DIAMOND DRILLING ASSESSMENT REPORT

M7, M18, M20 AND M25 CLAIMS

NTS 95 D/12

60°31'N 127°56'W

NORANDA EXPLORATION COMPANY, LIMITED (N.P.L.)

August 3-28, 1981

R.S. Rogers, M.Sc.

INDIAN and NORTHERN AFFAIRS

TRANSMITTAL FORM

M.R. File No. _____

S.M.R. File No. _____

Date Fwd 28 Jan 82

FROM Mining Recorder at Watson Lake

Supervising Mining Recorder at Whitehorse, Y.T.

FOR ACTION ARE:

☐ NEW APPL'N for PLACER LEASE to PROSPECT: Name:

☐ RENEWAL APPL'N PLACER LEASE to PROSPECT: Name: Lease No .....

☐ AFFIDAVIT of EXPENDITURE on PLACER LEASE. Name Lease No .....

☐ ASSIGNMENT of PLACER LEASE No. .....
From: To:

☐ GROUPING APPL'N UNDER SEC. 52(2) PLACER MINING ACT.
Owner:

☑ DIAMOND DRILL LOGS. LOCATION MAP ONLY AS PER LETTER 23 Dec. 81
Claims: Claim sheet no. 95-D-12
M, STRAT, SN, QTZ, PIC etc.

☐ QUARTZ ASSESSMENT REPORT
Claims: Claim sheet no.

Type of report: Submitted by:

Cls. work performed on: $ Req. for ren. application

E. M. Good
Signature

cc: Reg. Geol.

REPLY ACTION Date Ret.

090934

Signature

Indian and Northern Affairs Canada | Affaires indiennes et du Nord Canada

P. O. Box 269
Watson Lake, Yukon
Y0A 1C0

23 December, 1981

Your file Votre référence

Our file Notre référence

REGIONAL DIRECTOR RESOURCES

Attention: Supervising Mining Recorder

RESTRICTED

Enclosed for your files is a Diamond Drill report and logs submitted by Noranda Exploration Company for assessment on the M, STRAT, SOUTH NAHANNI, QTZ, PIC, and SN mineral claims located on 95-D-12.

Six holes were drilled for a total footage of 2,101 feet. I have requested from the company, a plan showing the location of each hole, which I will forward as soon as possible. Diamond Drill core is being stored on mineral claim M20.

Total credit requested is $49,600.00

Yours truly,

Patti L. McLeod
Mining Recorder
Watson Lake Mining District

PLM/pj
encl.
cc: Regional Geologist

090954

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LIST OF FIGURES

INTRODUCTION

The Quartz Lake property comprises 133 claims and fractions (9 of which are held under 21 year mining leases) owned in varying interests by Liard River Mining, Noranda Exploration Company Limited (N.P.L.) and Asarco Exploration Company of Canada, Ltd.

Diamond drilling in 1981 was performed on the following claims :

69450	M 7 Claim
70365	M 18 Claim
70367	M 20 Claim
70459	M 25 Claim

The property is located 45 miles northeast of Watson Lake, Yukon Territory; access is by air from Watson Lake. The 1981 program, under an option agreement between Noranda and Asarco, included 6 "BQ" diameter drill holes for a combined depth of 2101 feet, completed between August 3 and August 28, 1981.

DIAMOND DRILL PROGRAM

Drilling was contracted to Drilcor Industries, Ltd. of Richmond, B.C., who supplied a diesel powered Hydrawink drill unit and crew. Drilling was supervised by R.S. Rogers, G.C. MacDonald and G.E. Dirom, of Noranda Exploration Co. Ltd. (N.P.L.).

Drill core for the 1981 program is stored on the property on claim M20, excepting portions taken for assay and petrographic study. Assay technique followed accepted analytical practice,and will not be elaborated on here.

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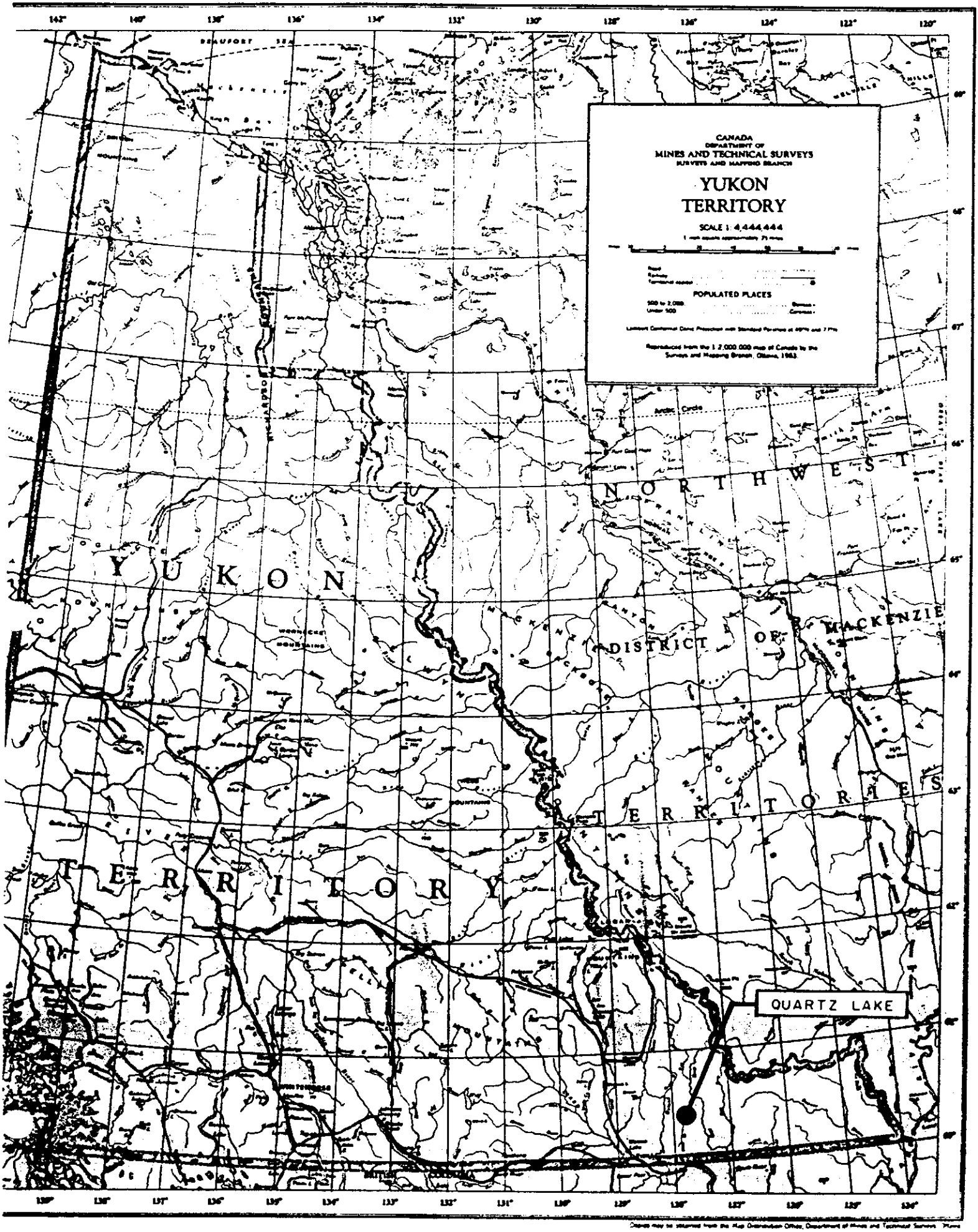
Drill logs and assay data summarize the 1981 program.

Submitted By :

R.S. Rogers, M.Sc.

Project Geologist
Noranda Exploration Co., Ltd. (N.P.L.)

December 17, 1981


CANADA
DEPARTMENT OF
MINES AND TECHNICAL SURVEYS
SURVEYS AND MAPPING BRANCH
YUKON
TERRITORY
SCALE 1: 4,444,444
POPULATED PLACES
Reproduced from the 1:2,000,000 map of Canada by the
Surveys and Mapping Branch, Ottawa, 1963
BEAUFORT SEA
Arctic Circle
YUKON
TERRITORY
NORTHWEST
TERRITORIES
DISTRICT OF MACKENZIE
QUARTZ LAKE

NORANDA EXPLORATION COMPANY, LIMITED

Started 04 Aug 81	Completed 05 Aug 81	Core Size BQ	Property Quartz lake	Project No 1093	NTS No. 95 D 5
FIELD COORDINATES			SURVEYED COORDINATES		Sheet 1 of 5
t. 94.332 N	Elev. 3770	Dip -90	Lat.	Elev.	Dip -90	Hole No.
p. 94.565 N	Depth 257	Bearing	Dep.	Depth 257	Bearing	145

Footage	Rec'y	Graphic Log	Description	% Sulp.	Est. Grade	Sample No.	Lt.
-26.0			Overburden, cased				
26.5			Argillite, pale green, finely laminar with bedding 35° to core axis; partings of dark purple argillite at base of this section				
28.0			Argillite, interbanded pink, purple and green, laminae to 1/4" thick, locally discontinuous with suggestion of crossbedding structures				
37.0			Argillaceous limestone, rusty tan color, finely laminar with rare hematitic partings. Some feathering manganese wad along bedding surfaces; the rock has a mottled, weathered appearance. One dominant fracture set at 90° to bedding				
39.0			Limy argillite, pale green to rusty, grading into next section. Some corroded sedimentary pyrite grains conformable to bedding, at 45° to core axis				
53.5			Argillite, finely laminar pale green, with occasional pink patches. Pink color is restricted to fractured surfaces, and appears to be an alteration envelope in this section				
66.1			Argillite as above, becoming increasingly pyritic towards base of section. Pyrite is clean, equant grains scattered at random orientations in the matrix, most likely diagenetic. At 54.2 a heavily pyritized 6" section of fault gouge.	5	-		

