URANIUM RECONNAISSANCE PROGRAM

NORTHERN BRITISH COLUMBIA

TULSEQUAH (104 K), DEASE LAKE (104 J-K), ATLIN (104 N)

DEASE LAKE PROJECT, 1977

MATTAGAMI LAKE MINES LIMITED

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Mattagami Lake Mines Limited

PREFACE

Mattagami Lake Mines Limited in 1977 commenced programmes of exploration for uranium in the Canadian Cordillera. The Dease Lake Project (1977) was part of this effort, as a result of which the CY and ENG claims were staked in the Atlin area.

In light of the British Columbia government policy of accepting work of this type for portable assessment credit (P.A.C.) it was decided to submit this report for consideration by the Ministry of Mines and Petroleum Resources.

As District Geology for Mattagami Lake Mines Limited, this writer supervised the field work and subsequent report writing. The report is submitted with a few minor changes relating to property submissions in the area of interest, and the addition of certificates of qualifications.

W. Mercer

District Geologist

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* * *

MAPS all in pocket

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ABSTRACT

A large area of northern British Columbia has been surveyed for uranium deposit potential during the summer of 1977. Map areas covered include 104 J, K and N. Work comprised airborne radiometric surveys, stream sediment and water geochemical surveys, radon in stream water surveys and ground radiometrics and geology.

Few significant uranium anomalies were found in map areas 104 J and 104 K and consequently these areas are not recommended for further uranium exploration. Potential for molybdenum deposits in these areas is believed to be high.

The Atlin area, NTS 104 N, appears to have good uranium potential especially with regards to the Surprise Lake batholith. This is a large alaskite intrusion with a high regional background. As a consequence of geochemical and radiometric anomalies in this area Mattagami has staked 187 units, comprising the Weir Mountain group of claims. Further work is recommended for this area.

CHAPTER I. INTRODUCTION

1 - 1 General

From June 29th to July 21st, 1977, a Mattagami crew conducted a uranium reconnaissance survey in northern British Columbia.

During the program a total of 95 stream sediments, 131 stream waters and 71 rock samples were analyzed. The sediments and some of the waters have been analyzed by Bondar-Clegg in Whitehorse, the rocks by Barringer Laboratories in Whitehorse. In addition, the waters were analyzed for radon gas in the field, and for uranium by ion extraction by Parslow, in Regina, Saskatchewan. All the samples have been analyzed for uranium and, whenever felt necessary, for other elements.

In conjunction with the geochemical sampling, a helicopter-borne radiometric survey was conducted during the same period, in the same areas.

This report will discuss the above results and make recommendations for further activities.

The field crew consisted of:

F. Morra - party chief
L. Withers- senior assistant
K. Berndt- junior assistant
W. Howard- junior assistant
N. Ball- junior assistant
W. Eng- helicopter pilot.

The competent help of all concerned is gratefully acknowledged.

Since this was the first year of this program in northern British Columbia, stream water, sediment and rock samples from a variety of terrains in different physiographic and geological regions were collected to provide information on background levels for uranium in different rock units.

1 - 2 Areas Surveyed

Three main areas have been radiometrically and geochemically surveyed (Figure 1):

i. Tulsequah area, NTS 104 K

ii. Dease Lake area, NTS 104 J-K

iii. Atlin area, NTS 104 N.

Areas that were given priority included those underlain by Tertiary sedimentary and volcanic rocks and by acid intrusions.

1 - 3 Methods of Work

Most of the region was surveyed using a Bell 47B1 helicopter for transportation. Wherever possible, a 4-wheel drive vehicle was also used. Previous experience has proven that helicopter supported reconnaissance stream sediment and water geochemical surveys can be carried out effectively over most of northern B.C., in conjunction with helicopter-mounted geophysical instrumentation for the radiometric survey.

The geophysical equipment used during the radiometric survey consisted of:

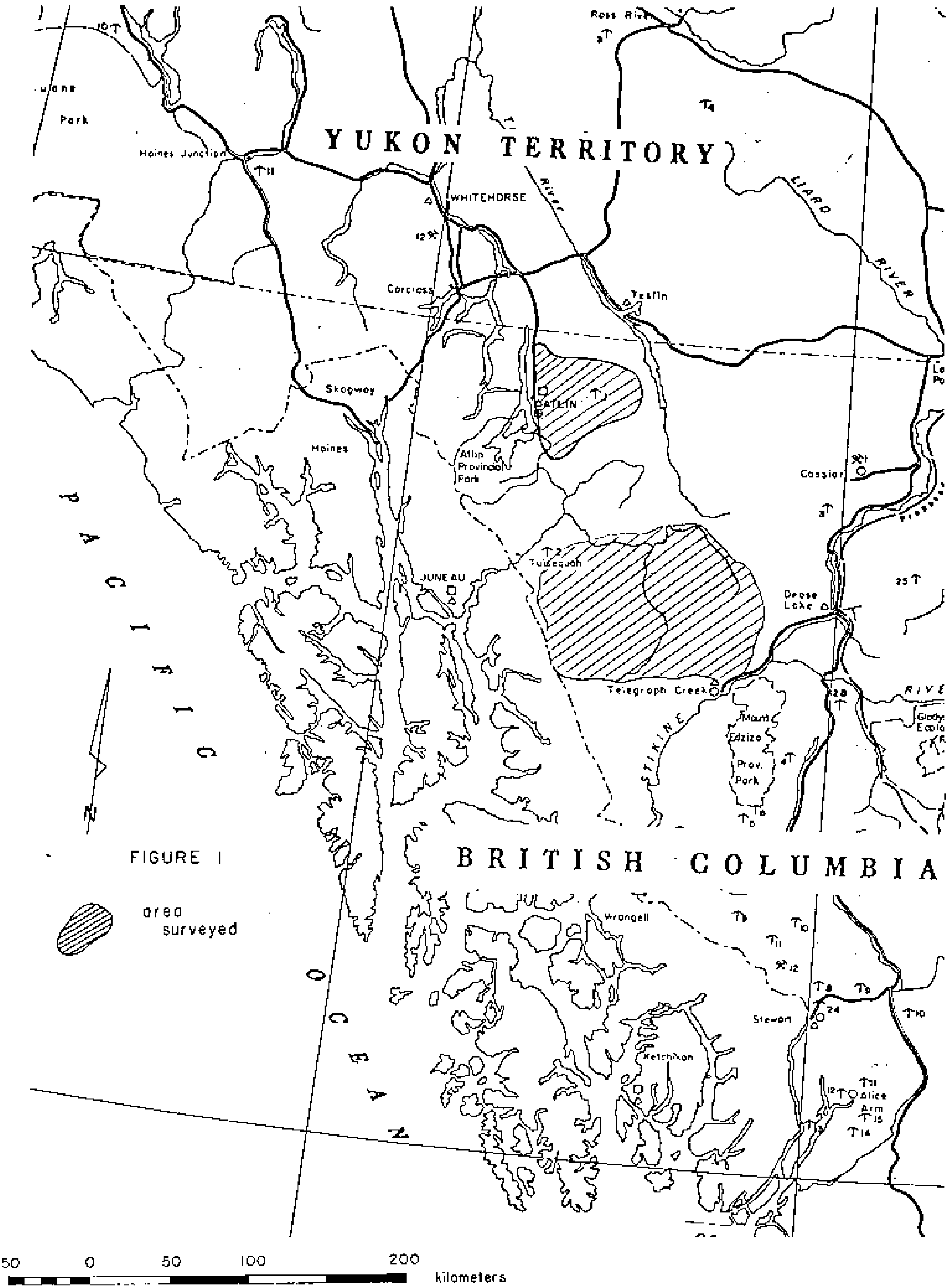

YUKON TERRITORY
BRITISH COLUMBIA
PACIFIC OCEAN
Haines Junction
Park
WHITEHORSE
Carcross
Teslin
Ross River
LIARD RIVER
Skagway
Haines
ATLIN
Atlin Provincial Park
Cassiar
Tulsequah
JUNEAU
Dease Lake
Telegraph Creek
STIKINE
Mount Edziza Prov. Park
Wrangell
Stewart
Ketchikan
Alice Arm
N
area surveyed
50 0 50 100 200
kilometers

FIGURE I

DISA 410 - A Exploranium, console electronics
GPX - 112 Exploranium, 6" X 4" crystal, detector
H.P. 7155 chart recorder
2 scintillometers (GRS 101 A, Exploranium-Geometrics)
2 spectrometers (TV 1-A, McPhar)
RD 200 radon gas emanometers.

Two major problems were encountered during the helicopter survey:

i. it was difficult, sometimes impossible, to maintain a constant clearance from the ground (30 m and a constant speed of 50 kph) in mountainous areas. In addition in these areas, the shielding or mass effects were the main cause for the generation of most of the radioactive anomalies recorded.

ii. In many areas, below an elevation of 5,000 feet (1400 m), the thick vegetation cover prohibited helicopter landing: in these areas the reconnaissance stream sediment and water geochemical survey does not have a systematic nor a statistical character.

Due to the very rainy summer weather, stream water samples results are probably to be considered lower than the average, due to the significant dilution effect on the level of element concentrations.

1 - 4 Presentation of Results

Geochemical and geophysical results will be presented in table form in Appendix I. Sample locations, fiducial points, helicopter flight path and ground traverses are plotted on NTS map sheets. Any datum which is considered to be of further interest is underlined in the tables.

During the reconnaissance survey, radiometric anomalies of interest were found in the Atlin map sheet (Weir Mountain). The ground has been staked by Mattagami and a separate report has been written with the results presented in more detail (see Morra, 1977, Weir Mountain Report).

canyon 50 m to the east identified the second anomaly at the contact of granodiorite (GSC Unit 13) and a quartz monzonite (GSC Unit 16) at fiducial No. 65 (see Map No. 1).

The following observations were made:

(i) Unit 16 has a background of 300 cps (GRS 101) in the area, with readings up to 500 cps

(ii) mafic dykes have much lower radioactivity, of the order of 100 cps

(iii) no breccia outcrops have been noticed during the ground traverse.

In conclusion, no définite explanation for the anomaly was obtained.

2 - 4 Geochemistry

Results for the geochemical investigation in the Tulsequah map sheet are presented in Map No. 2 and in Tables 1, 2 and 3.

There were problems collecting stream water samples for most were greatly enlarged by snowmelt. Hence stream sediment samples are probably the only reliable geochemical results.

Radon in water results (Table 2) are very low, usually approximating cell-background values. Four high radon in water results (approximately 20 cpm) should not be regarded as anomalies due to uranium, but rather due to the particular physiography of the sample site (valley bottoms, far from snowfields or glaciers).

The stream sediment sample results are consistently low (0.5 ppm U) except for sample No. 110 S 6, which gave 53 ppm U (Table 3). This sample was collected from a stream draining the radioactive anomaly described above in Section 2 - 3, at fiducial point No. 66 (see Map No. 1).

2 - 5 Economic Potential

The only above-average radioactive rock type in the area is a quartz monzonite (Unit 16). Allanite and uraniunite are thought to be the minerals responsible for the radioactivity. The best assay result obtained from Tulsequah area gave 22.0 ppm U_3O_8. This value is however very low for a contributing source rock.

The contacts between Unit 16 and other units may be of interest for porphyry Cu-Mo deposits, although the inaccessibility of the region would make any exploration program very expensive and exploitation difficult.

2 - 6 Detailed Geology

Eight geological traverses have been completed and they are shown in Map No. 2. The purpose of this part of the exploration was to investigate favourable lithological contacts for uranium deposits, especially sedimentary rocks in contact with volcanics.

In general, the results were disappointing.

2 - 6 - A Traverse No. 1. NNW of Trapper Lake

A traverse along a mountain valley included outcrops of Units 4, 14-15 (Sloko Group) and 11. Unit 4 consisted of chlorite-grade metamorphosed immature volcanoclastic sediments and basalt transitional to greenstone. It proved to be economically uninteresting. The boundary with Units 14-15 was not observed. Units 14-15 are volcanoclastic sediments, crystal tuff or mud breccia, and quartz-feldspar porphyry. The contact with Unit 11 (grey-brown shales) was observed, the unconformity having the highest radioactivity recorded during the traverse (110 cps, McPhar TV 1-A).

Samples analyzed were:

Type	Sample #	Geol. Unit	Cu (ppm)	U (ppm)
Rock	110 R 6	14-15		0.8
Rock	110 R 12	11		<0.2
Rock	110 R 13	11	12	0.4
Stream Sediment	110 S 1			2.0
Stream Sediment	110 S 2			5.0

The conclusion is that the uranium potential is low.

2 - 6 - B Traverse No. 2. West Side of Tatsaminie Lake (see Map No. 2)

Unit 4 (Pre-Jurassic limestone, siltstone, volcanics altered to greenstone) was investigated and the nature of

CHAPTER II. TULSEQUAH AREA - NTS 104 K

2 - 1 Logistics

A base camp was established on Trapper Lake, approximately 150 km south-southeast of Atlin. Fuel and camp supplies were transported into Trapper Lake by Taku Aviation of Atlin, using Beaver on floats. The logistically ideal position of the base camp permitted an excellent and complete exploration at a regional scale of all the geological formations present in the map sheet 104 K, with a minimum waste of helicopter flying time (e.g. "in transit" flights).

2 - 2 General Geology

The region forms part of the Intermontane Belt of the Canadian Cordillera, composed of Late Paleozoic (Units 1, 2, 3, GSC map 1262A, mainly present on the northeastern corner of the map sheet), Triassic (Units 4, 5, 7, 8, 9) and Jurassic (Units 10, 11) eugeosynclinal volcanic and clastic rocks. Mesozoic (Units 9, 12, 13) and Tertiary (Units 15 and 16) plutons of quartz-dioritic and quartz-monzonitic composition cover approximately 15% of the belt and mark the boundary between the Intermontane Belt and the Coast Crystalline Belt.

