F27 lb.

Granite/Pegmatite/Granite

Very coarse-grained white weathering rounded outcrops of pegmatite cap the highest peak on the claims and form veins in cirque walls. There are at least two ages of veins since horizontal veins transect vertical veins of the same composition.

The veins are made up of white feldspar, clear to grey quartz and white muscovite. Margins and segregations within pegmatites carry coarse black tourmaline and rarely garnets. Beryl was not noted on the property. Crystals vary up to a maximum of 10 cm and are particularly well developed in vugs.

A later fine grained granite contains garnet and occurs as dykes 10-20 cm thick cutting schists parallel and perpendicular to foliation.

Structure

The property is just west of the axis of the major anticline running the length of the Horseranch Range. The stratified rocks dip to the southwest at generally 30-50 degrees. A dip slope is present on the west facing cirque and exposes the largest amount of calc-silicate known on the property.

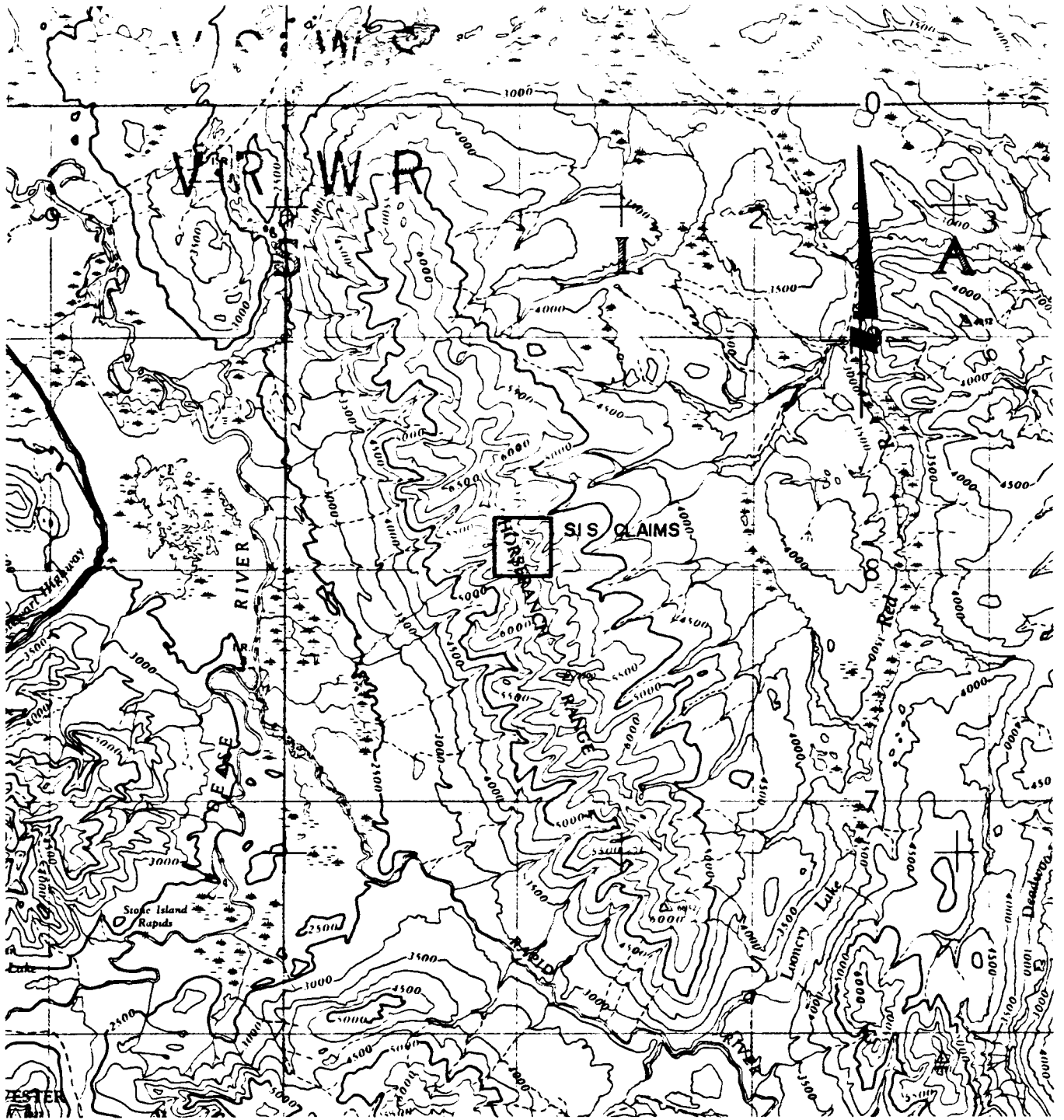
Regional metamorphism has affected all lithologies but metasomatism appears to be restricted to carbonate and schists within the core of the anticline especially near pegmatites. The mineralogical change from carbonates to garnet, diopside, plagioclase and quartz with a variety of grain size and an abundance of vein tourmaline is indicative of at least local metasomatism.

MINERALIZATION

Mineralization present on the property includes, scheelite, pyrite, pyrrhotite, chalcopyrite and tourmaline. Pyrite, pyrrhotite and trace chalcopyrite were found in mica schists along cleavages, in quartz veins and disseminated within the rocks in very low concentrations and will not be mentioned further. Scheelite appears to be restricted to calc-silicate skarns and recrystallized limestones and has not been found in granite or other metasedimentary rocks or quartz veins. Scheelite is generally present as 1-3 mm crystals ranging in size from less than 1 mm up to a maximum of 1 cm in coarser-grained skarns.

All scheelite fluoresces blue indicating low molybdenum content. Assays of nine samples taken on the property and four samples just east of the property range from 0 to 5,000 ppm with six greater than 1,000 ppm W. The average percentage of scheelite estimated from mineralized hand samples is 0.1 to 0.2%. Mineralized boulders occur in an area 2 km by 1 km. The majority of calc-silicate lamped does not contain any scheelite. A representative sample from several skarn beds gives 1,500 ppm W (sample no. 80-RYT-59).

Tourmaline mineralization, although of no commercial importance, is mentioned here because of its abundance and local concentration. Black stubby crystals are commonly found on vein and dyke selvages of pegmatites, within quartz segregations and associated with garnet in the pegmatites. Very coarse-grained brown clusters of tourmaline crystals occur with quartz and calcite in skarned limestone adjacent to pegmatites. Pneumatolytic or hydrothermal fluids present during the formation of these pegmatites were enriched in Bo and possibly Be, F and Cl. A recent paper