DATE 08 August 81 LOGGED BY R.S. Rogers

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ollared	Completed	Core Size	Property	Project No 1093	NTS No.
FIELD COORDINATES			SURVEYED COORDINATES		Sheet 2 of 5
t.	Elev.	Dip	Lat.	Elev.	Dip	Hole No. 145
p.	Depth	Bearing	Dep.	Depth	Bearing	

ootage	Rec'y	Graphic Log	Description	% Sulp.	Est. Grade	Sample No.	Lt.
77.1			Argillite, banded pink and purple with minor calcareous fractures at 90° to bedding. Partings show slickensided grooves which suggest some post lithification offset. ~~Sedimentary features include scour and fill channels,~~ graded bedding and varied sections				
82.0			Argillite, pasty green with pale pink tint, minor limy interbeds with manganese wad on partings				
87.0			Argillite, as above with pods of quartzite at scattered intervals, at 84.8 a sideritic fracture and a thin lamina of galena. Stockworking of galena increases ~~towards base of section, but is largely confined to thin~~ fractures and veinlets	5	1.0 Pb		
107.0			Argillite, pale green and minor pink interbands, pink ~~bands increase to 50% to end of section.~~ Fine laminar pyrite throughout. Bedding 60° to core axis	5			
117.2			Argillite as above, rare laminations of fine grained galena increase to base of section, in places crosscut bedding planes	5	1.0 Pb		
131.5			Argillite as above, galens in fractures with clean ~~white quartz increases in this section;~~ Bedding is distorted by small offsets, dominant bedding attitude is 30° to core axis	5	1.5 Pb		

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NORANDA EXPLORATION COMPANY, LIMITED

Collared	Completed	Core Size	Property	Project No 1093	NTS No.
FIELD COORDINATES			SURVEYED COORDINATES		Sheet 3 of 5
Lat.	Elev.	Dip	Lat.	Elev.	Dip	Hole No.
Dep.	Depth	Bearing	Dep.	Depth	Bearing	145

Footage	Rec'y	Graphic Log	Description	% Sulp.	Est. Grade	Sample No.	Lt.				
133.5			Massive pyrite with minor fine grained galena fracture filling	90	1.0 Pb						
142.5			Argillite, dark grey, heavily pyritized, bedding at 45° to core axis. Galena banded parallel to bedding from 138 to 142.5	20	3.0 Pb						
146.0			Argillite, dark grey as above, rare fine grained disseminated galena, abundant laminar pyrite	5	0.5 Pb						
162.0			Argillite, interbanded pale green and pink bedded at 35° to core axis, some laminar pyrite throughout. Fault gouge or shear at 148.0 to 148.8	<5							
163.5			Quartzitic breccia, pebbles to 1/2" diameter, poor recovery								
165.0			Argillite, dark grey to black, heavily pyritic, sheared texture with clasts of quartzitic material. Appears to be reminiscent of footwall rocks	15							
202.0			Argillite, pale green with partings of black argillite, moderately pyritic throughout. Rare quartzite clasts show rims of siderite, minor flecks of galena. Pink alteration increases to base of section	10	Tr. Pb						
204.0			Argillite, pasty green, becoming heavily pyritized to base of section. Bedding 60° to core axis								

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Collared	Completed	Core Size	Property	Project No 1093	NTS No.
FIELD COORDINATES			SURVEYED COORDINATES		Sheet 4 of 5
Az.	Elev.	Dip	Lat.	Elev.	Dip	Hole No.
Sup.	Depth	Bearing	Dep.	Depth	Bearing	145

Footage	Rec'y	Graphic Log	Description	% Sulp.	Est. Grade	Sample No.	Lt.				
13.0			Massive pyrite	90							
15.5			Massive pyrite with coarse angular breccia of white quartz	75							
22.0			Argillite, dark grey and black with heavy pyrite throughout, bedding distorted by interlaminar shears and microfolds	25							
26.5			Massive pyrite	90							
41.8			Argillite, dark grey to black, heavily sheared, coarse pyrite throughout	25							
45.5			Massive pyrite in quartzite matrix with black argillaceous or graphitic partings	90							
50.2			Argillite, dark grey to black, sheared with minor clasts of white quartz; moderate pyrite throughout	25							
51.5			Massive pyrite	95							
57 EOH			Argillite, dark grey to black as above	25							

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NORANDA EXPLORATION COMPANY, LIMITED

llered	Completed	Core Size	Property	Project No 1093	NTS No.
FIELD COORDINATES			SURVEYED COORDINATES		Sheet 5 of 5
t.	Elev.	Dip	Lat.	Elev.	Dip	Hole No.
p.	Depth	Bearing	Dep.	Depth	Bearing	145

ootage	Rec'y	Graphic Log	Description	% Sulp.	Est. Grade	Sample No.	Lt.				
			Recovery : 257.0 - 26.0 = 231.0 cored								
			220 feet recovered								
			220.0/231.0 = 95.2% Recovery								

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NORANDA EXPLORATION COMPANY, LIMITED

Collared 06 Aug 81	Completed 07 Aug 81	Core Size BQ	Property Quartz Lake	Project No 1093	NTS No. 95 D 15
FIELD COORDINATES			SURVEYED COORDINATES		Sheet 1 of 3
Lat. 94.565 N	Elev. 3790	Dip -90	Lat.	Elev.	Dip -90	Hole No. 146
Dep. 99.700 E	Depth 317.0	Bearing	Dep.	Depth 317.0	Bearing

Footage	Rec'y	Graphic Log	Description	% Sulp.	Est. Grade	Sample No.	Lt.
0-94.0			Overburden, broken grey argillite and one foot of a grano diorite boulder. At 93.8, a 2" plug of massive galena				
100.0			Breccia of grey argillite and angular white quartz pebbles. Pebbles show preferral orientation and flattening at 60° to core axis. Breccia is well cemented and fairly competent.				
108.2			Argillite, banded black and dark grey with stockwork of 1/8" barren quartz veinlets. Bedding is 60° to core axis. Rare quartzitic laminae up to 1/8" thick occur.				
119.0			Breccia of argillaceous dolomite, fragments are angular up to 1" in diameter. Dolomite crystals well developed as enhedral saddle shapes on parting surfaces. Abundant grey metallic mineral fills breccia voids, hardness of 4, Streak black, feathery cleavage developed in places, possibly boulangerite				
121.2			Argillite, pasty green banded at 55° to core axis				
122.5			Argillite, dark grey grading into a coarse, angular breccia of grey argillite and grey quartzite similar to interval at top of hole				
130.0			Argillite, grey and green with bedding 50° to core axis; 2 minor quartzite pods with disseminated pyrite				

DATE 08 August 81 LOGGED BY R.S. Rogers

NORANDA EXPLORATION COMPANY, LIMITED

lared	Completed	Core Size	Property	Project No 1093	NTS No.
FIELD COORDINATES			SURVEYED COORDINATES		Sheet 2 of 3
.	Elev.	Dip	Lat.	Elev.	Dip	Hole No.
.	Depth	Bearing	Dep.	Depth	Bearing	146

otage	Rec'y	Graphic Log	Description	% Sulp.	Est. Grade	Sample No.	Lt.				
53.0			Quartzite, light grey with partings of sheared green argillite. Moderate fine grained pyrite occurs as selvage in stockworking quartz veinlets. Pyrite increases towards base of section. At 149.2, 6" of massive galena in a sheared quartzitic matrix	2							
54.5			Breccia of white quartz and pale green argillite. Quartz pebbles are subangular with rims of clean, fine grained pyrite	2							
34.5			Argillite, dominantly pink with minor green interbeds, banded at 45° to core axis. Quartzitic laminae increase to base of section, and moderate pyrite is associated with these. From 188.0 + 190.5, minor galena in quartz veinlets cross cutting the sediments. At 216.0 a 2" chunk of massive pyrite.	5							
239.0			Quartz, massive and white with minor fine grained pyrite along fractures, grading into :	2							
240.5			Argillite, green and highly sheared, becoming a muddy gouge at 240.0								
250.0			Massive pyrite in a quartzite matrix								

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NORANDA EXPLORATION COMPANY, LIMITED

Illered	Completed	Core Size	Property	Project No 1093	NTS No.
FIELD COORDINATES			SURVEYED COORDINATES		Sheet 3 of 3
t.	Elev.	Dip	Lat.	Elev.	Dip	Hole No.
p.	Depth	Bearing	Dep.	Depth	Bearing	146

ootage	Rec'y	Graphic Log	Description	% Sulp.	Est. Grade	Sample No.	Lt.
10.0			Argillite, dark grey and black, convoluted bedding at 45° to core axis. Minor quartzitic pods, moderate pyrite throughout. Same unit identified in prior drilling as Black Thrust	5			
12.0			Fault gouge of grey, sheared argillite				
17.0 EOH			Argillite, banded pink and light green at 40° to core axis				
			RECOVERY : 317.0 - 94.0 = 223 feet cored				
			205 feet recovered				
			205/223 = 91.9% Recovery				

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Collared 08 Aug 81	Completed 11 Aug 81	Core Size BQ	Property Quartz Lake	Project No 1093	NTS No. 95 D 5
FIELD COORDINATES			SURVEYED COORDINATES		Sheet 1 of 2
Lat. 94.150 N	Elev. 3770	Dip -90	Lat.	Elev.	Dip -90	Hole No.
Dep. 99.700 E	Depth 305.0	Bearing	Dep.	Depth 305.0	Bearing	147

Footage	Rec'y	Graphic Log	Description	% Sulp.	Est. Grade	Sample No.	Lt.
-42.0			Overburden, cased				
60.5			Argillite, interbedded grey and pale green, banded at 40° to core axis; scattered quartzite pods, usually with moderately pyritic selvage rims. Grades into :	5			
68.2			Quartiztie, grey and white, heavily pyritized and with minor sphalerite and galena in crosscutting fractures	20			
106.5			Massive pyrite with patchy galena and sulfosalts, minor black argillite partings and quartzitic pebbles in breccia towards base of interval	90			
125.5			Argillite, highly sheared, black and pyritic; banding indeterminate	5			
132.0			Argillite, pale green, moderately pyritic with black graphitic partings	5			
138.0			Quartzite, banded, black and white with heavy disseminated pyrite				
147.0			Argillite, green interbedded with quartzite; moderate pyrite laminae throughout				
150.0			Massive pyrite in quartzite				

