

GEOLOGICAL & GEOCHEMICAL REPORT ON THE
FIDDLER CREEK CLAIMS

Sno #1 - 10

"A" Group

Located 20 air miles northeast
of Terrace, B.C.

Latitude 54°46'

Longitude 128°27'

By J.N. Schindler and R.A. Barker (P.Eng.)
for Amax Exploration, Inc.

Work was carried out during September
12th - 17th, 1966

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998

866

GEOLOGICAL AND GEOCHEMICAL REPORT

ON THE

FIDDLER CREEK MoS₂ PROPERTY

OMINECA MINING DIVISION, B.C.

103 I

J.N. Schindler

Vancouver Office
November, 1966

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SUMMARY

The Fiddler Creek Property is located twenty miles northeast of Terrace, B.C. in a rugged area near the head waters of a northwest-trending tributary of Fiddler Creek.

MoS₂ occurs in the southern half of a granitic intrusive localized at the contact between the Legate Creek apophysis and rocks of the Hazelton and Bowser Groups.

The plug is composed essentially of granite and is exposed along steep cliffs as an elongate body approximately 2500 to 3000 feet long and 400 to 500 feet wide. The intrusive trends approximately 140° and dips 45 to 50° southwest. Equigranular granodiorite and porphyritic granite are exposed on the hanging wall contact of the granitic intrusive, but their relationship to the granite is obscure.

Pink quartz feldspar biotite porphyry is exposed in a dyke 30 feet wide along the southwest hanging wall contact. Numerous porphyritic granodiorite dykes and basic dykes intrude the granitic intrusive. The granodiorite dykes are cut by quartz-pyrite-MoS₂ veins. The basic dykes, some as much as fifty feet wide, are the youngest intrusives and are post-MoS₂ in age.

Moderate to intense sericitization is widespread in the southern and central portions of the granite and is frequently associated with MoS₂. K-feldspathization is common along sulphide bearing quartz veins in the hanging wall granodiorite. Moderate

argillization is associated with sericite, pyrite and MoS_2 in the hanging wall granodiorite.

Pyrite is limited essentially to the granitic intrusive and to the volcanic rocks along the hanging wall contact of the intrusive in the Lynda #3 claim. Oxidation of the pyrite has produced a well developed iron stained zone. Higher grade molybdenite mineralization is associated with areas of more intense limonite staining.

Two main structural trends have been defined at 070° and 140° respectively. Porphyritic feldspar granodiorite dykes, basic dykes and high grade quartz-pyrite- MoS_2 veins define the trend of 070° in the central and southern portions of the granite. The trend of 140° is defined by acid and basic dykes as well as shear zones.

Molybdenum mineralization has been observed for a length of 1500 feet, a width of approximately 400 to 500 feet and through a height of 1000 feet. The zone is open on the foot wall side. The MoS_2 is fine grained and is localized in, or is closely associated with, the granitic intrusive. It occurs in narrow 1/4 to 1/8 inch wide quartz pyrite veins (singly or in stockworks), in high grade multiple-banded quartz pyrite veins, in silicified shears, disseminated in the main granite, and on dry fractures.

One hundred feet of rock samples, (sampled by the continuous chip method at 10 foot intervals) gave a weighted average

of assayed MoS_2 of 0.04% MoS_2 . The weighted average of MoS_2 equivalents calculated from assayed Mo is 0.06%. High grade veins 4 inches to 1 foot wide occur over a horizontal distance of 1000 feet. Three samples of float collected from the central part of the granite and derived from these veins assayed 0.23%, 1.30% and 1.38% MoS_2 (calculated) respectively.

Geochemical soil samples indicate a small area of anomalous concentrations of Mo in the volcanic rocks up dip from the granite. Soil samples from the central portion of granite gave Mo results in the range of 40 to 1600 ppm.

CONCLUSIONS

The geological setting of the mineralization, the intensity of the MoS_2 mineralization, its distribution and mode of occurrence, and its association with the wide spread hydrothermal alteration indicates that this property is worthy of further exploration.

Due to the limitations imposed by the topography, low returns for any surface program can be expected.

RECOMMENDATIONS

Two, fifteen hundred foot diamond drills at -50° are proposed to test the south and central parts of the molybdenum bearing stock.

INTRODUCTION

This report embodies the results of five days work carried out by the author on the Fiddler Creek MoS₂ Property, located twenty miles northeast of Terrace and six miles southwest of Dorreen, B.C. The area of interest lies near the headwaters of a northwest trending tributary of Fiddler Creek. Relief on the property is of the order of 2000 feet and access over the mineralized zone is limited by topography. For more detail on the location, topography, and vegetation of the property the reader is referred to a report by P.R. Kennedy and P.W. Richardson, entitled "Geological and Geochemical Report on the Fiddler Creek Claims", dated September 1966.

REGIONAL GEOLOGY

The property is located on the west side of a north trending bulge in the Legate Creek apophysis which is one of four easterly trending apophyses in the Terrace area. The apophysis intrudes both volcanic rocks of the Hazelton Group and sedimentary rocks of the Bowser Group.

PROPERTY GEOLOGY

MoS₂ is associated with the southern half of an elongate granitic intrusive roughly twenty-five hundred feet long and five hundred feet wide. The plug is localized along the contact between granodiorite of the Legate Creek apophysis and volcanic rocks of the Hazelton Group.

PetrologyTABLE ITABLE OF FORMATIONS

Post - MoS ₂	Basic Dykes Quartz Feldspar Biotite Porphyry
-----	-----
Contemporaneous with MoS ₂ mineralization	Porphyritic Granodiorite Dykes Granitic Intrusive Aphanitic, Fine Grained Granite Hanging Wall Granodiorite, Porphyritic Granite
-----	-----
Pre - MoS ₂	Regional Coast Range Granodiorite Bowser Group: Sedimentary Rocks Hazelton Group: Volcanic Rocks
-----	-----

Rocks of the Hazelton Group and Bowser Group exposed on the property have already been discussed by Kennedy ⁽¹⁾ and will not be described here.

Coast Range Granodiorite

Coarse grained, equigranular, chloritized, biotite granodiorite of the Legate Creek apophysis in this area is cut by granite dykes and veins in the southeast corner of the Lynda #5 claim. The Coast Range Granodiorite is, therefore, the oldest intrusive rock on the property. (See Figure 2).

Granitic Intrusive

An MoS₂-bearing granitic intrusive localized at the contact between the Legate Creek apophysis and the Hazelton volcanic rocks, is exposed in an elongate body 2500 to 3000 feet long and 400 to 500 feet wide. In the central and southern

portion of the intrusive the hanging wall contact dips 45° to 50° to the southwest. In the southern half of the intrusive the foot wall contact is covered by talus and therefore its attitude is not known.

The granitic intrusive is composed largely of aphanitic to fine grained granite, and small amounts of equigranular granodiorite and porphyritic granite which are exposed along the hanging wall contact. The relationships between the hanging wall granodiorite, the porphyritic granite and the aphanitic to fine grained granite are not known.

