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11/88

**ASSESSMENT REPORT  
SEISMIC REFRACTION STUDY  
CARRIED OUT ON  
SPRUCE CREEK  
ATLIN, BRITISH COLUMBIA**

104N/12E  
59°33'42" 133°32'30"  
Atlin M.D.

for

*Owner/Operator:* **CARNES CREEK EXPLORATION LTD.**  
406 - 837 West Hastings Street

Vancouver, B.C.  
V6C 1B6  
**GEOLOGICAL BRANCH  
ASSESSMENT REPORT**

prepared by **16,560**

**GEORGE P. KRUECKL, P.ENG.**  
Vancouver, B.C.

October 28, 1987

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## INTRODUCTION

Carnes Creek Exploration Ltd. of 406-837 West Pender has embarked on an exploration program on the Irving and Treetop leases in Spruce Creek near Atlin, B.C. The purpose of the investigation is to outline reserves of placer gold in the thick tertiary gravels beds that were exposed by past operators. The program involves mainly bore hole drilling and bulk testing. A two phase drilling program was proposed.

In order to facilitate locating proposed drill holes it was decided to carry out a seismic survey over the areas suspected to contain the thick tertiary gravel beds. The survey proposed covered an area of approximately 150 hectares involving 9 lines running roughly north-south. Only a preliminary interpretation of the seismic results was requested to guide the locating of proposed bore holes for the Phase I drilling program. A definitive interpretation of the seismic results would be completed after the Phase I drilling program is completed.

This report describes the seismic survey carried out and outlines the location of proposed bore holes for the Phase I drilling program.

## THE PROPERTY

### Placer Leases

The total property consists of 30 placer leases that were located on Spruce Creek and adjoining areas and are held by Irving Placer Mines Ltd. and Treetop Holdings Ltd. of Atlin, B.C. The leases are listed in Tables 1 and 2 following and their location is shown on Figure 2.

**TABLE 1**  
**Irving Mines Leases**

<u>PLM Name</u>	<u>Term of Lease (years)</u>	<u>Last Day of Term</u>	<u>Annual Rental Paid to</u>	<u>Name of Lessee</u>
1707	10	March 1992	March 1989	Irving
1708	10	March 1992	March 1989	Irving
1709	10	March 1992	March 1989	Irving
12247	10	March 1994	March 1988	Irving





**TABLE 2**  
**Treetop Holdings Leases**

	<u>Term of Lease</u>	<u>Last Day of Term</u>	<u>Annual Rental Paid to</u>	<u>Name of Lessee</u>
<b>Lower Spruce Creek</b>				
North Bench Leases				
PL 13210	10	Oct 31/95	Oct 31/87	Treetop
PL 13211	10	"	"	"
PL 13256	10	"	"	"
South Bench Leases				
PL 1465	10	Dec 29/89	Dec 29/88	Treetop
PL 13204	10	Dec 31/95	Dec 31/87	"
PL 13205	10	"	"	"
PL 13213	10	"	"	"
PL 13242	10	"	"	"
PL 13243	10	"	"	"
PL 13258	10	"	Dec 29/87	"
PL 13259	10	"	"	"
PL 13377	10	Restaked April 2/87	April 2/88	"
<b>Mid Spruce Creek</b>				
Creek Lease				
PML 1910	5	Sept 20/90	Sept 20/89	Treetop
South Bend Lease				
PL 6714	10	Oct 5/91	Oct 5/89	Treetop
PL 6715	10	Oct 5/91	Oct 5/89	"
PL 13257	10	Apr 11/96	Apr 11/90	"
<b>Upper Dominion Creek</b>				
Creek Leases				
PL 13357	10			Treetop
PL 13358	10			"
PL 13359	10			"
Bench Leases				
PL 13307	10			Treetop
PL 13308	10			"
<b>Tailings Disposal Area</b>				
PL 13374		Mar 10/87	Mar 10/88	Treetop
PL 13375		Mar 31/87	Mar 31/88	"
PL 13376		April 1/87	Apr 1/88	"
PL 13378		April 13/87	Apr 13/88	"
PL 13379		April 13/87	Apr 13/88	"

The agreement with Irving Placer Mines Ltd. includes the purchase of the processing plant and mine equipment.

Additionally, Treetop Holdings Ltd. has an agreement with Noland Mines Ltd. giving Treetop the right to reprocess the old Noland Mine tailings. The tailings agreement has been also included in Treetop's agreement with Petrocal. These tailings are located on placer leases 681, 790 and 1780 (owned by Noland Mines) and placer lease 1910 (Owned by Treetop Holdings) (Figure 5). An estimate 230,000 yards of tailings and pay gravels are available under the agreement.

Although the writer has examined the lease records at the gold commissioner's office in Atlin, B.C., any investigation into the legal status of the claims is beyond the scope of work for this report and the writer therefore does not accept responsibility for the legal status of the above leases.