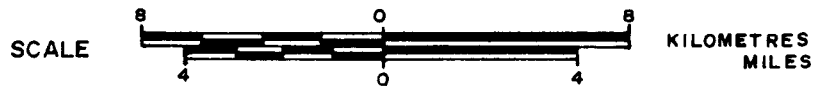
AMAX OF CANADA LIMITED

JOHNNY CREEK PROPERTY

LIARD MINING DIVISION — BRITISH COLUMBIA

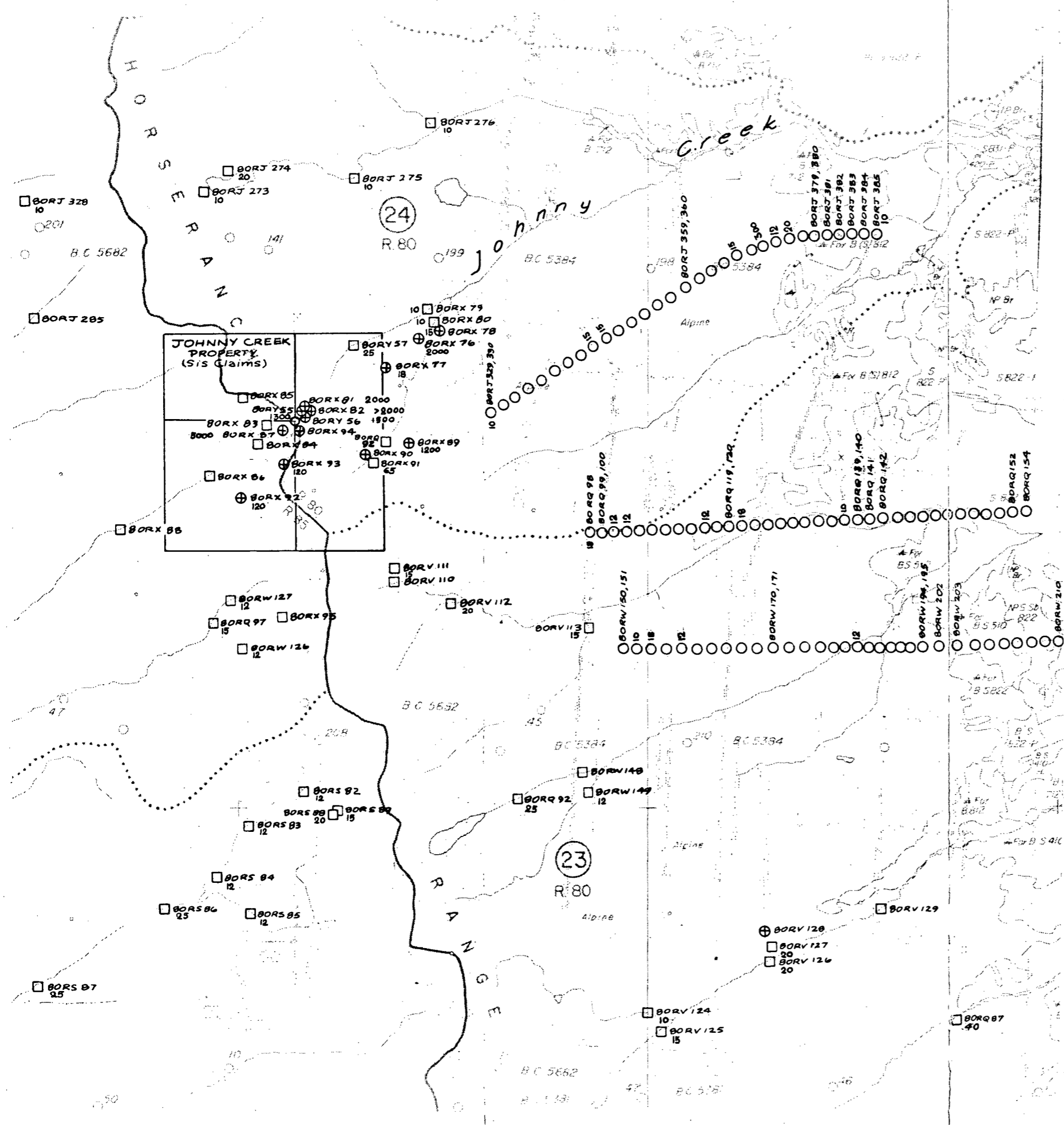
LOCATION MAP

H. D. Sellme
Aug 12/81



1 : 250,000

N.T.S. Ref 104 P 7
 FIG. 1



MINERAL RESOURCES BRANCH
ASSESSMENT REPORT
9401



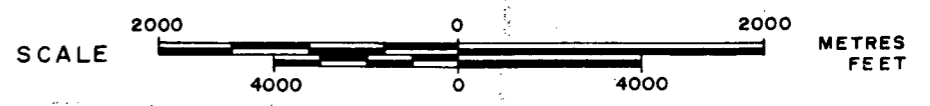
LEGEND

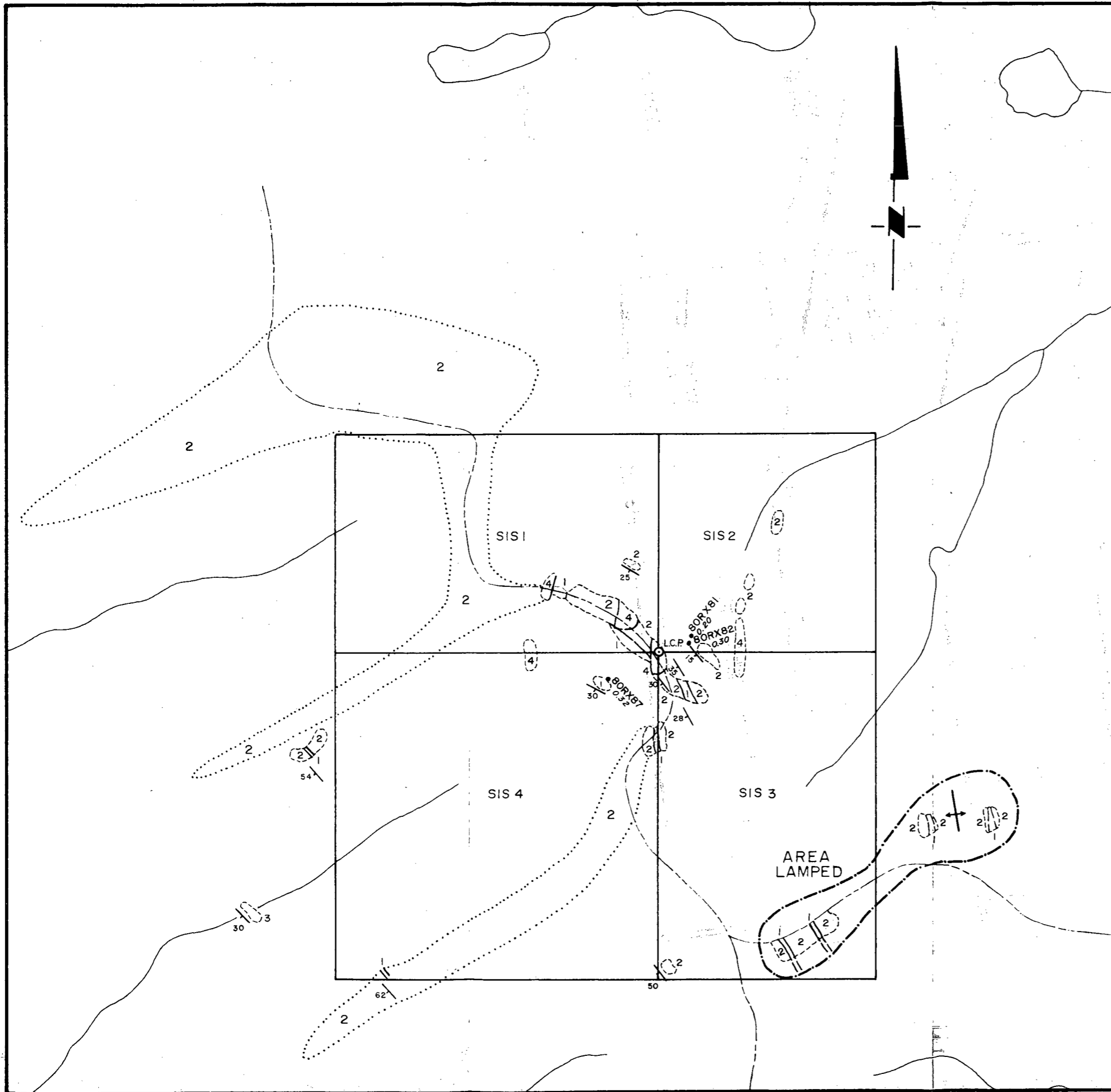
- BORJ329 Soil
 - BOR584 Silt
 - ⊕ BORV56 Rock chip
 - Legal corner post, claim boundary
- Sample site; sample number; p.p.m. values shown are: $W \geq 10$

AMAX OF CANADA LIMITED

JOHNNY CREEK PROPERTY
SIS CLAIMS
LIARD MINING DIVISION-BRITISH COLUMBIA
GEOCHEMICAL MAP

H. W. Selmer
Aug 12/81





LEGEND

- 4 Granite pegmatite.
- 3 Micaceous quartzite.
- 2 Muscovite-biotite schist, paragneiss.
- 1 Crystalline limestone, calc-silicate.

SYMBOLS

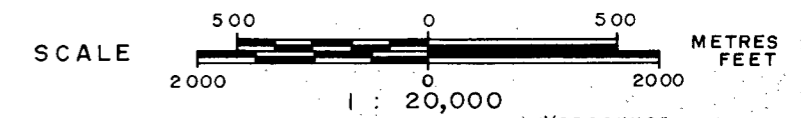
- Outcrop
- Limit of outcrop area.
- Geological contact.
- Bedding attitude.
- Anticline.
- Legal corner post, claim boundary.
- Stream.
- Ridge line (height of land)
- Assayed rock chip sample, sample number, % WO₃

MINERAL RESOURCES BRANCH
ASSESSMENT REPORT
9401
NO. _____

AMAX OF CANADA LIMITED
H.W. Bellmer
Aug 12/81

JOHNNY CREEK PROPERTY
SIS CLAIMS
LIARD MINING DIVISION — BRITISH COLUMBIA

GEOLOGICAL MAP



by Dick (G.S.C. p.77-1A p.260) on skarns north and west of the McDame area notes that Bo-Be-F-Cl bearing minerals are rare or absent in skarns generated from quartz monzonite and granodiorite stocks and batholiths. This would indicate that perhaps the genesis of the Johnny Creek skarns and scheelite is unrelated to quartz monzonite or granodiorite stocks.