Hanging Wall Granodiorite

Medium grained equigranular granodiorite is exposed along the hanging wall contact of the granitic intrusive. The granodiorite is composed of 60% plagioclase feldspar, 25% quartz, 15% biotite, and less than 1% disseminated pyrite. The rock shows a development of weak foliation and is cut by MoS_2 -bearing quartz veins. The relationship between the hanging wall granodiorite and the granodiorite of regional extent has not been established.

Porphyritic Granite

Pink porphyritic granite composed of 75 - 65% pinkish feldspar, 25 - 30% quartz, 3% fine grained brown biotite, 2% disseminated pyrite, and less than 1% epidote is exposed along the hanging wall contact of the granitic intrusive. The porphyritic texture of this rock results from medium grained rounded

quartz eyes in a slightly finer groundmass. This unit may well represent a porphyritic phase of the hanging wall granodiorite which has been altered by potash metasomatism.

Aphanitic to Fine Grained Granite

Pink aphanitic to fine grained granite composed essentially of pink feldspar and quartz comprises most of the granitic intrusive.

The granite is molybdenum and copper bearing in the central and southern portions, is highly fractured, well sericitized and quartz veined, and is intruded by numerous intermediate and basic dykes.

Porphyritic Granodiorite Dykes

Medium grey, porphyritic granodiorite dykes trending 070° and cut by quartz-pyrite- MoS_2 veins are exposed in the central and southern portions of the granitic intrusive. The dykes are composed of medium grained plagioclase feldspar phenocrysts set in a finer grained groundmass of granodiorite composition and composed of feldspar, quartz and biotite.

Pink Quartz Feldspar Biotite Porphyry

This rock is exposed in a dyke located along the southwest hanging wall contact of the granitic intrusive. It is composed of fine to medium grained phenocrysts of quartz, pink feldspar, and biotite set in a pink aphanitic groundmass. It carries accessory amounts of pyrite and is conspicuously devoid of quartz

essentially to the granitic intrusive and to the volcanic rocks comprising the cliffs in the Lynda #3 claim. Oxidation of the pyrite has produced a well developed iron-stained zone. Pyrite has been observed in virtually all the rocks within the main granitic intrusive. It occurs in quartz-pyrite-MoS₂ veins, barren quartz-pyrite veins, along dry fractures and disseminated as an accessory mineral. Within the main iron-stained zone, high grade quartz-pyrite-MoS₂ veins are rendered more conspicuous by the development of intense limonite staining.

Hematization

Hematite has been observed in the central portion of the granite where it occurs in narrow (less than 1/4") quartz veins near the hanging wall contact. The best developed hematization was observed in crackled argillized granite float in the northeast corner of the Lynda #3 claim.

Argillization

Weak to moderate argillization of plagioclase feldspars has been observed in float derived from the hanging wall-granodiorite. The argillic alteration is associated with a molybdenum bearing quartz vein stockwork and is also associated with sericite and pyrite.

Structure

The main structural feature of the property is the granite intrusive which trends 120° and dips 45 to 50° to the

veins.

The dyke intrudes both porphyritic granodiorite and the pink granite and is therefore younger than these units.

Basic Dykes

Numerous basic dykes are exposed in the main granitic mass. They trend 070° and 140° and as such reflect the general structural fabric within the granitic intrusive. The basic dykes are post quartz veining and molybdenite in age and are thought to be the youngest intrusive rocks on the property.

Alteration

Sericitization

Sericitization is the most widespread and most intense alteration observed in the granitic intrusive. Sericite is most common along the numerous fractures within the granite and to a lesser degree along quartz-pyrite-MoS₂ veins.

K-feldspathization

K-feldspathization is most conspicuously developed in the hanging wall-granodiorite where it occurs marginal to quartz-pyrite and quartz-pyrite-MoS₂ veins. Where the quartz-pyrite-MoS₂ veins are closely spaced, and where the potash metasomatism is well developed, the rock takes on the appearance of having been altered by pervasive K-feldspathization.

Pyritization

Distribution of pyrite in the property is limited

southwest. It appears to pinch out in the north and to be terminated by a north-trending fault in the south. Within the granite there are two main structural directions, 070° and 140° . Porphyritic feldspar granodiorite dykes, basic dykes, high-grade quartz-pyrite-molybdenite veins, and silicified MoS_2 shears define the trend of 070° in the south and central portions of the granite stock.

Shear zones along the southeast contact of the granite as well as the pink quartz feldspar biotite porphyry, and basic dykes strike 140° and are roughly parallel to the long axis of the granitic stock.

MoS_2 Mineralization

Molybdenite mineralization occurs over a length of approximately 1500 feet, a width of approximately 400 to 500 feet and through a vertical range of 1000 feet. For the most part, molybdenum is localized in, or closely associated with the granitic intrusive. In the Lynda #1 and #3 claims however it has also been found in the volcanic rocks on the hanging wall side of the intrusive stock.

MoS_2 is the primary molybdenum mineral. It occurs in:

- 1) narrow $1/4$ to $1/8$ inch wide quartz pyrite veins which occur singly or in stockworks,
- 2) high grade, multiple banded quartz-pyrite- MoS_2 veins,
- 3) in silicified shears,

4) disseminated within the main granitic intrusion,

5) on dry fractures in the volcanic rocks in the Lynda #1 claim. The molybdenite is characteristically fine grained and is associated with quartz, pyrite, sericite and K-feldspar.

The best grade of MoS_2 is exposed in the southeast corner of the granitic intrusive. Here high grade multiple banded MoS_2 -quartz-pyrite veins and MoS_2 in silicified shears, together with small quartz-pyrite- MoS_2 veins occur in close proximity.

In the central portion of the granitic intrusive well mineralized banded quartz- MoS_2 veins, four to six inches wide have been observed. These structures are well developed and can easily be traced for 100 feet or more. Three samples of float from these veins collected by Kennedy from talus in the central portion of the granite assayed 1.30%, 1.38% and 0.23% MoS_2 respectively.

The foot wall limits of the molybdenite mineralization have not been established because of the talus cover at the base of the cliffs. In the Sno #3 claim minor amounts of molybdenite in narrow 1/4 inch quartz-pyrite veins were observed at the outcrop talus interface.

Geochemistry

Twenty-three soil samples were collected to supplement the work of Kennedy carried out in July and August. The samples were collected by digging a hole with a mattock and using a

stainless steel trowel to extract the samples. Wherever possible the sample was collected from the B₁ horizon. Where no soil profile was present, for example, on very steep slopes and on talus slopes, the C horizon was sampled.

The results of the geochemical sampling are shown in Figure 2 and Appendix I. The soil sampling shows that anomalous concentrations of Mo are present in the volcanic rocks near the hanging wall contact in the Lynda #3 claim. Three other samples collected across the granite in the southeast and northeast corners of the Lynda #1 and #3 claim gave values ranging from 240 to greater than 1600 ppm.