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NORANDA EXPLORATION COMPANY, LIMITED

Offered	Completed	Core Size	Property	Project No 1093		NTS No.
FIELD COORDINATES			SURVEYED COORDINATES			Sheet 2 of 2
Az.	Elev.	Dip	Lat.	Elev.	Dip	Hole No. 147
Grp.	Depth	Bearing	Dep.	Depth	Bearing	

Footage	Rec'y	Graphic Log	Description	% Sulp.	Est. Grade	Sample No.	Lt.				
263.0			Argillite, black and minor dark grey. Moderately pyritic, banded 45° to core axis	10							
267.5			Argillite, pale green, light pyrite disseminated and in fractures	5							
277.0			Quartzite, black and grey, with moderately pyritic rims around quartzite grains. Black argillaceous partings	5							
281.0			Massive pyrite and pyritic mud	90							
295.5			Quartizte, dark grey to black, largely brecciated, moderately pyritic; black argillite partings	10							
296.5			Massive pyrite and pyritic mud	90							
305.0			Grey quartizte and grey argillaceous mud								
EOH			Casing left in hole 147								
			RECOVERY : 305.0 - 42.0 = 263.0 Cored								
			220 Recovered								
			220/263 = 83.6% Recovery								

DATE _____ LOGGED BY _____

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Collared 11 Aug 81	Completed 13 Aug 81	Core Size BQ	Property Quartz Lake	Project No 1093	NTS No. 95 D 5
FIELD COORDINATES			SURVEYED COORDINATES		Sheet 1 of 2
N. 94,350 N	Elev. 3775	Dip -90	Lat.	Elev.	Dip -90	Hole No.
E. 99,900 E	Depth 262.0	Bearing	Dep.	Depth 262.0	Bearing	148

Footage	Rec'y	Graphic Log	Description	% Sulp.	Est. Grade	Sample No.	Lt.
61.0			Overburden : Chips and rounded pebbles of black limestone, grey quartzite and a distinctive quartz-augen rock at 45.0. Rounded pebbles suggest a fluvial environment here				
76.0			Argillite, grey green; interbanded with grey quartzite with pyritic partings increasing to base of section	2			
125.0			Massive pyrite in quartzite matrix, with minor black argillite. Fracture filling of a soft grey metallic mineral, may be stibnite or a boulangerite relative. Minor galena in places as breccia filling. Possibly ~~ruby silver traces near 78.5 for 6" section.~~ 92.0 to 97.0 no recovery, mislatch	95	1.0%Pb (?)		
127.8			Breccia : grey quartzite with heavy pyrite, minor galena near base	25	(?) 1.0%Pb		
167.8			Argillite, green and pasty, minor fractures filled with galena to 140.5. Pyritic fractures increase past 140.5 to 159.5 with minor galena values	5	(?) 1.0%Pb		

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NORANDA EXPLORATION COMPANY, LIMITED

Collared	Completed	Core Size	Property	Project No 1093	NTS No.
FIELD COORDINATES			SURVEYED COORDINATES		Sheet 2 of 2
N. '	Elev.	Dip	Lat.	Elev.	Dip	Hole No.
E.	Depth	Bearing	Dep.	Depth	Bearing	148

Footage	Rec'y	Graphic Log	Description	% Sulp.	Est. Grade	Sample No.	Lt.
58.2			Quartzitic breccia with sheared partings of green argillite				
89.5			Argillite, banded pink and purple and green with minor offset fractures filled with pyrite. Banding is 50° to core axis. 213.5 to 215.8 nearly massive pyrite	2			
62.0			Argillite, green and grey, highly sheared, moderate pyrite in fractures throughout	5			

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NORANDA EXPLORATION COMPANY, LIMITED

Collared	Completed	Core Size	Property	Project No.	NTS No.
13 Aug 81	18 Aug 81	BQ	Quartz Lake	1093	95 D 5

FIELD COORDINATES			SURVEYED COORDINATES			
Lat. 93.955 N	Elev. 3780	Dip -90	Lat.	Elev.	Dip -90	Sheet 1 of 3
Dep. 99.300 E	Depth 460	Bearing	Dep.	Depth	Bearing	Hole No. 149

Footage	Rec'y	Graphic Log	Description	% Sulp.	Est. Grade	Sample No.	Lt.
0-37.0			Overburden				
38.5			Massive pyrite in black argillite matrix, minor galena in fractures	90%	1.5 Pb		
40.5			Argillite, black banded at 40° to core axis, heavily pyritized in parallel laminae and crosscutting veinlets of quartz	25%			
48.0			Massive pyrite with one 3" band of galena at 47.5	95%	1.07 Pb		
117.8			Argillite, black interbanded with grey quartzite at 45° to core axis, moderate pyrite throughtout	5%			
118.5			Massive pyrite	95%			
175.0			Argillite, black, interbedded with grey quartzite with banding 50° to core axis				
176.0			Massive pyrite	95%			
192.0			Black argillite and quartzite as above				
202.0			Argillite, pasty green with sheared contact at top of section				

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NORANDA EXPLORATION COMPANY, LIMITED

Drilled	Completed	Core Size	Property	Project No	NTS No.

FIELD COORDINATES			SURVEYED COORDINATES			Sheet 2 of 3
Az.	Elev.	Dip	Lat.	Elev.	Dip	Hole No.
Sp.	Depth	Bearing	Dep.	Depth	Bearing	149

Footage	Rec'y	Graphic Log	Description	% Sulp.	Est. Grade	Sample No.	Lt.				
205.5			Pyritic mud	75%							
259.0			Argillite, green and grey interbedded with grey quartzite; all highly sheared								
295.0			Argillite, dark grey with 50% angular clasts of white quartz								
299.5			Massive pyrite with grey quartzitic matrix	95%							
357.0			Argillite, grey; heavily sheared with banding at 45° to core axis. Moderate disseminated pyrite	10%							
360.0			Pyritic mud	90%							
399.0			Argillite, dark grey with mottled white clasts or mylonite of quartzite								
422.0			Quartzite, barren grey and undisturbed								
434.0			Argillite, black with moderate pyrite disseminations	10%							
442.0			Quartzite, barren grey as above								

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NORANDA EXPLORATION COMPANY, LIMITED

Collared	Completed	Core Size	Property	Project No 1093	NTS No.
FIELD COORDINATES			SURVEYED COORDINATES		Sheet 3 of 3
Lat.	Elev.	Dip	Lat.	Elev.	Dip	Hole No.
Dep.	Depth	Bearing	Dep.	Depth	Bearing	149

Footage	Rec'y	Graphic Log	Description	% Sulp.	Est. Grade	Sample No.	Lt.
845.0			Pyritic silt, very fine grained, grading into :				
860.0 EOH			Quartzite, grey and highly sheared				
			Note : Hole encountered artesian conditions at this depth, and drilling was no longer feasible. Hole 149 abandoned, casing left in ground.				

DATE _____ LOGGED BY _____

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NORANDA EXPLORATION COMPANY, LIMITED

Started 19 Aug 81	Completed	Core Size BQ	Property Quartz Lake	Project No 1093	NTS No. 95 D 5
FIELD COORDINATES			SURVEYED COORDINATES		Sheet 1 of 2
L. 96.050 N	Elev. 4200'	Dip -90	Lat.	Elev.	Dip	Hole No. 150
D. 101,600 E	Depth 500	Bearing	Dep.	Depth	Bearing

Footage	Rec'y	Graphic Log	Description	% Sulp.	Est. Grade	Sample No.	Lt.
11			Overburden				
37.2			Argillite, green; highly sheared with convoluted banding and microfoliation; dominant bedding is at 40° to core axis				
103.5			Argillite, rusty green and grey with minor quartz stock-working. No visible sulphides in this section. Some minor interlaminar quartzite lenses throughout section				
120.5			Argillite, rusty green and grey, slightly more competent than above section. Banding is at 65° to core axis				
152.0			Limestone, grey to black with crosscutting calcite veinlets. Banding is 65° to core axis, no visible sulphides. Grades into :				
173.5			Argillite, rusty brown and bleached purple with bedding dominantly at 75° to core axis. No sulphides in this section				
279.0			Argillite, green and pasty, monotonous barren section bedded at 70° to core axis. Minor rusty argillite on partings. No sulphides evident.				