Tertiary (Units 14, 17, 18) and Quaternary (parts of Unit 18) volcanics are also common.

The boundary between the Intermontane and the Coast Crystalline Belts is the loci of numerous porphyry

Cu-Mo deposits, extending along a belt in a northwest-southeast direction for several hundred kilometers. As discussed in the Dease Lake Project - Preliminary Report (April, 1977), U-Mo association is common in several deposits and therefore specific target areas were selected in the Tulsequah map sheet on the basis of the above consideration.

Exploration for Tertiary basal type of uranium deposits was mainly carried out in the Dease Lake map sheet (NTS 104 J) and in the very east portion of Tulsequah map sheet (Heart Peaks). Discussion of the results will be presented in Chapter III.

2 - 3 Radiometric Surveys

Results of the radiometric investigation for each unit shown on GSC geology map are given below.

In general the following units have very low radioactivity:

Units 1,2	- Permian serpentinite - peridotite
Unit 3	- Permian limestones and dolomites
Unit 4	- Pre-Jurassic limestones, clastic sediments and greenstones
Unit 5	- Triassic schists and gneisses
Unit 7	- Triassic basic and intermediate lavas, and volcanoclastic sediments
Unit 9	- Triassic limestone, argillite and chert
Unit 10	- Jurassic siltstone, mudstone, sandstone
Unit 11	- Jurassic conglomerates and pyroclastic rocks.

Units 4, 7 and 9 have the lowest background, approximately 15-20 cps. The other units (1,2,3,5,10) have a background ranging from 15 to 55 cps.

The following units have higher background radioactivity:

Unit 6 - Triassic diorite - granodiorite
Unit 8 - Triassic volcanoclastic sediments
Unit 12 - Jurassic granodiorite - diorite
Unit 13 - Cretaceous granodiorite - quartz diorite
Unit A - Undifferentiated diorite gneiss, age unknown.

The background radioactivity averages 80 cps, varying from 50 to 150 cps.

Background radioactivity is greatest in the following units:

Unit 14 - Tertiary felsic and intermediate flows
Unit 15 - Tertiary granites, porphyries
Unit 16 - Tertiary monzonite
Unit 17 - Late Tertiary/Pleistocene trachyte and rhyolite
Unit 18 - Pleistocene and younger volcanics.

Background values are generally higher than 100 cps, with anomalies few and far between.

It is important to note that radioactivity in Units 17 and 18 is mainly due to ^{40}K, the rock being very sanidine rich (more than 50% by volume).

Two radioactive anomalies were found in the general area - one by airborne surveying and the other by ground traverse. The first, in a canyon 15 km north of Whiting Lake (132^{o} 51' W and 58^{o} 12' N), appeared to be due to a zone of quartz monzonite cut by a network of mafic breccia dykes. Due to steep cliffs the ground was inaccessible.

Geological ground traverses in another nearby the alteration studied. The volcanics extensively outcrop along the west side of the lake, on a plateau about 500 m high. No sediments were noted at the base of the plateau, nor anywhere else.

The volcanics along the first stream to the north are fractured, sheared and metamorphosed. The alteration in the volcanics is however due more to hydrothermal effects than to metamorphism. Intensive calcite veining with copper stain is present along fractures and shear planes in this unit. No silification or pyritization was noted.

Samples analyzed gave the following results:

Stream sediment # 110 S 3: 0.2 ppm U
Stream sediment # 110 S 4: 0.2 ppm U.

The conclusion is that uranium potential is very low.

2 - 6 - C Traverse No. 3. East of Headwaters of Whiting River (see Map No. 2)

At the junction of the two glacier-fed streams rocks of the Sloko Group (Unit 15, felsites) were observed. Cliff-face outcrops of white-grey felsite are cut by numerous dykes of an even more felsic rock, weathering a lighter grey, 0.5 m in width. Radioactivity detected with the GRS 101 was of the order of 130 to 160 cps.

Above the white-grey felsite, beside a moraine, a distinct unit of a yellow (limonite) and brown (goethite) stained felsite can be observed. This unit outcrops extensively above and below the middle ridge of the mountain. It is folded but its average strike is 60^{0}. The thickness of this unit is estimated to be between 75 m and 100 m.

Samples analyzed gave the following results:

Sample Type	#	U (ppm)	Cu (ppm)	Mo (ppm)	Ag (ppm)
Rock	110 R 28		18.0	4	<0.4
Rock	110 R 29		18.0	4	<0.4
Stream Sediment	110 S 114	0.6			
Stream Sediment	110 S 115	0.6			

The conclusion is that the uranium potential is very low.

2 - 6 - D Traverse No. 4. Sutlahine River area.

One airborne anomaly (fiducial point No. 113, Map No. 1) was found and subsequently ground checked. Ground survey with McPhar spectrometer indicated a K-rich granite aplite (alaskite ?), 130 m wide and open to the north-northwest. Total count readings up to 350 cps (rock sample 110 R 117) were associated with magnetite. The ? alaskite is riddled with numerous small dykes of lamprophyre along joints.

A gossan zone was noted on a slope in Unit 7 volcanics and was investigated. The gossan was found to be due to weathered pyrite in fractures up to 5 cm wide within an off-white coarse grained monzonite. The trachy-andesites above and below the intrusion are not pyrite-rich. McPhar TV 1-A total count reached 100 cps around the fractures. No other mineralization was observed.

The conclusion is that uranium potential is very limited, the alaskite containing little uranium and high potassium. The gossan may carry Cu, Mo or Sb but economic potential is limited by the low fracture density and by the inaccessibility.

Samples analyzed gave the following results:

Sample No. 110 R 117: 22.0 ppm U (rock type: alaskite).

2 - 6 - E Traverse No. 5. Sutlahine River (see Map No. 2)

A ground traverse across Unit 16 (Late Cretaceous-Early Tertiary quartz monzonite) investigated uranium and molybdenum potential. The unit presents a background radioactivity of 200 cps (GRS 101), with higher response up to 300 cps in places.

Petrographically, the quartz monzonite is very homogenous and medium grained. Quartz veins are present, but are very pure and completely barren of mineralization. Small dykes of basaltic and trachy-basaltic composition are often present along the jointing of the intrusive rock.

Some pyrite occurs as small cubes within the quartz monzonite. No other mineralization was noted along the traverse.

The conclusion is that uranium potential is low.

2 - 6 - F Traverse No. 6. Northwest Trapper Lake (Map No.2)

Along the northwest shore of Trapper Lake the rocks are fine grained, pink to buff weathering felsites grading into fine grained granitic rock (50 cps, McPhar TV 1-A). Chloritized volcanic agglomerate (20 cps), knobby in outcrop, weathering grey to dark purple appears in large quantity adjacent to the felsite. Secondary Cu mineralization was found among beach cobbles of volcanic agglomerate.

The general lithology of Unit 7 is a light grey to purple, fine to medium grained porphyritic felsite. Along the traverse up the stream at the northwest corner of the lake, chloritized agglomerate is overlain by hematite and manganese stained basalt, giving a reading of 60 cps. Behind a 15 m waterfall, Cu staining in red weathering volcanics was observed. Above an extensive talus slope, rocks of the Stuhini Group (Unit 7) and of the Sloko Group (Unit 14) have been faulted and folded into a gentle syncline.

Samples analyzed gave the following results:

Sample Type	#	Rock Type	Results		
Rock	110 R 25	felsite	Cu: 32		
Rock	110 R 26	volcanic	Cu: 100	Ni: 47	Zn: 115
Stream Sediment	110 S 14		U: 0.3		
Stream Sediment	110 S 15		U: 0.2		
Stream Sediment	110 S 17		U: 0.2		
Radon In Water	110 G 14		Radon: 0.6 cpm		
Radon In Water	110 G 15		Radon: 11.0 cpm		
Radon In Water	110 G 16		Radon: 2.8 cpm		
Radon In Water	110 G 17		Radon: <0.5 cpm		

Conclusion is that uranium potential is very low.

2 - 6 - G Traverse No. 7. Metlatulin Mountain (Map No. 2)

Almost all of this traverse was over dark green porphyritic clinopyroxene-bearing basalt with only scattered crystals of pyrite and odd crystals of chalcopyrite. Towards the top of Metlatulin Mountain quartz-carbonate veins and stringers become common, but these contain only scattered pyrite mineralization.

Trachy-basalt was observed in cobbles on a talus slope. McPhar TV 1-A gave background readings of 15 cps, with the highest up to 25 cps.

Conclusion is that economic potential is very low for uranium. There might be chances of pyrite-chalcopyrite mineralization in the more felsic parts of the volcanics, but certainly not on the north side of Metlatulin Mountain.

2 - 6 - H Traverse No. 8. Nahlin Mountain (see Map No. 2)

Ground total McPhar TV 1-A counts were low for all units: 15 cps in limestone (Unit 3); 25 cps in serpentinite-peridotite (Unit 1).

The geology is simple and consists of faulted blocks of serpentinized peridotite and argillaceous limestone. The former contains small veinlets up to 1.5 cm wide of chrysotile and serpentine, as well as small veinlets of carbonate and quartz. The veinlets are most common in outcrop peripheral to a hornblende diorite (Unit 12c) but do not contain any mineralization other than occasional pyrite. The peridotite has also been chloritized and sheared.

The limestone is deeply weathered and powdery argillaceous carbonates are common on rock surfaces.

Occasionally small veinlets of hematite have been identified.

Samples analyzed gave the following results:

Sample No.	Rock Type	Assay Results
110 R 108	Quartz-carbonate Vein	Zn (ppm): 32
110 S 110		U (ppm): 0.2
110 S 111		U (ppm): 0.2
110 S 112		U (ppm): 0.2
110 S 113		U (ppm): 0.2
110 G 110		Radon (cpm): 0.6
110 G 111		Radon (cpm): <0.3
110 G 112		Radon (cpm): 0.4
110 G 113		Radon (cpm): <0.3

Conclusion is that economic potential is very low for uranium.

CHAPTER III. DEASE LAKE AREA - NTS 104 J (Map No. 3)

3 - 1 Logistics

Same as for Tulsequah area (Chapter II.)

3 - 2 General Geology (Gabrielse and Souther, 1956 and 1961)

The map area lies mainly within the Stikine Plateau, a region of subdued topography flanked to the northeast by the moderately rugged Cassiar Mountains and to the southwest by the extremely rugged Coast Mountains.

The exploration program in the Dease Lake map sheet was concerned with the following lithological units:

Unit 9: Poorly consolidated, flat lying or gently dipping sedimentary rocks are exposed in the canyons of Nahlin and Stikine Rivers. They are thought to be fluvial debris deposited in a Tertiary lake. Fossil plants are present.

Unit 10: This unit comprises Late Tertiary and Pleistocene nearly flat lying basaltic rocks of Level Mountain and Heart Peaks, erupted at various times. The older flows along the flanks of Level Mountain rest on a surface of moderate relief and have been dissected by stream erosion before extrusion of younger lavas. Evidence of intraglacial eruption is found in pillow lavas, presumably formed in marginal glacial lakes, high on the slopes of Level Mountain.

The presence of the contact between Units 9 and 10 is favourable for Tertiary basal uranium deposits. Two areas have been investigated in detail: (A) Nahlin Crossing, on the northwest corner of the map sheet, and (B) Level Mountain-Heart Peaks area. A third favourable area, the Stikine Canyon, was prospected by helicopter-borne radiometric survey only.

3 - 3 Geological Survey Results (see Map No. 3)

3 - 3 - A Nahlin Crossing

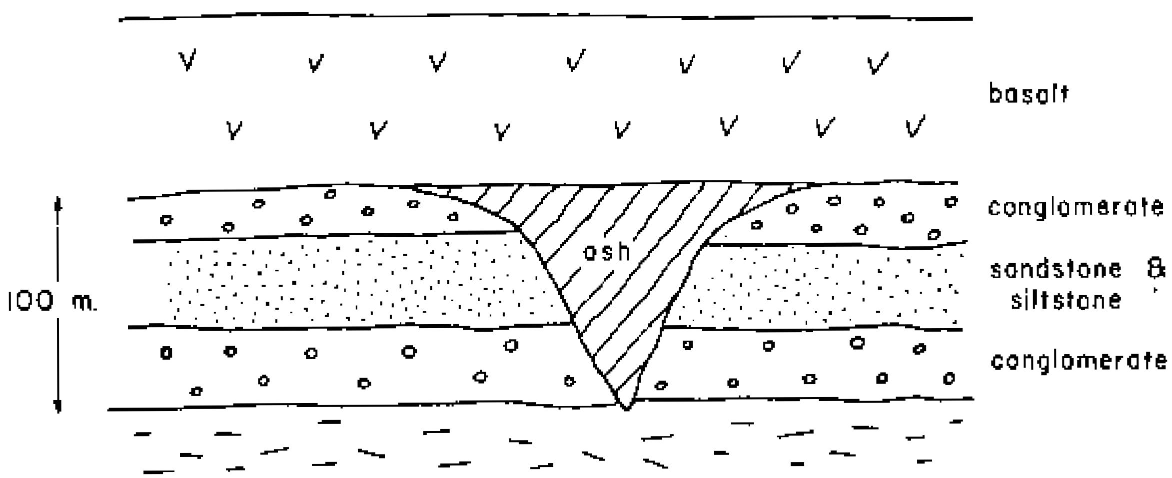
A helicopter-borne radiometric survey, followed by a ground radiometric and geological traverse has been done in the northwest corner of map sheet 104 J, along the Nahlin River canyon.