#### Location and Access

The Irving and Treetop properties, having geographic coordinates  $59^{\circ} 34'$  north latitude and  $133^{\circ} 27'$  west longitude, are located in the Atlin placer mining district approximately nine (9) miles east of the town of Atlin, B.C. and one hundred twenty (120) miles southeast of Whitehorse, Yukon (Figures 1 & 2). A gravel and paved highway in excellent condition extends from Whitehorse to Atlin and a gravel and dirt bush road both in good condition extends east from Atlin to the property on Spruce Creek.

Whitehorse is serviced daily by major airlines from both Edmonton, Alberta and Vancouver, B.C. The Atlin airstrip 3,000 feet in length is well compacted and therefore is capable of handling most single prop, twin prop and some jet aircraft.

The property is accessible from mid-May to November depending on weather conditions

### Physiography and Climate

The topographic relief of the Spruce Creek drainage area is moderate, between 2,890 and 5,180 feet and includes the Dominion-Spruce Mountains. Spruce Creek is one of the larger creeks in the Atlin area. The creek line elevation for the length of the property ranges from 2,890 feet in the west to 2,920 feet in the east, the stream gradient averaging 2%. Spruce Creek drains into Pine Creek which subsequently drains into Atlin Lake.

Vegetation consists mainly of isolated stands of stunted spruce and balsam within large areas of dense willow. The treeline is approximately at the 3,900 feet elevation.

The average annual precipitation for the area is 12 to 15 inches with slightly more at the higher elevations. The property is usually clear of snow in early May and the first snow usually occurs in mid-September. The temperature ranges from +25°C in summer to -40°C in winter. The ground is usually frozen from November to late May.

Normal summer water flow in Spruce Creek is in the order of 15 cubic feet per second. Depending on both winter snow pack in the mountains and extreme summer temperatures, spring run-off can be as high as 70 cubic feet per second and mid-summer flow as low as 5 cubic feet per second.

### **HISTORY AND PREVIOUS WORK**

Placer gold was first discovered on Pine and Spruce Creeks early in 1898. The original discovery was approximately 1 mile upstream from the Bench claims examined in this report. Most of the shallow, easily worked gravel deposits were worked out in the next few seasons by holders of individual claims and leases. The difficulty of working deeper ground and disposing of tailings on 100 foot claims forced many miners to leave the area. This made it possible for those who remained to group several claims or leases to be worked together.



During the spring and summer of 1987, Carnes Creek Exploration Ltd. of Vancouver optioned the leases held by Irving Placer Mines Ltd. and Treetop Holdings Ltd. to carry out an exploration and bulk testing program for the purpose of going into production by the spring of 1988.

Petrocal has, through a joint venture agreement, obtained financing from Carnes Creek Exploration Ltd. The financing involves \$1.5 million flow through share offering with Knight's Financial.

## **GEOLOGY**

### **Bedrock Geology**

The geology of the Spruce Creek watershed is well documented in Geological Survey of Canada, Memoir 37, portions of the Atlin District by D.D. Carnes, 1914, and Memoir 307, Atlin Map Area by J.O. Atkin, 1959.