DATE _____ LOGGED BY _____

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ollared	Completed	Core Size	Property	Project No 1093	NTS No.
FIELD COORDINATES			SURVEYED COORDINATES		Sheet 2 of 2
nt.	Elev.	Dip	Lat.	Elev.	Dip	Hole No. 150
ep.	Depth	Bearing	Dep.	Depth	Bearing	

Footage	Rec'y	Graphic Log	Description	% Sulp.	Est. Grade	Sample No.	Lt.				
308.5			Argillite, green interbedded with rusty pink, tight ~~convoluted folds throughout, bedding 60° to core axis.~~ Rusty partings at 285.0 and a small (3 inch) band of rusty quartz. No visible sulphides. At 301.0, minor shear or fault gouge								
392.5			Argillite, pasty green with dark green partings banded 50° to core axis. At 337.5, one inch of grey quartzite with an oolitic texture. Other quartzite bands from ~~362.0 to 363.5; 368.5 to 369.5; 372.2 to 373.5~~								
407.0			Argillite, grey and black, highly sheared; graphitic slips, no sulphides. Poor recovery here (less than 50%)								
465.0			Argillite, grey and black with minor green. Banding 45° to core axis; ~~no sulphides. Rare quartzitic pods~~								
500.0			Argillite, grey and black, highly sheared, mylonitic in places, occasional clasts of pasty green argillite or grey quartzite. "Black Thrust" type stratigraphy								

DATE _____ LOGGED BY _____

NORANDA EXPLORATION COMPANY, LIMITED

N.T.S. 95D /5

PROPERTY QUARTZ LAKE 1093

DATE August 8, 1981

SAMPLE REPORT

SAMPLE NO.	LOCATION & DESCRIPTION	TYPE	WIDTH Feet	oz/ton Ag	% Pb	% Zn	ASSAYS				SAMPLED BY
26	DDH 145 82.0 - 87.0 Feet	BQ	5	1.16	2.00	0.02					Rogers
27	" " 107.0 - 112.0 "	"	5	0.30	0.44	0.04					Firko
28	" " 112.0 - 117.0 "	"	"	0.88	1.32	0.04					"
29	" " 117.0 - 122.0 "	"	"	0.24	0.46	0.12					"
30	" " 122.0 - 127.0 "	"	"	0.18	0.34	0.02					"
31	" " 127.0 - 132.0 "	"	"	2.98	4.54	0.02					"
32	" " 132.0 - 137.0 "	"	"	1.26	2.74	0.02					"
33	" " 137.0 - 142.0 "	"	"	0.03	0.08	0.02					"
34	" " 142.0 - 147.0 "	"	"	1.06	2.78	0.02					"
35	" " 147.0 - 152.0 "	"	"	0.06	0.12	0.02					"
36	" " 152.0 - 157.0 "	"	"	0.02	0.02	0.02					"
37	" " 157.0 - 162.0 "	"	"	0.60	0.94	0.02					"
38	" " 162.0 - 167.0 "	"	"	0.10	0.08	0.02					"
39	" " 167.0 - 172.0 "	"	"	0.04	0.06	0.02					"
40	" " 197.0 - 202.0 "	"	"	0.02	0.02	0.02					"
41	" " 202.0 - 207.0 "	"	"	0.42	0.12	0.02					"
42	" " 207.0 - 212.0 "	"	"	5.02	0.32	0.02					"

N.T.S. 95D/5

PROPERTY QUARTZ LAKE 1093

DATE August 8, 1981

DDH 145

SAMPLE REPORT

AMPLE NO.	LOCATION & DESCRIPTION	TYPE	WIDTH Feet	ASSAYS							SAMPLE BY
				Ag	Pb	Zn					
0243	DDH 145 212.0 - 217.0 Feet	BQ	5	0.44	0.02	0.02					Firko
0244	" " 217.0 - 222.0 "	"	"	0.08	0.02	0.02					"
0245	" " 222.0 - 227.0 "	"	"	0.30	0.12	0.02					"
0246	" " 227.0 - 232.0 "	"	"	0.10	0.02	0.02					"
0247	" " 232.0 - 237.0 "	"	"	0.16	0.09	0.02					"
0248	" " 237.0 - 242.0 "	"	"	0.24	0.08	0.02					"
0249	" " 242.0 - 247.0 "	"	"	0.38	0.18	0.02					"
0250	" " 247.0 - 252.0 "	"	"	0.06	0.02	0.02					"
0251	" " 252.0 - 257.0 "	"	"	0.06	0.02	0.02					"

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PROPERTY QUARTZ LAKE 1093

DATE August 14, 1981

SAMPLE REPORT

DDH 146

SAMPLE NO.	LOCATION & DESCRIPTION	TYPE	WIDTH Feet	ASSAYS Ag	Pb	Zn					SAMPLE BY
0252	DDH 146 103.0 - 108.0 Feet	BQ	5	0.12	0.14	0.06					Rogers
0253	" " 108.0 - 113.0 "	"	"	3.30	4.40	0.06					"
0254	" " 113.0 - 118.0 "	"	"	4.54	7.40	0.02					"
0255	" " 118.0 - 123.0 "	"	"	0.10	0.14	0.02					"
0256	" " 123.0 - 128.0 "	"	"	0.02	0.06	0.02					"
0257	" " 128.0 - 133.0 "	"	"	0.10	0.10	0.04					"
0258	" " 133.0 - 138.0 "	"	"	0.02	0.02	0.02					"
0259	" " 138.0 - 143.0 "	"	"	0.24	0.42	0.02					"
0260	" " 143.0 - 148.0 "	"	"	3.00	0.22	0.02					"
0261	" " 148.0 - 153.0 "	"	"	4.52	3.38	0.02					"
0262	" " 183.0 - 188.0 "	"	"	0.12	0.04	0.02					"
0263	" " 188.0 - 193.0 "	"	"	0.12	0.22	0.02					"
0264	" " 193.0 - 198.0 "	"	"	0.02	0.02	0.02					"
0265	" " 242.0 - 247.0 "	"	"	2.50	0.62	0.02					"
0266	" " 247.0 - 252.0 "	"	"	11.7	0.76	0.02					"

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NORANDA EXPLORATION COMPANY, LIMITED

N.T.S. 95D/5

PROPERTY QUARTZ LAKE 1093

DATE August 16, 1981

DDH 147

SAMPLE REPORT

SAMPLE NO.	LOCATION & DESCRIPTION	TYPE	WIDTH Feet	ASSAYS Ag	Pb	Zn					SAMPLED BY
0267	DDH 147 52.0 - 57.0 Feet	BQ	5	0.04	0.02	0.02					Firko
0268	" " 57.0 - 62.0 "	"	"	0.02	0.02	0.02					"
0269	" " 62.0 - 67.0 "	"	"	0.10	0.02	0.02					"
0270	" " 67.0 - 72.0 "	"	"	0.22	1.48	0.02					"
0271	" " 72.0 - 77.0 "	"	"	0.12	0.26	0.02					"
0272	" " 77.0 - 82.0 "	"	"	0.40	0.68	0.02					"
0273	" " 82.0 - 87.0 "	"	"	0.16	0.20	0.02					"
0274	" " 87.0 - 92.0 "	"	"	0.16	0.02	0.02					"
0275	" " 92.0 - 97.0 "	"	"	0.12	0.02	0.02					"
0276	" " 97.0 - 102.0 "	"	"	0.26	0.12	0.02					"
0277	" " 102.0 - 107.0 "	"	"	0.16	0.04	0.02					"
0278	" " 142.0 - 147.0 "	"	"	0.04	0.02	0.02					"
0279	" " 147.0 - 152.0 "	"	"	0.04	0.02	0.02					"
0280	" " 152.0 - 157.0 "	"	"	0.04	0.02	0.02					"
0281	" " 172.0 - 177.0 "	"	"	0.16	0.64	0.02					"
0282	" " 177.0 - 182.0 "	"	"	0.22	0.34	0.02					"
0283	" " 182.0 - 187.0 "	"	"	0.26	0.74	0.02					"

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PROPERTY QUARTZ LAKE 1093

DATE August 22, 1981

SAMPLE REPORT

DDH 149

SAMPLE NO.	LOCATION & DESCRIPTION	TYPE	WIDTH Feet	ASSAYS Ag	Pb	Zn					SAMPLED BY
0304	DDH 149 37.0 - 41.0 Feet	BQ	4	2.24	5.86	0.02					Firko
0305	" " 41.0 - 46.0 "	"	5	0.26	0.36	0.22					"
0306	" " 46.0 - 51.0 "	"	"	1.82	5.60	0.28					"
0307	" " 112.0 - 117.0 "	"	"	0.12	0.14	0.02					"
0308	" " 117.0 - 122.0 "	"	"	0.04	0.08	0.02					"
0309	" " 122.0 - 127.0 "	"	"	0.20	0.68	0.02					"
0310	" " 167.0 - 172.0 "	"	"	0.02	0.02	0.02					"
0311	" " 172.0 - 177.0 "	"	"	0.04	0.02	0.02					"
0312	" " 177.0 - 182.0 "	"	"	0.04	0.02	0.02					"
0313	" " 200.0 - 205.0 "	"	"	0.12	0.02	0.02					"
0314	" " 205.0 - 210.0 "	"	"	0.06	0.02	0.02					"
0315	" " 290.0 - 295.0 "	"	"	0.16	0.02	0.02					"
0316	" " 295.0 - 300.0 "	"	"	0.04	0.02	0.02					"
0317	" " 300.0 - 305.0 "	"	"	0.02	0.02	0.02					"

STATEMENT OF QUALIFICATIONS

I, Randall Stewart Rogers, of the City of Whitehorse in the Yukon Territory, do hereby certify:

THAT I have been employed as a Geologist by Noranda Exploration Company, Limited (No Personal Liability) since 01 January, 1980;

THAT I am a graduate of the University of British Columbia with the degree of Bachelor of Science (Honours) in Geology;

THAT I am a graduate of Queen's University at Kingston, Ontario, with the degree of Master of Science in Mineral Exploration;

THAT I am a Notary Public in and for the Yukon Territory;

THAT I am a member of the Canadian Institute of Mining and Metallurgy (Geology Section) and

THAT I am a member of the Geological Association of Canada.

Dated at Whitehorse, Yukon Territory; this 16 day of December, 1981.