GEOCHEMISTRY

Very few samples were collected in 1980 for geochemical analyses. Three silt samples on the east side of the divide returned tungsten values of 0, 25 and 65 and four samples on the west side returned nil tungsten. All samples were taken in cirque headwaters. The low values might be explained by the low concentration of scheelite in float and bedrock although higher values were expected beneath a calc-silicate outcrop on the west side of the ridge which gave 200 grains of scheelite per pan.

Other elements analysed for and found to be anomalous are fluorine, with maximum values of 1,000 ppm in silt (80-RXL-91) and 2,800 ppm fluorine (80-RXT-94) in skarn and silver with maximum values of 1.8 ppm (80-RXL-83) in silt and 2.2 ppm Ag (80-RXT-94) in skarn. One sample of black dense hornfels carries 104 ppm Cu (Sample no. 80-RXT-93). All samples were analysed for Mo, Cu, Ni, Co, Mn, Fe, Ag, Zn, Pb, W and F by Roszbacher Lab., Burnaby.

THIN SECTIONSF27 lb Contact - skarn and hornfelsed siliceous sediment

This section contains two layers of differing compositions separated by a transitional contact. The skarn is composed of garnet, calcite, diopside, and quartz. The sediment consists of very fine grained quartz, plagioclase, Kspar and biotite. Kspar and biotite concentrate furthest from the skarn. Sphene is minor but characteristic of the transition area.

Mode

| | |
|----|--------------|
| 26 | garnet |
| 17 | diopside |
| 15 | plagioclase |
| 21 | quartz |
| 8 | Kspar |
| 6 | calcite |
| 3 | biotite |
| 2 | sphene |
| 1 | clinozoisite |
| 1 | opaques |

Massive garnet occurs in the skarn. It becomes fine grained and intermixed with diopside near the border.

Diopside grows in clumps, some of them drawn out parallel to layering, in the outer part of the skarn and in the hornfels beside it. Diopside can be seen adjacent to biotite in possible replacement reaction. The diopside is very pale green in hand specimen and clear in thin section; it is probably very Fe-poor. Polysynthetic twins are rare.

Plagioclase is most abundant in the sediment next to the skarn. It is calcic in composition, An 65. Some grains are elongated, but not oriented, parallel to the layering. Plagioclases are anhedral and form a fairly even mosaic.

Quartz is abundant in the sediment. Segregation bands consist of somewhat coarser grained quartz than the matrix. A few very coarse quartz mosaics occur within the massive garnet of the skarn.

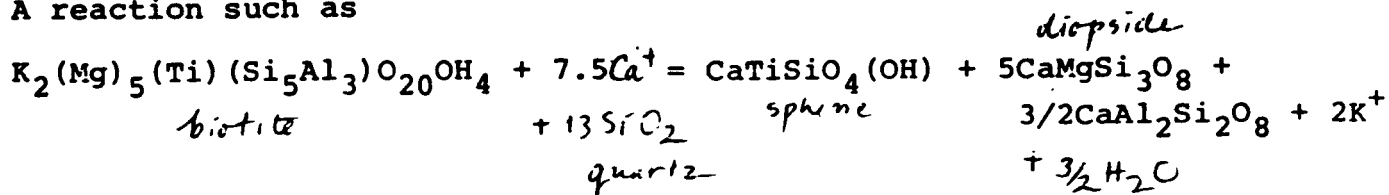
Very fine grained Kspar, accompanied by quartz, grows with biotite in the K-rich part of the sediment furthest from the skarn.

Coarse calcite forms clumps within the massive garnet. Late fractures in garnet are calcite-filled.

Biotite forms polygonal clumps mimetic after oriented, synkinematic lenses and streaks. A few biotites are altered to chlorite.

Sphene concentrates as discrete euhedral to subhedral crystals along the border of the skarn. Some sphenes occur next to biotites, partly surrounding them.

A reaction such as



F27 lb cont.

would describe the observed replacement relations. It also illustrates cation mobility during skarn formation.

Clinozoisite forms " webby ", perhaps late, growths in the massive garnet.

The opaque mineral is gold in color; it is a sulfide. It forms discrete grains, particularly in the biotite-Kspar layer.

RECOMMENDATIONS

It is recommended that a 1981 work program on the property consist of:

1) Geological mapping at 1:5,000 scale beginning with widely spaced traverses followed by more detailed fill in geology to determine presence of mineralized layers, stratigraphy and metamorphic aureoles if present.

2) Night ultraviolet lamping over accessible areas on and off the claim block.

3) Soil geochemical sampling and heavy mineral samples (panned soils) at 25 m intervals on lines 200 m apart. Rock geochemical sampling for W, Sn, F, Cu, Pb, Zn and possibly Bo and Be.

H. W. Sellmer Aug 12/81.
H.W. Sellmer

APPENDIX I

STATEMENT OF COSTS

Geological & Geochemical Survey

Period of Work: July 22-26, 1980

Personnel:

M. McGill: BSc - RR #3, Bobcaygeon, Ontario
Geologist - 4 days @ \$61.15 \$ 244.60

P. Harker:
Prospector - 4 days @ \$130.00 520.00
c/o 601-535 Thurlow St. Vancouver, BC

Room & Board: 8-man days @ \$25/day 200.00

Geochemical Analyses: Rossbacher Laboratory, Burnaby

16 samples 9 element (Mo, Cu, Ni, Co, Mn, Fe, Ag,
Zn, Pb) @ 4.20 67.20

16 W @ 2.25 36.00

13 F @ 3.00 39.00

6 Soil Prep. @ .30 1.80

10 Rock Prep. @ 1.15 11.50

4 Samples Assayed WO_3 Inv. #1173 @ 8.00 32.00

187.50

1 Thin section - Vancouver Petrographics,
Fort Langley, B.C. Inv. #2397 32.79

Helicopter - Transwest Helicopters
Inv. #0545, #0552 2.6 @ 2.80 728.00

Report Preparation 150.00

\$2,062.89
=====

APPENDIX II

STATEMENT OF QUALIFICATIONS

H. W. Sellmer - STATEMENT OF QUALIFICATIONS

1964 B.Sc. Geology (Honours) University of B.C.

1966 M.Sc. Geology University of B.C.

Amax Exploration, Inc. - May 1, 1966

Staff Geologist - Planned, organized and supervised small property and prospect evaluation programs utilizing geochemical, geophysical and geological techniques. Assessed results and proposed new programs.

1970 - District Geologist -

Supervised all exploration work in a district. Interpreted the results of all exploration techniques in terms of major program objectives. Recommended mineral properties for option and favourable geological areas for prospecting programs. Handled preliminary negotiations for mineral properties, reviewed and prepared exploration contracts. Planned, organized and supervised and reported on all exploration programs in a district.

1974 - Regional Manager-Western Canada-

Overall responsibility for the exploration effort of the Company in Western Canada.

STATEMENT OF QUALIFICATIONS

Murray K. McGill HSc Lakehead University 1980

- May/77 - Sep/77 - Junior Geological Assistant Denison Mines Ltd
- Uranium Exploration
- May/78 - Sep/78 - Shell Canada Ltd. - Junior Geological Assistant
- Base Metals Exploration
- May/79 - Sep/79 - Senior Geological Assistant - Kaiser Resources Ltd.
(Coal Division, Sparwood, B.C.)
- May/80 - Sep/80 - AMAX of Canada Limited - Senior Geological Assistant

- Peter Harker - Prospector since 1960 with experience in Northwest Territories, Yukon, British Columbia, Ontario
- Passed the B.C. Department of Mines & Petroleum Resources Mineral Exploration Course for Prospectors

APPENDIX III

GEOCHEMICAL ANALYSES

Rossbacher Laboratory

GEOCHEMICAL ANALYSTS & ASSAYERS

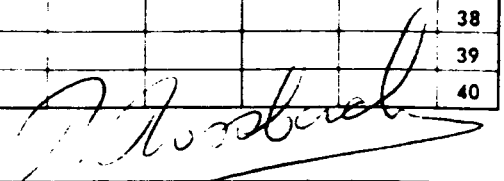
2225 S SPRINGER AVE.
 BURNABY, B. C.
 CANADA
 TELEPHONE: 299-6910
 AREA CODE: 604
 CERTIFICATE NO. 81030-1
 INVOICE NO. 1173
 DATE ANALYSED MARCH 11, 1971
 PROJECT 1090

