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Assessment Report

on

Geology and Geochemistry

Boot 1-35,38,39 Claims

Watson Lake Mining District

NTS 105G/6

Latitude 61°24'N, Longitude 131°07'W

22 February, 1978

R.J. Cathro, P. Eng. Consulting Engineer

090296

This report has been examined by the Geological Evaluation Unit and is recommended to the Commissioner to be considered as representation work in the amount of

$2422.00

D. B. Craig

Resident Geologist or
~~Resident Mining Engineer~~

Considered as representation work under Section 53 (4) Yukon Quartz Mining Act.

B. R. BAXTER
Supervising Mining ~~Recorder~~
Commissioner of Yukon Territory

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INTRODUCTION

The Boot claims were staked in August 1977 by Firth Project (Chevron Canada Ltd.) to protect a tungsten-bearing skarn zone. Only one tungsten mineral, scheelite, is present, associated with both skarn and intrusive rocks with the best mineralization occuring in altered intrusive at its contact. The main showing was discovered during a regional uranium prospecting program by the recognition of skarn minerals. Samples taken at that time contained only traces of scheelite mineralization. Later night prospecting with ultraviolet lights outlined higher concentrations of scheelite.

A secondary, but interesting exploration target, is gold values obtained from the Boot claims. Limited assaying suggests a direct relationship between tungsten and gold while geochemical analysis indicates the gold may be concentrated in a separate area.

Exploration of the claim group was carried out from August 20-30 on behalf of Firth Project by an Archer, Cathro and Associates Ltd. crew made up of Uwe Schmidt, geologist, and assistants Doug Eaton and Joan Cockell, supervised by the writer. Mapping, prospecting, soil sampling, night lamping and sampling were done during this period. Geochemical analysis for tungsten was done at Chemex Labs Ltd. in North Vancouver, B.C. by pyrosulfate fusion of a minus 80 mesh fraction which is then dissolved in water and colourometrically analyzed using zinc pyrosulfate.

PROPERTY, LOCATION AND ACCESS

The Boot property consists of 37 contiguous mineral claims recorded at Watson Lake as follows:

Claim Name	Grant Numbers	Expiry Date
Boot 1-24	YA25436-YA25459	26 August, 1978
25-35	YA25687-YA25697	7 September, 1978
38-39	YA25698-YA25699	7 September, 1978

The claims are located at latitude 61°24'N and longitude 131°07'W within claim sheet NTS 105G/6, 90 km southeast of Ross River. The nearest road is the Robert Campbell Highway, an all-weather road which lies 36 km north of the property. The nearest lake suitable for float-equipped aircraft is located 3 km to the north of the claims. The crew used a float-equipped Turbo Beaver and Bell 206A helicopter to mobilize from Ross River to the property. Both aircraft are available for charter in Ross River.

GEOLOGY AND GEOMORPHOLOGY

The Boot property is situated in southeastern Pelly Mtns., which are characterized by steep, rugged terrain. Local relief commonly reaches 1800 m in elevation with isolated peaks exceeding 2100 m. The major valley bottoms are broad and U-shaped, having an elevation of about 1200 m. Pleistocene glaciation covered all or most of the area. Ice movement was northwesterly in a large area surrounding the claim group. Present expressions of glaciation are the abundant cirque valleys in the mountains and lateral moraines in the larger valleys. Glacial till thickness varies from a few centimetres in steeper regions to tens of metres on the valley bottoms.

The area around the Boot claim group is underlain by a variety of metamorphic rocks intruded by a porphyritic quartz monzonite stock of Cretaceous age. Prior to the publication of GSC Open File 486 in August 1977, the only geological mapping available for the project area was preliminary map 7-1960 published by the GSC in 1960. The new GSC map has subdivided the metamorphic rocks into an older group that were probably sedimentary, Windermere-equivalent rocks of Hadrynian or Cambrian age, and a younger group that includes Klondike schist-equivalent rocks of unknown age. The younger group may have been thrust tectonically to their present position (Allochthonous). The older suite below the thrust fault that is presumably still situated at its site of deposition is referred to as Autochthonous. Relationships are obscured by regional metamorphism and a strong structural overprint that are possibly related to movement of the Tintina Fault or overthrusting. Rock units and age relationships in the current GSC interpretation are shown in Table 1 and correlation of new and old mapping are shown on Table II following this page. The newer map was not available at the time of field work but mapping has since been reassigned to conform to it.