Unit 9 (Tertiary lacustrine sandstone, siltstone and conglomerate) outcrops at the base of the canyon. Its thickness averages 100 m and it is capped by a rusty brown columnar basalt of Tertiary age (Unit 10). The sedimentary formation also presents in places a lateral contact with a white coloured, thick pile of volcanic ash. The stratigraphic relationships between sandstone, conglomerate and ash are not clear. The contacts are often masked by a thick overburden. The volcanic ash is also capped by rusty brown columnar basalt (Unit 10, see Figure 2). The sediments are very poorly consolidated, so that it is sometimes difficult to distinguish them from fluviatile sand and gravel of Pleistocene and recent time, if the volcanics are not present. Some coalified

FIGURE 2

INTERPRETATION OF STRATIGRAPHIC RELATIONS

UNIT 10, DEASE LAKE AREA



wood was observed in the sediments.

Radioactivity is present in Unit 9, especially in the uppermost sedimentary layers, in the vicinity of the contact with the basalt. Exploranium GRS 101 scintillometers registered up to 160 cps, which is approximately 4 times higher than the background in similar rock types in the area.

The volcanic ash has constant radioactivity of 200 cps, but the ^{40}K contribution seems to be high.

The basalt has low radioactivity, on the order of 30 cps (GRS 101).

Samples analyzed gave the following results:

Sample #	Rock Type	U (ppm)	Radon (cpm)	Cu (ppm)
110 R 53	sandstone	3.0		
110 R 54	conglomerate	1.4		
110 R 55	volcanic ash	4.0		
110 R 56	siltstone	2.0		38
110 S 8		1.0		
110 S 9		0.3		
110 S 10		0.2		
110 S 11		0.4		
110 S 13		0.2		
110 G 8			<0.3	
110 G 9			11.3	
110 G 10			3.6	
110 G 11			1.0	
110 G 13			1.2	

The conclusion is that although the area is stratigraphically favourable for uranium deposits and radioactivity slightly higher than normal on some sedimentary horizons, geochemical results are not encouraging. The area does not deserve any further exploration activity.

3 - 3 - B Level Mountain-Heart Peaks Area

The interesting area covers approximately 3.5 sq. km on the west side of Heart Peaks, in Tertiary lava flows and tuffs (Unit 10). Part of the Heart Peaks area is located within Tulsequah map sheet (NTS 104 K) but results of the survey are given in this section.

Background counts using Exploranium GRS 101 scintillometer area as follows:

olivine basalt:	50-70 cps (max. 100 cps)
altered olivine basalt:	130 cps average
mud seep:	160 cps average
gravel-mud slope wash:	150-200 cps
red volcanic felsite (tuff ?):	225 cps average
grey-green volcanic felsite (tuff):	250 cps average (max. 1000 cps).

One radon sample obtained from a spring gave an exceptionally high result (sample 110 G 18, 375 cpm). However, radon from spring samples often gives unrealistic results.

It was thought that the high radon counts could have been the result of water circulating through uranium-rich sediments below the basalt. However, this hypothesis did not prove to be confirmed in the field. Geological mapping in the area did not reveal the presence of any sediments in the Heart Peaks area other than of volcanic origin.

Radiometric investigation using GR 410 spectrometer and geochemical analyses of rocks and stream sediment samples collected both indicate that most of the radioactivity is due to ^{40}K. Results are shown in Tables 5, 6 and 7.in the appendix.

The radiometric results, in particular, evidence the ^{40}K contribution in the generation of the radioactive anomaly in Heart Peaks. The two highest total counts obtained with GR 410 Exploranium are both over 1000 cps (fiducial points 151 and 155), but uranium activity is very limited.

The other radioactive anomaly found in Dease Lake map sheet is located on Level Mountain plateau (fiducial point No. 26, Map No. 3). Outcrop is very poor, less than 1%. The anomaly was detected with the airborne system. Ground check revealed a 4-5 m thick horizon of volcanogenic conglomerate and sandstone (3.8 ppm U_3O_8), in between dacite (0.4 ppm U_3O_8) and tuffaceous material (2.8 ppm U_3O_8). This slight anomaly seems to be of very local nature and it does not warrant any further investigation.

The last area prospected, the Stikine Canyon, did not present any radioactive anomaly detectable with the airborne system.

Economic Potential

The radioactive anomalies of some importance found within the Dease Lake map sheet are mainly due to ^{40}K activity from Tertiary volcanics. No fluvial or lacustrine sediments have been found in contact below the volcanics, although this does not deny their presence. The area seems to have better potential for Cu deposits and a few exploration companies are actively involved in surface exploration and drilling immediately south of Heart Peaks.

CHAPTER IV. ATLIN LAKE AREA - NTS 104 N

4 - 1 Logistics

A base camp was established on Birch Creek, 16 km east of Atlin.

Car-borne radiometric survey has been conducted along every road in the area accessible with the crew-cab 4 X 4 pickup. Two portable spectrometers were constantly kept in operation while travelling, with the crystals pointed in opposite directions.

Geochemical survey was greatly facilitated by the possibility of using the truck for transportation, in addition to the helicopter support. Helicopter-borne radiometric survey was extensively conducted over the Surprise Lake batholith, east of Atlin.

4 - 2 General Geology

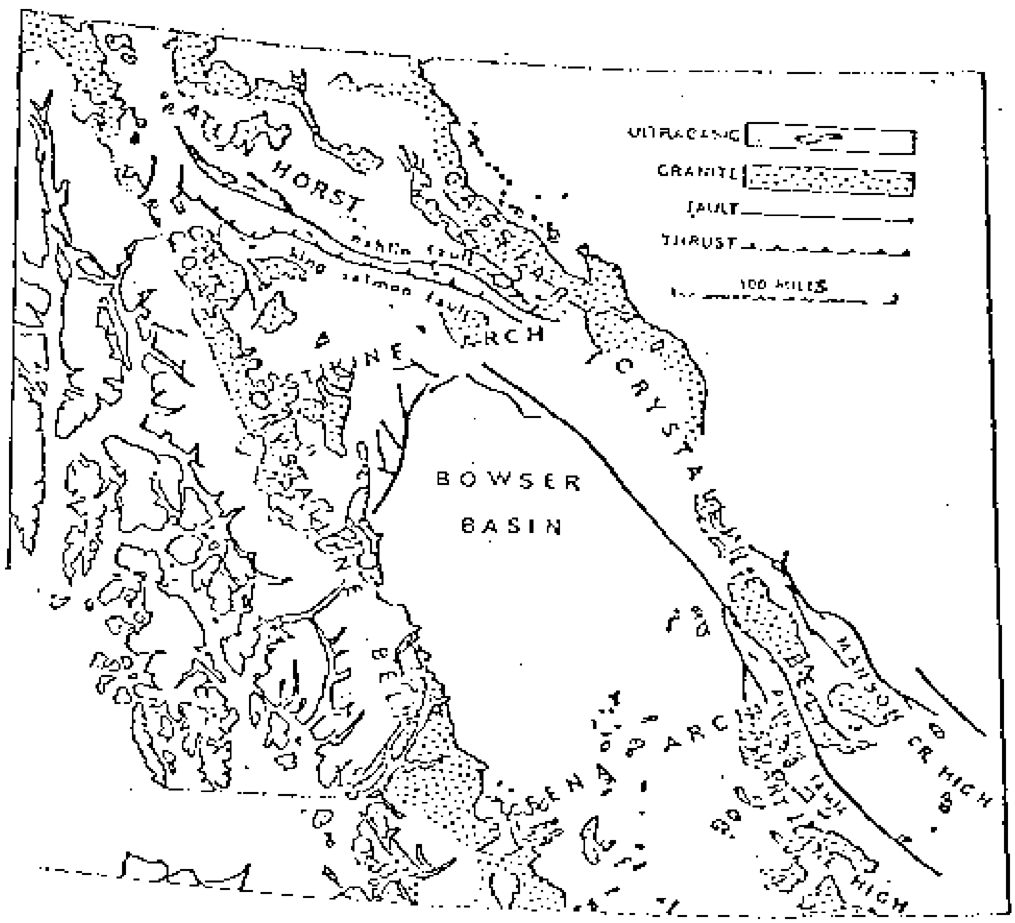
The Atlin region is characterized by wedge-shaped crustal blocks bounded by steep faults along which or near which most of the ultrabasic bodies have been emplaced (Figures 3 and 4).

The Atlin horst is mainly composed of Paleozoic strata of the Cache Creek Group. The ultrabasic rocks are Upper Paleozoic peridotite and serpentinite of the Atlin intrusions. Jurassic granitic rocks of the Coast intrusions occupy large areas. Cretaceous alaskite, the Surprise Lake batholith, occurs as a lenticular body between Teslin Lake and Atlin Lake.

Scattered Tertiary volcanic rocks outcrop over the Atlin plateau.

FIGURE 3

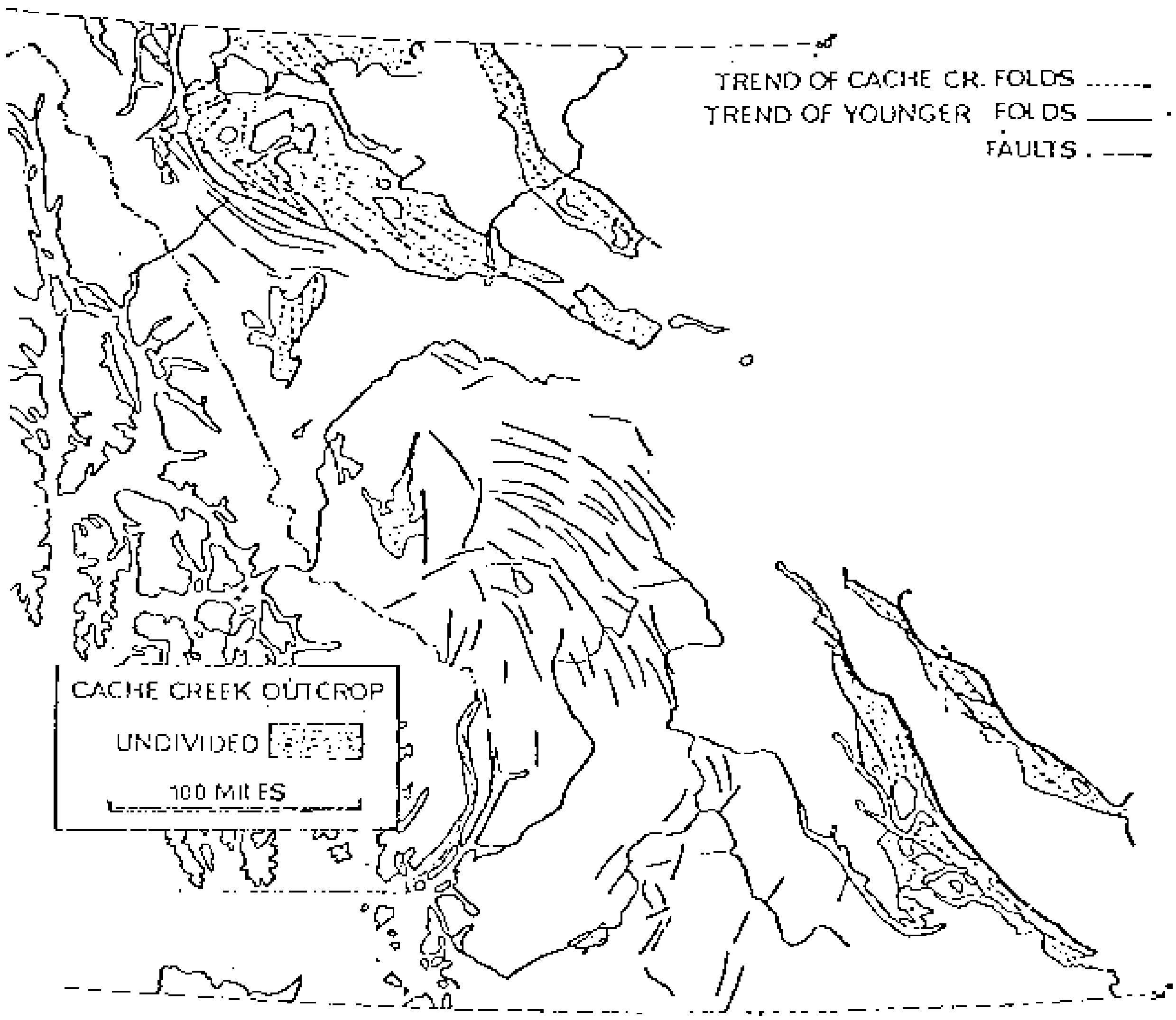
Map showing the positions of the major tectonic elements of north central British Columbia and their relationship to granitic and ultrabasic rocks.



after: Souther and Armstrong, 1966

F I G U R E 4

Map showing the present distribution of Cache Creek-Slide Mountain rocks and the trend of pre-Upper Triassic (Cache Creek) and post-Middle Triassic (Mesozoic) folds.



after:Souther and Armstrong, 1966

Immediately to the west of Atlin is the Coast Crystalline Belt, with its large concentration of plutons.

4 - 3 Mineral Occurrences

Several mineral deposits in the Atlin map sheet are associated with the Surprise Lake batholith and contiguous Cache Creek sediments, metasedimentary and metavolcanics. The most numerous occurrences are of Au, W, Pb, Ni and Mo. Zn, Cu and U are also present in lesser amounts. The deposits are classified as contact metasomatic, skarn and porphyry. One small U anomaly on the west shore of Atlin Lake occurs in pegmatites.

The only economically important hardrock deposits in the area are the Ruby Creek (Adanac) Mo deposit, with its 94×10^6 tonnes of 0.16% MoS_2, and the Atlin Rufner Ag-Pb deposit.