CERTIFICATE OF ANALYSIS

TO: AMAX MINERALS EXPLORATION
 601-535 THURLOW ST.
 VANCOUVER, B.C.

| No. | Sample | pH | Mo | Cu | W | PPB Au | | | | | | No. |
|-----|---------|----|----|----|-------|--------|--|--|--|--|--|-----|
| 01 | 20RXT9 | | | | 1 | | | | | | | 01 |
| 02 | L12 | | | | 1 | | | | | | | 02 |
| 03 | 11 | | | | 1 | | | | | | | 03 |
| 04 | T12 | | | | 1 | | | | | | | 04 |
| 05 | 13 | | | | 1 | | | | | | | 05 |
| 06 | 14 | | | | 2 | | | | | | | 06 |
| 07 | L15 | | | | 1 | | | | | | | 07 |
| 08 | 16 | | | | 1 | | | | | | | 08 |
| 09 | T17 | | | | 1 | | | | | | | 09 |
| 10 | 18 | | | | 1 | | | | | | | 10 |
| 11 | L20 | | | | 1 | | | | | | | 11 |
| 12 | T21 | | | | 1 | | | | | | | 12 |
| 13 | 22 | | | | 1 | 10 | | | | | | 13 |
| 14 | 23 | | | | 1 | | | | | | | 14 |
| 15 | 24 | | | | 1 | 10 | | | | | | 15 |
| 16 | 25 | | | | 1 | | | | | | | 16 |
| 17 | L26 | | | | 1 | | | | | | | 17 |
| 18 | T27 | | | | 1 | 10 | | | | | | 18 |
| 19 | L28 | | | | 1 | 10 | | | | | | 19 |
| 20 | L29 | | | | 1 | | | | | | | 20 |
| 21 | 35 | | | | | 10 | | | | | | 21 |
| 22 | 36 | | | | | 260 | | | | | | 22 |
| 23 | 59 | | | | | 10 | | | | | | 23 |
| 24 | 60 | | | | | 10 | | | | | | 24 |
| 25 | 61 | | | | | 10 | | | | | | 25 |
| 26 | 62 | | | | | 10 | | | | | | 26 |
| 27 | L63 | | | | | 10 | | | | | | 27 |
| 28 | T78 | | | | 500 | | | | | | | 28 |
| 29 | 82 | | | | >2000 | | | | | | | 29 |
| 30 | L83 | | | | 2 | | | | | | | 30 |
| 31 | 84 | | | | 1 | | | | | | | 31 |
| 32 | 85 | | | | 1 | | | | | | | 32 |
| 33 | 86 | | | | 1 | | | | | | | 33 |
| 34 | 20RXL91 | | | | 1 | | | | | | | 34 |
| 35 | | | | | | | | | | | | 35 |
| 36 | | | | | | | | | | | | 36 |
| 37 | | | | | | | | | | | | 37 |
| 38 | | | | | | | | | | | | 38 |
| 39 | | | | | | | | | | | | 39 |
| 40 | | | | | | | | | | | | 40 |

Certified by



Kossbacher Laboratory

GEOCHEMICAL ANALYSTS & ASSAYERS

BURNABY, B. C.
CANADA
TELEPHONE: 299-6910
AREA CODE: 604
CERTIFICATE NO. **80311**

CERTIFICATE OF ANALYSIS

INVOICE NO. **283**

DATE ANALYSED **July 1950**

PROJECT **1090**

TO: AMAX MINERALS EXPLORATION
601 - 535 THURLOW ST.
VANCOUVER, B.C.

| No. | Sample | pH | Mo | Cu | Ni | Co | Mn | Fe | Ag | Zn | Pb | W | No. |
|-----|----------|-----|----|-----|----|----|------|-----|-----|-----|-----|------|-----|
| 01 | 80RXL 58 | 3.5 | | | | | | | | | | | 01 |
| 02 | 59 | 0 | 1 | 10 | 26 | 14 | 400 | 28 | 0.6 | 122 | 34 | 2 | 02 |
| 03 | 60 | 0 | 3 | 16 | 34 | 18 | 360 | 3.1 | 0.8 | 102 | 50 | 5 | 03 |
| 04 | 61 | 0 | 1 | 6 | 20 | 12 | 160 | 2.5 | 0.4 | 80 | 24 | 5 | 04 |
| 05 | 62 | 0 | 1 | 10 | 24 | 14 | 400 | 2.9 | 0.4 | 106 | 34 | 12 | 05 |
| 06 | 63 | 0 | 1 | 8 | 26 | 16 | 600 | 3.3 | 0.4 | 72 | 22 | 2 | 06 |
| 07 | 64 | | 1 | 8 | 22 | 10 | 280 | 2.1 | 0.2 | 42 | 10 | 0 | 07 |
| 08 | 65 | | 1 | 6 | 20 | 10 | 240 | 2.1 | 0.2 | 34 | 6 | 2 | 08 |
| 09 | 66 | | 1 | 6 | 20 | 10 | 280 | 2.1 | 0.2 | 42 | 6 | 2 | 09 |
| 10 | 80RXL 67 | | 1 | 6 | 22 | 12 | 300 | 2.2 | 0.4 | 42 | 6 | 0 | 10 |
| 11 | 768 | | 1 | 22 | 32 | 18 | 2980 | 3.6 | 2.6 | 498 | 760 | 18 | 11 |
| 12 | 75 | | 1 | 2 | 4 | 2 | 40 | 0.4 | 0.4 | 24 | 16 | 2000 | 12 |
| 13 | 76 | | 3 | 6 | 18 | 12 | 440 | 1.4 | 1.6 | 58 | 8 | 2000 | 13 |
| 14 | 77 | | 1 | 232 | 80 | 36 | 180 | 3.5 | 0.6 | 52 | 2 | 12 | 14 |
| 15 | 78 | | 3 | 4 | 16 | 12 | 480 | 1.8 | 1.8 | 42 | 6 | 15 | 15 |
| 16 | 179 | | 1 | 20 | 28 | 16 | 360 | 2.9 | 0.4 | 68 | 4 | 10 | 16 |
| 17 | 80 | | 1 | 8 | 12 | 8 | 160 | 1.2 | 0.2 | 26 | 2 | 12 | 17 |
| 18 | 781 | | 2 | 30 | 8 | 8 | 560 | 2.3 | 1.0 | 20 | 2 | 2000 | 18 |
| 19 | 80RXL 82 | | 3 | 2 | 12 | 10 | 460 | 1.4 | 1.4 | 20 | 2 | 8 | 19 |
| 20 | 517 A | | 6 | 20 | 12 | 6 | 440 | 2.3 | 0.4 | 38 | 18 | 12 | 20 |
| 21 | 80RXL 55 | | 1 | 6 | 6 | 6 | 340 | 1.6 | 0.2 | 52 | 2 | 5 | 21 |
| 22 | 80RXL 56 | | 1 | 2 | 2 | 4 | 270 | 0.8 | 0.2 | 18 | 2 | 5 | 22 |
| 23 | 80RXL 57 | | 1 | 6 | 6 | 6 | 260 | 1.5 | 0.4 | 54 | 2 | 2 | 23 |
| 24 | | | | | | | | | | | | | 24 |
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Kossbacher Laboratory

GEOCHEMICAL ANALYSTS & ASSAYERS

BURNABY, B. C.
CANADA
TELEPHONE 299-6910
AREA CODE 604
CERTIFICATE NO. 80352-8

CERTIFICATE OF ANALYSIS

INVOICE NO. 283
DATE ANALYSED Aug. 1970

TO: AMAX MINERALS EXPLORATION
601 - 535 THURLOW ST.
VANCOUVER, B.C.