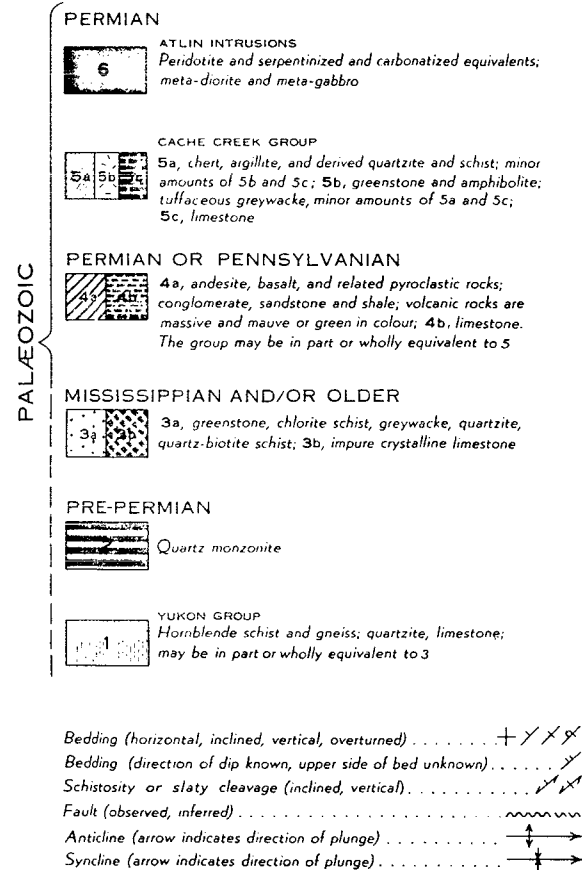
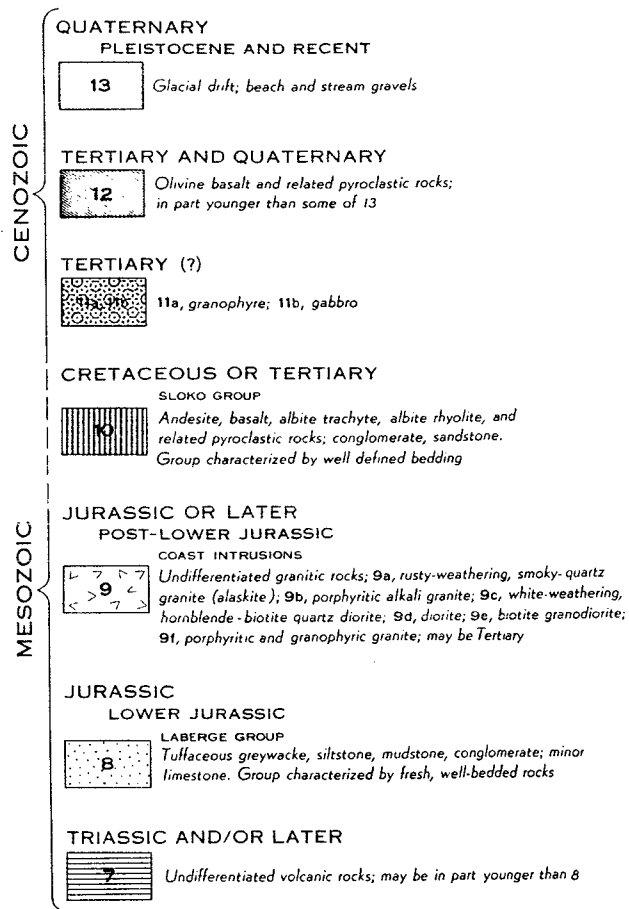
With the exception of the Canyon walls and the limited bedrock exposure found in actively mined areas of Spruce Creek, rock outcrops in the valley floor are scarce. The basal formation of the creek from its mouth upstream, beyond the east limit of the property, consist of serpentine, greenstone and magnesian rocks with the occasional small patch of pyroxenite (Figure 3).

These formations are the series of rocks the early day prospectors called the "Gold Series", and are found in all major gold camps throughout British Columbia and portions of the Yukon. It is generally understood that placer gold in tertiary stream channels originated as a result of erosion of the "Gold Series" rocks which contained significant numbers of gold rich quartz veins. This theory has never been verified on Spruce Creek since extensive till cover masks most of the bedrock.

### **Surficial Geology**

The whole of the Spruce Creek valley is marked by terraces of glacial gravels and areas of heavy glacial till. It appears that during Tertiary time the Spruce Creek valley was eroded and a deep channel incised in its mature valley. During the

## LEGEND





**CARNES CREEK EXPLORATION LTD.**

**SPRUCE CREEK PROJECT**

**REGIONAL GEOLOGY**

**KRUECKL & ASSOCIATES MINING CONSULTANTS LTD**

N.T.S. 104N/128 11

SCALE: 1:250,000

FIG.

DATE: JULY, 1987

DRAWN: G.K./dw

3

*Handwritten signature and number:*  
*[Signature]*  
 #12308



succeeding glacial periods the valley was filled with glacial drift, in which the stream cut a new channel, leaving the old channel, with its flatter gradient, deeply buried. The new creek channel gradually cut its way down through the glacial drift and in places cut the tertiary channel.

The original discoveries on Spruce Creek were on this so-called "blue wash" which consisted of a reconcentration of the tertiary gravels mixed with reconcentrated glacial gravels. The original tertiary gravels that were undisturbed are marked by a distinctive yellow-orange colour.

The width of the yellow gravel deposits that have been worked varies widely. In Spruce Creek the deep workings near the mouth of Dominion Creek are 150 to 200 feet wide and the distance between rims in the lowest section of the creek that was worked had a width in excess of 1,200 feet, although the width mined in this area was considerably less than this.