The Surprise Lake batholith is now being actively explored for U deposits, due to the recent uranium discoveries at Trout Lake (Cordilleran Engineering Ltd, 1976).

Mattagami's exploration plan was initially mainly devoted towards contact metasomatic type of uranium deposits, possibly related to the Surprise Lake alaskite-Cache Creek Group contacts.

The small patches of Tertiary volcanics scattered over the region were explored with the hope to find favourable situations for Tertiary basal type of deposits.

4 - 4 Radiometric Survey (Map No.'s 4 and 5)

If we compare the radiometric results in Table 4 (Tulsequah) with those in Table 12 (Atlin) we immediately note the great difference in results obtained in the two regions. The average radiometric response in the Atlin area is at least twice as great for the total counts and three times as great for the uranium counts, relative to the Tulsequah area. The reason for this is mainly due to the presence, in the Atlin region, of the anomalously radioactive alaskitic Surprise Lake batholith, where most of the investigation was concentrated.

The highest value obtained was at fiducial point No. 68 (Table 12) on Weir Mountain.

Table 8 presents some ground radiometric scintillometer values. The alaskite is the rock type with the highest background, of 300 to 350 cps (GRS 101). For comparison, the Jurassic granite of the Coast intrusions has a background of 100 cps.

The other rock types present in the map sheet give lower radioactive response, with the lowest background radioactivity of all detected in the ultrabasic rocks of the Atlin Intrusions (25 cps). The patches of Tertiary basaltic rocks mentioned earlier, gave results varying from 30 to 80 cps (GRS 101) and the only outcrop of sediments found at the base of the volcanics (see Traverse No. 1, Ruby Creek Section 7 - 7 - A) was carefully checked with the scintillometer. Its radioactivity was constantly 70 to 80 cps (McPhar TV 1-A) with no vertical or lateral variations.

The most interesting radiometric anomaly was found around Weir Mountain, within the Surprise Lake batholith. Details of the ground radiometric investigation conducted in that area are given on Traverse No. 4, Section 4 - 7 - D, Weir Mountain area, and in Weir Mountain Report No. 2.

The Trout Lake area was flown with our helicopter-borne radiometric instrumentation, but radioactive response was constantly low due to the thick overburden and complete lack of outcrops.

The Snowdon Range east of Trout Lake still has high radioactivity, being part of the Surprise Lake batholith. The ground investigation of the alaskite of the Snowdon Range is presented in the Traverse No. 5, Section 4 - 7 - E (see below). In general the airborne radiometric survey indicates similar total counts on the Snowdon Range compared with the Weir Mountain area. However, much higher values in the spectrometer K and Th channels (resulting in a high contribution in the U channel) for the former area were observed.

The contacts between the intrusive and the Paleozoic sediments, metasediments and metavolcanics have been radiometrically investigated. No positive results were obtained except for one area, at the headwaters of Boulder Creek at the contact of Cretaceous alaskite and Paleozoic ultrabasic rocks of the Atlin intrusions.

A tungsten occurrence is marked on the GSC geology map at the location of the above anomaly and the ground is all staked. The anomaly has very limited extent, 10 m by 2 m, and assay reports of grab samples collected from the mineralized zone are not encouraging, being 0.006% and 0.076% U_3O_8 (Report of the Minister of Mines, 1955, pg. 8). The only uranium mineral identified was the copper uranium arsenate zeunerite.

4 - 5 Geochemistry

4 - 5 - 1 General

Results of the geochemical investigation in the Atlin map sheet are presented in Map No. 5 and in Tables 8, 9, 10 and 11.

Since this was the first year of exploration for Uranium in northern B.C. for Mattagami, different geochemical sampling techniques were used and results compared, to assess the most successful and effective method of detecting a uranium anomaly. The uranium in stream water results by ion extraction (Parslow, Regina) proved to be completely unreliable. This method will not be used in the future.

The combined results of radon in water and uranium in stream water and stream sediments proved to be more or less useful in delineating a uranium anomaly in the Weir Mountain area, west of Trout Lake. At the present stage, we can say that sediment samples probably give the best results.

Stream sediment samples and radon in soil were used in the second, more detailed, phase of exploration in the area (see Morra, 1977, Report on Weir Mountain, No. 2) and they proved to be the best geochemical methods in this particular mountainous terrain.

Problems are involved with the use of stream water: fluctuations in the water flow, rainfall, steep topography, etc. which make chemical weathering relatively less significant in comparison with physical weathering.

Transport of uranium dissolved in stream water may be negligible.

The radon in water results are affected by the temperature of the water, by flow, turbulence, distance between the water sample collected and the stream sediment from which radon may be derived and other factors.

All these techniques, if used separately, can easily miss an anomaly on the ground. Hence, the necessity of using all methods combined where possible.

For purpose of comparison, radon in water, stream water and stream sediment samples results were plotted on a log-log paper. The only weak relationship found was between radon in water and stream sediment samples (Figure 5). Radon in water against stream waters (Figure 6) and stream waters against stream sediments (Figure 7) do not show any relationship. This descrepancy in results from the different methods used was expected.

Uranium and radon dispersion and concentrations are strongly affected by chemical and mechanical factors, each playing a different role on the various geochemical sampling techniques. It is impossible to allow for all the factors influencing concentration levels of uranium and radon when assessing the results of a geochemical survey, although this may be considered the final goal of exploration geochemistry.

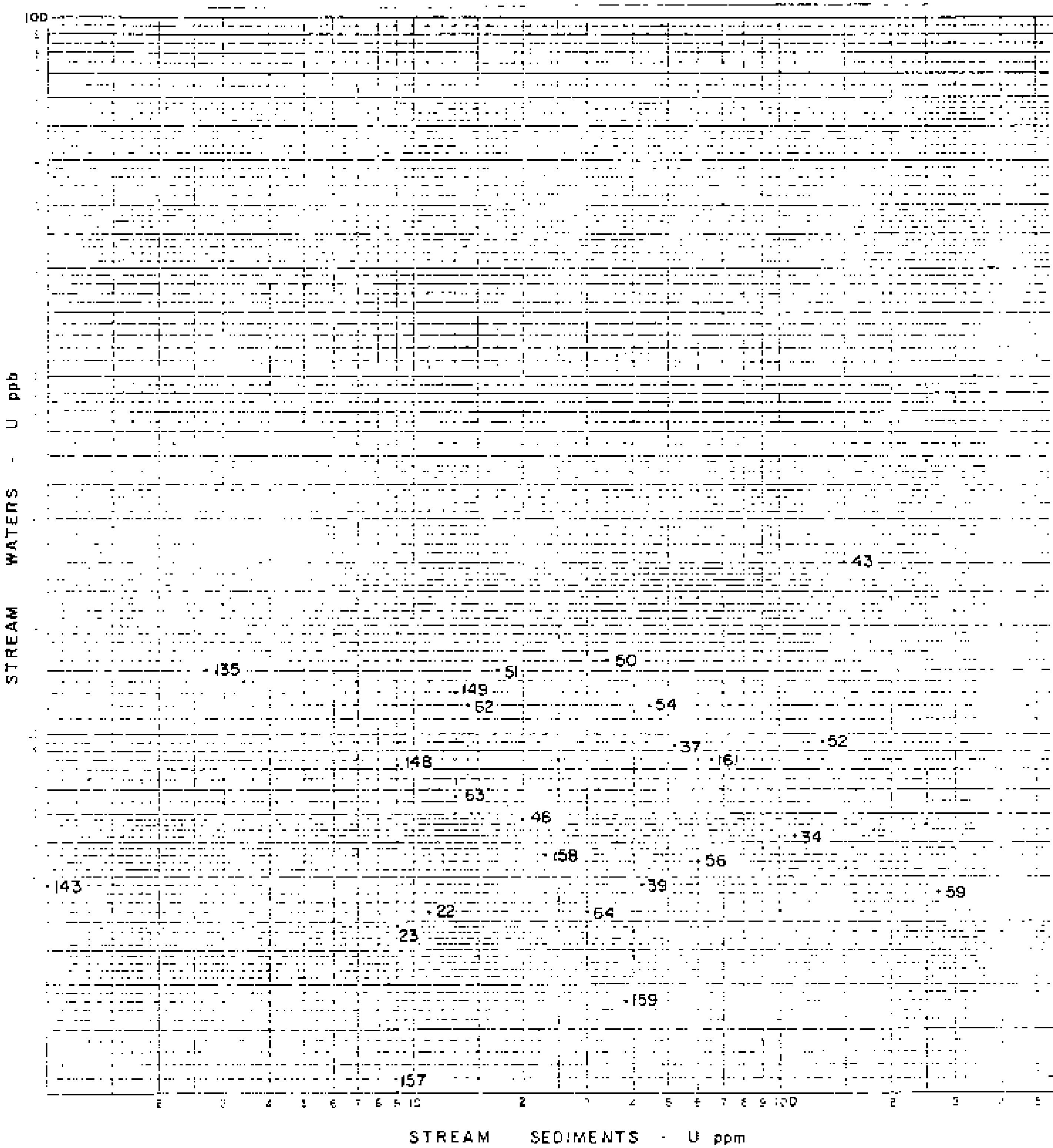
4 - 5 - 2 Discussion of Results

Results indicate a strong radioactive anomaly in the Surprise Lake batholith. To better understand this type of anomaly we have to compare the results obtained here with those obtained in the Tulsequah area.

FIGURE 7

RELATIONSHIP BETWEEN STREAM-WATER

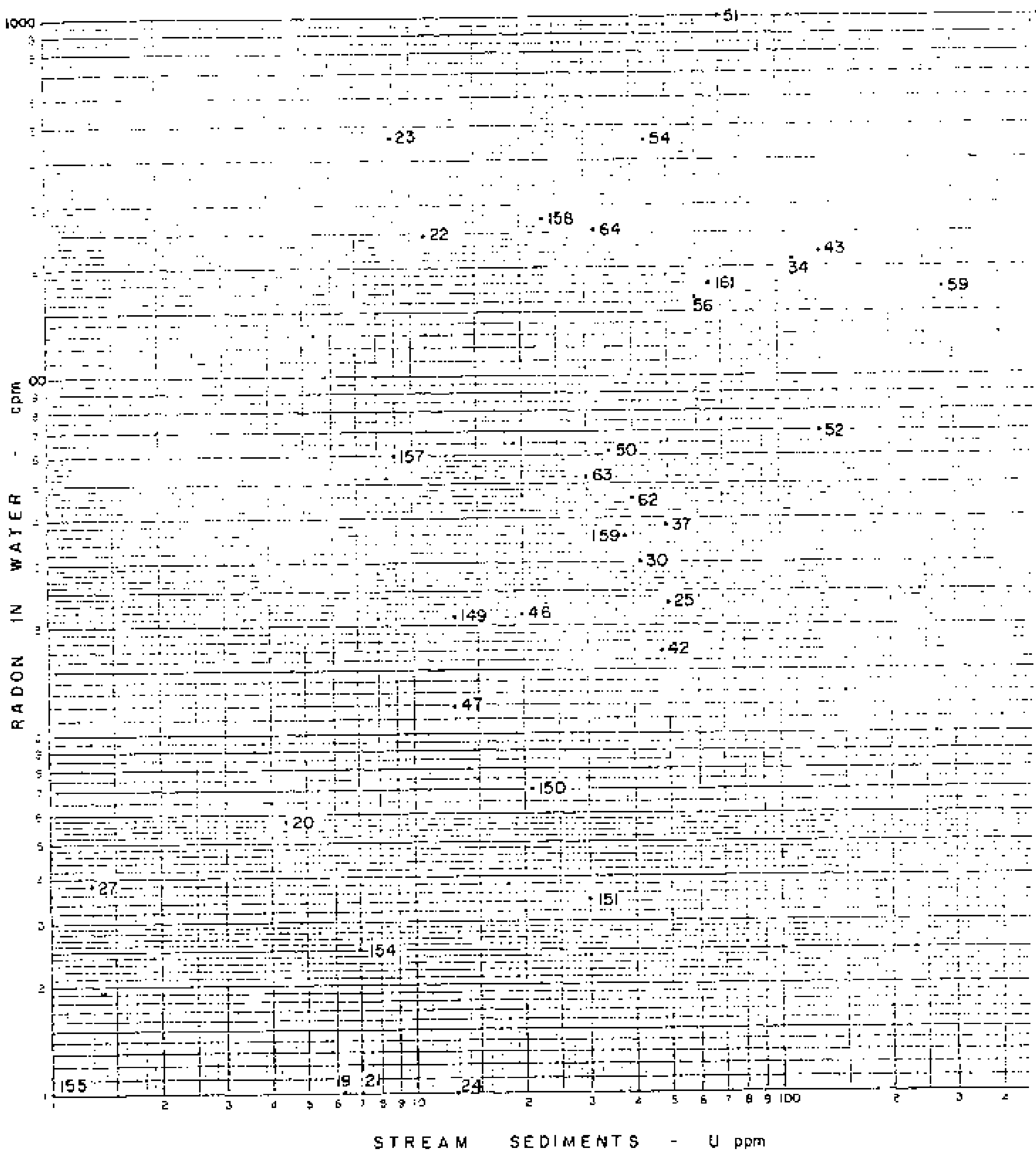
AND STREAM-SEDIMENT SAMPLE ASSAY RESULTS