PROJECT 1290

| No. | Sample | pH | Mo | Cu | Mi | Co | Mn | Fe | Ag | Zn | Pb | W | F | No. |
|-----|---------|----|----|----|----|----|-----|----|-----|----|----|------|------|-----|
| 01 | 80RYT55 | | 5 | 2 | 20 | 20 | 590 | 12 | 0.2 | 84 | 12 | 1300 | 1400 | 01 |
| 02 | .56 | | 5 | 4 | 22 | 18 | 720 | 18 | 0.2 | 50 | 2 | 1500 | 1400 | 02 |
| 03 | L57 | | 1 | 26 | 34 | 14 | 260 | 22 | 0.2 | 58 | 2 | 25 | 600 | 03 |

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CANADA
TELEPHONE. 299-6910
AREA CODE. 604
CERTIFICATE NO. **80352-4**

CERTIFICATE OF ANALYSIS

INVOICE NO. **283**
DATE ANALYSED **July 1980**
PROJECT **1090**

TO: AMAX MINERALS EXPLORATION
601 - 535 THURLOW ST.
VANCOUVER, B.C.

| No. | Sample | Mo | Cu | Al ₂ O ₃ | CaO | MgO | Fe ₂ O ₃ | Aj | Zn | -1/16 | W | F | No. |
|-----|----------|------|-----|--------------------------------|-----|------|--------------------------------|-----|-----|-------|------|------|-----|
| 01 | 80RXL 83 | 1 | 50 | 56 | 46 | 580 | 4.2 | 1.2 | 132 | 8 | 0 | 620 | 01 |
| 02 | 84 | 1 | 30 | 42 | 22 | 500 | 3.9 | 0.8 | 94 | 4 | 0 | 300 | 02 |
| 03 | 85 | 1 | 24 | 16 | 12 | 380 | 2.9 | 0.4 | 72 | 2 | 0 | 410 | 03 |
| 04 | 86 | 1 | 47 | 50 | 30 | 520 | 4.4 | 1.0 | 108 | 6 | 0 | 720 | 04 |
| 05 | 787 | 1 | 6 | 20 | 16 | 340 | 1.3 | 1.8 | 36 | 2 | 5000 | 200 | 05 |
| 06 | 188 | 1 | 30 | 40 | 24 | 400 | 2.8 | 0.4 | 74 | 4 | 0 | 270 | 06 |
| 07 | 789 | 3 | 6 | 20 | 16 | 620 | 1.7 | 1.4 | 26 | 4 | 1200 | 780 | 07 |
| 08 | 90 | 2 | 4 | 18 | 14 | 320 | 1.0 | 1.4 | 8 | 2 | 0 | 300 | 08 |
| 09 | 191 | 1 | 44 | 50 | 28 | 520 | 3.9 | 0.6 | 110 | 4 | 65 | 1000 | 09 |
| 10 | 80RXT 92 | 2 | 15 | 28 | 18 | 700 | 1.5 | 1.2 | 12 | 2 | 220 | 500 | 10 |
| 11 | 93 | 4 | 104 | 24 | 22 | 880 | 2.9 | 1.6 | 22 | 8 | 0 | 740 | 11 |
| 12 | 94 | 6 | 6 | 36 | 24 | 460 | 2.2 | 2.2 | 140 | 2 | 0 | 2800 | 12 |
| 13 | 195 | 1 | 32 | 30 | 18 | 460 | 3.7 | 2.6 | 86 | 4 | 0 | 600 | 13 |
| 14 | 96 | 0 3 | 30 | 32 | 12 | 980 | 1.7 | 1.0 | 60 | 12 | 0 | 460 | 14 |
| 15 | 97 | 12 1 | 8 | 18 | 10 | 1200 | 2.1 | 0.4 | 36 | 2 | 0 | 240 | 15 |
| 16 | 798 | 1 | 4 | 2 | 2 | 1100 | 0.6 | 0.2 | 90 | 14 | 0 | 320 | 16 |
| 17 | 80RXL 99 | 0 1 | 10 | 22 | 10 | 440 | 2.2 | 0.4 | 53 | 4 | 0 | 300 | 17 |
| 18 | 80RXT 91 | | | | | | | | | | | 800 | 18 |
| 19 | 82 | | | | | | | | | | | 295 | 19 |
| 20 | 75 | | | | | | | | | | | 3900 | 20 |
| 21 | | | | | | | | | | | | | 21 |
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CERTIFICATE OF ANALYSIS

BURNABY, B. C.
 CANADA
 TELEPHONE: 299-6910
 AREA CODE: 604
 CERTIFICATE NO. 80311-A
 INVOICE NO. 283
 DATE ANALYSED AUG, 1980
 PROJECT 1090

TO: AMAX MINERALS EXPLORATION
 601 - 535 THURLOW ST.
 VANCOUVER, B.C.

| No. | Sample | pH | Mo | Cu | PPM F | | | | | | No. |
|-----|---------|----|----|----|----------|--|--|--|--|--|-----|
| 01 | 80RXL58 | | | | ✓ | | | | | | 01 |
| 02 | 59 | | | | 510 | | | | | | 02 |
| 03 | 60 | | | | 460 | | | | | | 03 |
| 04 | 61 | | | | 330 | | | | | | 04 |
| 05 | 62 | | | | 350 | | | | | | 05 |
| 06 | 63 | | | | 350 | | | | | | 06 |
| 07 | 64 | | | | 400 | | | | | | 07 |
| 08 | 65 | | | | 160 | | | | | | 08 |
| 09 | 66 | | | | 480 | | | | | | 09 |
| 10 | 67 | | | | 440 | | | | | | 10 |
| 11 | T 68 | | | | 430 | | | | | | 11 |
| 12 | 75 | | | | 3900 | | | | | | 12 |
| 13 | 76 | | | | 800 | | | | | | 13 |
| 14 | 77 | | | | 190 | | | | | | 14 |
| 15 | 78 | | | | 760 | | | | | | 15 |
| 16 | L 79 | | | | 540 | | | | | | 16 |
| 17 | 80 | | | | 260 | | | | | | 17 |
| 18 | T 81 | | | | 460 | | | | | | 18 |
| 19 | 80RXT82 | | | | 310 | | | | | | 19 |
| 20 | STD A | | | | 160 | | | | | | 20 |
| 21 | 80RXL55 | | | | 500 | | | | | | 21 |
| 22 | 56 | | | | 260 | | | | | | 22 |
| 23 | 80RXL57 | | | | 430 | | | | | | 23 |
| 24 | | | | | | | | | | | 24 |
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A. Kossbacher

Rossbacher Laboratory Ltd.

GEOCHEMICAL ANALYSTS & ASSAYERS

2225 S. SPRINGER AVE.,
 BURNABY, B. C.
 CANADA
 TELEPHONE: 299-6910
 AREA CODE: 604

CERTIFICATE OF ANALYSIS

CERTIFICATE NO. 81035

TO: AMAX MINERALS EXPLORATION
 601-535 Thurlow St.
 Vancouver, B.C.

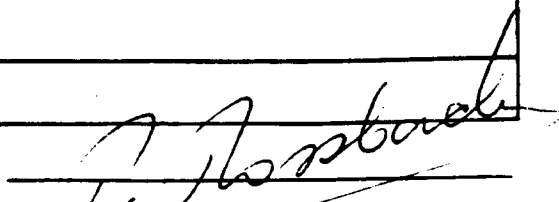
INVOICE NO. 1173

DATE RECEIVED

ATTN: 1090 T. Fuller

DATE ANALYSED March, 1981

| SAMPLE NO.: | | WO ₂ |
|-------------|------|-----------------|
| 80RXT 81 | 0.20 | |
| 80RXT 82 | 0.30 | |
| 80RXT 87 | 0.32 | |
| 80RXT170 | 0.60 | |
| 80RXT195 | 0.18 | |
| 80RYT 86 | 1.14 | |
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APPENDIX IV

ANALYTICAL TECHNIQUES

Kossbacher Laboratory

GEOCHEMICAL ANALYSTS & ASSAYERS

BURNABY, B. C.
CANADA
TELEPHONE: 299 6910
AREA CODE 604

April 30, 1974

SUMMARY OF SOME ANALYTICAL TECHNIQUES CURRENTLY IN USE AT ROSSBACHER LABORATORY

A ANALYTICAL TECHNIQUES FOR GEOCHEMICAL SAMPLES

SAMPLE PREPARATION

Packages of samples are opened as soon as they arrive at the laboratory and the bags placed in numerical sequence in an electrically heated sample drier (maximum temperature 70°C).

After drying soil and sediment samples they are lightly pounded with a wooden block to break up aggregates of fine particles and are then passed through a 35 mesh stainless steel sieve. The coarse material is discarded and the minus 35 mesh fraction replaced in the original bag providing that this is undamaged and not excessively dirty.