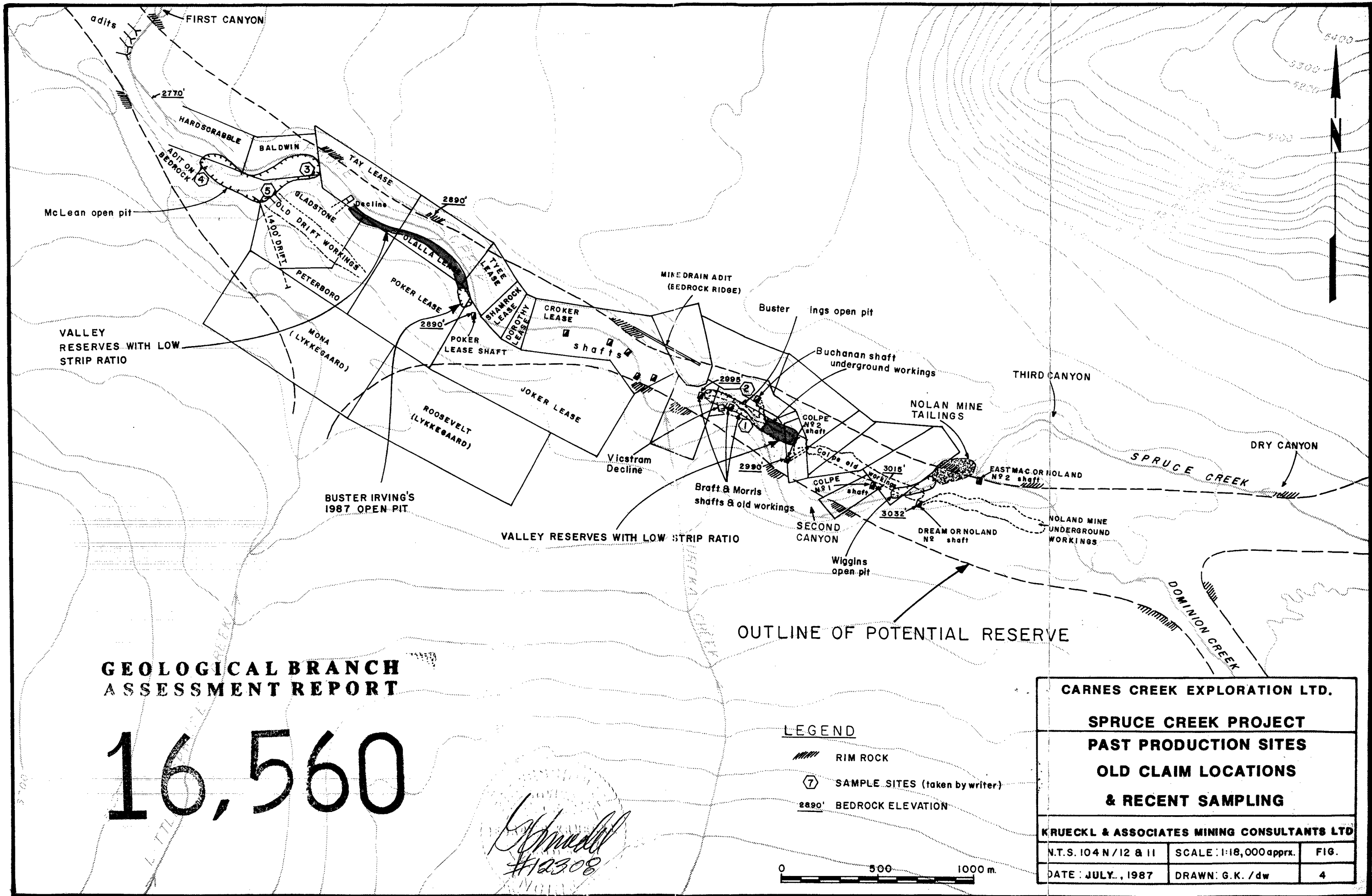
### Economic Geology

The Spruce Creek gravel is generally considered to be the highest grade in the camp, with the production from the Noland Mine contributing greatly to the over all high gold recoveries for the area.

The average fineness of the gold recovered in the Atlin area ranges from 841  $\frac{3}{4}$  on Spruce Creek to 774 on Boulder Creek; and the average for the camp is 813, which is considerably lower than the average for the province, which has been determined as 861.

Figure 4 shows the location of exposed rim rock and the extent of the historically known placer deposits in the area.

The yellow gravel found on the property is composed mostly of angular and rounded pebbles, cobbles, and boulders, having a matrix of quartz and feldspar grains, cemented by iron oxide ladden silts and clays. On Spruce Creek large boulders are uncommon and most of those seen are less than 2 feet in diameter. The gravel is semi-consolidated and in some underground workings is unsupported.