(Randall Stewart Rogers) - Geologist
Noranda Exploration Co., Ltd. (NPL)

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NORANDA EXPLORATION COMPANY, LIMITED

STATEMENT OF COST

PROJECT QUARTZ LAKE DATE December 2, 1981

TYPE OF REPORT DIAMOND DRILLING

a) Wages:

No. of Days	51	
Rate per Day $	86.1963	
Dates From:	Jan 1/81 - Oct 31/81	
Total Wages	51 x $ 86.1963	4,396.01

b) Food and Accomodation:

No of days	51	
Rate per day $	58.7014	
Dates From:	Jan 1/81 - Oct 31/81	
Total Cost	51 x $ 58.7014	2,993.77

c) Transportation:

No of days	51	
Rate per day $	725.9135	
Dates From:	Jan 1/81 - Oct 31/81	
Total Cost	51 X $ 725.9135	37,021.59

d) Instrument Rental:

Type of Instrument
No of days
Rate per day $
Dates From:
Total Cost X $

Type of Instrument
No of days
Rate per day $
Dates From:
Total Cost X $

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f) Analysis		1,658.50
g) Cost of preparation of Report		
Author		344.79
Drafting		344.79
Typing		344.79
h) Other:		
	Contractors	65,373.68
	Camp & Field Supplies	5,047.22
Total Cost		$117,525.14

I Certify the above
costs to be correct

J.E. OSCROFT
Br. Accountant

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APPENDIX III - CLAIM STATISTICS

CLAIM NAME	GRANT NO.	EXPIRY DATE	REGISTRATION
South Nahanni 1	57465	Dec. 31 1991	Liard River Mining Ltd.
" " 2	57466	Dec. 31 1988	" " " "
" " 8	57550	Dec. 31 1986	" " " "
" " 9	57551	Dec. 31 1986	" " " "
" " 10	57552	Dec. 31 1986	" " " "
" " 11	57553	Dec. 31 1991	" " " "
" " 12	57554	Dec. 31 1991	" " " "
" " 13	57555	Dec. 31 1988	" " " "
" " 14	57556	Dec. 31 1988	" " " "
" " 15	57580	Dec. 31 1986	" " " "
" " 16	57557	Dec. 31 1989	" " " "
" " 17	57558	Dec. 31 1991	" " " "
" " 18	57559	Dec. 31 1987	" " " "
" " 19	57560	Dec. 31 1986	" " " "
" " 20	57561	Dec. 31 1987	" " " "
" " 21	57562	Dec. 31 1987	" " " "
" " 22	57563	Dec. 31 1986	" " " "
" " 23	57564	Dec. 31 1986	" " " "
SN 24	60046	Dec. 31 1986	" " " "
" 25	60047	Dec. 31 1986	" " " "
" 26	60048	Dec. 31 1986	" " " "
" 27	60049	Dec. 31 1986	" " " "
" 28	60050	Dec. 31 1986	" " " "
" 29	60051	Dec. 31 1986	" " " "
" 30	60052	Dec. 31 1986	" " " "
" 31	60053	Dec. 31 1986	" " " "
" 32	60054	Dec. 31 1987	" " " "
" 33	60055	Dec. 31 1986	" " " "
" 34	60056	Dec. 31 1986	" " " "
" 35	60057	Dec. 31 1986	" " " "
" 36	60058	Dec. 31 1986	" " " "
" 37	60059	Dec. 31 1986	" " " "
" 38	60060	Dec. 31 1986	" " " "
" 39	60061	Dec. 31 1986	" " " "

CLAIM NAME	GRANT NO.	EXPIRY DATE	REGISTRATION
South Nahanni 40	60062	Dec. 31 1986	Liard River Mining Ltd.
" " 41	60063	Dec. 31 1986	" " " "
" " 47	60069	Dec. 31 1986	" " " "
" " 50	63343	Dec. 31 1986	" " " "
M 7	69450	Dec 31 1986	Asarco Exploration Company Canada Ltd.
M 8	69451	Dec. 31 1986	" " "
M 17	70364	Dec. 31 1986	" " " "
M 18	70365	Dec. 31 1986	" " " "
M 19	70366	Dec. 31 1986	" " " "
M 20	70367	Dec. 31 1986	" " " "
M 21	70368	Dec. 31 1986	" " " "
M 22	70369	Dec. 31 1986	" " " "
M 23	70457	Dec. 31 1986	" " " "
M 24	70458	Dec. 31 1986	" " " "
M 25	70459	Dec. 31 1986	" " " "
M 26	70460	Dec. 31 1986	" " " "
M 27	70461	Dec. 31 1986	" " " "
M 28	70462	Dec. 31 1986	" " " "
M 29	70463	Dec. 31 1986	" " " "
M 30	70464	Dec. 31 1986	" " " "
M 31	70645	Dec. 31 1986	" " " "
M 32	70646	Dec. 31 1986	" " " "
M 33	70647	Dec. 31 1986	" " " "
M 34	70648	Dec. 31 1986	" " " "
M 35	70649	Dec. 31 1986	" " " "
M 36	70650	Dec. 31 1986	" " " "
M 37	70651	Dec. 31 1986	" " " "
M 38	70652	Dec. 31 1986	" " " "
Qtz. 1	Y84112	Dec. 31 1986	Noranda Exploration Company, Limited (NPL)
" 2	Y84113	Dec. 31 1986	" " " "
" 3	Y84114	Dec. 31 1986	" " " "
" 4	Y84115	Dec. 31 1986	" " " "
" 5	Y84116	Dec. 31 1986	" " " "
" 6	Y84117	Dec. 31 1986	" " " "

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CLAIM NAME		GRANT NO.	EXPIRY DATE	REGISTRATION
Qtz	7	Y84118	Dec. 31 1986	Noranda Exploration Company, Limited (NPL)
"	8	Y84119	Dec. 31 1986	"
Strat	1	Y84583	Dec. 31 1986	"
"	2	Y84584	Dec. 31 1986	"
"	3	Y84585	Dec. 31 1986	"
"	4	Y84586	Dec. 31 1986	"
"	5	Y84587	Dec. 31 1986	"
"	6	Y84588	Dec. 31 1986	"
"	9	Y84591	Dec. 31 1986	"
"	10	Y84592	Dec. 31 1986	"
"	11	Y84593	Dec. 31 1986	"
"	12	Y84594	Dec. 31 1986	"
"	13	Y84595	Dec. 31 1986	"
"	14	Y84596	Dec. 31 1986	"
"	19	Y93401	Dec. 31 1986	"
"	21	Y93403	Dec. 31 1986	"
"	23	Y93405	Dec. 31 1986	"
"	25	Y93407	Dec. 31 1986	"
"	27	Y93409	Dec. 31 1986	"
"	29	Y93411	Dec. 31 1986	"
"	31	Y93413	Dec. 31 1986	"
"	41	Y93423	Dec. 31 1986	"
"	42	Y93424	Dec. 31 1986	"
"	43	Y93425	Dec. 31 1986	"
"	44	Y93426	Dec. 31 1986	"
"	45	Y93427	Dec. 31 1986	"
"	46	Y93428	Dec. 31 1986	"
"	47	Y93429	Dec. 31 1986	"
"	48	Y93430	Dec. 31 1986	"
"	49	Y93431	Dec. 31 1986	"
"	50	Y93432	Dec. 31 1986	"
"	51	Y93493	Dec. 31 1986	"
"	52	Y93494	Dec. 31 1986	"
"	53	Y93495	Dec. 31 1986	"
"	54	Y93496	Dec. 31 1986	"
"	55	Y93433	Dec. 31 1986	"
"	56	Y93434	Dec. 31 1986	"

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CLAIM NAME	GRANT NO.	EXPIRY DATE	REGISTRATION
Strat 57	Y93435	Dec. 31 1986	Noranda Exploration Company Ltd. (N.P.L.)
" 58	Y93436	Dec. 31 1986	" " " "
" 59	Y93437	Dec. 31 1986	" " " "
" 60	Y93438	Dec. 31 1986	" " " "
" 61	Y93439	Dec. 31 1986	" " " "
" 62	Y93440	Dec. 31 1986	" " " "
" 63	Y93441	Dec. 31 1986	" " " "
" 64	Y93442	Dec. 31 1986	" " " "
" 65	Y93497	Dec. 31 1986	" " " "
" 66	Y93498	Dec. 31 1986	" " " "
" 67	Y93499	Dec. 31 1986	" " " "
" 68	Y93500	Dec. 31 1986	" " " "
" 69	Y93443	Dec. 31 1986	" " " "
" 70	Y93444	Dec. 31 1986	" " " "
" 71	Y93445	Dec. 31 1986	" " " "
" 72	Y93446	Dec. 31 1986	" " " "
Pic 1 Fr.	Y72515	Dec. 31 1986	Asarco Exploration Company Canada Ltd.
Pic 2 Fr.	Y72516	Dec. 31 1986	" " " "
Pic 3 Fr.	Y72517	Dec. 31 1986	" " " "

Lot 1 (SN 3 M.C.)
Lot 2 (SN 4 M.C.)
Lot 3 (SN 5 M.C.)
Lot 4 (Dorothy M.C.)
Lot 5 (SN 6 M.C.)
Lot 6 (SN 7 M.C.)
Lot 7 (SN 48 M.C.)
Lot 8 (SN 49 M.C.)
Lot 9 (WHI 3 Fr. M.C.)

Leased claims good for 21 years; Renewable for additional 21 years in 1994.