Rock samples are exposed to the air until the outside surfaces are dry; only if abnormally wet are rocks placed in the sample drier. Rock samples are processed in such manner that a fully representative 1/2 g. sample can be obtained for analysis. The entire amount of each sample is passed through a jaw crusher and thus reduced to fragments of 2 mm. size or less. A minimum of 1 kg. is then passed through a pulverizer with plates set such that 95% of the product will pass through a 100 mesh

Rock Chips

Composite rock chip samples generally consist of some ten small fragments broken from unweathered outcrop with a steel hammer. Each fragment weighs some 50 gms. Samples are placed in strong polythene bags and sealed with non-contaminating wire tabs. Samples are restricted to a single rock type and obvious mineralization is avoided.

Soil, sediment and rock samples are packed securely in cardboard boxes or canvas sacks and dispatched by road or air.

Procedures for Collection and Processing
of Geochemical Samples

Analytical Methods for Ag, Mo, Cu, Pb, Zn,
Fe, Mn, Ni, Co and W in sediments and soils;
Mo, Cu, Zn, Ni and SO_4^{--} in waters.

Amak Exploration, Inc.
Vancouver Office.

September 1970

SAMPLE COLLECTION

Soils

B horizon material is sampled and thus organic rich topsoil and leached upper subsoil are avoided. Occasionally organic rich samples have to be taken in swampy depressions.

Samples are taken by hand from a small excavation made with a cast iron mattock. Approximately 200 gms of finer grained material is taken and placed in a numbered, high wet-strength, Kraft paper bag. The bags are closed by folding and do not have metal tabs.

Observations as to the nature of the sample and the environment of the sample site are made in the field.

Drainage Sediments

Active sediments are taken by hand from tributary drainages which are generally of five square miles catchment or less. Composite samples are taken of the finest material available from as near as possible to the centre of the drainage channel thus avoiding collapsed banks. More than one sample is taken if marked mineralogical or textural segregation of the sediments is evident.

Some 200 gm of finer material is collected unless the sediment is unusually coarse in which case the weight is increased to 1 kg. Samples are placed in the same type of Kraft paper bag as are employed in soil sampling. Water samples are taken at all appropriate sites. Approximately 100 ml are sampled and placed in a clean, screw sealed, polythene bottle. Observations are made at each site regarding the environment and nature of the sample.

Calibration

1. Set 1 gamma/ml to read 40 equivalent to 20 gamma/gm

Factor $\frac{1}{2}$ x meter reading

Check standards

4, 10, 20, 40 ppm Ag in sample

2. Set 15 gamma/ml to 100 equivalent to 100 ppm

Check standards

40, 100 ppm

Factor directly in ppm Ag

3. Rotate burner to maximum angle

Set 10.0 gamma/ml Ag to read 100

Check standards

100, 200, 400, 1000 ppm Ag

Factor 10x scale reading

4. Samples higher than 1000 ppm should be re-analyzed by assay procedure

5. Background correction for sample reading between 1 to 5 ppm

Calibrate AA in step 1

Dial wavelength to 300 (peak)

Read the samples again

Subtract the background reading from the first reading

Standards

1. 1000 gamma/ml Ag - 0.720 gm Ag_2SO_4 dissolved in 20 mls $Hx10_3$ and dilute to 500 mls

2. 150 gamma/ml Ag - 10 mls of above + 20 mls $HClO_4$, dilute to 100 mls

3. Recovery spiked standard

5 gamma/ml Ag - 5 mls 100 gamma/ml dilute to 100 mls with "mixed" acid

Working AA Standards

Pipette .2, .5, 1, 2, 5, 10 mls of 100 gamma/ml and 2, 5 mls 100 gamma/ml dilute to 100 mls with 20% $HClO_4$. This equivalent to 4, 10, 20, 40, 100, 200, 400, and 1000 ppm Ag in the sample .50 g diluted to 10 mls.

Recovery Standard

Pipette 2 mls of 5 gamma/ml Ag in mix acids into a sample and carry through the digestion. This should give a reading of 20 ppm Ag + original sample content.

Follow the general geochemical procedure for sample preparation and digestion.

For low assay Ag, the same procedure is used. Ag is then calculated in oz/ton.

1 ppm = .0292 oz/ton

conversion factor

oz/ton = .0292 x ppm Ag

screen. Where samples are appreciably heavier than 2 kg the material is split after jaw crushing by means of a Jones splitter. After pulverizing the sample is mixed by rolling on paper and is then placed in a Kraft paper bag.

SAMPLE DIGESTION

Digestion tubes (100 x 16 mm) are marked at the 5 ml level with a diamond pencil. Tubes are cleaned with hot water and concentrated HCl. 0.5 g samples are weighed accurately, using a Fisher Dial-O-Gram balance, and placed in the appropriate tubes.

To each of the samples thus prepared are added 2 ml of an acid mixture comprising 15% nitric and 85% perchloric acids. Racks of tubes are then placed on an electrical hot plate, brought to a gentle boil ($\frac{1}{2}$ hour) and digested for $4\frac{1}{2}$ hours. Samples unusually rich in organic material are first burned in a porcelain crucible heated by a bunsen burner before the acid mixture is added. Digestion is performed in a stainless steel fume hood.

After digestion tubes are removed from the hot plate and the volume is brought up to 5 ml with deionized water. The tubes are shaken to mix the solution and then centrifuged for one minute. The resulting clear upper layer is used for Cu, Mo, Pb, Zn, Ag, Fe, Mn, Ni and Co determination by a Perkin-Elmer 200B atomic absorption spectrophotometer. Analytical procedures are given on the following pages.

ANALYTICAL PROCEDURES

Silver

1. Scope - This procedure covers a range of silver in the sample from less than .5 to 1000 ppm
2. Summary of Method - The sample is treated with nitric and perchloric acid mixture to oxidize organics and sulphides. The silver then is present as perchlorate in aqueous solution. The concentration is determined by atomic absorption spectrophotometer
3. Interferences - Silver below 1 gamma/ml is not very stable in solution. Maintaining the solution in 20% perchloric prevents silver being absorbed on the glass container. Determination must be completed on the same day as the digestion.

Samples high in dissolved solids, especially calcium, cause high background absorbance. This background absorbance must be corrected using an adjacent Ag line.

Silver AA Settings P.E. 290

Lamp - Ag

Current 4 ma position 3

Slit 7 A

Wavelength 3231A Dial 287.4

Fuel - acetylene - flow - 14

Oxidant - air - flow - 14

Burner - techtron AB_51 in line

Maximum Conc. 3 to 4x

Zn Geochemical AA Setting

Lamp Zn

Current 9 #3 Slit 20A

Wave length 2133 Dial 84.9

Fuel - Acetylene Flow 14

Oxidant - Air Flow 14

Burner - P.E. short path 90°

Range

0 - 20 gamma/ml Factor 4x - 0 to 400 ppm

0 - 50 gamma/ml Factor 10x - 0 to 1000 ppm

For Waters - Burner AB- 51 in line 1 gamma/ml read 100 to give 0
to 1000 ppb

High Zn Burner Boling in line. Wavelength 3075. Dial 250 Slit 7A
Fuel 14 Air 14.5

0 to 1000 gamma/ml read 0 to 20 Factor 400 x

Pure Standard 10,000 gamma/ml

1 gm Zn dissolved, H₂O, HCl, HNO₃, HClO₄, fumed to HClO₄ -
make up to 100 mls H₂O

1000, 100 gamma/ml and 100 ml by dilution in 20 % HClO₄

0 to 200 gamma/ml Zn use combined Cu, Ni, Co, Pb, Zn standards

Pipette

1, 2, 3, 5, 8, 10 mls of 10,000 gamma/ml - dilute to 100 mls
with 20% HClO₄ to give

100, 200, 300, 500, 800, 1000 gamma/ml Zn for high standards

Co Geochemical AA Setting

Lamp - 5 multi element

Current 10 #4 Slit 2A

Wavelength 2407 Dial 133.1

Fuel - Acetylene Flow 14

Oxidant - Air Flow 14

Burner - AB 51 in line

Range

0 - 10 gamma/ml read 100 Factor 2 x reading to 200 ppm

0 - 20 gamma ml read 100 Factor 4 x reading to 400 ppm

Burner at maximum angle

0 - 100 gamma/ml read 100 Factor 20 x reading to 2000 ppm

0 - 200 gamma/ml read 100 Factor 40 x reading to 4000 ppm

Standards - 1000 gamma/ml

1.000 gm cobalt metal dissolved in HCl, HNO₃, and fumed into
HClO₄, dilute to 1 liter