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**16,560**

*G. K. Krueckl*  
#12308

**LEGEND**

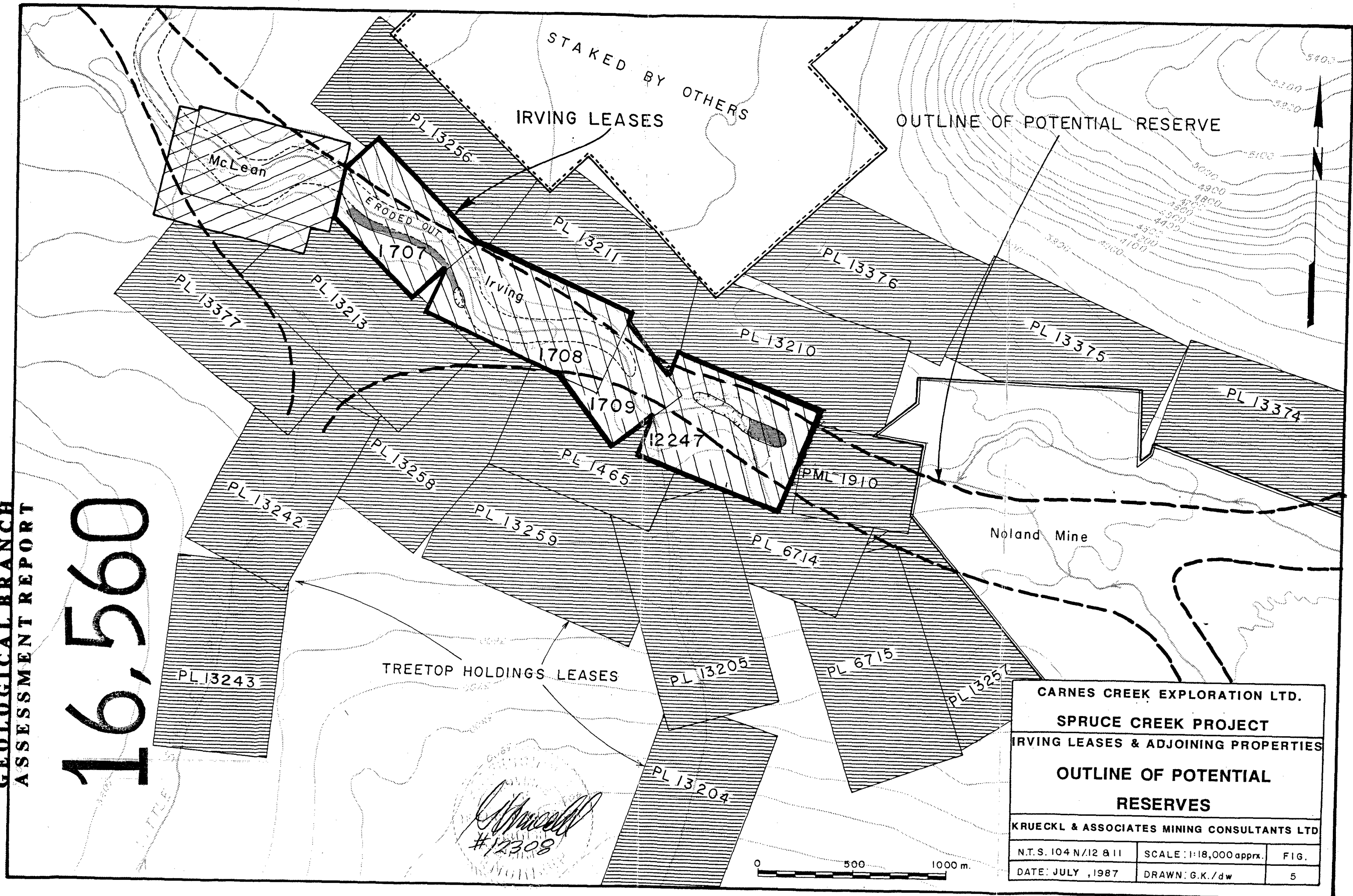
-  RIM ROCK
-  SAMPLE SITES (taken by writer)
-  2890' BEDROCK ELEVATION



<b>CARNES CREEK EXPLORATION LTD.</b>		
<b>SPRUCE CREEK PROJECT</b>		
<b>PAST PRODUCTION SITES</b>		
<b>OLD CLAIM LOCATIONS</b>		
<b>&amp; RECENT SAMPLING</b>		
<b>KRUECKL &amp; ASSOCIATES MINING CONSULTANTS LTD</b>		
N.T.S. 104 N/12 & 11	SCALE: 1:18,000 apprx.	FIG.
DATE: JULY, 1987	DRAWN: G.K. /dw	4

GEOLOGICAL BRANCH  
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16,560



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CARNES CREEK EXPLORATION LTD.		
SPRUCE CREEK PROJECT		
IRVING LEASES & ADJOINING PROPERTIES		
OUTLINE OF POTENTIAL RESERVES		
KRUECKL & ASSOCIATES MINING CONSULTANTS LTD		
N.T.S. 104 N/12 & 11	SCALE: 1:18,000 appr.	FIG.
DATE: JULY, 1987	DRAWN: G.K./dw	5

The clay in the yellow gravels for the most part clings tenaciously to pebbles, grains and gold nuggets, and, in many of the past operations on Spruce Creek, including the Noland Mine, gold adhering to clay was washed through sluices. Some of these sluice tailings were saved, and after weathering and consequent disintegration were again sluiced and much of the gold in them recovered.

The full thickness of the yellow gravel deposits are not exposed in underground workings since only about the lowermost 4 feet of gravels and 2 feet of bedrock were mined. In Pine Creek and Boulder Creek the yellow gravel was reported to be as much as 20 feet thick. On Spruce Creek greater thicknesses, up to 100 feet have been documented, the average being about 40-50 feet. The writer witnessed tertiary gravel thicknesses in excess of 70 feet on the Irving Leases.