The average pH of nine soil samples is 4.9. The chemical transportation of molybdenum in this environment can therefore be considered a minimum. The intensely fractured and highly altered nature of the granite, however, has resulted in mechanical plucking of MoS₂. Geochemical, and assay results, of samples taken in the granite are minimum readings.

Assay Results

One hundred feet of rock was sampled at ten foot intervals by the continuous chip method. These samples were assayed for total Mo, MoS₂ and Cu. The theoretical MoS₂ content of the samples calculated from the assayed total Mo is shown together with the assay results and other data in Appendix II.

The weighted average of the assayed MoS₂ is 0.04% and

the weighted average of the calculated MoS_2 is 0.06%. The difference between these figures is due to molybdenum present in the oxide form. The weighted average of the copper content is 0.04%.

Sample 16-388 represents material selected from a six inch wide quartz- MoS_2 vein located at the southern end of the granitic intrusive. The vein assayed 1.07% MoS_2 over six inches. High grade MoS_2 in a silicified shear zone approximately one foot wide occurs within fifteen feet of this vein. It is worthy of note that Kennedy found float assaying between .23% and 1.38% MoS_2 derived from the central portion of the granitic intrusion approximately 1000 to 1200 feet to the northwest.

Vancouver Office

November, 1966



J.N. Schindler



R.A. Barker (P.Eng.)

REFERENCE

- (1) Kennedy, P.R. and Richardson, P.W., September 1966,
Geological and Geochemical Report on the Fiddler Creek
Claims, Vancouver Office

APPENDIX IGEOCHEMICAL SOIL SAMPLING DATA

<u>SAMPLE NUMBER</u>	<u>SOIL TYPE</u>	<u>Mo</u>	<u>Cu</u>	<u>THM</u>	<u>pH</u>
UJS -1	B ₁	2	0	2	4.8
2	B ₁	20	4	2	-
3	B ₁	20	16	2	-
4	B ₁	30	16	2	4.8
5	B ₁	30	70	1	-
6	-----no-----sample-----				
7	B ₁	30	8	2	-
8	B ₁	30	0	2	4.6
9	B ₁	40	16	2	-
10	B ₁	80	12	2	-
11	B ₁	80	0	1	4.6
12	B ₁	80	8	2	-
13	B ₁	80	0	2	-
14	B ₁	120	8	2	4.8
15	B ₁	40	16	2	-
16	B ₁	80	16	2	-
17	B ₁	120	16	2	4.5
18	B ₁	60	16	0	5.4
19	B ₁	60	24	1	
20	E ₁	30	8	1	
21	C ¹	40	40	0	5.5
22	C	1600	640	2	-
23	C	240	200	5	-
UJS -24	C	480	400	*	5.2

* denotes Cu interference

Average pH of nine soil samples is 4.9.

APPENDIX IIASSAY DATA

LINE NO.

LINE NO.	LOCATION South-North	Number	Interval Feet	<u>Assayed</u>	<u>Calcu- lated</u>	<u>Assayed</u>	
				Total Mo %	MoS ₂ %	MoS ₂ %	Cu %
1	0-10'	16380	10'	0.04	0.07	0.06	0.09
1	10-20	16381	10	0.01	0.02	0.02	0.06
1	20-30	16382	10	0.02	0.03	0.03	0.05
1	30-40	16383	10	0.04	0.07	0.04	0.03
1	40-50	16384	10	0.05	0.08	0.07	0.03
1	50-60	16385	10	0.11	0.18	0.10	0.03
1	60-70	16386	10	0.02	0.03	0.02	0.01
1	70-80	16387	10	0.01	0.02	0.02	0.02
1		16388	6"	0.64	1.07	0.86	0.02
	SW to NE						
2	0-10	16389	10'	0.03	0.05	0.03	0.03
2	10-20	16390	10	0.01	0.02	0.01	0.02
	Float	17605	-	0.14	0.23	0.23	0.90
	Float	17606	-	0.83	1.38	1.58	0.04
	Float	17607	-	0.78	1.30	0.50	0.03

Weighted average * 0.04% MoS₂
 Weighted average * 0.06% MoS₂ (calculated)
 Weighted average * 0.04% Cu

* sample 16388 excepted

APPENDIX IIIFIDDLER CREEK ASSESSMENT WORK - September 12th - 17th, 1966Helicopter Costs

Sept 12 - Access Flight Terrace-Fiddler Hiller 12E (N-90469) 1 hr.05 mins. @ \$130/hr.	= \$ 140.83
Sept 14 - Flight used on property to move crew Hiller (N-90469) Total time 45 mins. @ \$130/hr.	97.50
Sept 15 - Flight used on property to move crew Hiller (N-90469) Total time 45 mins. @ \$130/hr.	97.50
Sept 17 - Flight to move crew Fiddler Creek to Terrace S-55 (CF-JTC) 50 mins @ \$170/hr.	142.00
Sept 24 - Flight Terrace to Fiddler Creek to spot DDH sites G2 Bell (CF-JSK) 1 hr. @ \$103/hr.	103.00

Personnel Employed and Salaries

J.A.G. Phillips, 808-103 Ave., Dawson Creek 6 days at \$13.33/day	79.98
J.N. Schindler, 601-535 Thurlow St., Vancouver, B.C. 6 days	169.98

Board

12 man days @ \$2.50/man day	30.00
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Assaying

11 rock samples @ \$13/sample	143.00
Cost of shipping samples Terrace-Vancouver (CN Express)	3.90

Cont'd.....

Geochemical Samples

23 samples @ \$2/sample	\$	46.00
Cost of shipping samples Terrace-Smithers (Canadian Coachways)		3.85

Report Preparation

Writing, draughting and typing		100.00
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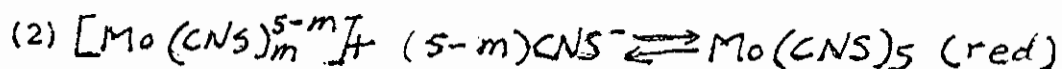
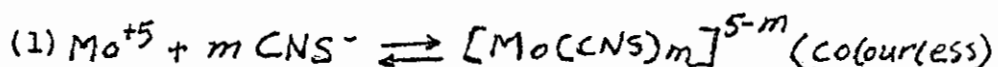
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INTRODUCTION

This report is a detailed description of the geochemical analytical method used by the Southwest Potash Corporation field laboratory in the determination of trace molybdenum in soil, stream sediment, rock chips, and water samples.

The method used is a modification of the classical thiocyanate-stannous chloride colorimetric technique. In acid solution in the presence of a suitable reducing agent, such as stannous chloride, thiocyanate reacts with molybdenum to form an amber colour. Such a thiocyanate complex of quinquevalent molybdenum ions is extracted in immiscible organic solvents such as ether or alcohol. The intensity of the coloured complex obeys Lambert-Beer's law and is proportional to the quantity or concentration of molybdenum present.

The reactions are given by the equations:



Only the quinquevalent molybdenum ion gives a coloured thiocyanate complex. According to Sandell, not all molybdenum is reduced to the quinquevalent form. It is estimated only about two-thirds of the total molybdenum present gives a colour reaction. However, because the standards are

treated in the same manner as the unknowns, any error cancels itself out and has no effect on the reported result.