Pipette

1, 2, 10, 20 mls into 100 ml vol flasks diluted to mark
with 20% HClO₄

This gives

10, 20, 100, 200 gamma/ml Co

Mixed - combination standards of Cu, Ni, Co, Pb, Zn

of

1, 2, 5, 10, 20, 30, 50, 80, 100, 150, 200 gamma/ml are used
for calibration

Mn Geochemical AA Setting

Lamp Multi element Ca, Ni, Co, Mn Cr

Current 10 #4 Slit 7A

Wave length 4030.8 Dial 425.2

Fuel - Acetylene Flow 14.0

Oxidant - Air Flow 14.0

Burner - P.E. short path (or AB 50)

Range

0 - 100 gamma/ml Factor 20x - 0 to 2000 ppm

0 - 200 gamma/ml Factor 40x - 0 to 4000 ppm

Burner 90°

0 - 1000 gamma/ml Factor 200x - 0 to 20,000 ppm

0 - 2000 gamma/ml Factor 400x - 0 to 40,000 ppm

EDTA Extraction - use AB 51 in line

0 - 20 gamma/ml Factor 4x - 0 to 400 ppm

Standards

Fisher 10,000 gamma/ml (ml)

10x Dilution 1000 gamma/ml

Pipette

.5, 1, 2, 3, 5, 8, 10, ml of 1000 gamma/ml

2, 3, 5, 8, 10, 15, 20 ml of 10,000 gamma/ml dilute to 100

mls with 20% HClO₄. This gives

5, 10, 20, 30, 50, 80, 100, 200, 300, 500, 800, 1000, 1500,

2000 gamma/ml

Mo Geochemical AA Setting

Lamp ASL H/C Mo

Current 5 #5 Slit 7A

Wavelength 3133 Dial 260.2

Fuel - Acetylene Flow 12.0 to give 1" red feather

Oxidant - Nitrous oxide Flow 14.0

Burner - AB 50 in line

Caution read the operation using N₂O and acetylene flame at
end of general AA procedure

Range

0 - 10 gamma/ml Factor 2x - 0 to 200 ppm

Rotate burner to max. angle

0 - 50 gamma/ml Factor 10 x 0 to 1000 ppm

0 - 100 gamma/ml Factor 20 x 0 to 2000 ppm

Standards 1000 gamma/ml

Dissolve .750 gms MoO₃ (acid molybdic) with 20 mls H₂O, 6
lumps NaOH, when all dissolved, add 20 mls HCl, dilute to 500 mls
100 gamma/ml - 10 x dilution

Pipette

.2, .5, 1, 2, 3, 5, 8, 10 mls of 100 gamma/ml

2, 3, 5, 8, 10 mls of 1000 gamma/ml add 5 mls 10% AlCl₃

and dilute to 100 mls with 20% HClO₄

This gives

.2, .5, 1, 2, 3, 5, 8, 10, 20, 30, 50, 80, 100 gamma/ml Mo

Fe Geochemical AA Setting

Lamp - Fe

- Do not use multi element Fe

Current 10 #4 Slit 2A

Wavelength 3440.6 Dial 317.5

Fuel - Acetylene Flow 14.0

Oxidant - Air Flow 14.0

Burner - PE Short Path 90°

Range

0 - 5000 gamma/ml 0.1 x % - 0 to 10.0%

0 - 10,000 gamma/ml 0.2 x % - 0 to 20.0%

Higher Fe - 10 x dilution

Standards 10,000 gamma/mlWeigh 5.000 gms iron wires, into beaker, add H₂O, HCl, HNO₃,HClO₄, heat to HClO₄ fumes. Add HClO₄ to 100 mls + 100 mlsH₂O, warm, dilute to 500 mls

Pipette

1, 5, 10, 20, 30, 50, 80 mls 10,000 gamma/ml dilute to 100 mls with 20% HClO₄ to give

100, 500, 1000, 2000, 3000, 5000, 8000 gamma/ml to be equivalent to .2, 1.0, 2.0, 4.0, 6.0, 10.0%, 16.0% Fe in geochem sample

Ni Geochemical AA Setting

Lamp P.E. H/C. Ni or multi element Cu, Ni, Co, Mn, Cr

Current 10 #4, Slit 2A

Wave length 3415 Dial 312.5

Fuel - Acetylene Flow 14.0

Oxidant - Air Flow 14.0

Burner AB 51 in line

Range

0 - 20 gamma/ml Factor 4x - 0 - 400 ppm

0 - 100 gamma/ml Factor 20x - 0 - 2000 gamma

45° 0 - 200 gamma/ml Factor 40x - 0 - 4000 ppm

0 - 500 gamma/ml Factor 100x - 0 - 10,000 ppm

Ni in waters and very low ranges

Wave length 2320 Dial 113

Range 0 - 5 gamma/ml Factor 1x - 0 - 100 ppm

Standards 10,000 gamma/ml1.000 gm pure Ni metal dissolved in HCl, HNO₃, HClO₄ to perchloric fumes, dilute to 100 ml H₂O

1000 gamma/ml and 100 gamma/ml Successive 10x dilutions in 20% HCl

1, 2, 5, 8, 10 mls of 100 gamma/ml

2, 5, 8, 10 mls 1000 gamma/ml

2, 5, 8, 10 mls 10,000 gamma/ml - dilute to 100 mls in 20%

HClO₄. This gives

1, 2, 5, 8, 10, 20, 50, 80, 100, 200, 500, 800, 1000 gamma/ml

Combined Standards - Cu, Ni, Co, Pb, Zn is used as a working standard

Cu Geochemical AA Setting

Lamp Single Cu or

5 multi element

Current 10 for multi element #4 Slit 7A

4 for single #3 Slit 7A

Wavelength 3247 Dial 280

Burner Techtron AB 51 (For Cu in natural waters)

P.E. Short Path (For geochem)

Fuel Acetylene Flow 14

Oxidant Air Flow 14

Range

0 - 5 gamma/ml Factor 1x to 100 ppm (for low Cu)

0 - 20 gamma/ml Factor 4x to 400 ppm

Burner 90°

0 - 200 gamma/ml Factor 40x to 4000 ppm

Wavelength 2492 Dial 147

Burner in line

Range

0 - 1000 gamma/ml Factor 200x to 20,000 ppm

0 - 2000 gamma/ml Factor 400x to 40,000 ppm

Higher range than 40,000 ppm requires 10x dilution

Standards

10,000 gamma/ml

1.000 gm metal powder, H₂O, HCl, HNO₃ until dissolved, addHClO₄, fume dilute to 100 mls1000 gamma/ml 10x dilution above in 20% HClO₄2000 gamma/ml 20 mls 10,000 gamma/ml - dilute to 100 mls in
20% HClO₄100 gamma/ml 10x dilution 1000 gamma/ml dilute to 100 mls in
20% HClO₄200 gamma/ml 10x dilution 2000 gamma/ml dilute to 100 mls in
20% HClO₄

Pipette

1, 2, 3, 5, 8, 10 mls 100 gamma/ml - dilute to 100 mls with
20% HClO₄ to give 1, 2, 3, 5, 8, 10 gamma/ml

Combined standards Cu, Ni, Co, Pb, Zn

1, 2, 5, 10, 20, 30, 50, 80, 100, 150, 200 gamma/ml

Pb Geochemical AA Setting

Lamp ASL H/c Pb

Current 5 ma Slit 7A

Wave length 2833 Dial 208

Fuel - acetylene Flow 14

Oxidant - air Flow 14

Burner AB 51 in line

Range

0 - 20 gamma/ml to read 0 to 80. Factor 5x 0 to 500 ppm

0 - 200 gamma/ml to read 0 to 80. Factor 50x 0 to 5000 ppm

Standards - 10,000 gamma/ml

1.000 pure metal, dissolved in HNO₃, fumed to HClO₄ make up to 100 mls in 20% HClO₄1000 gamma/ml and 100 gamma/ml Successive 10x dilutions in 20% HClO₄