The rock units, from oldest to youngest, are described as follows:

<u>Autochthonous ? rocks, Omineca Crystalline Belt</u>

Unit Ꝑn-Augen Gneiss

Ꝑn is a light grey, coarse-grained, feldspar-quartz-biotite augen gneiss that is considered to be the oldest unit by the GSC. Both it and the overlying biotite-garnet-muscovite schist unit (ꝐЄsc) are thought to be autochthonous meta-sedimentary rocks. Feldspar staining has shown that the largest white porphyroblasts are K-feldspar. Biotite is the main mafic mineral and it is

TABLE I

GSC GEOLOGICAL INTERPRETATION IN FIRTH PROJECT AREA

(based on Open File 486, D.J. Tempelman-Kluit, et al, 1977)

	ERA	PERIOD	MAP UNIT	LITHOLOGY
Possibly Allochthonous?	Mesozoic	Cretaceous	Kqm	porphyritic biotite quartz monzonite
	(Intrusive into Ᵽ€sc, Ᵽ₱K4, gradational to Ᵽn)			
	Paleozoic?	Age Unknon	Ᵽ₱K2	siliceous phyllite, greywacke, marble
	(Contact between Ᵽ₱K4 and Ᵽ₱K2 is gradational)			
			Ᵽ₱K4	muscovite-biotite feld-spathic gneiss, micaceous quartzite, minor marble
	(Contact between Ᵽ₱K4 and Ᵽn is gradational)			
Autochthonous	Paleozoic?	Cambrian?	Ᵽ€sc	biotite-garnet-muscovite schist
	(Contact between Ᵽ€sc and Ᵽn is gradational)			
	Hadrynian?	Windermere equivalent	Ᵽn	biotite-muscovite-quartz feldspar augen gneiss

Table II. Unit Correlation of Old and New GSC Mapping

AGE	UNIT	AGE	UNIT
Jurassic and/or Cretaceous	Unit 9 Biotite Quartz Monzonite	Cretaceous	Kqm Biotite Quartz Monzonite
	—— Intrusive Contact ——		—— Intrusive Contact ——
Unknown	Unit A Chloritic schist, phyllite, carbonate, micaceous marble	Unknown	(Allochthonous?) <u>Klondike Schist</u> ꝐPK2 Black siliceous phyllite ꝐPK4 Muscovite-biotite and chloritic quartzose gneiss
			—[Possible Thrust Plane]——
Unknown	Unit C Quartzose, micaceous gneiss, granitoid gneiss and augen gneiss	Cambrian? and Windermere?	(Autochthonous) Ꝑ€sc Biotite-garnet-muscovite schist — — — — — — Ꝑn Biotite-feldspar augen gneiss
GSC Map 7-1960 Wheeler, Green and Roddick 1960		GSC Open File 486 Tempelman-Kluit et al 1977	

aligned, along with feldspar augen and quartz, in one strong foliation plane.

Unit P€sc - Biotite-garnet-muscovite-schist

Biotite-garnet-muscovite schist is the characteristic rock type of this unit. Variations in mineral composition include carbonate lenses, diopside and garnet and variations in biotite-muscovite content. This unit is actually less abundant and more intermittent than suggested by GSC mapping.