Following a description of the analytical methods, a summary of the 1963 field laboratory is given in the appendix plus some recommendations for improving future laboratory operations.

SAMPLE PREPARATIONS

(a) Soil and Silt

Soil and silt samples when received are commonly wet or moist and must be dried before sieving. Treat the samples in the following steps:

1) Put the sample bags on an aluminum foil tray and place on top of an oil stove. Time required is usually eight hours.

2) Sieve the dried samples with a minus 35-mesh screen onto a one foot square piece of heavy brown paper. Use a new piece of paper every day and clean the sieve with a paint brush between samples.

3) Using a volumetric scoop (calibrated to deliver a given weight of sample) 'weigh' out a known amount (usually 1 gram) of screened sample and transfer it into a marked test tube.

4) Return the remaining fines (pulp) of the sieved sample into its original sample bag.

5) Put the samples in storage boxes if available or string with a piece of twine in batches of about 30 for bulk storage in gunny sacks.

(b) Rock Chips

1) With the sample still in its bag, crush with a hammer into small pieces.

2) Transfer several pieces of crushed rock into a porcelain mortar and grind.

3) Sieve the ground sample through a minus 35-mesh screen and proceed through steps 2 to 5 as followed for soil and silt samples. If the original bag is badly damaged during crushing transfer the pulps to a new bag.

DIGESTION

Samples of soil, silt and rock chips are digested in a hot water bath. The heat is supplied by a three-burner Coleman stove. Digestion is best done outside the laboratory where the toxic nitric fumes can dissipate into the atmosphere away from both laboratory equipment and personnel.

Digestion is carried out as follows:

1) Measure out volumetrically with leucite scoop 1 gm of the sieved sample and place in a 15 x 125 rimmed test tube.

2) Using an automatic pipette, add 4 ml of diluted (3:1) nitric acid.

- 3) Digest the samples, a rack at a time for 2 hours.
- 4) Shake the tubes occasionally to aid digestion.
- 5) Remove the rack and allow to cool.
- 6) Using poly wash bottle, fill all tubes up to the 4 ml mark with water.

DETERMINATION

(a) Soil, Silt and Rock Chip

Samples are usually treated in batches of ten and in racks of forty.

- 1) Using an auto-pipette, transfer a 1 ml aliquot from each digested solution to a marked rimless test tube. Use a smaller aliquot if high molybdenum content is suspected.

NOTE: Clean the auto-pipette thoroughly between each sample by rinsing at least three times with de-mineralized water. Shake the pipette in the air to dry. Contamination could easily occur at this step without suitable rinsing.

- 2) To each test tube using an automatic pipette, add 2 ml of 10% HCl.
- 3) Using a spatula, add 0.2 gm of sodium tartrate.
- 4) Using a burette, add 1.5 ml of KSCN. Shake to mix.
- 5) Using a burette, add 0.5 ml of SnCl₂ solution. Shake to mix.

NOTE: If the iron content of the testing solution is high, a larger amount of SnCl₂ solution may be required, (SnCl₂ should be added to completely eliminate the blood red colour of the ferric thiocyanate).

- 6) Using a wash bottle, add water to bring the total volume of the solution up to the 10 ml mark.
- 7) Using a burette, add exactly 1 ml of ether.
- 8) Stopper the test tubes with corks and shake vigorously for 45 seconds. It is advisable to number the corks to avoid mixing up tubes.
- 9) Allow the phases to separate.
- 10) Compare the colour of the ether layer to that of the molybdenum standards. Colour intensities should be compared and matched against a white background.

CALCULATIONS

(a) Soil, Silt and Rock Chip

The concentration of molybdenum in parts per million (ppm) is calculated from the following factors:

- 1) The weight of sample used for digestion.
- 2) Volume of solution for digestion.
- 3) Volume of aliquot taken for determination.
- 4) Gamma content of the matched standard.

The concentration in ppm is given by the formula

$$\text{ppm} = \frac{\text{volume digested sample solution(ml)}}{\text{weight of sample (gm)}} \times \frac{\text{value of matched standard (gammas)}}{\text{aliquot of sample(ml)}}$$

= gammas per gram (which equals parts per million)

STANDARDS(a) Molybdenum Standard Solutions

1) Stock standard concentrated: (100 gammas/ml). Dissolve 0.075 gm of MoO_3 in 20 ml of 10% NaOH. (10 gm of NaOH crystals in 100 ml of water). Dilute to 100 ml. Add diluted HCl until the solution is acid (use pH hydrion paper). Fill to 500 ml mark of the flask. Prepare this solution once a season.

2) Stock standard diluted: (1gamma/ml). Dilute 1 ml of stock standard to 100 ml mark of the volumetric flask. Prepare this diluted solution each time a new standard is made.

(b) Working Molybdenum Standard for Soil, Silt & Rock Chip

Two sets of working standards representing a low and a high range are prepared by diluting the working standard. The amount of standard solution diluted is outlined in the following tables.

Pipette from stock standard solutions the required volumes into a series of 7 test tubes. The amount and concentration of stock standard solution used is outlined in the following tables.

LOW RANGE

STANDARDS	A	B	C	D	E	F	G	H
ml of 1 $\frac{1}{2}$ /ml standard	0	0.5	1.0	1.5	2.5	3.0	4.0	5.0
Gammas	0	0.5	1.0	1.5	2.5	3.0	4.0	5.0
ppm*	0	2.0	4.0	6.0	10.0	12.0	16.0	20.0

* Concentration based on aliquot representing one quarter of a gram as used in procedure given above.

HIGH RANGE

STANDARDS	I	J	K	L	M	N	O
ml of 100 $\frac{1}{2}$ /ml standard	0.1	0.2	0.25	0.5	0.8	1.00	1.5
Gammas	10	20	25	50	80	100	150
ppm*	40	80	100	200	320	400	600

Treat the standards as outlined in the procedure given for the unknowns. It is important that the standards and unknowns undergo identical treatment. Cover the standards with a sheet of aluminum foil to shield them against any heat or light when not in use. Prepare new standards at least once every three weeks or sooner if fading is suspected.

PREPARATION OF REAGENTS

The following reagents are used in the test on soil, silt and rock chip samples.

1) 10% HCl: Add 100 ml of concentrated HCl into a 2 litre beaker and dilute to one litre. Store in a poly bottle.

2) Diluted HNO₃: Dilute 750 ml of concentrated HNO₃ to one litre. Store in a poly bottle.

3) Thiocyanate solution: Dissolve 5 gm of KSCN in 100 ml of water. Prepare fresh solution daily.

4) SnCl₂ solution: Dissolve 13 gm of SnCl₂ in 17 ml of concentrated HCl. Heat the mixture in a hot water bath. Make up to 100 ml with water when crystals have been completely dissolved. Add a piece of metallic tin to ensure stability of SnCl₂. Prepare a fresh solution daily.

5) Sodium tartrate - use directly as a solid.