Pipette

1, 2, 5, 9, 10 mls 100 gamma/ml

2, 5, 8, 10, 20 mls 1000 gamma/ml dilute to 100 mls in 20%

HClO₄ this gives

1, 2, 5, 8, 10, 20, 50, 80, 100, 200 gamma/ml

Combined Standards Cu, Ni, Co, Pb, Zn, are used as working standards

W in Soils and Silts

Reagents and apparatus

Test tubes - pyrex disposable

Test tubes - screw cap

Bunsen Burner

Flux - 5 parts Na₂CO₃

4 parts NaCl

1 part KNO₃ pulverized to -80 mesh7% SnCl₂ in 70% HCl20% KSCN in H₂O

Extractant - 1 part tri-n-butyl phosphate

9 parts carbon tetrachloride

Standards

1000 gamma/ml W

.18 gms Na₂WO₄ 2H₂O dissolved in H₂O, make up to 100 mls

100 gamma/ml, 10 gamma/ml by dilution

Standardization

Pipette .5, 1, 2, 3, 5, 8, 10 ml of 10 gamma/ml

and 1.5, 2 mls of 100 gamma/ml - dilute to 10 mls

continue from step #4

Artificial colors - Nabob pure Lemon Extract, dilute with 1:1 ethanol and water to match. Tightly seal these for permanent standards

Procedure

1. Weigh 1.0 gram sample, add 2 gm flux, mix

2. Sinter in rotary for 2 to 3 minutes (Flux dull red for one minute)
3. Cool, add 10 mls H₂O, heat in sand bath to boiling, cool, let sit overnight
4. Stir, crush, and mix. Let settle
5. Take 2 ml aliquot into screw cap test tube
6. Add 7 mls SnCl₂, heat in hot water bath for 5 minutes (80°C)
7. Cool to less than 15°C
8. Add 1 ml 20% KSCN, mix (if lemon yellow; compare color standard 10x)
9. Add ½ ml extractant, cap, shake vigorously 1 minute
10. Compare color

Molybdenum in Water Samples

1. Transfer 50 mls to 125 separatory funnel
2. Add 5 ml .2% ferric chloride in conc HCl
3. Add 5 mls of mixed KSCN and SnCl₂
4. Add 1.2 mls isopropyl ether, shake for 1 minute, and allow phases to separate
5. Drain off water
6. Compare the color of extractant

Standardization

Pipette 0, .2, .5, 1, 2, 3, 4, 5, mls of 1 gamma/ml and 1, 1.5, 2, mls of 10 gamma/ml dilute to 50 mls with demineralized H₂O, and continue step #2.

This equivalent to

1, 4, 10, 20, 40, 60, 80, 100, 200, 300, 400 ppb Mo

Artificial color - Nabob orange extract dilute with 1:1 H₂O to methanol to match. Seal tightly

SnCl₂ - 15% in 15% HCl

300 gm SnCl₂ · 2H₂O + 300 mls HCl, until SnCl₂ dissolved
dilute to 2 liters

KSCN - 5% in H₂O

Mixed SnCl₂ - KSCN

3 parts SnCl₂ to 2 parts KSCN

Water Samples Run for AA

1. Cu - 2 gamma/ml reads 80 scale therefore 1 unit = 25 ppb
2. Zn - 1 gamma/ml reads full scale therefore 1 unit = 10 ppb
3. Ni - 2.5 gamma/ml reads 50 scale therefore 1 unit = 50 ppb

Burner: long slot techtron burner in line

Sulphate in Natural Waters

1. Pipette 0.5 ml sulphate reagent mix into a colorimetric tube
2. Add 5 ml water sample and mix
3. Read at 343 ~~mμ~~ against a demineralized water blank
4. Read again at 400 ~~mμ~~ and subtract from sulphate reading
5. Calculate ppm sulphate from the graph

Reagent

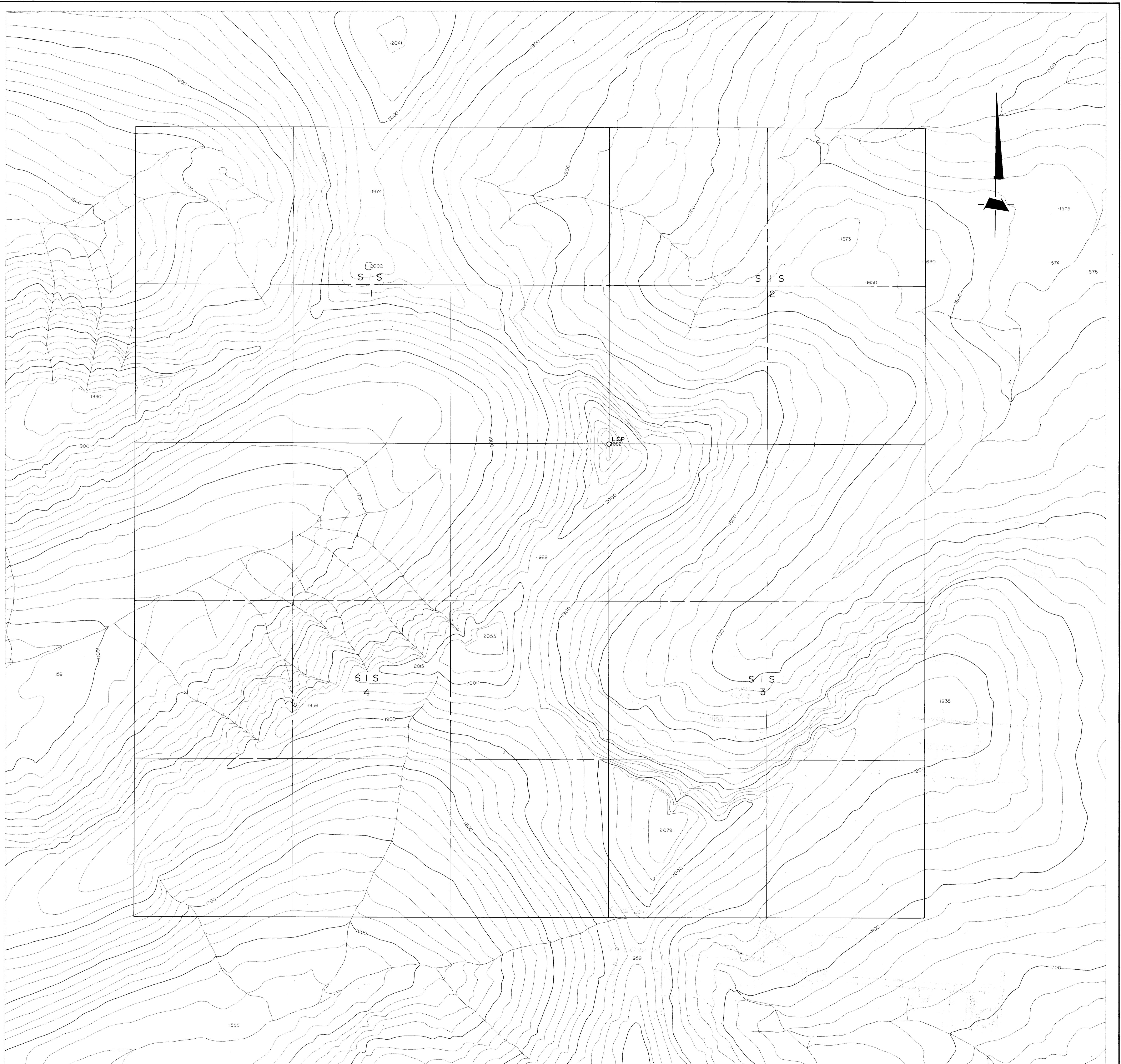
Dissolve 54 grams red mercuric oxide (J.T. Baker 2620- Can Lab) in 185 ml 70% perchloric acid and 20 ml H₂O, shake for one hour. Add 46.3 grams ferric perchlorate [Fe(ClO₄)₃ · 6H₂O] (GFS 39) and 47 grams aluminum perchlorate [Al (ClO₄)₃ · 3H₂O] (GFS 2) Add 400 ml water to dissolve, let settle overnight, decant into bottle and make to 1 liter

pH MEASUREMENTS

Soil and drainage sediment samples are dampened with water in a glass beaker to a pasty consistency. Demineralized water is used for this purpose as it has a low buffer capacity and thus does not influence the pH of the sample. Measurement is made with a Fisher Acument pH meter. Electrodes are stored in buffer overnight. A 30 minute warm up time is allowed for the instrument each morning. A 10 ml aliquot is taken from water samples for pH measurement.

ROSSBACHER LABORATORY

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MINERAL RESOURCES BRANCH
ASSESSMENT REPORT
9401

H.W. Sellmer
Aug 12/81

AMAX OF CANADA LIMITED
JOHNNY CREEK PROPERTY
SIS CLAIMS
LIARD MINING DIVISION-BRITISH COLUMBIA
TOPOGRAPHIC MAP

SCALE METRES
FEET
1 : 5 000

To accompany 1981 Assessment Report by H.W. Sellmer

Vancouver
N.T.S. Ref 104 P 7
FIG. 4