Figure 5 shows the leases and projected rim rock which approximates the boundary of tertiary gravels as determined prior to the seismic work.

### 1987 INVESTIGATIONS

The 1987 investigations of the Spruce Creek site involved a seismic survey, a two phase bore hole drilling program, test pit sampling on the Noland Mine tailings piles, and a bulk testing program in the area of the Irving leases. The current report deals with only the seismic survey portion of the investigations and the proposed Phase I bore hole locations.

The field portion of the seismic refraction study was conducted by Geotronics Surveys Ltd. during the period from June 26 to July 12, 1987 under the direction of Andrew Rybaltowski both of Vancouver, B.C. A three man crew carried out the work in the field and the preliminary interpretation of the results was prepared at the site during the latter stages of the survey and in Vancouver after demobilization. The survey parameters were as follows:

- in line refraction seismic technique;
- 24 geophones to a spread;
- distance between geophones: 15 meters;

- length of each spread: 345 meters;
- Instrumentation;
  - two 12 channel seismographs "Nimbus" by EG & G Geometrics radio blasting system, seismic source synchronizer by Input-Output.
- explosives: Forcite 75%, seismocaps - 2 m.s. delay

#### **a) Methodology**

In line refraction seismic is based on observation of the first arrivals of direct and refracted compressional waves. The term "in line" refers to relative position of the seismic energy sources and detectors (geophones). The two leading geometrical parameters of a seismic survey are, total length of seismic spread and distances between geophones. Above parameters are directly related to depth of penetration and resolution of the survey. The number of explosions (shots) per spread and the amount of explosives is dictated by interpretational routine and the elastic properties of investigated strata.

The preliminary interpretation of seismic survey was done using half intercept time method and selectively delay time method. The final interpretation will be based on Generalized Reciprocal Time method and advanced correlation with drilling results.

#### **b) Field Conditions and Location of Seismic Lines**

Access to the lines was difficult since most of the area could not be accessed by 4x4 vehicles that were provided out of Whitehorse. In most instances all of the equipment and part of the explosives needed to be backpacked up the valley sides for an estimated 1/2 to 1 kilometers, the vertical climb being about 100 to 150 meters. Several changes to the proposed line locations were required and Table 3 details these changes with respect to the baseline.



TABLE 3

<u>Section Line</u>	<u>Proposed Line*</u>	<u>Actual Line</u>	<u>Remarks</u>
L00+00	235 m north 450 m south	Nil 345 m south	Explosives would disturb mining operations. Explosives would disturb mining operations.
L10+00	200 m north 450 m south	200 m north 235 m south	OK Large Beaver Pond obstruction
L20+00	335 m north	335 m north	OK
L20+00	600 m south	610 m south	OK
L30+00	200 m north 450 m south	Nil Nil	Explosives would disturb mining operations. " "
L40+00	450 m north 450 m south	380 m north 585 m south	" " OK
L50+00	360 m north 140 m south	360 m north 140 m south	OK OK
L60+00	310 m north 115 m south	310 m north 115 m south	OK OK
L70+00	280 m north 55 m south	280 m north 55 m south	OK OK
L80+00	335 m north 125 m south	335 m north 125 m south	OK OK

Special Lines

SL-N Az N <sup>o</sup> 14 <sup>o</sup> E	365 m
SL-S Az N135 <sup>o</sup> E	<u>310 m</u>
TOTAL	5,085 m

\* Proposed line locations were determined in the field as a result of bedrock exposures and other various physiographic features.

## STATEMENT OF COSTS

The seismic program involved the following breakdown of activities and costs:

Field Engineering - Steve Hodgson  
Seismic Survey - Geotronics Surveys Ltd.  
Orthophotograph - Delta Surveys Ltd.  
Report Preparation - George Krueckl

### Field Engineering - Steve Hodgson

Since the survey was conducted early in the program and agreements with Irving Placer Mines had not been finalized, Carnes Creek found it prudent to have a representative on site to carry out any liaison with Irving and other adjoining operators in the area. Steve Hodgson through Krueckl & Associates provided the on site engineering requirements which, in addition to liaison with local operators also involved, lease record research, permitting requirements with mines department, providing accommodation, and progress reporting.