Allochthonous ? rocks, Klondike Schist equivalent of unknown age

Unit PPK4-Chloritic gneiss and schist

A variety of rock types have been assigned to PPK4, including chloritic schist, gneiss, marble and skarn. The gneiss member contains abundant but variable amounts of quartz and a variety of micas, predominatly chlorite with some muscovite and biotite, and has little K-feldspar. It is easily differentiated from augen gneiss of unit Pn, which has no schist or carbonate component, has a uniform quartz content, is uniformly high in K-feldspar, and contains biotite as the only important mafic mineral. Porphyroblasts are uncommon in PPK4 gneisses and usually consist of quartz rather than feldspar. Complex folding is often observed on a small scale. Isoclinal, recumbent and shear folds are defined by irregular quartz lenses and mica. A later, weaker foliation is superimposed on earlier complex structures. In contrast to this Pn, augen gneiss has no polyphase deformation and biotite, feldspar and quartz are only aligned in one plane. Carbonate rocks in PPK4 show a variety of metamorphic effects. Some exposure of argillaceous carbonates show no significant metamorphism but others are altered to garnet-diopside skarn, calc-silicate hornfels and mica marbles and have been mapped separately as unit Psk by Firth Project. Skarn development and associated tungsten mineralization has been observed in several locations. The best example occurs on the Boot claim group.

Unit ℙPK2-Chloritic schists and argillaceous carbonates

Unit ℙPK2 consists of black siliceous phyllites, chlorite schists, argillaceous carbonates and micaceous marbles. It differs from unit ℙPK4 in its absence of chloritic quartz-feldspathic gneisses. However, unit boundaries are difficult to draw in the field since carbonate rocks are common to both units and both are possible allochthonous. Banded barite was found in this unit at one location on the Boot claim group, which may indicate a Devono-Mississippian age.

Intrusive rocks of mid-Cretaceous age

Kqm - Porphyritic biotite-muscovite quartz monzonite

The largest body of intrusive rocks, a stock of porphyritic quartz monzonite is situated 2 km east of the Boot claim group centred at the westernmost of three Grass Lakes. A cupola of the same rock type lies in contact with tungsten-bearing skarns on the Boot claims. It is characterized by large white phenocrysts of K-feldspar that range from 1 to 10 cm in length and average 4 cm. The matrix is made up of coarse, equigranular plagioclase, quartz, K-feldspar and biotite varying in grain size from 2 to 5 cm. Quartz associated with traces of tourmaline in one to two centimetres wide veins are spaced from 50 to 100 cm apart. Hydrothermal alteration is weakly developed but does include some feldspar alteration to clay, chloritization of biotite, carbonate development and secondary biotite formation near intrusive-skarn boundaries.

STRUCTURE

Structure within the district is dominated by the northwest trending

Tintina Fault which passes 10 km south of Grass Lakes. The structural influence of this fault is best seen south of the fault in less metamorphosed units. Foliations north of the fault are parallel to it and a northerly trending set that are subsidiary structures of the Tintina Fault.

Strong foliation of mica is present in all metamorphic rocks. Biotite is the only abundant mica in augen gneiss unit Pn while chlorite, muscovite and some biotite are present in the overlying units P€sc, PPK4 and PPK2. Garnet, biotite and muscovite are common in P€sc.

At least two periods of deformation have been recognized in units PPK2, PPK4 and P€sc. The first phase consists of strong mica development and tightly spaced isoclinal, assymetric and disharmonic minor folds with amplitudes of about 20 cm. The second phase consists of planar deformation that has been superimposed on the folding. No addditional mica development appears to have accomplished this phase. In areas where stress was applied perpendicular to axial planes, fold closure has resulted. In other areas, shear has paralleled axial planes and has produced shear folds. Disharmonic folds have developed in areas of mixed composition such as quartzose and carbonate lenses.

On a regional scale, metamorphic units appear to be flat-lying or gently dipping. Minor folds have no large equivalents of the type that should have resulted from a gently dipping thrust fault. No evidence for such an event has been found within the district although good examples are reported to the southeast by the GSC.

Only one foliation is present in the augen gneiss, whereas two phases of deformation are represented in the other metasedimentary units. This suggests either that the gneiss is younger than the other foliated rocks or that evidence of bedding or earlier foliations have been obliterated in the gneiss.