STRAT 19 Y93401 | STRAT 13 Y84595 | STRAT 14 Y84596 | STRAT 5 Y84587 | STRAT 6 Y84588

MEAHAN L

STRAT 21 Y93403 | STRAT 11 Y84593 | STRAT 12 Y84594 | STRAT 3 Y84585 | STRAT 4 Y84586

STRAT 23 Y93405 | STRAT 9 Y84591 | STRAT 10 Y84592 | STRAT 1 Y84583 | STRAT 2 Y84584

STRAT 25 Y93407 | SN 47 60069 | SN 15 57580 | SN 16 57557 | SN 17 57558

NORANDA

STRAT 27 Y93409 | SN 10 57552 | PIC 2 Fr. Y72516 SN 2 57466 | PIC 3 Fr. Y72517 SN 1 57465 | SN 11 57553 | LAKE SN 18 57559 | SN 19 57560 | SN 30 60052 | SN 31 60053

STRAT 29 Y93411 | SN 9 57551 | SN 4 | SN 3 | SN 12 57554 | SN 20 57561 | SN 21 57562 | SN 24 60046 | SN 25 60047 | SN 28 60050

STRAT 31 Y93413 | SN 8 57550 | DOROTHY | SN 5 | SN 13 57555 W.H.I. 3 Fr. | SN 22 57563 | SN 23 57504 | SN 27 60049 | SN 26 60048 | SN 29 60051

SN 41 60063 | SN 7 | SN 6 | SN 14 57556 | SN 34 60056 | SN 35 60057 | SN 38 60060 | SN 39 60061

SN 50 63343 | SN 49 | SN 48 | SN 32 60054 PIC 1 Fr. Y72513 | SN 33 60055 | SN 36 60058 | SN 37 60059 | SN 40 60062

M 21 70368 | M 19 70366 | M 17 70364 | M 7 69450 | QTZ 1 Y84112 | QTZ 2 Y84113 | STRAT 42 Y93424 | STRAT 41 Y93423

M 22 70369 | M 20 70367 | M 18 70365 | M 8 69451 | QTZ 3 Y84114 | QTZ 4 Y84115 | STRAT 44 Y93426 | STRAT 43 Y93425

M 29 70463 | M 27 70461 | M 25 70459 | M 23 70457 | M 31 70645 | QTZ 5 Y84116 | QTZ 6 Y84117 | STRAT 46 Y93428 | STRAT 45 Y93427

M 30 70464 | M 28 70462 | M 26 70460 | M 24 70458 | M 32 70646 | QTZ 7 Y84118 | QTZ 8 Y84119 | STRAT 48 Y93430 | STRAT 47 Y93429 | STRAT 71 Y93445 | STRAT 72 Y93446

M 33 70647 | M 34 70648 | STRAT 63 Y93441 | STRAT 64 Y93442 | STRAT 56 Y93434 | STRAT 55 Y93433 | STRAT 50 Y93432 | STRAT 49 Y93431 | STRAT 69 Y93443 | STRAT 70 Y93444

M 35 70649 | M 36 70650 | FORT 52 | STRAT 62 Y93440 | STRAT 58 Y93436 | STRAT 57 Y93435 | STRAT 52 Y93494 | STRAT 51 Y93493 | STRAT 67 Y93499 | STRAT 68 Y93500

M 37 70651 | M 38 70652 | FORT 54 | STRAT 61 Y93439 | STRAT 60 Y93438 | STRAT 59 Y93437 | STRAT 54 Y93496 | STRAT 53 Y93495 | STRAT 65 Y93497 | STRAT 66 Y93498

QUARTZ CREEK

PYRITE CREEK

CLAIM NAME
GRANT NUMBER

1981 GROUPING MAP

BOUNDARY OF LEASE

RECEIVED 21 JAN 1982 MINING RECORDER WATSON LAKE, Y.T. I.A. & N.D.

090954

REVISED
NOV., 1975
DEC., 1981

QUARTZ LAKE PROJECT

CLAIM MAP

PROJ. No. 912
N.T.S. 95D/12
DWG No.

SURVEY BY
DRAWN BY JAN VAN VOORST
DATE MAY 1975
SCALE 1" = 1000'

NORANDA EXPLORATION

OFFICE VANCOUVER


80 (747.8), (90')
45% REC'Y
79 (163'+)
(NO BEDROCK)
95,000 N
99,100 E
99,300 E
99,500 E
99,700 E
99,900 E
100,100 E
100,300 E
100,500 E
71 (752) (48')
42.1% REC'Y
72 (769) (67')
56% REC'Y
73 (793) (117')
57% REC'Y
209-221, -12' MASSIVE PYRITE
225.5-232, -6.5' 2.0% Pb
78 (213')
(NO BEDROCK)
~ 24 S
SECTION 94,750 N
146 (790)
141 (818) (154')
94,550 N
148 (775)
76 (750) (50')
49.7% REC'Y
50-63' 1.98, 3.6, 13'
145 (770)
139 (773) (39')
110-135', 6.70, 10.68, 2.06, 25'
77 (779) (79')
29.4% REC'Y
181-189' 0.30, 5.3, 8'
SECTION 94,350 N
143 (782) (81')
147 (770)
144 (777) (40')
94,150 N
94,000 N
149 (780)
74 (788) (25')
63-78' 0.94, 4.26, 15'
~ 32 S
93,950 N
SECTION 93,925 N
90 (822) (56')
75.9% REC'Y
111-127' 0.40, 6.7, 16'
70 (818) (46')
58% REC'Y
69 (810) (32')
60.8% REC'Y
68 (798) (25')
64.7% REC'Y
103-113' 46.45, 0.7, 10'
231.5-282', 50.5' MASSIVE PYRITE
290-300', 10.0'
192-202', 1.55 Oz/T Ag
89 (789) (22')
67 (796) (22')
48% REC'Y
~ 34 S
93,750 N
SECTION 93,725 N
138 (830) (16')
93,550 N
75 (837) (13')
46.8% REC'Y
MOD. PYRITE
3 000'66
93,000 N
PROPOSED HOLES
APPROXIMATE LOCATION
(818) Elevation, (25') OVERBURDEN
63 - 78' 0.94, 4.26, 2.06, 15'
Oz/T Ag, % Pb, % Zn, Ft.
7 1/8 E 3 000'101
REVISED
May 1980
SEP 1980
PROJ. No. 942
N.T.S. 95 O/12
DWG. No.
QUARTZ LAKE PROJECT
PRELIMINARY SOUTH ZONE
DRILL PLAN
090954
SURVEY BY: G.E.O.
DRAWN BY: J.v.V.
DATE: 1/25/80
SCALE: 1" = 100'
NORANDA EXPLORATION
OFFICE:

QUARTZ LAKE PROJECT (McMILLAN OPTION)

1981 SUMMARY REPORT

Randall S. Rogers, M.Sc.
Noranda Exploration Co., Ltd. (NPL)
Whitehorse, Yukon Territory.

November 1, 1981

Noranda Exploration Company, Limited
(no personal liability)
Suite 203 - 107 Main Street
Whitehorse, Yukon Territory
Y1A 2A7

noranda

Phone (403) 667-4805

Dr. J.A. Morin
D.I.A.N.D.
Whitehorse, Y.T.

05 Feb 82

Dear Jim;

Further to our conversations this winter, enclosed please find the 1981 summary report for Quartz Lake. As this is an internal report for Noranda, I would request it be retained for your own consumption only. As you can see, there are still a lot of unanswered questions at Quartz Lake; my own feeling is that these can be resolved by (i) a lot of regional work, in an effort to fit the package into a stratigraphic setting; and (ii) deep drill holes, particularly on the eastern margin of the known ore zones. The latter plan is not likely to occur for some time, as Noranda is loathe to spend heaps of money on deep drill holes (unfortunately).

Should you require any more samples, we've got a fair pile of rock and sulphide core sections in our warehouse. Call myself or Gary Yeo if we can help at all.

I'm also enclosing a copy of my paper on the Wernecke breccias; I've changed some of my thoughts on that since writing it, but you may find the references useful.

Yours Truly,

Randy Rogers.

SUMMARY AND RECOMMENDATIONS

The 1981 exploration program at Quartz Lake, Yukon Territory was directed at the South Zone in an effort to delineate that ore zone and thereby increase the known reserves contained within the property. Work included the preparation of a contoured orthophotograph at 1" : 500' by Pacific Survey Corporation; linecutting. surveying and camp construction by Yukon Pacific Mines, Ltd.; C.E.M. surveys by Noranda Exploration Co., Ltd.; gracity surveys by Sharpe Geophysical Ltd.; diamond drilling by Drilcor Industries, Ltd. (supervised by Noranda Exploration Co., Ltd.) and geological mapping by Mr. Pierre Vaillancourt, a M.Sc. candidate at the University of Western Ontario. No new mineral occurrences were found on the property in the 1981 season; the South Zone orebody was extensively delineated in the current program. One exploratory drill hole was spotted northeast of the South Zone orebody, this returned no significant mineralization.

It is believed that the 1981 program has identified the complete extent of economic mineralization within the confines of the property detectable by conventional methods. At this writing, the only possible location of further reserves would be at depth in the eastern margin of the claim group, or at depth stacked below known ore zones. These would be beyond the penetration capability of conventional geophysical techniques, and only detected with deep diamond drilling. At present, such a drill program is not warranted.

Future exploration activity at Quartz Lake should be directed at potential reserves outside of the property. A program should be initiated to explore for Pb-Zn-Ag mineralization peripheral to the McMillan Option in comparable stratigraphy. Increased exploration and staking activity by competing interests in the last two seasons has been noted.

An exploration program for the 1982 field season, to investigate the area of influence peripheral to the McMillan Option is strongly recommended.

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INTRODUCTION

The Quartz Lake Property (McMillan Option) comprises 131 claims and fractions located in the Watson Lake Mining District of Yukon Territory held variously by Liard River Mining Co., Ltd.; Noranda Exploration Co., and ASARCO Exploration Co. of Canada, Ltd.

Exploration to date has defined a main ore zone (McMillan Deposit) with 1.2 million tons of ore grading 8.32% Zn, 4.13% Pb and 1.7 OPT Ag. Other mineralized zones have been identified peripheral to the Main Zone; chief among these is the South Zone which was extensively explored in the 1981 season.

The present study will review the 1981 exploration activity on the Quartz Lake South Zone with a view to defining the most cost-effective program of exploration for the 1982 season.

Current studies in progress at this writing include petrographic and regional synthesis studies by Mr. Pierre Vaillancourt, M.Sc. candidate at the University of Western Ontario; air photo interpretation by the author at Noranda Exploration, Whitehorse and continued investigation by Mr. J.A. Morin, D.I.A.N.D., Whitehorse.

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LOCATION, HISTORY AND ACCESS

Location :

The Quartz Lake property is located forty miles northeast of Watson Lake, Yukon Territory at latitude 60° 31' N and longitude 127° 55' W on N.T.S. 95D/5,12 (Figure 1). The property straddles the height of land between the Coal and Hyland Rivers, within the Hyland Plateau physiographic area. Local tributary streams including Mine and Pyrite Creeks appear to follow definite northerly trending fault traces. The South Zone of the property occupies a broad glacial valley incorporating drainages of both these creeks. Local relief rarely exceeds 2500 feet with a mean elevation of 3500 feet a.s.l. Outcrop exposure is poor, with most slopes choked in glacial and alluvial debris.