Consulting Fees, 20 days @ \$345/day	\$ 6,900.00
Expenses: Airfares, transportation & accommodation	<u>2,394.08</u>
Sub-total	<u>\$ 9,394.08</u>

### Seismic Refraction Survey - Geotronics Survey Ltd. (June 26 to July 12, 1987)

Mobilization/demobilization	\$ 5,000.00
4-man crew, 100 hours @ \$110/hour	11,000.00
Explosives, 20 cases @ \$150/case	3000.00
Seismocaps, 110 @ \$4/cap	440.00
Room and board, \$65/mandays for 14 days	3,640.00
Truck rental and gas, \$120/day for 14 days	1,680.00
Instrument rental, 1,500/week for 2 weeks	3,000.00
Preliminary interpretation	<u>2,000.00</u>
Sub-total	<u>\$29,760.00</u>

**Orthophotograph - Delta Surveys Ltd.**

Orthophoto production covering Carnes Creek Exploration leases  
totalling 851 hectares in the Spruce Creek area \$ 3,685.15

**Report Preparation**

George Kruecki, P. Eng.  
Consulting fees, 33 hours @ \$43.75 \$ 1,443.75

Andrew Rybaltowski, Geophysicist  
Consulting fees, 3 days @ 225 675.00

Typing services 148.50

Drafting services 189.00

Supplies 15.50

Printing and binding (estimate) 80.00

TOTAL \$45,391.70

**DISCUSSION AND CONCLUSIONS**

The seismic refraction study has shown that the bedrock elevations, as recognized from past production in Spruce Creek (Grey Channel) and adjoining underground workings (Red Channel), can be projected laterally away from the creek for a considerable distance. In at least one area the bedrock elevation at creek level extends south under about 100 meters thickness of overburden for a distance of 500 meters towards the area underlain by Little Spruce Creek. Since the interpretation of refraction results is preliminary, a definitive definition of rim rock was not intended at this time and the study results was considered adequate for locating bore holes for the Phase I drilling program (see Figure 6).

A definitive interpretation of the refraction data will be carried out on completion of the Phase I drilling program.

The seismic refraction study outlines where there is potential for deep channels and where the thick tertiary material may be projected laterally into areas where previously rim rock had been assumed:

- a) North of Spruce Creek on sections L40+00 through to L80+00, the rim rock is interpreted as being about 200 meters further north;
- b) On section L80+00 the rim rock appears to be 100 to 200 meters further south than previously indicated;
- c) On section L00+00 through to L40+00, the rim rock is interpreted as being about 300 to 500 meters further south.
- d) A bedrock depression possibly having a lower elevation than in the adjacent Spruce Creek has been identified on section L10+00 and L20+00 some 300 to 400 meters south of Spruce Creek.

The interpretation of refraction results did not define the lateral extension of tertiary gravels that are exposed in mining sites on the Spruce Creek valley floor. It is one of the purposes of the Phase I drilling to outline the lateral extension of gravels.

## RECOMMENDATIONS

### Proposed Bore Hole Drilling Program

Nineteen bore holes have been proposed for the Phase I drilling program. These are shown on Figure 6. The following table summarizes the proposal:

**TABLE 4**  
**Proposed Bore Holes - Phase I**

<u>Hole #</u>	<u>Section Line</u>	<u>Offset (m)</u>	<u>Depth (m)</u>	<u>Remarks</u>
1	L00+00	S 100	75	
2	L10+00	N 150	20	
3		S 50	85	
4		S 200	70	
5	L20+00	N 200	35	
6		S 50	90	
7		S 300	60	
8	L30+00	N 100	30	
9		S 50	75	
10		S 300	60	
11	L40+00	N 100	25	
12		S 50	75	
13		S 300	55	
14	L50+00	N 500	85	
15		N 150	75	
16		S 50	45	
17	L80+00	N 250	35	
18		N 100	60	
19	SL Az N 14° E	N 600	<u>85</u>	
	TOTAL		1,140meters	
			3,740feet	

**Final Interpretation of Seismic Results**


A final interpretation of the refraction study data should be carried out together with the results from the Phase 1 drilling program. This information should be made available to guide the work scheduled for the Phase 2 drilling program and for developing the proposed computer mine model which would be part of a preliminary feasibility report.