6) Isopropyl ether - use directly but with caution as it is highly inflammable and explosive peroxides may form.

Use de-mineralized water for all reagents, preparations and analytical determinations.

pH DETERMINATION

A line-operated Beckman Model H-2 meter is used in making pH measurements. Following a warm-up period, the meter is calibrated with standard buffer solutions before using and rechecked between every 20 determinations, or every hour whichever comes first.

(a) Soil and Silt

Measurements are made as follows:

- 1) Pour approximately 15 gm of the sieved sample into a 30 ml poly beaker. Wet the sample with distilled water (use neutral stream water). Do not use de-mineralized water (water passed through a resin de-mineralizer is acidic). Swirl the beaker occasionally during the determination to ensure the sample is in a homogeneous state.
- 2) Gently insert the electrodes into the dampened sample.
- 3) Observe the pH reading when the needle reaches a steady state.
- 4) Discard the tested sample, clean the beaker and electrodes with water. Wipe the electrodes with a cleaning tissue. It is important that the electrodes be thoroughly cleaned after every determination.

(b) Rock Chips

pH determination is not required for rock chip.

WATER DETERMINATION

Water samples require no special preparation preceding the actual analysis . Samples are usually treated in sets of six.

(a) Determination

- 1) Pour water sample into a separatory funnel up to the 50 ml mark.
- 2) Using an automatic pipette, add 5 ml of diluted HCl.
- 3) Using an automatic pipette, add 1 ml of ferric ammonium sulphate solution. Tilt funnel to mix.
- 4) Using an automatic pipette, add 3 ml of KSCN solution. Tilt funnel to mix.
- 5) Using an automatic pipette, add 3 ml of SnCl₂ solution. Tilt funnel to mix.
- 6) Using a burette, add 2 ml of ether. Shake for 45 seconds. Release pressure every 10 seconds during shaking.
- 7) Allow phases to separate.
- 8) Discard the aqueous (water) layer into a beaker. Stop at 10 ml mark.
- 9) Drain off the remaining aqueous and the organic phases into a 16 x 150 rimless test tube.
- 10) Compare the colour of the organic layer to that of the molybdenum standards.

(b) Calculation

The concentration of molybdenum in water is expressed in parts per billion (ppb), i.e., 1/1000 gammas per gram or gammas per 1000 grams. The concentration is calculated using two factors.

- 1) The initial volume of sample used for determination.
- 2) The value of the matched standard x 1,000.

The concentration of molybdenum in water is given by the formula:

$$\text{ppb} = \frac{\text{value of the matched standard (gammas)}}{\text{volume of water used for determination (ml)}} \times 1,000$$

= gammas per 1000 millilitres (since density of water is equal to 1)

= gammas per 1000 grams, or ppb

(c) Standards

1) Pipette 0, 0.25, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 5.0, 8.0 ml of the dilute (1 gamma/ml) stock standard solution into the separatory funnels.

2) Add water to 50 ml mark and proceed with step (2) to step (9) given above for water determinations.

(d) pH Determination

Measurements are taken as follows:

- 1) Approximately 25 ml of sample is transferred into a 30 ml poly beaker for measurement.
- 2) Insert the electrode and take a reading.
- 3) Discard the sample; wash down and dry the electrodes.

(e) Preparation of Reagents

In addition to some reagents already mentioned on the previous pages the following are needed in the water test.

1) Ammonium sulfate solution: Dissolve 1 gm of ferric ammonium sulfate crystals in 100 ml of water. Warm the mixture in a water bath. Prepare fresh solution once every five days.

2) KSCN solution: Dissolve 10 gm of KSCN crystals in 100 ml of water. KSCN dissolves in cold water. Prepare fresh solution daily.

3) SnCl_2 solution: Heat 30 gm of SnCl_2 in 50 ml of concentrated HCl in a water bath till a clear solution appears. Dilute the solution to 300 ml. Insert a piece of metallic tin to stabilize the solution. Prepare fresh solution daily.

4) Diluted HCl: Dilute 800 ml of concentrated to one litre.

ADDENDUM TO REPORT ENTITLED:

GEOLOGICAL AND GEOCHEMICAL REPORT
ON THE
FIDDLER CREEK CLAIMS - SNO # 1 - 10 incl.
"A" GROUP
LATITUDE 54°46', LONGITUDE 128°27'.

by: J.N. Schindler and R.A. Barker (P.Eng.), November 1966

for

AMAX EXPLORATION, INC.

SAMPLE PREPARATION

All soil and stream sediment samples are treated in an indentical manner as follows:

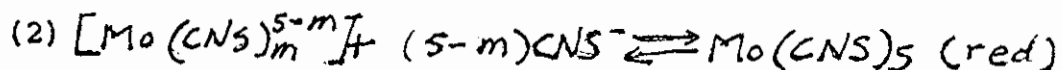
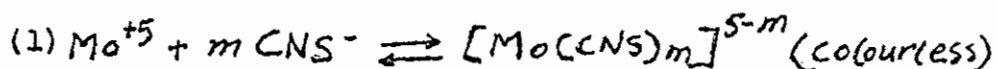
- (1) The samples are collected in thick kraft paper soil sample envelopes. Upon return to camp, the envelopes are hung up for two or three days to air dry the samples so the bags will stand shipment without breaking.
- (2) Upon receipt at the Smithers Laboratory, the samples are thoroughly dried in the same bags by hanging them in a heated drying cupboard overnight. Heating the samples on an aluminum tray is no longer practiced (see Company standard practice for geochemical analytical method)
- (3) The dried samples are seived with a 35 mesh screen and the minus 35 mesh component is analyzed.

INTRODUCTION

This report is a detailed description of the geochemical analytical method used by the Southwest Potash Corporation field laboratory in the determination of trace molybdenum in soil, stream sediment, rock chips, and water samples.

The method used is a modification of the classical thiocyanate-stannous chloride colorimetric technique. In acid solution in the presence of a suitable reducing agent, such as stannous chloride, thiocyanate reacts with molybdenum to form an amber colour. Such a thiocyanate complex of quinquevalent molybdenum ions is extracted in immiscible organic solvents such as ether or alcohol. The intensity of the coloured complex obeys Lambert-Beer's law and is proportional to the quantity or concentration of molybdenum present.

The reactions are given by the equations:



Only the quinquevalent molybdenum ion gives a coloured thiocyanate complex. According to Sandell, not all molybdenum is reduced to the quinquevalent form. It is estimated only about two-thirds of the total molybdenum present gives a colour reaction. However, because the standards are

treated in the same manner as the unknowns, any error cancels itself out and has no effect on the reported result.

Following a description of the analytical methods, a summary of the 1963 field laboratory is given in the appendix plus some recommendations for improving future laboratory operations.

SAMPLE PREPARATIONS

(a) Soil and Silt

Soil and silt samples when received are commonly wet or moist and must be dried before sieving. Treat the samples in the following steps:

1) Put the sample bags on an aluminum foil tray and place on top of an oil stove. Time required is usually eight hours.