Full Logarithmic, 5 × 5 Cycles

FIGURE 5

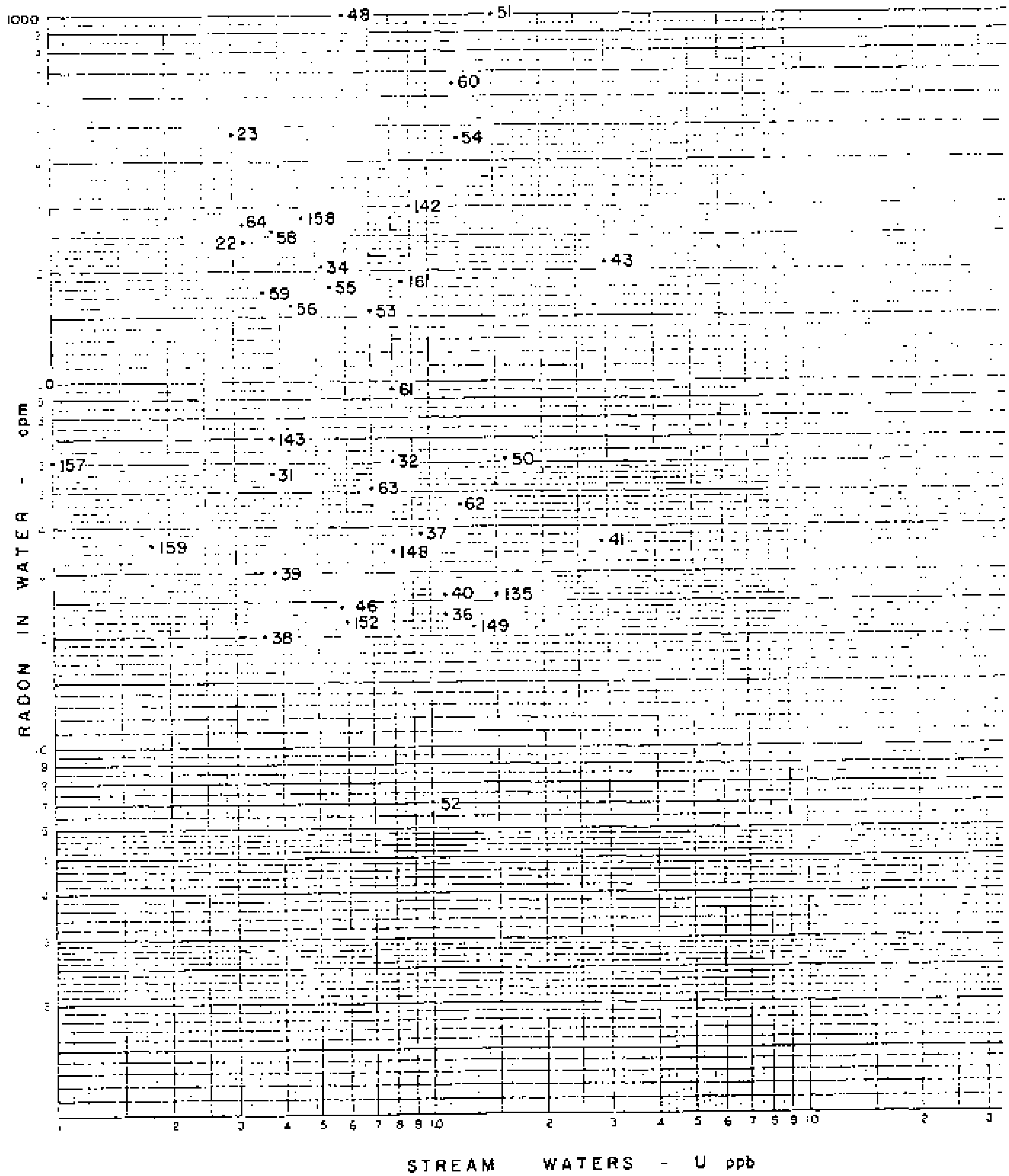
RELATIONSHIP BETWEEN RADON IN WATER AND STREAM SEDIMENT SAMPLE RESULTS



Full Logarithmic, 3 × 3 Cycles

FIGURE 6

RELATIONSHIP BETWEEN RADON IN WATER AND STREAM WATER SAMPLE RESULTS



Full Logarithmic 3 × 3 Cycles

Radon in water results are seldom above 1 cpm in the Tulsequah map sheet (Table 2). In the Atlin map sheet the threshold for an anomaly from radon in water was considered 100 cpm (Table 9). The highest value obtained was 1118.7 cpm (sample 110 G 51) from Weir Mountain, which represents the highest result obtained during the whole summer's exploration.

Stream sediment samples often give results in excess of 20 ppm uranium and four samples gave results in excess of 100 ppm (Table 11). If compared with Table 3, Tulsequah, the difference is quite pronounced. The highest uranium concentrations come from sediment samples collected in the Weir Mountain area, although not necessarily coincident with the highest radon in water results. Stream water uranium concentrations also define the Weir Mountain anomaly.

The highest uranium content in stream waters is from sample No. 43 (3.0 ppb), collected a few km north of Zenazie Creek. The stream sediment sample No. 43 (148.0 ppm) also stresses this anomaly. This area looks promising and deserves further detailed investigation.

4 - 6 Economic Potential

All the geophysical and geochemical uranium anomalies were found within the alaskite body of the Cretaceous Surprise Lake batholith. The strongest anomalous area was delineated within the alaskite, in the Weir Mountain area and 187 B.C. units were subsequently staked by Mattagami.

Stream water and sediment samples and, in particular, radon in water measurements indicate the presence of uranium rich zones. Uranium minerals were not observed anywhere. Four rock samples from Weir Mountain indicate that uranium mineralization is associated with lead and zinc. The assay results of the above mentioned rock samples (#'s 95, 96, 97 and 98) are given in Table 8. The best assay value obtained was 3.6 lb/ton U_3O_8, with 4% Zn and 0.11% Pb.

The mode of occurrence of the uranium is not known. The high geochemical values scattered over a large area indicate that uranium might be present in different concentrations in different places within the alaskite (in fractures, as small veins ?) rather than being concentrated in one single localized deposit.

Outside the Surprise Lake batholith geochemical and geophysical results for uranium in the Atlin area are considerably lower and are comparable to the average results obtained from Tulsequah and Dease Lake areas. The Cache Creek Group and the ultrabasic rocks of the Atlin intrusions do not present any potential for uranium except possibly at their contacts with the Cretaceous alaskite.

4 - 7 Detailed Geology

Six geological traverses have been completed and their locations shown in Map No. 5. The purpose of this part of the exploration was to investigate: (i) the contacts between Tertiary volcanics and sediments, outcropping in relatively small areas around Surprise Lake; (ii) the general background radioactivity of the lithological units in the area; and (iii) to evaluate the nature of the radioactive anomalies found within the Surprise Lake batholith.

4 - 7 - A Traverse No. 1. Ruby Creek

The traverse was done to investigate the radioactivity of basal sedimentary rocks capped by Tertiary basalt, exposed along the east bank of Lower Ruby Creek.

The basalt has prominent columnar jointing; it is weathered to grey - dark purple, black on fresh surface. Vesicles abound and the rock is horizontally bedded. Radioactive response in 70 cps (GRS 101). The creek bed is in part underlain by alaskite.

A 60 m section of poorly consolidated pebble conglomerate outcrops beneath a volcanic agglomerate. The thickness of the conglomeratic unit is not known. Its radioactivity is low, 70 to 80 cps, with no variations along the vertical section of the unit.

Alaskite glacial and fluvial float occurs in the stream valley. Fine grained molybdenite was noted in this alaskite. Also, a few very fine grained wolframite grains in the more quartz-rich portion of the alaskite was found. Crystalline wolframite in quartz from recent talus was also noted.

Conclusions: The contact between Tertiary volcanics and sediments did not reveal any anomalous radioactivity. The above background geochemical results obtained from stream sediment and water analyses reflect the radioactive alaskite only.

4 - 7 - B Traverse No. 2. Atlin Road - Ruffner Mine Past Volcanic Creek Trail, Along Fourth of July Creek

Outcrops of the Paleozoic Cache Creek Group were examined. The group is lithologically complex, comprising greenstone and volcanic greywacke, amphibolite, argillite and limestone.

The rocks are altered and weathered to brown-red colour, and strongly fractured. Carbonate veins cross-cut all the units. Background radioactivity is low (40 cps) with maximum readings up to 50 cps.

Most of the area is underlain by Jurassic intrusive rocks of the Fourth of July Creek body (Coast intrusions). The rock is a hornblende biotite granite, frequently pophyritic, with white or reddish feldspar phenocrysts up to 5 cm in diameter.

Radioactivity in the above mentioned intrusion is of the order of 90 cps, with a maximum of 150 cps (GRS 101). ^{40}K contribution is high. Uranium is on the average for granitic rocks at 3 to 4 ppm.

The contact between the intrusion and the Cache Creek Group was not observed anywhere along the traverse.

The conclusion is that the area does not present any potential for economic uranium deposits.

4 - 7 - C Traverse No. 3. Truck Traverse Along Warm Bay Road South From Atlin To O'Donnel River

Pennsylvanian and Permian rocks of the Atlin intusions were observed on several road cuts for 5 km south of Atlin. The rock is a serpentinized periodotite, weathered and strongly fractured. Radioactivity is very low at 15 cps.

Further south, the Cache Creek Group (greenstone, volcanic greywacke, chert, amphibolite and limestone) is exposed. Radioactivity averages 60 cps, with the highest value from black chert outcrop at 90 cps.

Few anomalous geochemical values were obtained from stream water samples on Pine Creek, but they are due to the rock of the drainage basin of the creek which includes the radioactive alaskite of the Surprise Lake batholith. The highest radon value for surface running water was 10.5 cpm, others were mostly 5 cpm.

A warm spring gave 298.4 cpm, but springs frequently give misleading results.

It is concluded that the area has little potential for economic uranium deposits. No further work is warranted.

4 - 7 - D Traverse No. 4. Weir Mountain Area

Ground traverse using Exploranium GRS 101 scintillometers and McPhar TV 1-A spectrometers was completed immediately east of Mount Weir, on the Surprise Lake batholith.

Results are interesting:

alaskite (with orthoclase phenocrysts):	450-500 cps ("fresh")
alaskite (fine grained):	450-500 cps ("fresh")
	300 cps ("weathered")
alaskite (coarse grained):	400 cps ("fresh")
	325 cps ("weathered")
alaskite (all varieties with black smoky quartz ± biotite fillings along fractures):	500-575 cps ("fresh").

The term "fresh" refers to clean, rust-free breaking surfaces. Even "fresh" appearing specimens are truly weathered. Because of this the highest radiometric values were found in residual soils and gravels at hilltops and in muds in spring discharges on valley sides.

The values are as follows:

soil gravel:	up to 1600 cps at depth of 30 cm
	up to 650 cps at surface
spring muds:	up to 525 cps at surface; most of spring mud values are same as weathered alaskite: 300-350 cps.

The soil anomalies are thought to result from supergene enrichment of uranium. Spring mud anomalies occur in certain springs, particularly those on the western slope of the mountain east of Weir Mountain. They occur below black-veined alaskite. The spring muds give up to 525 cps compared to the surrounding rock, debris and soil at about 350 cps. Stream muds are not anomalous.

Conclusions: highest radioactivity was found in black smoky quartz veins with biotite filling the fractures. Biotite appears to be associated directly with uranium mineralization. Uranium is always in excess relative to thorium, especially in soil and spring anomalies.

4 - 7 - E Traverse No. 5. Snowdon Range

Alaskite outcrops were examined with the aid of a McPhar TV 1-A spectrometer. The rock type is the same as described for Traverse No. 4 (see above). The texture of the alaskite is here more homogeneous, compared with the Weir Mountain area. No K-feldspar phenocrysts were observed. Quartz is less 'smoky' and quartz veins are absent. The alaskite has a fresher general appearance, although intensely weathered alaskite is present too. Fracturing and jointing in not as well developed as in Weir Mountain, less numerous and more widely spaced.

Outcrops are much more numerous here than in the Weir Mountain area. The topography is very similar in the two areas.

The traverse was conducted between two peaks: the southern one formed by a relatively fresh alaskite; the northern one presents outcrops of intensely weathered alaskite. The difference is also noticable radiometrically:

(i) southern (fresh): 280-320 cps
(ii) northern (weathered):180-220 cps.

Orange-brown weathered crushed rock and colluvial soil are present among the outcrops and at the glacial cirque floors. Background radiometric readings over the crushed rock and the soil are 350 and 500 cps respectively.

Uranium and thorium contents of 321 ppm and 113 ppm respectively were suggested by spectrometer readings obtained using a McPhar TV 1-A in a small pit dug in the soil. A second hole in a yellow-brown colluvial alpine soil gave count rates suggesting 160 ppm U_3O_8 and 88 ppm ThO_2. A third hole in a brown weathered zone, a few metres wide and 100 m long, next to fresh resistant alaskite bedrock, gave count rates implying 450 ppm U_3O_8 and 105 ppm ThO_2.

Uranium is probably concentrated in the soil by surface leaching processes acting on the surrounding alaskite. Assuming that these uranium anomalies are derived from surface depletion of a constantly high background alaskite containing about 8 ppm U_3O_8, the best targets for an enrichment point of view are the valley sides and the bottoms. However, it is this writer's opinion that the enrichment in the soils is unlikely to form an economic uranium deposit in this area.

To conclude, the traverse revealed zones of weathered alaskite with an areal extent less than in the Weir Mountain area. Background radioactivity is also less if compared with that on the west side of Trout Lake. Ground geological and radiometric traverses, and radon in soil measurements are recommended to evaluate the potential of this eastern limb of the Surprise Lake batholith in more detail.

4 - 7 - F Traverse No. 6. Boulder Creek

A traverse was done along Boulder Creek to evaluate the economic potential for uranium in the alaskite-Cache Creek contact and the alaskite-ultramafic Atlin intrusions contact. Results were negative.