MINERALIZATION AND EXPLORATION METHODS

The main showing (Zone A) is exposed in outcrop about halfway down the west ridge of a north-facing cirque at a contact between skarn (₱sk of P₱K4) and a porphyritic quartz monzonite stock. The contact runs vertically up the ridge to the west and then swings north parallel to the ridge. Thus, the skarn is occurring as a relatively thin (100 m) veneer along the ridge. Compositional differences in the skarn suggest that the original bedding dips gently into the hillside.

The showing consists of a 1.5 m thick zone of unusually high grade scheelite mineralization occurring at the base of a 5 m by 5 m outcrop that is exposed through talus on the hillside. The zone is bounded to the south by quartz monzonite and is overlain by hornfelsed garnet-epidote skarn. Mineralization can be traced about 250 m to the north as float in talus. It occurs at progressively lower elevations to the north, which suggests that the zone has an attitude approximately parallel to bedding attitude of the skarn. The abundance of float suggests good continuity for the first 150 m.

The strongly mineralized host rock has the appearance of an altered foliated intrusion rather than a skarn. It contains about 15% secondary biotite in weakly aligned clots surrounded by a light coloured matrix that looks like altered feldspar. A stained polished section shows an irregular wispy content of potassium feldspar. The rock is strongly limy and has a faint clay odour. The scheelite occurs as clusters of 1 to 2 mm euhedral grains associated with the biotite and as accumulations parallel to the foliation. The skarn overlying Zone A contains minor scheelite as disseminations and associated with three directions of narrow quartz veining. This type of mineralization is scattered throughout the talus and makes it more difficult than normal to trace Zone A on surface. A chip sample taken in daylight across 1.5 m of the Zone A outcrop assayed 4.87% WO_3 and 0.09 oz/ton Au, while two specimens of the best mineralization assayed 16.1% and 11.7% WO_3 respectively. The higher grade specimen also returned 0.191 oz/ton Au, 86 ppm Cu, 5 ppm Mo and 4 ppm Ag. A semi-quantitative spectrographic analysis of the same specimen indicated a weakly anomalous content of Bi, Sr and Ti. Both copper and molybdenum are unusually low for Yukon tungsten occurrences. Daylight sampling along 12 m of talus containing the maximum abundance of Zone A-type float gave an average of 0.11% WO_3, trace Au and 0.03 oz/ton Ag from eight assays that ranged from 0.02% to 0.23% WO_3, trace to 0.01 oz/ton Au, trace to 0.12 oz/ton Ag. Each sample represented an individual panel 1.5 m by 1.2 m and consisted of small chips from at least 50 talus boulders within the panel.

Zone B occurs 500 m southeast, where the contact between the intrusion and gently dipping skarn crosses the cirque floor and extends vertically up the north-facing wall of the cirque. Little is known about this zone as it has only been seen in talus below the cliff and as float in an overburden-covered area above the cliff. The talus contains a few well-mineralized boulders of foliated, biotite-rich rock almost identical to Zone A, as well as many skarn fragments containing low-grade disseminations and veinlets. Only one piece of the better-grade material was found on top of the ridge.

Talus from quartz monzonite on the cirque-wall and ridge between Zones A and B also contains minor scheelite, which occurs primarily as euhedral grains along planes of weakness and result in a spectacular display of mineralization, with little real grade, during night lamping.

Two sets of old claim posts were found on the ridge near Zone B. The older set was cut from stunted trees and probably dates from 1954. A second set made from 2 x 4 lumber was probably staked in 1966 during an extensive regional airborne mag and EM survey. Groundwork appears to have been limited to soil sampling.

Grid and contour soil sampling, silt sampling and minor creek and soil panning were used to determine the best exploration method for this type of occurrence. Creek panning with limited soil panning located several regional anomalies and proved to be the most efficient technique.

In the cold Yukon climate, tungsten mineralization weathers and disperses in the geochemical cycle as almost insoluble grains of scheelite and wolframite that generally become finer grained with increasing distance from source. As standard geochemical assays are commonly done on minus 80 mesh material, a sample with coarse scheelite near the mineralized source can be diluted by screening.