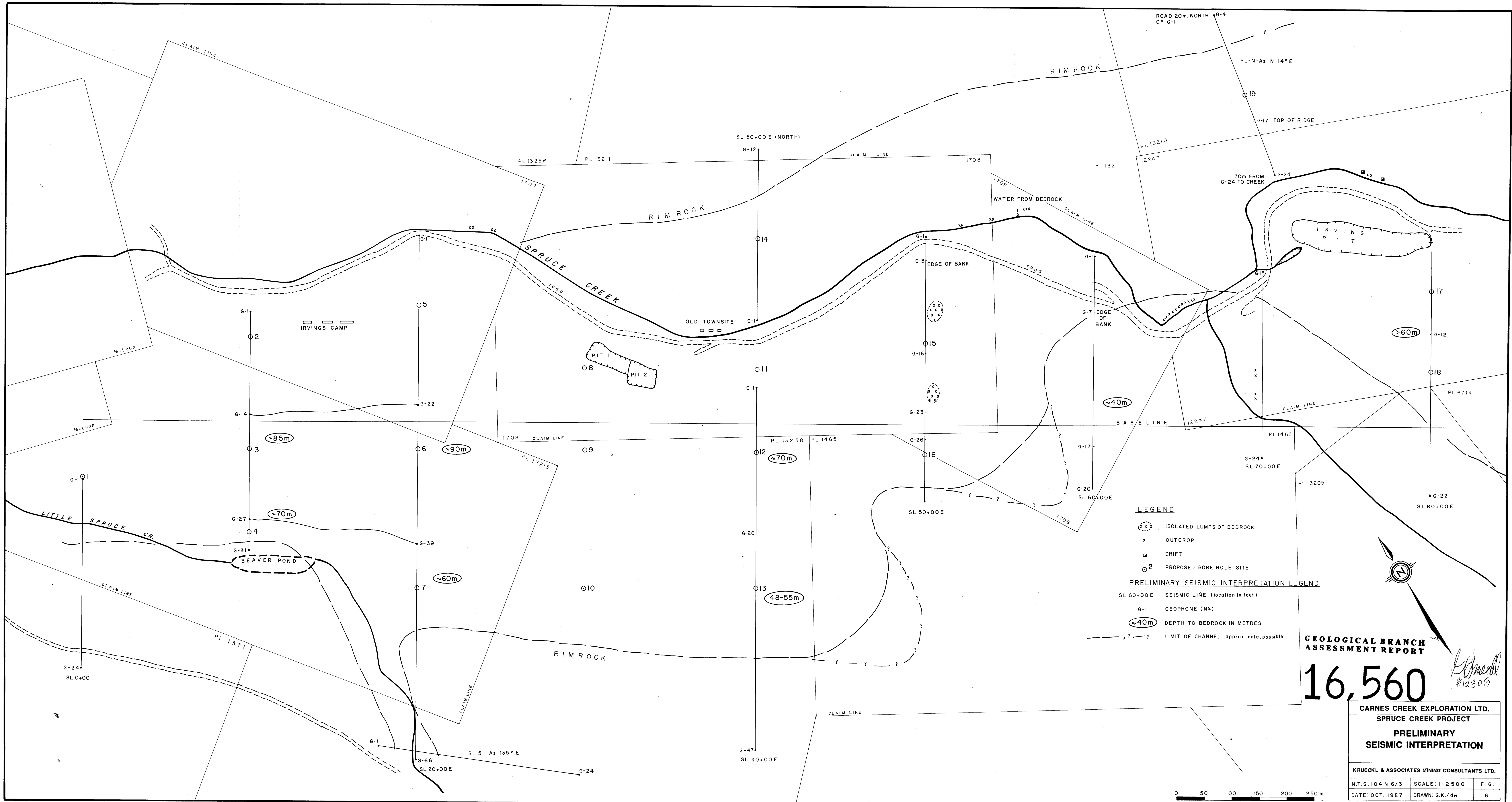
### CERTIFICATE

I, George P. Krueckl, with residence in of the City of Richmond, Province of British Columbia, hereby certify as follows:

1. I am a Consulting Geological Engineer with an office at #704 - 626 West Pender Street, Vancouver, B.C. V6B 1V9, (604) 685-5272.
2. I am a registered Professional Engineer of the Province of British Columbia.
3. I graduated with a degree of Bachelor of Science, Geological Engineering, from the University of Saskatchewan, 1962.
4. I have practised my profession for 25 years.
5. I have no direct or indirect interest in the shares of Carnes Creek Exploration Ltd. and the Spruce Creek Placer Leases subject of this report, nor do I intend to have any interest.
6. Permission is granted to publish this report dated October 28, 1987 in a Statement of Material Facts for Carnes Creek Exploration Ltd. Written permission from the author is required to publish this report for any other purpose.

Dated at Vancouver, Province of British Columbia, this 28th day of October, 1987.

  
George P. Krueckl, P. Eng.  
Consulting Engineer  
#12308



**LEGEND**

- (x x x) ISOLATED LUMPS OF BEDROCK
- x OUTCROP
- DRIFT
- 2 PROPOSED BORE HOLE SITE

**PRELIMINARY SEISMIC INTERPRETATION LEGEND**

- SL 60+00E SEISMIC LINE (location in feet)
- G-1 GEOPHONE (N°)
- (~40m) DEPTH TO BEDROCK IN METRES
- - - - - LIMIT OF CHANNEL: approximate, possible

**GEOLOGICAL BRANCH  
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# 16,560

*G. Arnold*  
#12308

<b>CARNES CREEK EXPLORATION LTD.</b>		
<b>SPRUCE CREEK PROJECT</b>		
<b>PRELIMINARY SEISMIC INTERPRETATION</b>		
<small>KRUECKL &amp; ASSOCIATES MINING CONSULTANTS LTD.</small>		
<small>N.T.S. 104 N 6/3</small>	<small>SCALE: 1:2500</small>	<small>FIG.</small>
<small>DATE: OCT. 1987</small>	<small>DRAWN: G.K./dw</small>	<small>6</small>