The contacts are sharp, and no shear or alteration zones are present nearby. They are easily detectable radiometrically giving a sudden increase in radiometric response from between 30 and 50 cps to 300 to 500 cps for the Cache Creek and alaskite respectively (GRS 101).

At the headwaters of Boulder Creek there is a tungsten showing, with wolframite mineralization in quartz veins. A uranium mineral, zeunerite, has been identified in the showing, but with no economic importance. This uranium occurrence is barely detectable by analyses of stream sediment samples which were collected along the creek (see Map No. 5, samples 19, 20, 21, 22 and 23).

Rock samples from the alaskitic rock vary from 3.6 to 38 ppm U_3O_8. Background value is about 5 ppm. The rock is medium grained, equigranular, composed of quartz, plagioclase and potassium feldspar in approximately equal volume percentages. No mafic minerals are visible. Quartz is smoky. Plagioclase sometimes exhibits kaolinitic alteration.

Conclusion: the area does not seem to have any great potential for economic uranium deposits since the most favourable host rock, the alaskite, is very fresh and texturally and mineralogically homogeneous. The contacts with adjacent older metavolcanics and metasediments are sharp and barren of any mineralization.

CHAPTER V. GENERAL SUMMARY AND RECOMMENDATIONS

Results of this study indicate that :

1. Economic potential in the Tulsequah and Dease Lake areas is low. The boundary between the Coast Crystalline Belt and the Intermontane Belt represents a very favourable target area for porphyry Cu-Mo deposits, although the inaccessibility of the region would strongly effect the economic potential of any deposit.
2. A uranium anomaly was found in the Atlin map sheet. The area is located immediately west of Trout Lake and is underlain by Cretaceous alaskite. Further geochemical and geophysical work further defined the anomaly and 187 B.C. units were subsequently acquired by Mattagami.
3. Tertiary and younger volcanic and sedimentary rocks are low in uranium everywhere in the areas examined. No further work is recommended to be conducted in this area with the Tertiary basal conglomerate type of uranium deposits as model.
4. The helicopter supported regional radiometric and geochemical survey proved to be the best reconnaissance technique to use. Problems that are encountered are:
   (i) in rough mountainous areas particular attention has to be devoted to false radiometric anomalies due to mass and shielding effects;
   (ii) in plateau, plain and valley areas some difficulty in landing may be encountered below elevations of 1300 m above sea level because of tree and bush cover.

5. The geochemical sampling, and in particular the stream sediments, was a very helpful exploration technique in covering large areas very quickly. On the other hand, the effectiveness of the stream water samples was not as good due to the adverse metereological conditions. This may be expected to be normal during the summer in this type of terrain, especially in the Tulsequah area.
6. The radon-in-water technique using a radon emanometer revealed to be quite a reliable, quick and inexpensive technique for uranium exploration. Its use in the future is strongly recommended.

Respectfully submitted,

F. Morra

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CERTIFICATION

I, Franco Morra, residing at 11234 - 72 Avenue, Edmonton, Alberta, do hereby certify that:

1. I graduated with a degree in geology from the University of Milan, Italy (BSc, Hon., 1972) and from the University of Alberta, Edmonton (MSc, 1977).

2. I have practiced my profession since 1972 and I am presently employed by Mattagami Lake Mines Limited as an exploration geologist.

3. To the best of my knowledge and experience all information contained within the scope of this report is believed to be accurate.

F. Morra, B.Sc., M.Sc.
Exploration Geologist

Dated: ____________

CERTIFICATE

I, William Mercer, of the City of Edmonton, Province of Alberta, do hereby certify that:

1. I am a geologist residing at 6814 - 110 Street, Edmonton.
2. I am a graduate of Edinburgh University, Scotland, with a BSc Hons (1968) in geology and McMaster University, Ontario, with a PhD (1975) in geology.
3. I have been practicing my profession since 1974 and am at present District Geologist for Mattagami Lake Mines Limited in Edmonton.
4. I am a fellow of the Geological Association of Canada and a member of the Society of Economic Geologists and the Canadian Institute of Mining and Metallurgy.
5. I supervised the work that is described in this report.

Dated: ______________

____

W. Mercer, PhD

APPENDIX I.

GEOCHEMICAL AND RADIOMETRIC RESULTS

Methods of Analyses

U in waters: fluorimetric analysis

U in rocks: nitric followed by fluorimetric analysis

Cu, Mo, Zn in rocks: perchloric - nitric followed by atomic absorption

U in sediments: nitric followed by fluorimetric analysis

W in sediments: colorimetric analysis

Mo, Cu, Ni, Zn in sediments: hydrochloric - nitric followed by atomic absorption

TABLE I

TULSEQUAH - NTS 104-K

Rock-samples analyses.

Sample No.	Rock-type	c.p.s.	U (ppm)	Other Elements (ppm)
110-R-6	agglomerate	100	.8	
12	sst	80	.2	
13	volcanoclastic sed.	90	.4	Cu: 12
23	alaskite	210	4.0	
25	alaskite	65		Cu: 32
26	volcanic	35		Cu: 100; Ni: 47; Zn: 115
28	felsite			Cu: 18; Mo: 4
29	felsite			Cu: 18; Mo: 4
51	monzonite	300	14.6	
52	aplite	300	3.2	
101	monzonite	205	2.0	
104	monzonite	110		Cu: 29; Mo: 2
108	limestone	30		Zn: 32
117	granite	300	22.0	
121	py-chl-vein	95		Cu: 88
123	tuffaceous mud	220	1.4	
124	tuffaceous mud	245	1.8	
125	Unweathered tuff	550	1.4	
126	weathered tuff	500	0.2	
128	tuff	550	1.4	
129	tuff	500	1.2	
130	pebble ash flow	550	0.4	
131	felsite	600	0.8	
132	quartz vein	50	0.2	

TABLE II

TULSEQUAH - NTS 104-K

Radon-in-water results.

Sample No.	Corrected c.p.m.
110-G-3	<1
4	<1
5	<1
6	<1
7	1.2
14	<1
15	11.0
16	2.8
17	<1
101	1.8
102	9.7
103	<1
104	<1
105	11.0
106	<1
107	<1
108	8.1
109	<1
110	<1
111	<1
112	<1
113	<1
114	<1
115	<1

TABLE III

TULSEQUAH - NTS 110-K

Stream-sediment sample results

Sample No.	U (ppm)	Other Elements (ppm)
110-S-1	2.0	
2	5.0	
3	.2	
4	.2	
6	53	
7	7	
14	.3	
15	.2	
16	.2	
17	.2	
102	5.0	Cu: 6; Mo: 2
103	.6	
104	.2	
105	.2	Cu: 6; Mo: 2
106	.6	
107	.4	
109	3	Cu: 5; Zn: 42
110	.2	
112	.2	
113	.2	
114	.6	
115	.6	
117	3	
118	3	
119	4	
120	.2	
121	4	
101	.4	

TABLE IV

TULSEQUAH - NTS 104-K

Radiometric survey results

Fiducial Point No.	Geology (By GSC Units)	Counts-ground level:(GR410) Tot.	K	U	Th	GRS101-TV1A (cps)
6	7	214	133	46	17	
7	7	342	228	72	13	
8	16	393	262	91	37	
9	16	485	453	117	40	65
10	16	327	179	59	21	
13	16	565	475	162	90	
15	6	367	175	100	45	
16	4	329	144	65	20	
18	11	286	117	69	11	40
20	8/15	321	180	61	20	
21	7	380	234	83	38	
24	7	346	249	74	15	
26	A	323	180	46	23	
27	4	375	252	79	20	
30	14	563	451	147	93	
32	3	287	122	56	16	
34	4	455	377	80	41	
38	4	327	230	58	24	
41	11	259	61	68	12	25
42	12	396	255	85	29	100
48	3	269	98	43	12	50
49	4	380	221	74	23	
50	18	318	180	59	28	55
57	4	338	202	63	22	
66	16	790	545	262	153	
67	7	320	223	38	19	
77	13	649	571	195	126	
79	14/15	476	392	112	83	
85	7	324	244	60	9	
90	1	237	53	34	15	
101	7	334	246	53	23	
102		294	162	46	14	
109	16	498	348	133	67	
113	16	798	609	262	141	
115	16	502	417	133	70	
128	16	722	553	203	119	
130	16	568	495	146	93	

TABLE V

DEASE LAKE - NTS 104-J

Rock-samples analyses

Sample No.	Rock-type	Assay Results U (ppm)
110-R-53	sst	3.0
54	conglomerate	1.4
55	volcanic ash	4.0
56	siltstone	2.0
70	conglomeratic tuff	3.8
71	dacite	.4
72	volcanogenic sst	2.8
73	volcanogenic sst	3.8
74	volcanic ash	2.8
75	volcanic ash conglomerate	3.2
76	tuff	1.4
78	felsite	6.4
79	felsite	4.8
80	tuff	2.8
81	tuff	1.2

TABLE VI

DEASE LAKE - NTS 104-J

Stream-sediment samples results

Sample No.	Assay results U (ppm)
110-S-8	1.0
9	.3
10	.2
11	.4
13	.2
116	3.0
117	3.0
118	3.0
119	4.0
120	.2
121	4.0

TABLE VII

DEASE LAKE - NTS 104-J

Radiometric survey results

Fiducial Point No.	Counts-ground level (GR410) Tot.	K	U	Th
3	298	118	50	20
4	304	147	61	20
15	426	342	99	36
26	453	352	102	51

HEART PEAKS - NTS 104-K

Fiducial Point No.	Counts-ground level (GR410)			
137	392	270	75	45
138	378	250	89	34
144	613	380	189	126
145	760	559	249	164
148	981	693	341	222
150	428	292	116	40
151	1183	1068	392	252
154	366	190	102	21
155	1038	843	344	222

TABLE VIII

ATLIN - NTS 104-N

Rock-sample analyses

Sample No.	Rock-type	Radiom. response c.p.s.	Assay Results U (ppm)			
110-R-82	alaskite	300	3.6			
84	altered alaskite	1000	4.8			
85	granite	300	6.2			
86	skarn	400	5.6			
87	alaskite	400	38.0			
88	qtz-monzonite	300	7.2	Mo:	350	
89	qtz-monzonite	300	14.6			
90	alaskite	4200	240.0			
91	alteration soil	700	260.0			
92	granite	350	12			
93	granite	750	3.0			
94	granite	700	18.0			
95	alaskite	2000	40.0	Pb:	16500	Zn:
96	alaskite	2300	142.0		1500	34500
97	alaskite	2100	320.0		6400	3750
98	alaskite	6000	1800.0		1100	40000
99	soil alteration	390	40.0			
134	basalt	30	1.0			
135	basalt	80	4.0			
140	peridotite	15		Ni:	200	
145	alaskite		8.0			
146	alaskite		10.0			
147	granodiorite	90	1.0			
148	granodiorite	310	4.4			
151	granodiorite	320	10.8			
158	skarn	300		Mo:	6	
163	residual soil	1500	7.2			
164	residual soil	1500	280.0			
165	residual soil	1050	26.0			
166	residual soil	1100	66.0			
167	alaskite	600	50.0			
168	alaskite	320	8.0			

TABLE IX

ATLIN - NTS 104-N

Radon-in-stream-water results

Sample No.	Corrected c.p.m.
110-G-19	1.0
20	5.8
21	0.5
22	246.6
23	478.1
24	.8
25	23.6
26	7.6
27	3.8
28	2.6
30	7.7
31	56.1
32	62.1
33	19.4
34	211.7
36	23.6
37	38.8
38	20.5
39	30.7
40	26.6
41	37.6
42	17.3
43	220.1
44	4.1
45	10.3
46	24.6
47	12.7
48	947.5
49	7.5
50	62.8
51	1118.7
52	69.6
53	153.1
54	466.5
55	189.9
56	165.4
57	14.5
58	265.5
59	176.4
60	641.1
61	95.0
62	46.6
63	52.8
64	260.0

TABLE IX (cont'd)

Sample No.	Corrected c.p.m.
110-G-125	2.5
126	.6
128	8.0
129	2.1
130	5.2
131	5.2
132	6.7
133	4.2
134	2.3
135	26.0
136	4.4
137	16.0
138	3.0
139	3.8
140	2.0
141	1.7
142	298.4
143	69.4
144	10.5
145	2.3
146	7.9
147	.3
148	34.8
149	21.6
150	7.1
151	3.5
152	22.6
153	.7
154	2.5
155	.7
156	1.6
157	60.8
158	281.1
159	36.3
161	187.0

TABLE X

ATLIN - NTS 104-N

Stream-water analyses

Sample No.	U (ppb)
110-W-22	.32
23	.30
31	.38
32	.78
34	.52
36	1.10
37	.94
38	.36
39	.38
40	1.10
41	2.80
43	3.0
46	.58
48	.6
50	1.6
51	1.5
52	.96
53	.68
54	1.20
55	.56
56	.44
58	.38
59	.36
60	1.20
61	.78
62	1.20
63	.68
64	.32
135	1.50
142	.88
143	.38
148	.82
149	1.30
152	.62
157	< .05
158	.46
159	.18
161	.86

TABLE XI

ATLIN - NTS 104-N

Stream-sediment sample analyses

Sample No.	U (ppm)		
110-S-19	6.2	W: 23	
20	4.4	8	
21	7.0	5	
22	11.0	13	
23	9.0	28	
24	13.0	Mo: 120	
25	15.0	115	
26		10	
27	1.3		
29	22.0		
34	110.0		
37	52.0		
39	43.0		
42	48.0		
43	148.0		
46	20.0		
47	13.0		
50	35.0	W: 6	
51	17.0	6	
52	130.0	10	
54	44.0	6	
56	61.5	6	
59	270		
62	14.0	12	
63	13.0	8	
64	31.0	8	
65	39.0	10	Pb: 50
66	24.0	12	70
126	.2		
127	.2		
129	3		
130	10		
132	11		
133	2		
135	2.7		
136	.2		
138	.4		
139	.5		
140	.2		
141	.2		
143	.2		
144	.2		
145	.2		
146	.2		
147	.2		
148	9		

TABLE XI (cont'd)

Sample No.	U (ppm)				
110-S-149	13				
150	21				
151	30				
154	7				
155	.8				
157	9.0	W:	8	Mo:	3
158	23.0	W:	3	Mo:	6
159	38.0				
160	24.0				
161	65.0				

Technical Studies (Report Writing)

Salaries	1,328.52	
Salaries, Temporary	116.93	
Publications	124.93	
Misc. Supplies	9.30	
Payroll Burden	192.63	
	1,772.31	1,772.31
TOTAL		$26,303.79

SUMMARY OF ACTIVITIES

June 29: Moved camp to Trapper Lake from Whitehorse. Radiometric survey Whitehorse - Trapper Lake

30: Geological mapping. Radiometric survey Trapper Lake area (Tulsequah map sheet)

July 1: Exploration in Tulsequah map sheet - NTS 104 K

2: Exploration in Tulsequah map sheet

3: Exploration in Tulsequah map sheet

4: Exploration in Tulsequah map sheet

5: Exploration in Tulsequah map sheet

6: Exploration in Tulsequah map sheet and Dease Lake map sheet (NTS 104 J)

7: Exploration in Tulsequah map sheet

8: Withers - Morra: property evaluation - Cu in Kaketza Mountain (Dease Lake map sheet, 104 J) Rest of crew: exploration in Tulsequah map sheet

9: Exploration in Heart Peaks, Dease Lake map sheet

10: Exploration in Heart Peaks, Dease Lake map sheet

11: Moved camp to Atlin map sheet (Pine Creek, 10 miles east of Atlin) - NTS 104 N

12: Exploration in Atlin area

13: Car-borne radiometric survey in Atlin map sheet (Boulder Creek). Helicopter inspection.