Two silt samples from the Boot claims were subjected to simple screen analysis to study the relationship between sample size and tungsten assay. The results, which are tabulated on the following page, show that good tungsten anomalies were obtained in all fractions although dramatic increases were observed in coarse fractions of the sample taken closest to the showing.

Table III Screen Analysis of Silt Samples near Zone A, Boot Claim Group

	-6 +12	-12+20	-20+32	-32+80	-80	
400 m downstream from Zone A	150 15	300 <15	500 NSS	350 NSS	125 <15	ppm W ppb Au
800 m downstream from Zone A	25 300	22 160	30 60	60 < 15	25 <15	ppm W ppb Au

NSS = not sufficient sample

Gold is strongly anomalous in one sample but does not show a direct correlation with the richest tungsten sample, suggesting that the two metals may not be intimately associated to the skarn. The number of samples that have been tested in this way is insufficient to draw firm conclusions but there is a tendency for the coarest fractions to contain the most tungsten close to the bedrock source. Silt samples taken on the Boot claim group in conjunction with panning showed good correlation with scheelite estimates in pans. Soils were also tested by panning below the main showing and a pan concentrate from a soil sample site assaying 90 ppm W contained approximately 400 scheelite grains.

GEOCHEMISTRY

Soil samples were collected both on a small grid and randomly while prospecting. Only the minus 80 fraction mesh was analyzed from each sample. Background in this district is about 2 to 5 ppm over intrusive or gneissic rocks and assays greater than 10 ppm are considered to be anomalous. The grid is situated on a plateau south of the cirque and is above timberline, which is about the 5500 foot elevation. Intrusive rock is usually masked by a moss and lichen cover and weathers readily to felsenmeer and deeply fractured sub-outcrop. Samples were collected at a 50 m spacing on lines 50 m apart and the results are plotted on Figure B1. Most of the samples were anomalous in tungsten, with six exceeding 100 ppm W and one assaying 200 ppm W. This compares with 35 and 90 ppm W obtained from two soils immediately below mineralization at Zone A.

Contour sampling of soil of talus fines also produced good contact. This method was used outside the grid area on the Boot claims and during preliminary examination of unstaked areas of mineralization. The highest soil value obtained on the claim group during this work, 325 ppm W, was obtained northeast of the grid. Soil values elsewhere on the claims range up to 95 ppm W.

CONCLUSIONS AND RECOMMENDATIONS

The unexpected discovery of tungsten mineralization in the Grass Lakes area late in the field season gave very encouraging preliminary results. The limited work done to date has outlined tungsten mineralization which resulted in the staking of the Boot claim group. The tungsten occurs principally as scheelite and is seldom accompanied by sulphides. The showings are quite inconspicuous and were only found through the recognition of the host skarn assemblages.

A secondary, but interesting exploration target, is the good gold values obtained from the Boot claims. Limited assaying suggests a direct relationship between tungsten and gold while the geochemical screen analysis indicated the gold may be concentrated in a separate area.

Further work on the Boot claims should include a control grid survey, detail mapping and sampling and diamond drilling.