2) Sieve the dried samples with a minus 35-mesh screen onto a one foot square piece of heavy brown paper. Use a new piece of paper every day and clean the sieve with a paint brush between samples.

3) Using a volumetric scoop (calibrated to deliver a given weight of sample) 'weigh' out a known amount (usually 1 gram) of screened sample and transfer it into a marked test tube.

4) Return the remaining fines (pulp) of the sieved sample into its original sample bag.

5) Put the samples in storage boxes if available or string with a piece of twine in batches of about 30 for bulk storage in gunny sacks.

(b) Rock Chips

1) With the sample still in its bag, crush with a hammer into small pieces.

2) Transfer several pieces of crushed rock into a porcelain mortar and grind.

3) Sieve the ground sample through a minus 35-mesh screen and proceed through steps 2 to 5 as followed for soil and silt samples. If the original bag is badly damaged during crushing transfer the pulps to a new bag.

DIGESTION

Samples of soil, silt and rock chips are digested in a hot water bath. The heat is supplied by a three-burner Coleman stove. Digestion is best done outside the laboratory where the toxic nitric fumes can dissipate into the atmosphere away from both laboratory equipment and personnel.

Digestion is carried out as follows:

1) Measure out volumetrically with leucite scoop 1 gm of the sieved sample and place in a 15 x 125 rimmed test tube.

2) Using an automatic pipette, add 4 ml of diluted (3:1) nitric acid.

- 3) Digest the samples, a rack at a time for 2 hours.
- 4) Shake the tubes occasionally to aid digestion.
- 5) Remove the rack and allow to cool.
- 6) Using poly wash bottle, fill all tubes up to the 4 ml mark with water.

DETERMINATION

(a) Soil, Silt and Rock Chip

Samples are usually treated in batches of ten and in racks of forty.

- 1) Using an auto-pipette, transfer a 1 ml aliquot from each digested solution to a marked rimless test tube. Use a smaller aliquot if high molybdenum content is suspected.

NOTE: Clean the auto-pipette thoroughly between each sample by rinsing at least three times with de-mineralized water. Shake the pipette in the air to dry. Contamination could easily occur at this step without suitable rinsing.

- 2) To each test tube using an automatic pipette, add 2 ml of 10% HCl.
- 3) Using a spatula, add 0.2 gm of sodium tartrate.
- 4) Using a burette, add 1.5 ml of KSCN. Shake to mix.
- 5) Using a burette, add 0.5 ml of SnCl₂ solution. Shake to mix.

NOTE: If the iron content of the testing solution is high, a larger amount of SnCl₂ solution may be required, (SnCl₂ should be added to completely eliminate the blood red colour of the ferric thiocyanate).

6) Using a wash bottle, add water to bring the total volume of the solution up to the 10 ml mark.

7) Using a burette, add exactly 1 ml of ether.

8) Stopper the test tubes with corks and shake vigorously for 45 seconds. It is advisable to number the corks to avoid mixing up tubes.

9) Allow the phases to separate.

10) Compare the colour of the ether layer to that of the molybdenum standards. Colour intensities should be compared and matched against a white background.

CALCULATIONS

(a) Soil, Silt and Rock Chip

The concentration of molybdenum in parts per million (ppm) is calculated from the following factors:

- 1) The weight of sample used for digestion.
- 2) Volume of solution for digestion.
- 3) Volume of aliquot taken for determination.
- 4) Gamma content of the matched standard.

The concentration in ppm is given by the formula

$$\text{ppm} = \frac{\text{volume digested sample solution(ml)}}{\text{weight of sample (gm)}} \times \frac{\text{value of matched standard (gammas)}}{\text{aliquot of sample(ml)}}$$

= gammas per gram (which equals parts per million)

STANDARDS(a) Molybdenum Standard Solutions

1) Stock standard concentrated: (100 gammas/ml). Dissolve 0.075 gm of MoO_3 in 20 ml of 10% NaOH. (10 gm of NaOH crystals in 100 ml of water). Dilute to 100 ml. Add diluted HCl until the solution is acid (use pH hydrion paper). Fill to 500 ml mark of the flask. Prepare this solution once a season.

2) Stock standard diluted: (1gamma/ml). Dilute 1 ml of stock standard to 100 ml mark of the volumetric flask. Prepare this diluted solution each time a new standard is made.

(b) Working Molybdenum Standard for Soil, Silt & Rock Chip

Two sets of working standards representing a low and a high range are prepared by diluting the working standard. The amount of standard solution diluted is outlined in the following tables.

Pipette from stock standard solutions the required volumes into a series of 7 test tubes. The amount and concentration of stock standard solution used is outlined in the following tables.

LOW RANGE

STANDARDS	A	B	C	D	E	F	G	H
ml of 1 ^μ /ml standard	0	0.5	1.0	1.5	2.5	3.0	4.0	5.0
Gammas	0	0.5	1.0	1.5	2.5	3.0	4.0	5.0
ppm*	0	2.0	4.0	6.0	10.0	12.0	16.0	20.0

* Concentration based on aliquot representing one quarter of a gram as used in procedure given above.

HIGH RANGE

STANDARDS	I	J	K	L	M	N	O
ml of 100 ^μ /ml standard	0.1	0.2	0.25	0.5	0.8	1.00	1.5
Gammas	10	20	25	50	80	100	150
ppm*	40	80	100	200	320	400	600

Treat the standards as outlined in the procedure given for the unknowns. It is important that the standards and unknowns undergo identical treatment. Cover the standards with a sheet of aluminum foil to shield them against any heat or light when not in use. Prepare new standards at least once every three weeks or sooner if fading is suspected.

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The following reagents are used in the test on soil, silt and rock chip samples.

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3) Thiocyanate solution: Dissolve 5 gm of KSCN in 100 ml of water. Prepare fresh solution daily.

4) SnCl₂ solution: Dissolve 13 gm of SnCl₂ in 17 ml of concentrated HCl. Heat the mixture in a hot water bath. Make up to 100 ml with water when crystals have been completely dissolved. Add a piece of metallic tin to ensure stability of SnCl₂. Prepare a fresh solution daily.

5) Sodium tartrate - use directly as a solid.

6) Isopropyl ether - use directly but with caution as it is highly inflammable and explosive peroxides may form.

Use de-mineralized water for all reagents, preparations and analytical determinations.

pH DETERMINATION

A line-operated Beckman Model H-2 meter is used in making pH measurements. Following a warm-up period, the meter is calibrated with standard buffer solutions before using and rechecked between every 20 determinations, or every hour whichever comes first.

(a) Soil and Silt

Measurements are made as follows:

1) Pour approximately 15 gm of the sieved sample into a 30 ml poly beaker. Wet the sample with distilled water (use neutral stream water). Do not use de-mineralized water (water passed through a resin de-mineralizer is acidic). Swirl the beaker occasionally during the determination to ensure the sample is in a homogeneous state.

2) Gently insert the electrodes into the dampened sample.

3) Observe the pH reading when the needle reaches a steady state.