14: Car-borne raiometric and geological mapping in Atlin map sheet. Visit to Mo property (Adanac) in Ruby Creek. Helicopter inspection.

15: Geological mapping on Ruby Creek. Atlin map sheet. Helicopter inspection.

16: Geochemical and car-borne radiometric survey from Atlin to Gladis Lake.

PART B. PERSONNEL AND EQUIPMENT COSTS

Personnel

5 geologists 23 days June 29th to July 21st
Salary cost $4059.59
Man days = 115
Average cost $35.30 per man day

Equipment- Scientific

Exploranium GR410 Spectrometer, crystal, chart recorder	$1778 per month
Exploranium GRS 101 scintillometers (2)	210 each per month
McPhar TV1A spectrometer (2)	419.25 each per month
EDA RD200 radon equipment	525 per month

Equipment - Miscellaneous

Bell 47G3B1 helicopter	161.20 per hour
Ford 4X4 crew cab with winch and canopy, Canuck Rentals	695.50 per month
CN VHF truck radiotelephone	68.75 per month
SBX11 HF radio	150.00 per month

Assays

95 stream sediment	
131 stream waters	3.75 average cost per sample
71 rock samples	

TABLE XII

ATLIN - NTS 104 N

Radiometric survey results

Fiducial Point	Total	Counts per second (GR 410) K	U	Th
29*	1066	748	374	248
30	708	617	180	108
31	712	502	254	122
32*	676	511	200	114
33*	1082	658	381	196
34*	1034	679	345	300
37*	1071	793	348	234
38	865	714	271	207
39	344	181	82	41
42*	949	679	348	255
65	633	496	170	114
68	1529	1021	711	344
48	843	647	254	187
52	743	507	200	143
53	718	552	181	135
55	832	504	291	186
56	784	493	298	173
57	714	515	215	132
61	349	144	73	37
76	682	506	180	154
77	620	453	182	120
78	1097	735	379	283
79	773	522	229	155
80	1073	755	365	281
81	739	513	281	161
82	775	430	300	172
84	761	557	271	163
85	571	372	174	114
86	881	705	233	205
87	935	717	290	220
88	890	686	268	192
90	746	494	229	154
91	971	552	301	263

*counts obtained "in flight" at 30 m clearance from ground; all other counts are to be considered at ground level.

Property evaluation of Au, Py property on McKee Creek, south of Atlin (John Harvey's property)

July 17: Geochemical and car-borne radiometric survey from Atlin to south end of Atlin Lake. Helicopter radiometric survey on Trout Lake area, 30 miles east of Atlin. Geological mapping and ground scintillometer survey on Trout Lake

18: Helicopter-borne radiometric survey on Trout Lake. geochemical sampling, geological mapping and ground radiometric survey on Snowdon Range, 35 miles northeast of Atlin

19: Radiometric survey, geochemical sampling, geological mapping on Trout Lake, Surprise Lake areas, northeast of Atlin

20: Geological mapping, ground radiometric survey and geochemical sampling on Weir Mountain, 25 miles east of Atlin

21: Moved camp from Birch Creek, Atlin, to Johnsons Crossing highway, 60 miles northeast of Teslin, Yukon. Geological mapping on Weir Mountain, B.C.

APPENDIX II.

HELICOPTER TIME SHEET AND SUMMARY OF ACTIVITIES

DEASE LAKE PROJECT

HELICOPTER TIME SHEET

Date	Hours
June 29	2.5
June 30	2.3
July 1	4.0
July 2	4.4
July 3	4.9
July 4	5.5
July 5	0.4
July 6	2.9
July 7	2.9
July 9	3.0
July 10	4.2
July 11	3.1
July 16	0.9
July 17	2.5
July 18	3.7
July 19	5.7
July 20	3.6
July 21	2.4
	58.9 Total hours

Not included in this calculation is the time spent for property evaluations, nor for the staking. Mobilization is included.

APPENDIX III.

PART A. STATEMENT OF COSTS - DEASE LAKE PROJECT, JANUARY 1977 to DECEMBER 1977

Geological

Salaries	$ 906.24	
Salaries, Temporary	3,153.35	
Telephone	9.00	
Postage and Freight	198.21	
Travel	596.45	
Equipment Rental	1,797.71	
Equipment Operations	71.78	
Vehicle Rental	347.75	
Vehicle Operations	681.95	
Camp Installation	9.99	
Camp Supplies	841.61	
Misc. Supplies	297.59	
Aircraft Charter	12,813.33	
Assays	1,060.60	
Payroll Burden	394.27	
	$23,179.83	$23,179.83

General

Telephone	361.33	361.33

Supervision(W. Mercer)

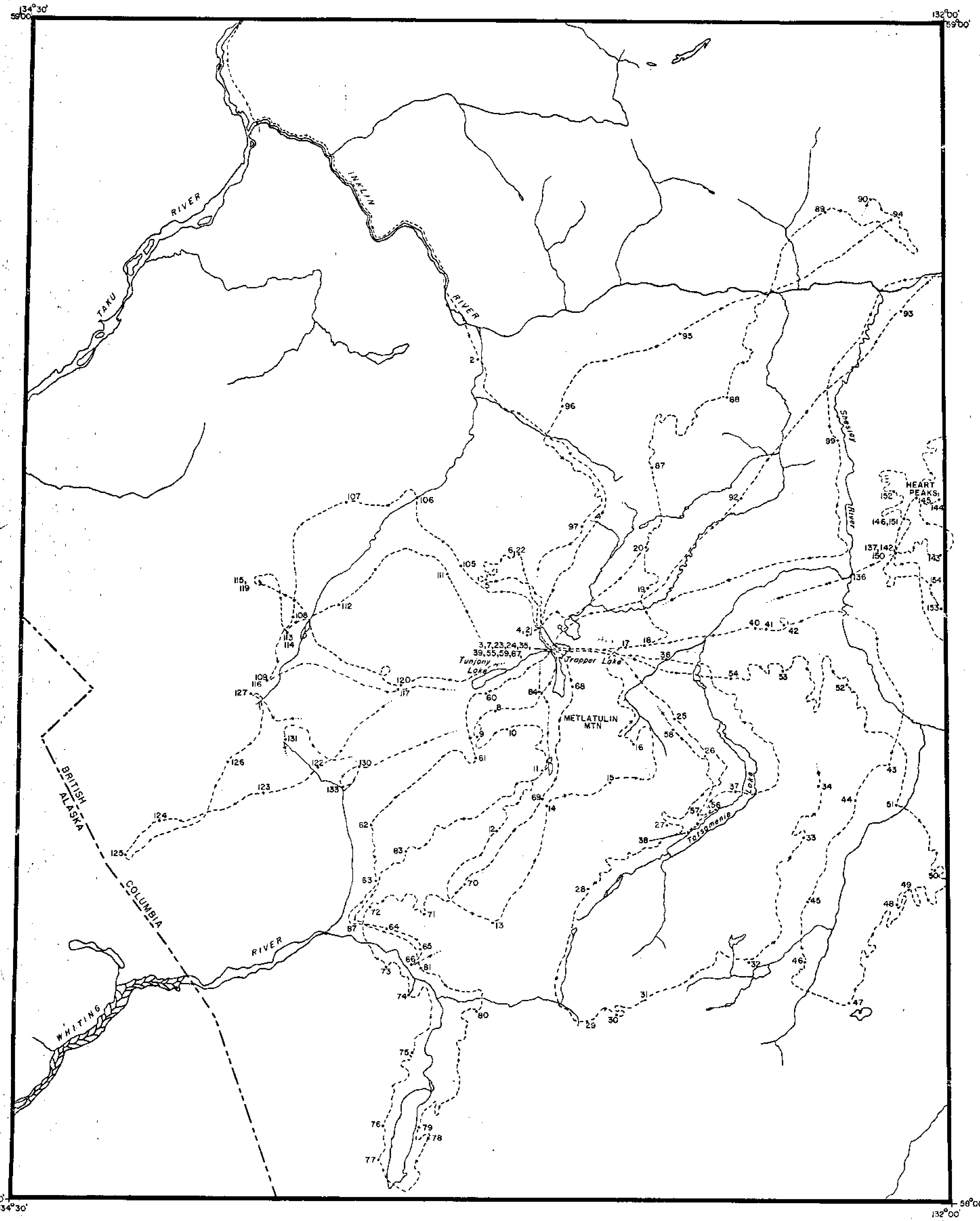
Salaries	296.12	
Travel	151.65	
Vehicle Rental	88.28	
Payroll Burden	47.30	
	583.35	583.35

Draughting

Salaries	68.54	
Contractor Fees	322.00	
Payroll Burden	16.43	
	406.97	406.97

MINERAL RESOURCES BRANCH
ASSESSMENT REPORT
~~PART II~~ NO. 7610

MAP NO. 1 - HELICOPTER RADIOMETRIC SURVEY



TULSEQUAH

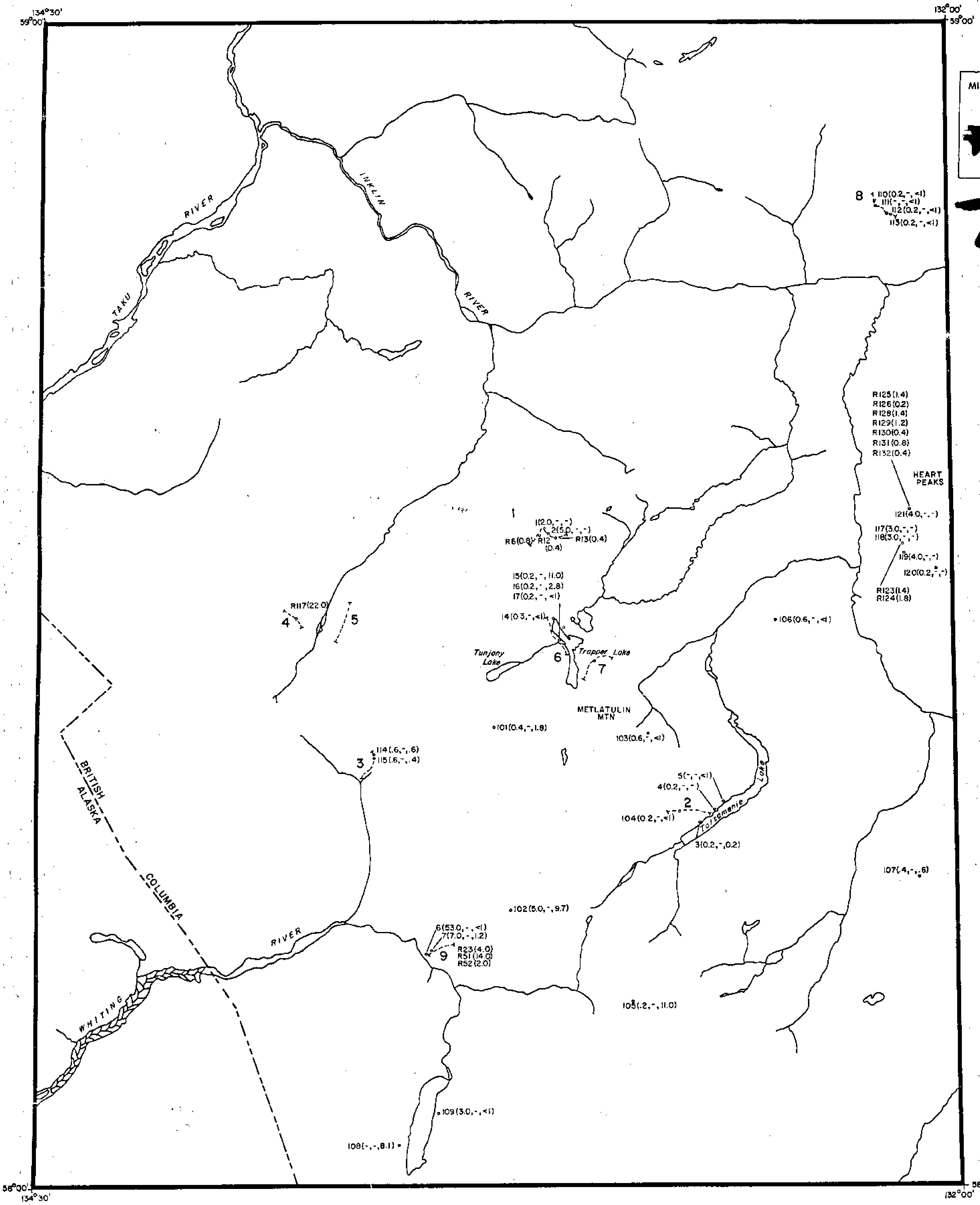
NTS 104 K

SCALE 5 0 5 10 Kilometres

HELICOPTER - BORNE RADIOMETRIC SURVEY FLIGHT PATH

· 45 FIDUCIAL POINT

MAP NO. 2 - GEOCHEMICAL SURVEY



TULSEQUAH

NTS 104 K

SCALE 5 0 5 10 Kilometres

• R31(0.4) ROCK SAMPLE(U ppm)