History :

The mineralization at Quartz Lake was apparently discovered in 1892 by prospectors from the Cassiar gold fields investigating placer gold traces in the Hyland River area. The late Ken McMillan of Lower Post, B.C. rediscovered the prospect in 1930, staking the showing in that year and again in 1948. Noranda Mines optioned McMillan's ground in 1948 and explored for one season. New Jersey Zinc explored with hand trenching and 657 feet of drilling up to 1950 under option from Noranda; in 1951 ASARCO entered the joint venture resulting in the formation of Liard River Mining Co., Ltd., ultimately earning a majority share position with diamond drilling, geophysical and geochemical surveys. In 1975 Noranda entered into a new joint venture agreement with ASARCO and the Liard River Mining Co., by which a majority interest could be earned by Noranda. A joint venture agreement was formalized in 1980

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between Noranda and ASARCO. Major diamond drilling programs were undertaken in 1980 and 1981.

Access :

Access to the property is dominantly by air from Watson Lake: suitable helicopter pads abound on the property and the lakes are suitable for fixed wing use. Cat trails service most of the drill sites, and packhorses were used with some success in the early years. A good winter cat trail extends from Irons Creek on the Alaska Highway to within 20 miles of the property. A permanent camp was established on the South Zone during the 1981 field program (Appendix V).

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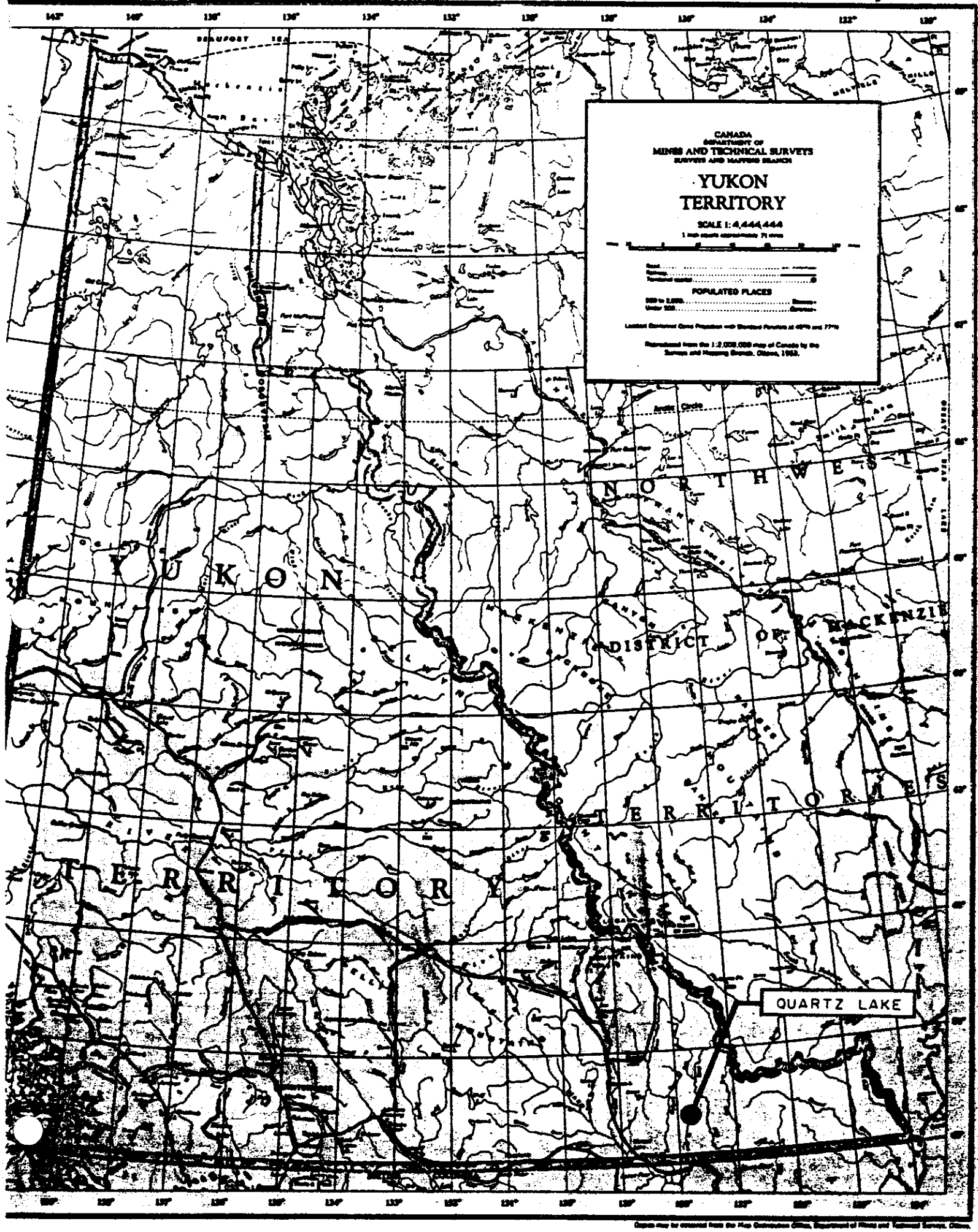
CANADA
DEPARTMENT OF
MINES AND TECHNICAL SURVEYS
SURVEYS AND MAPPING BRANCH
YUKON
TERRITORY
SCALE 1: 4,444,444
POPULATED PLACES
YUKON
TERRITORY
NORTHWEST
TERRITORIES
DISTRICT OF MACKENZIE
QUARTZ LAKE

GEOLOGICAL SETTING

The geological setting of the Quartz Lake Deposit has been covered at length by Gabrielse and Blusson (1968), Dirom (1979), MacDonald (1981), Morin (1981), Rogers (1981a) and Vaillancourt (1981). The geology of the area will thus be only briefly summarized here, and the reader is directed to the cited sources for further detail.

Hadrynian rocks occur in a north-trending synclinorium with core of Lower Paleozoic sedimentary rocks (Figure 2). The Hadrynian lithologies comprise the "Grit Unit" : dark shales, slate and siltstone, gritty quartzite, limestone, quartz-pebble and feldspar-quartz pebble conglomerate and sandstone; maroon, green and buff shale, slate and phyllite. For the most part, the Grit Unit in the immediate area consists of coarse clastic rocks forming blocky outcrops of quartzose sandstone and conglomerate, and argillite. The Paleozoic inlier consists of Cambro-Ordovisian argillites, phyllitic limestone, wavy-banded limestone and quartzite. Regionally, a Cretaceous (?) biotite-hornblende granodiorite to quartz monzonite intrusive with porphyritic phases is present; this unit is not known to date on the Quartz Lake property.

On a local scale, the metasedimentary rocks have been divided tentatively into four units: the Ridge Group, the Mine Group, and Range Group and the Canyon Formation.

The Hadrynian Canyon Formation is the oldest unit identified on the property, and includes buff to grey interbedded phyllite and limestone with minor intercalated argillite. The Cambrian Range

Group overlies the Canyon Formation, comprising interbedded grey limestone, dark grey argillite, quartzite and quartz pebble conglomerate. The Mine Group hosts the Main Zone deposit and consists of grey to green argillite, quartzite and limestone. The Ridge Group includes interbedded limestone, quartzite and grey-green to buff argillites.

South Zone mineralization is essentially conformable to Mine Group stratigraphy in a completely sheared and folded zone overlying a horizon of intense shearing and mylonitization known informally as the Black Thrust. Ore minerals include pyrite, sphalerite, galena, chalcopyrite, arsenopyrite, tetrahedrite, boulangerite and others in a gangue dominated by quartz, siderite, ankerite, calcite and dolomite. Mineralization is both concordant and discordant. Concordant mineralization includes beds of massive sphalerite, galena, pyrite and siderite apparently complicated by structural truncation and gross metal zonation. Discordant mineralizatinn comprises fracture filling and stockworking quartz veinlets with variable galena, sphalerite, siderite and pyrite genetically younger than the concordant mineralization, and with mineral proportionality closely reflecting the adjacent concordant horizon.

Mineralogical and petrographic studies are detailed in Rogers (1981a) and will not be elaborated on here.

TABLE I

TABLE OF FORMATIONS

CAMBRO - ORDOVICIAN	RIDGE GROUP	light grey quartzite grey limestone grey-green to buff argillite
	MINE GROUP	grey, siliceous limestone grey to green argillite white quartzite
	RANGE GROUP	green to black argillite grey limestone tan to buff quartzite
HADRYNIAN	CANYON FORMATION	limestone buff to grey phyllite minor grey to black argillite

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1981 EXPLORATION PROGRAM

The 1981 program at Quartz Lake was directed at delineating the South Zone mineralization. Work included the preparation of a contoured orthophotograph, linecutting, C.E.M. surveys, gravity surveys, diamond drilling and geological mapping. Table II summarizes activity during the 1981 field season at Quartz Lake.

TABLE II

SUMMARY OF ACTIVITY

1981

May	7	Yukon Pacific linecutters to Watson Lake.
May	10	Linecutters to Quartz Lake, under supervision of R.L. McIntyre, Noranda Exploration Co., Ltd. - camp construction, line cutting.
May	27	McIntyre out.
May	31	T. McKinley, Noranda Exploration, to Quartz Lake.
June	06	Linecutters complete Quartz Lake job. CEM, gravity and survey crew to Quartz Lake. T. Walker, Noranda Exploration Geophysisist to Quartz Lake.
June	07	Walker and McKinley out.
Aug.	03	Diamond drill mobilized to Quartz Lake.
Aug.	04	Commence drilling. R.S. Rogers, Noranda Exploration supervising.
Aug.	07	ASARCO tour to Quartz Lake with G.E. Dirom.
Aug.	08	C. Logan, Noranda Exploration, to Quartz Lake.
Aug.	09	Logan and Dirom out.
Aug.	23	Diamond drilling completed.
Aug.	25	Drill crew demobilized to Watson Lake.
Aug.	28	Demobilization completed. Rogers returns to Whitehorse.
Sept.	14	Rogers to Quartz Lake: Inventory and winterize camp.