Respectfully submitted,

ARCHER, CATHRO & ASSOCIATES LTD.,

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RJC:jm

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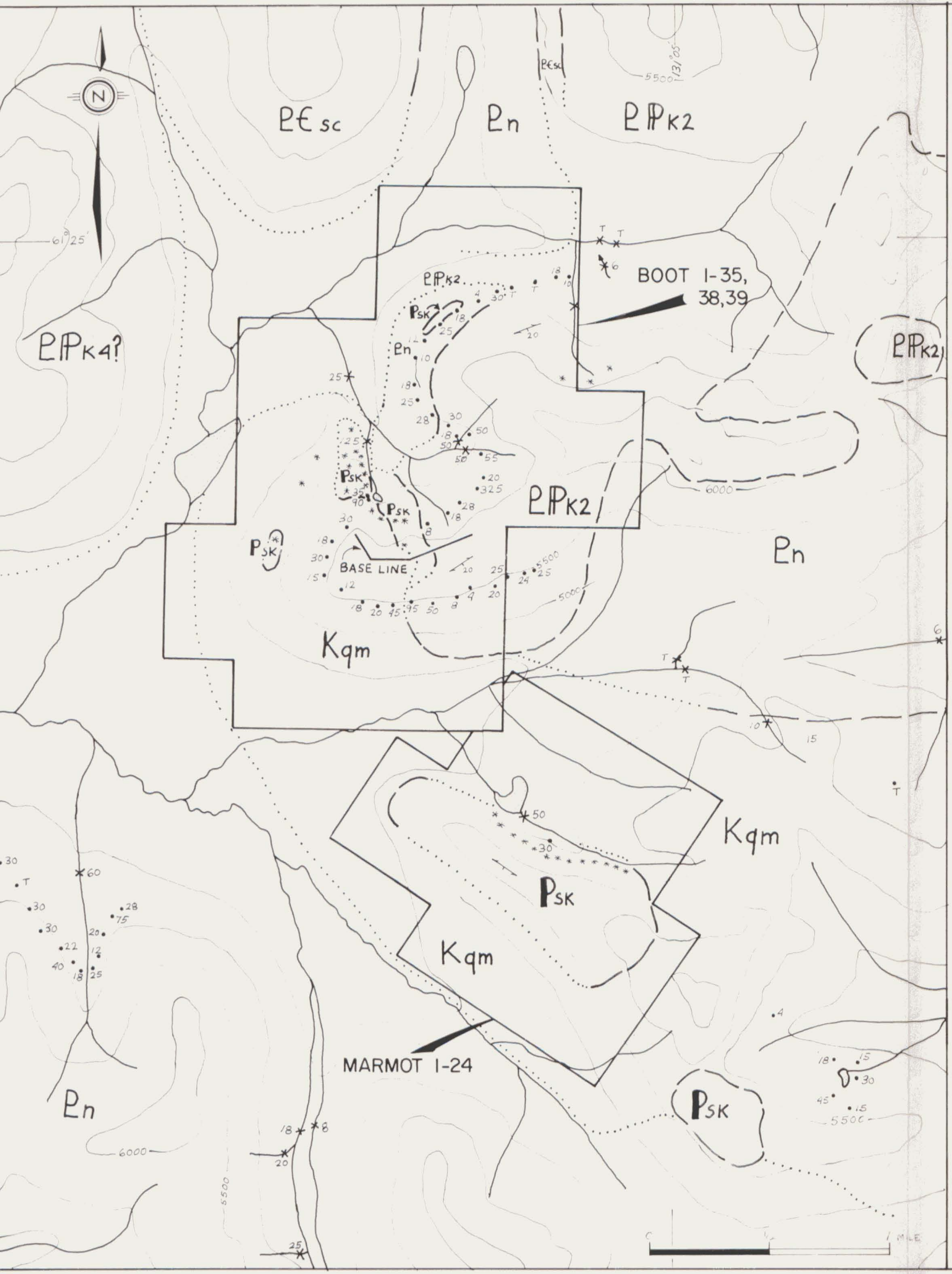
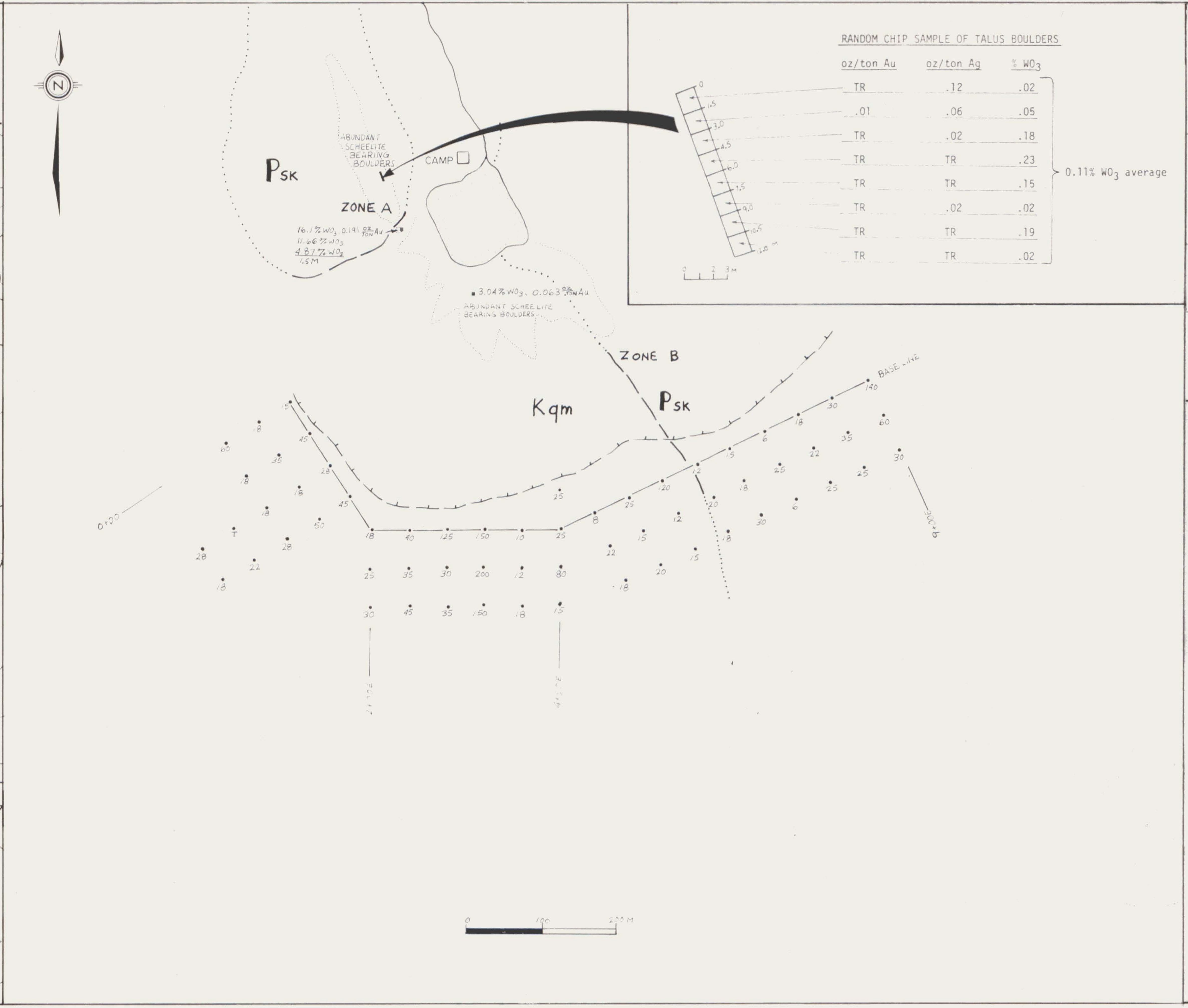
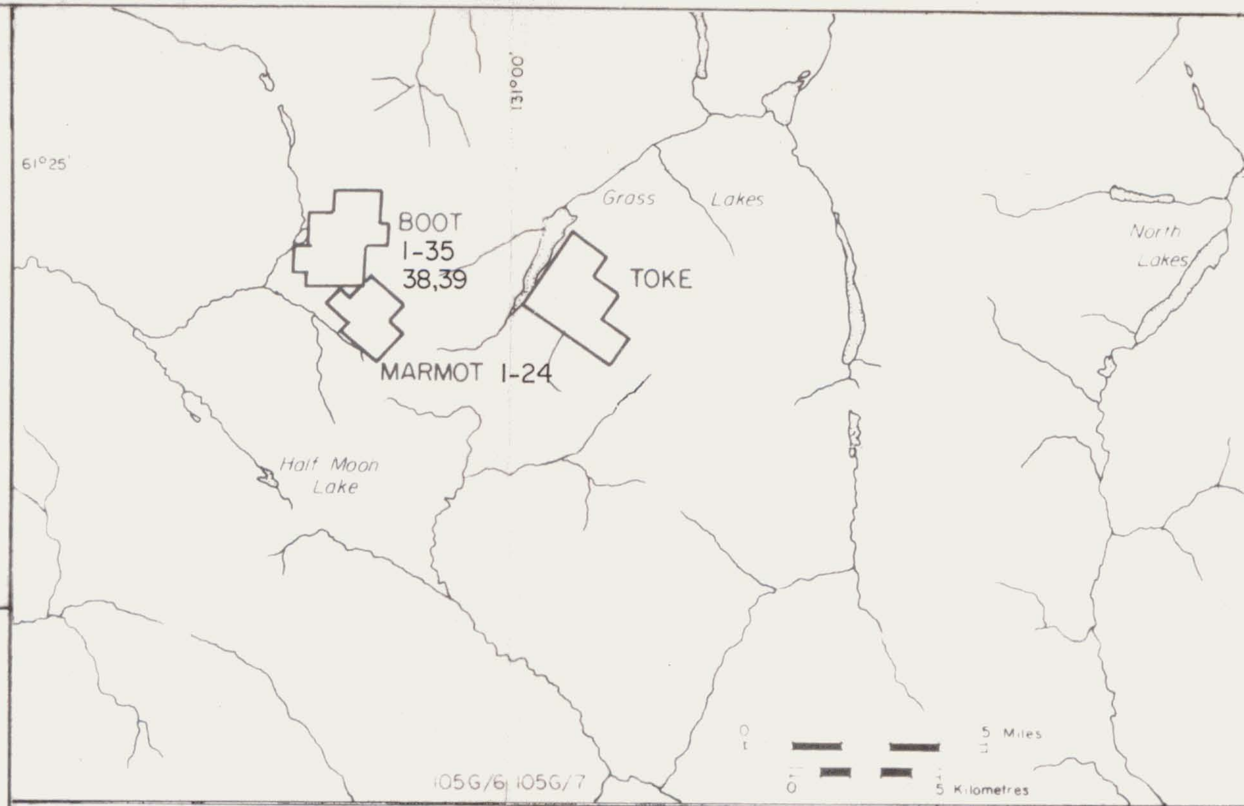