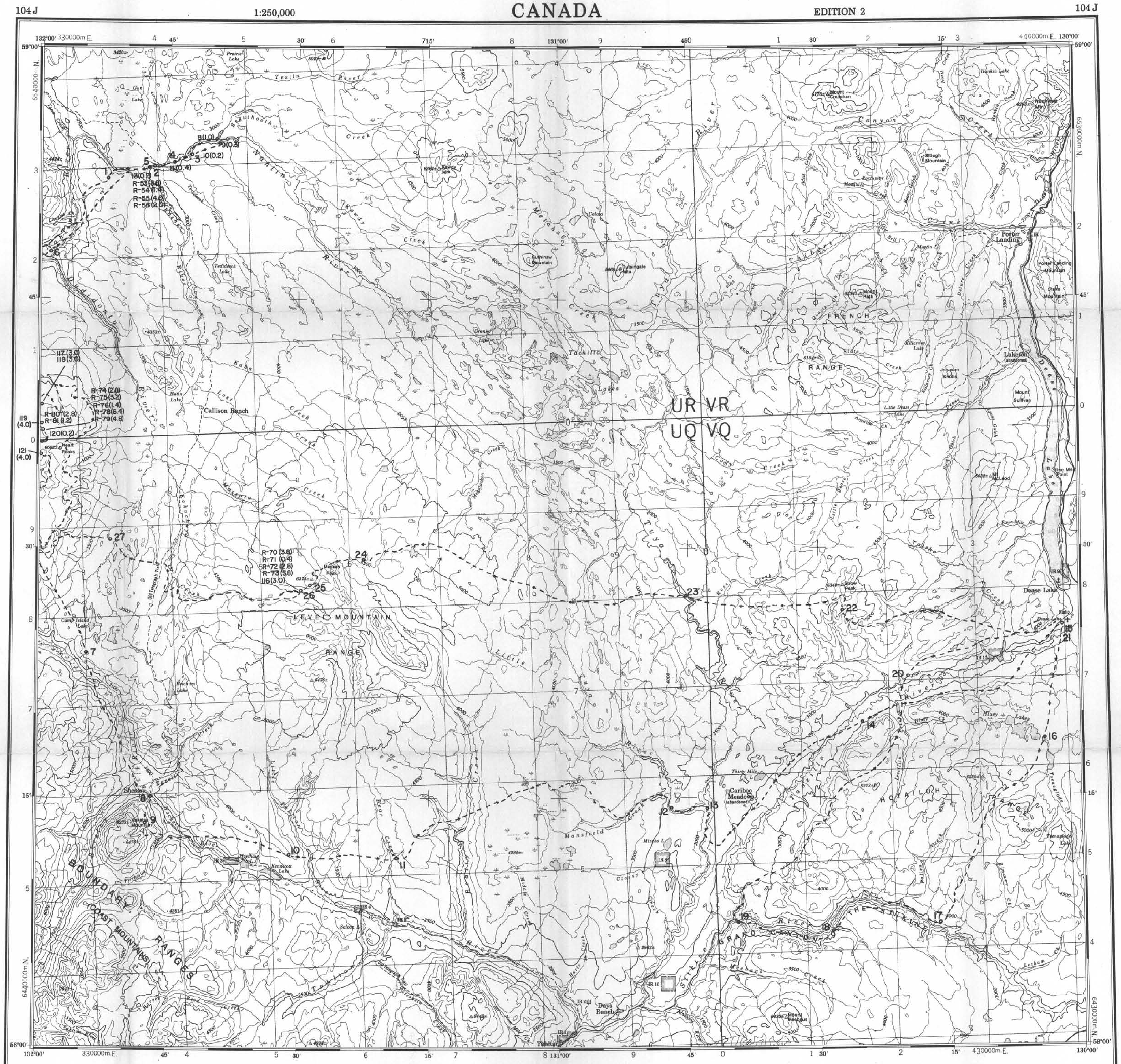
4 TRAVERSE NUMBER & PATH

U IN SEDIMENTS(ppm) U IN WATER(ppb)
• 133(0.2,0.3,24)
SAMPLE NUMBER RADON READING(cpm)

MINERAL RESOURCES BRANCH
ASSESSMENT REPORT
7610 ~~ARCH~~
NO.

MAP NO. 3
HELICOPTER RADIOMETRIC SURVEY AND GEOCHEMICAL RESULTS

104 J | 1:250,000 | CANADA | EDITION 2 | 104 J



Refer to this map as: 104 J EDITION 2 MCE SERIES A 502

CONVERSION SCALE FOR ELEVATIONS — Feet / Metres

TEN THOUSAND METRE UNIVERSAL TRANSVERSE MERCATOR GRID ZONE 9

GRID ZONE DESIGNATION 9V — 100,000 M. SQUARE IDENTIFICATION UR VR / UQ VQ

EXAMPLE OF METHOD USED TO GIVE A REFERENCE TO NEAREST 1000 METRES

EXAMPLE MILITARY GRID REFERENCE NU5404

If reporting beyond 18° in any direction, prefix Grid Zone Designation as: 15VNU5404

(dashed line)	HELICOPTER - BORNE RADIOMETRIC SURVEY FLIGHT PATH
o 26	FIDUCIAL POINT
R-72 (2.8)	ROCK SAMPLE (U ppm)
121 (4.0)	SEDIMENT SAMPLE (U ppm)

RELIABILITY DIAGRAM - CROQUIS D'EXACTITUDE

A. Second edition map, derived from large scale mapping.
A. Deuxième édition, tirée de cartographie à grande échelle.

Produced, 1969, by the SURVEYS AND MAPPING BRANCH, DEPARTMENT OF ENERGY, MINES AND RESOURCES. Printed 1971

Magnetic declination 1969 varies from 29°22' easterly at centre of west edge to 29°26' easterly at centre of east edge. Mean annual change 4.3' westerly.

Roads: loose or stabilized surface, all weather — 2 lanes or more / less than 2 lanes; loose surface, dry weather

FOR COMPLETE REFERENCE SEE REVERSE SIDE

DEASE LAKE
CASSIAR DISTRICT
BRITISH COLUMBIA

Scale 1:250,000 Échelle

Miles 5 0 5 10 15 20 Miles
Kilomètres 5 0 5 10 15 20 25 30 Kilomètres

CONTOUR INTERVAL 500 FEET. Elevations in Feet above Mean Sea Level. North American Datum 1927. Transverse Mercator Projection

ÉQUIDISTANCE DES COURBES 500 PIEDS. Élévations en pieds au-dessus du niveau moyen de la mer. Système de référence géodésique nord-américain, 1927. Projection transverse de Mercator

Copies may be obtained from the Map Distribution Office, Department of Energy, Mines and Resources, Ottawa.

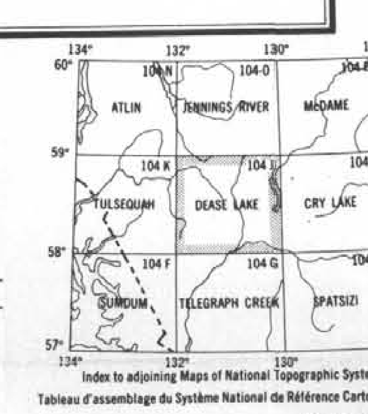
Ces cartes sont en vente au Bureau de distribution des cartes, ministère de l'Énergie, des Mines et des Ressources, Ottawa.

Établie en 1969, par la DIRECTION DES LEVÉS ET DE LA CARTOGRAPHIE, MINISTÈRE DE L'ÉNERGIE, DES MINES ET DES RESSOURCES. Imprimée en 1971

La déclinaison magnétique pour 1969 varie de 29°22' est au centre de la limite Ouest à 29°26' est au centre de la limite Est. Variation moyenne annuelle 4.3' Ouest.

Routes: gravier aggloméré, toute saison — 2 voies ou plus / moins de 2 voies; de gravier période sèche

POUR UNE LISTE COMPLÈTE DES SIGNES, VOIR AU VERSO



Index to adjoining Maps of National Topographic System
Tableau d'assemblage du Système National de Référence Cartographique

DEASE LAKE
104 J
EDITION 2

MAP NO. 4 HELICOPTER RADIOMETRIC SURVEY - ATLIN

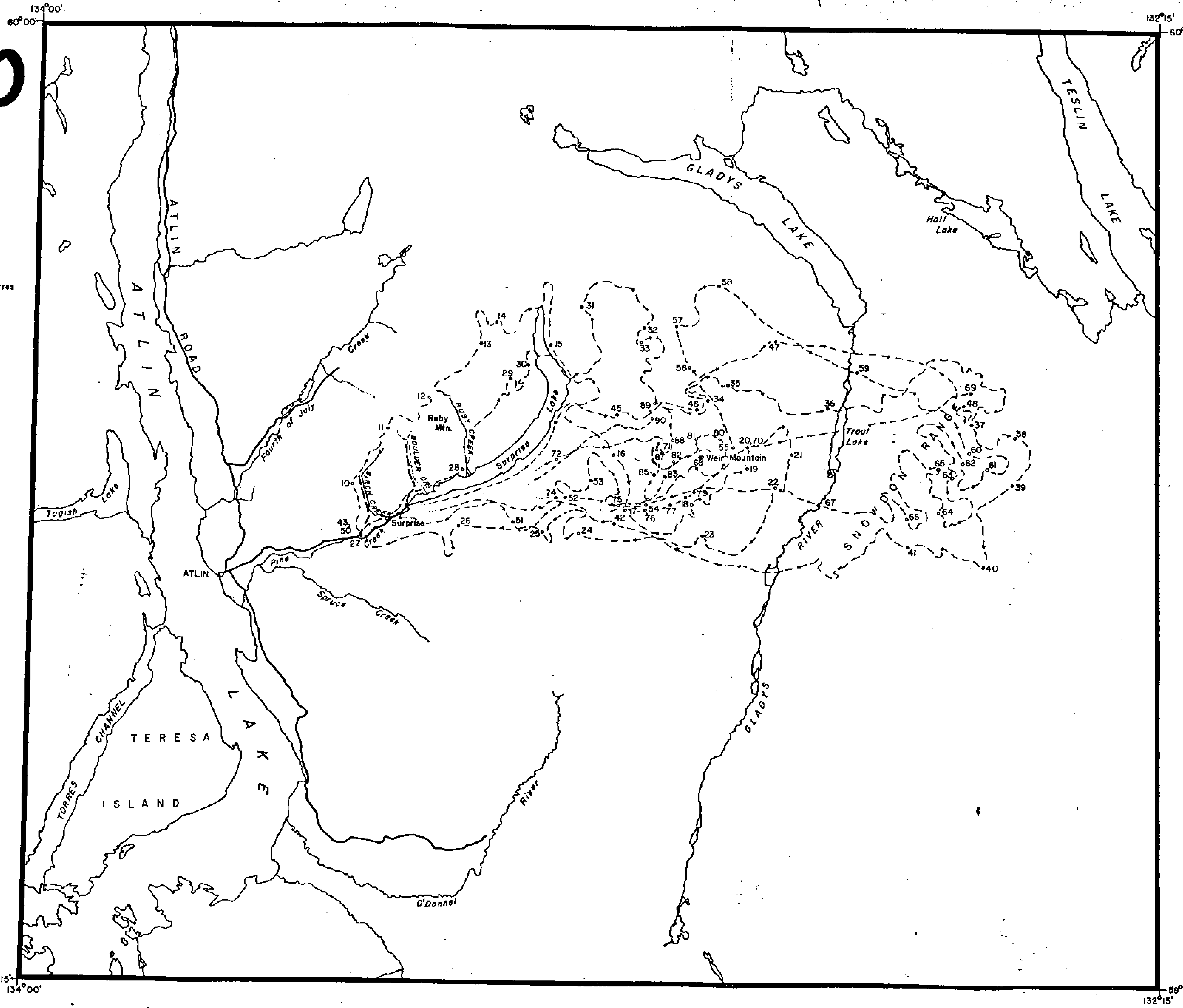
ATLIN

NTS 104 N

5 0 5 10 Kilometres

HELICOPTER - BORNE RADIOMETRIC SURVEY PATH

• 53 FIDUCIAL POINT



ATLIN

NTS 104 N

5 0 5 10 Kilometres

Sample Number — U in water (ppb)

22 (11.0, 0.32, 246.6)

U in sediments (ppm) — Radon analysis (cpm)

R-84 (4.8) Rock Sample (U ppm)

5 TRAVERSE