4) Discard the tested sample, clean the beaker and electrodes with water. Wipe the electrodes with a cleaning tissue. It is important that the electrodes be thoroughly cleaned after every determination.

(b) Rock Chips

pH determination is not required for rock chip.

WATER DETERMINATION

Water samples require no special preparation preceding the actual analysis. Samples are usually treated in sets of six.

(a) Determination

- 1) Pour water sample into a separatory funnel up to the 50 ml mark.
- 2) Using an automatic pipette, add 5 ml of diluted HCl.
- 3) Using an automatic pipette, add 1 ml of ferric ammonium sulphate solution. Tilt funnel to mix.
- 4) Using an automatic pipette, add 3 ml of KSCN solution. Tilt funnel to mix.
- 5) Using an automatic pipette, add 3 ml of SnCl₂ solution. Tilt funnel to mix.
- 6) Using a burette, add 2 ml of ether. Shake for 45 seconds. Release pressure every 10 seconds during shaking.
- 7) Allow phases to separate.
- 8) Discard the aqueous (water) layer into a beaker. Stop at 10 ml mark.
- 9) Drain off the remaining aqueous and the organic phases into a 16 x 150 rimless test tube.
- 10) Compare the colour of the organic layer to that of the molybdenum standards.

(b) Calculation

The concentration of molybdenum in water is expressed in parts per billion (ppb), i.e., 1/1000 gammas per gram or gammas per 1000 grams. The concentration is calculated using two factors.

- 1) The initial volume of sample used for determination.
- 2) The value of the matched standard x 1,000.

The concentration of molybdenum in water is given by the formula:

$$\text{ppb} = \frac{\text{value of the matched standard (gammas)}}{\text{volume of water used for determination (ml)}} \times 1,000$$

= gammas per 1000 millilitres (since density of water is equal to 1)

= gammas per 1000 grams, or ppb

(c) Standards

- 1) Pipette 0, 0.25, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 5.0, 8.0 ml of the dilute (1 gamma/ml) stock standard solution into the separatory funnels.

- 2) Add water to 50 ml mark and proceed with step (2) to step (9) given above for water determinations.

(d) pH Determination

Measurements are taken as follows:

- 1) Approximately 25 ml of sample is transferred into a 30 ml poly beaker for measurement.
- 2) Insert the electrode and take a reading.
- 3) Discard the sample; wash down and dry the electrodes.

(e) Preparation of Reagents

In addition to some reagents already mentioned on the previous pages the following are needed in the water test.

1) Ammonium sulfate solution: Dissolve 1 gm of ferric ammonium sulfate crystals in 100 ml of water. Warm the mixture in a water bath. Prepare fresh solution once every five days.

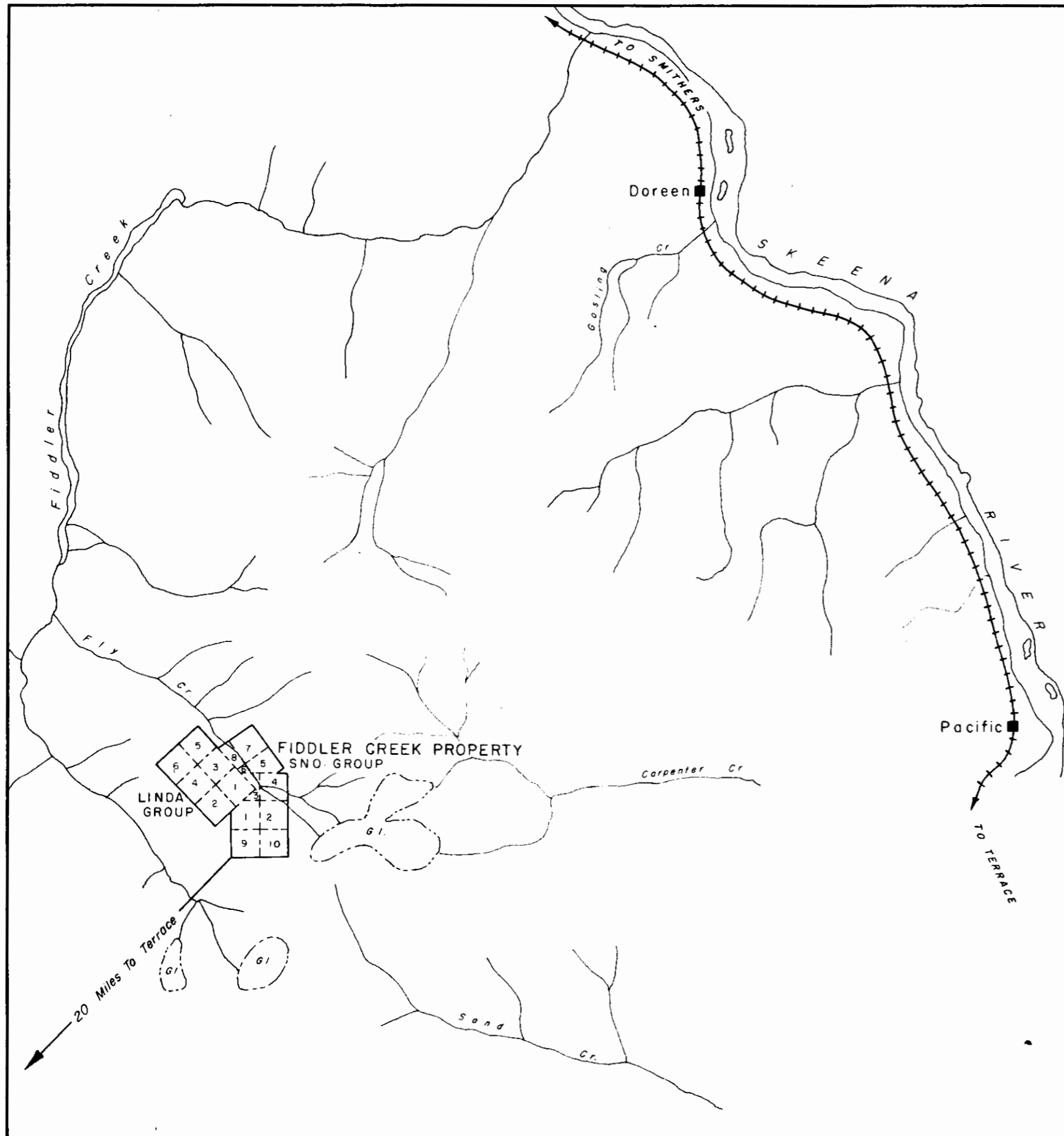
2) KSCN solution: Dissolve 10 gm of KSCN crystals in 100 ml of water. KSCN dissolves in cold water. Prepare fresh solution daily.

3) SnCl_2 solution: Heat 30 gm of SnCl_2 in 50 ml of concentrated HCl in a water bath till a clear solution appears. Dilute the solution to 300 ml. Insert a piece of metallic tin to stabilize the solution. Prepare fresh solution daily.

4) Diluted HCl: Dilute 800 ml of concentrated to one litre.