RANDOM CHIP SAMPLE OF TALUS BOULDERS

oz/ton Au	oz/ton Ag	% WO_3
TR	.12	.02
.01	.06	.05
TR	.02	.18
TR	TR	.23
TR	TR	.15
TR	.02	.02
TR	TR	.19
TR	TR	.02

0.11% WO_3 average



LEGEND

CRETACEOUS

Kqm — Porphyritic biotite quartz monzonite , white K-feldspar phenocrysts and coarse grained matrix

- (gradational contact) -

CRETACEOUS ?

Pn — Very coarse grained biotite-feldspar augen gneiss with white K-feldspar porphyroblasts (deformed equivalent of Kqm)

PALEOZOIC ?

PЄsc — Biotite-garnet-muscovite schist

Psk — Garnet-diopside skarn, banded calc-silicate hornfels, micaceous marble

PPk2 — Rusty black phyllite, chlorite schist, biotite-chlorite schist, limy argillite

PPk4 — Chloritic quartzose gneiss, micaceous marble

Float occurrences of scheelite located by night lamping

Foliation

Geological boundary; assumed, approximate

Break in slope

Rock, Soil, Silt — PPM W - analyzed by Chemex Labs Ltd., North Vancouver or % WO_3

T = < 4ppm

Association of Professional Engineers of the Yukon Territory
R. J. CATHRO
GEOLOGICAL ENGINEER
Feb 22/78

Fig. B1

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GEOLOGY and TUNGSTEN GEOCHEMISTRY

BOOT and MARMOT CLAIM GROUPS

FIRTH PROJECT

To accompany report dated Dec 1977