APPENDIX IV

GEOCHEMICAL ANALYTICAL METHODS



Department of
 Mines and Petroleum Resources
 ASSESSMENT REPORT
 NO. 866 MAP #1

AMAX EXPLORATION INC.

FIDDLER CREEK MoS₂ PROPERTY
 OMINECA MINING DIVISION B.C.

LOCATION MAP

SCALE 1" = 1 MILE

866

[Handwritten Signature]

Vancouver

H.P.

FIG. 1

LEGEND

- POST - MoS₂**
- Basic dykes
 - Quartz-feldspar biotite porphyry
 - Porphyritic granodiorite dykes
 - Aphanitic-fine grained granite
 - Hangingwall granodiorite (P = Porphyritic Granite ?)
 - Regional Coast Range Granodiorite
- CONTEMPORANEOUS WITH MoS₂ (?)**
- Bawser Group Sedimentary Rocks
 - Hazelton Group Volcanic Rocks
- PRE - MoS₂**

SYMBOLS

- 4" - 12" Banded quartz pyrite MoS₂ vein (altitude known, unknown)
- 1/8" - 1/2" quartz pyrite - MoS₂ vein (altitude known, unknown)
- Shear zone with MoS₂
- Unmineralised shear zone
- MoS₂ float
- Geological contact, altitude known
- Geological contact, altitude unknown
- Geological contact inferred
- Outcrop - talus contact
- Numbered hand specimen
- Stream
- Intermittent stream
- Cliff
- Claim boundary
- Claim post
- Proposed diamond drill hole with inclination
- Diamond drill water supply

SOIL SAMPLE (ppm)

- 0 - 9 Background
- 10 - 19 Passive
- 20 - 40 Anomalous
- > 40 Strongly anomalous

SILT SAMPLE (ppm)

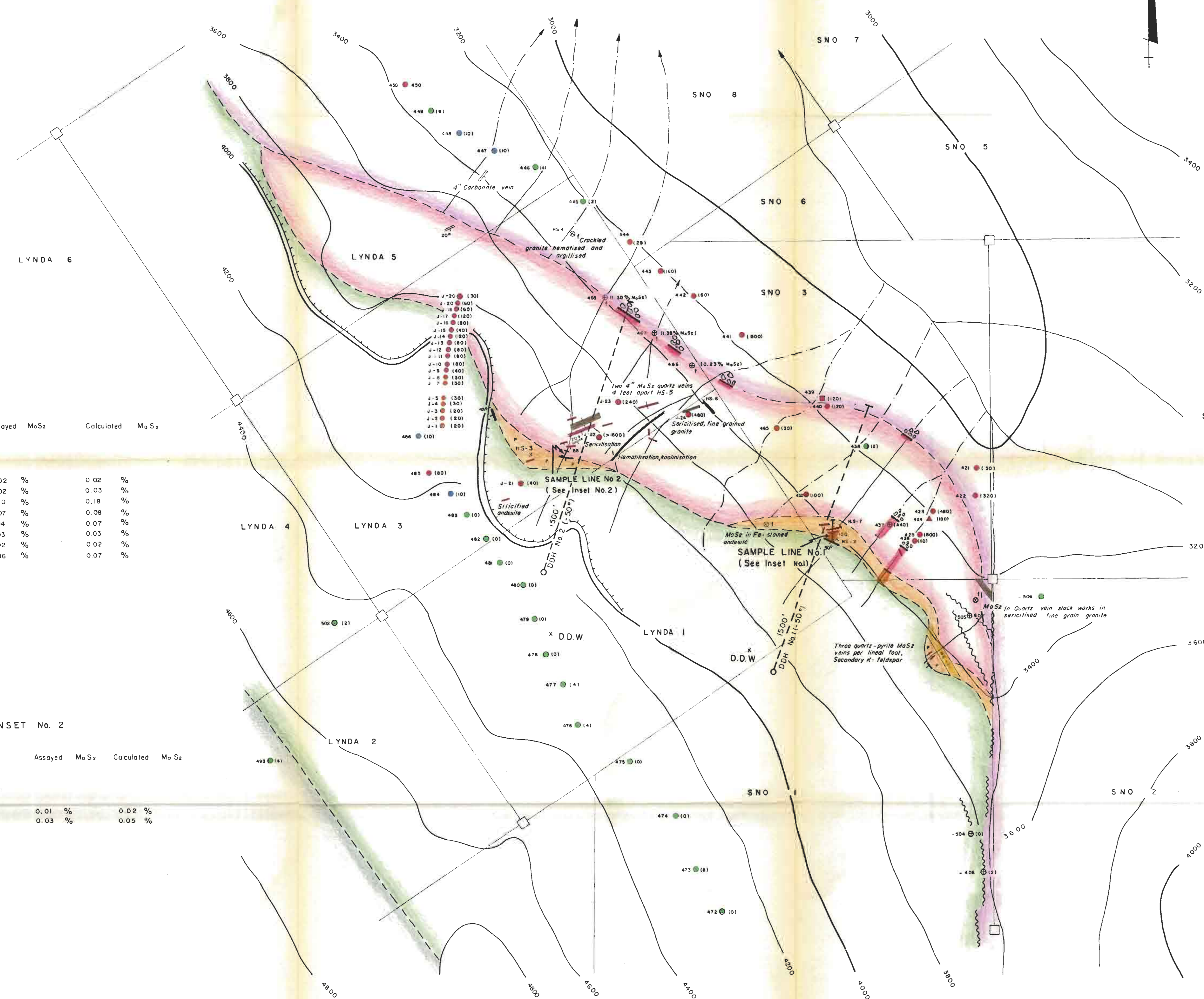
- 120

WATER SAMPLE (ppb)

- < 4 Background
- > 4 Anomalous

ROCK CHIP SAMPLE (ppm)

- Rock chip sample
- J-O-1 Samples by Schindler All other samples collected by Kennedy



INSET No. 1

Line No. 1	Assayed MoS ₂	Calculated MoS ₂
J-20 (180)	0.02 %	0.02 %
J-18 (180)	0.02 %	0.03 %
J-17 (180)	0.10 %	0.18 %
J-16 (180)	0.07 %	0.08 %
J-15 (180)	0.04 %	0.07 %
J-14 (120)	0.03 %	0.03 %
J-13 (80)	0.02 %	0.02 %
J-11 (180)	0.06 %	0.07 %
J-10 (180)		
J-9 (180)		
J-8 (130)		
J-7 (130)		

INSET No. 2

Line No. 2	Assayed MoS ₂	Calculated MoS ₂
493 (14)	0.01 %	0.02 %
	0.03 %	0.05 %

Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 866 MAP #2

866

AMAX EXPLORATION INC.
FIDDLER CREEK MoS₂ PROPERTY
OMINECA MINING DIVISION
GEOLOGY, GEOCHEMISTRY AND ASSAY RESULTS
SCALE 1" = 200' (Approx.)

DATE	NOV-30-1988	DRAWN BY	FILE 103-1-9	FIG. 2
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To accompany report "FIDDLER CREEK MoS₂ PROPERTY" Date NOV 1988