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ORTHOPHOTOGRAPHY

A contoured orthophotograph at 1" = 500' was prepared by Pacific Survey Corporation, 1409 West Pender Street, Vancouver, to cover an area of 16 square miles in the Quartz Lake area (Figure 3). Preparation of the orthophotograph cost $3300.00.

The monochrome orthophoto was prepared from 1960 federal government aerial photographs (Series A17108-65/68) at a scale of 1:52,000 using vertical and horizontal control from 1:50,000 topographic maps. Aero-triangulation produced mapping at a scale of 1" to 500' with a 20 foot contour interval on a Wild-1 photogrammetric instrument. The resultant topographic map was scribed and produced in a mylar copy. Orthophotography was produced with the aid of a Gestalt Photo-Mapper, a high speed, computer controlled differential rectification system. Finally, the topographic detail was superimposed on the orthophotograph to produce the contoured photograph used in the field.

The orthophotograph was a valuable aid for field geological mapping in the 1981 season, but was not prepared in time for pre-season planning of drill sites or linecutting. Distinct lineaments on the photo suggest surface traces of local faulting, some structural data is evident, and glacial features are clearly defined. A separate photo-interpretation study is proposed for the winter of 1981-82 to be undertaken by the author at Noranda Exploration Co., Whitehorse, Y.T.

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LINECUTTING

A linecutting contract was let to Yukon Pacific Mines, Box 4927, Whitehorse, Y.T.; represented by Mr. R. Bailey. The contract called for the establishment of a system of baselines, gridlines and tielines according to a strict set of specifications and tolerances. Linecutting was contracted at a flat rate of $410.00 per mile. A survey of South Zone drill collars at $2500.00 and the construction of a camp at $3500.00 were called for in the contract dated 6 May, 1981.

The linecutting crew assembled in Watson Lake on 7 May, and arrived at Quartz Lake property on 10 May, 1981, under the supervision of R.L. McIntyre, Geological Technician, Noranda Exploration Co., Ltd. McIntyre was replaced on May 31 by T. McKinlay, Geologist, Noranda Exploration Co., Ltd.

The following linecutting was completed : (Figure 4)

1. Baselines :

BL 32+00 S :	20+00W to 92+00E	11,200 ft
BL 0+00 E :	0+00S to 56+00S	5,600 ft
BL 44+00 E :	8+00S to 56+00S	4,800 ft
BL 88+00 E :	8+00S to 56+00S	4,800 ft
		26,400 ft

All baselines were cut to specifications: transit controlled, cut with axe and power saw to minimum 3 foot width with baseline stations chained to 100 foot intervals and slope corrected to 0.5% tolerance.

2. Gridlines :

a) Lines 14+00W, 16+00W, 18+00W and 20+00W cut from 4+00N to 56+00S. 30,000 ft

b) Lines 4+00E, 8+00E ..... 92+00E cut from 8+00S to 56+00S. 100,800 ft

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These lines were turned off the baselines with transit or turning board, with directions maintained by foresight-backsight on pickets. The lines were to be cut to allow unimpeded travel with 100 foot picketed stations. Field inspection of the grid by the author on arriving at the property indicated that the contractor had not fulfilled the specifications for these lines. Grid stations were poorly marked, lines were generally impassable and survey errors reflected a completely amateurish undertaking.

3. Tielines

Tielines to parallel BL 32+00S at 56+00S and 8+00S were called for in the contract. These could not be located in the field.

4. Detailed Grids

a) Eastern Grid : a detailed grid was cut with N-S lines at 200 foot spacings from 68+00E to 92+00E and 32+00S to 48+00S. This grid was suitable for geophysical use and generally complied to contract specifications.

b) South Zone Grid : a grid called for in the vicinity of 1980 drilling was not completed.

In addition to linecutting, the contractor constructed a camp at the western edge of the grid near the old ASARCO camp. This included erection of an 8-man bunkhouse and a cookshack with associated clearing and rough construction. These structures were well built and should endure for some time.

A South Zone drill collar survey was performed in the field but no map was supplied by the contractor. A plot of his field notes by the author shows that the survey was barely adequate to fix drill collars in space.

It is suggested that future linecutting contracts be let with caution as the lowest bid on any particular job may not provide the greatest dollar value in performance. Perhaps stricter supervision of contractors by company personnel should be coupled with the retention of only those contractors with proven capability.

C.E.M. SURVEY

A C.E.M. co-axial shootback survey was completed between June 6 and June 29 by J. Moore and R. Kaatz, Noranda Exploration Co., Ltd. A medium frequency (1830 Hz) survey using 300 foot coil separation was completed on N-S gridlines 400 feet apart, with a detailed survey from 68+00E to 92+00E on lines spaced 200 feet apart between 32+00S and 48+00S. A high frequency (5010 Hz) survey using 400 foot coil separation was executed on lines 20+00W, BL 0+00E, 20+00E, BL 44+00E, 68+00E, BL 84+00E and BL 32+00S. The survey results are presented in Figure 5 and Figure 6. (The latter is a detailed survey over the South Zone drill area using lines 100 feet apart).

The co-axial shootback EM method (JEM) is particularly well suited to exploration in the Yukon Territory as it is relatively unaffected by steep topography. The method is similar to conventional horizontal shootback techniques, using two coils traversing lines perpendicular to inferred strike alternately transmitting and receiving at each station. The transmitting coil is held in a vertical position with the axis of the coil pointing along the traverse line, and values of resultant dip angles are recorded. (In the absence of a buried conductor, $\theta 1 + \theta 2 = 0$). No phase angle measurements are taken. Advantages of the technique include poor discrimination of conductors due to overburden effects and the potential for the generation of false anomalies over large, poorly conductive features such as wet fault zones. Conductors are identified by classic "W" profiles in dip angle.

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High Priority Anomalies : (Figure 5)

ANOMALY "A" : 16+00W, 33+00S to 4+00E, 31+00S

A broad C.E.M. anomaly is seen in medium frequency profiles across the South Zone drill area. Assymetry suggests broad flat conductor dipping gently north. High frequency response is negligible. (Explored by South Zone drilling).

ANOMALY "B" : 16+00W, 1+00S to 8+00W, 2+00S

A weak zone of medium frequency response straddles Mine Creek in this region. No high frequency lines traversed this anomaly.

ANOMALY "C" : 12+00E, 18+00S to 16+00E, 18+00S

A minor medium frequency response is seen on the southwestern flank of Little Mountain. Explored with DDH 150, (1981).

Low Priority Anomalies :

ANOMALY "D" : 0+00E, 44+00S

A one line anomaly in medium and high frequency C.E.M. occurs along the baseline at this point. Investigated on the surface by the author; massive pyrite float in a quartzitic gangue was discovered in a shallow test pit, and samples sent for assay (pending at this writing). No further investigation in 1981.

ANOMALY "E" : 68+00E, 32+00S

A good one line anomaly occurs in medium frequency C.E.M. with peripheral "noise" on adjacent detailed survey lines. The pattern in C.E.M. profile suggests a narrow vertical conductor extending from this point to 90+00E, 38+00S. High frequency response is uniformly poor.

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The detailed South Zone C.E.M. survey (Figure 6) defined a sinuous anomaly extending from 10+00W, 32+00S to 4+00W, 31+00S. This is likely an extension of Anomaly "A" described above. In profile, a classic "W" profile is seen with assymetry suggesting a broad conductor with gentle northerly dip. This would agree with 1980 stratum contour projections from drill hole data, defining the ore zone at an attitude of 125/11N. Drilling in 1980 and 1981 explored the South Zone quite thoroughly.

A small anomaly on the detailed survey at 43+00S, 0+00E would seem to coincide with Anomaly "D" above; as yet this spot is untested by drilling. It is suggested that this anomaly be tested by trenching in 1982, as the pyritic float found by the author at this point could be explained by orthoprojection of the South Zone ore body across the valley and into the hillside here.

No further electromagnetic surveys are proposed for the South Zone of Quartz Lake. It is felt that the current coverage has defined all the near-surface anomalies within the range of conventional techniques. The possibility of deeper ore zones either below the South Zone or buried beneath the eastern part of the grid is possibly, but these would be beyond the penetration of C.E.M. or VLF-EM techniques. (See comments under "Diamond Drilling" and relevant geological cross-sections following).

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GRAVITY SURVEY

A gravity survey was carried out in June by a crew from Sharpe Geophysical, Toronto. The area surveyed was essentially the same as that explored by C.E.M., extending from 20+00W to 92+00E and 0+00S to 56+00S (Figure 7). As before, detailed surveys were initiated over the South Zone drill area (Figure 8).

Figure 7 shows four distinct linear anomalies.

ANOMALY "A" : includes the South Zone drill area and the area of detailed study described below. This area has been extensively drilled.

ANOMALY "B" : defines a sinuous linear feature up to 500 feet wide from 12+00E, 12+00S to 44+00E, 14+00S, roughly coincident with a previously described C.E.M. anomaly (explored in 1981 by DDH 150).

ANOMALY "C" : is a poorly defined irregularity on line 72+00E from 31+00S to 42+00S. Adjacent lines show higher than normal background "noise" but no clear anomalies are defined (not explored in 1981).

ANOMALY "D" : is poorly defined at 16+00W near 0+00S (not explored in 1981).

Figure 8 shows a contoured plan of the South Zone detailed gravity survey. A large central anomaly is clearly similar in shape and extent to that detailed in the C.E.M. survey; (extending from 34+00S, 10+00W to 31+00S, 4+00W). This anomaly has been tested by DDH 68, 70, 74, 90, 147 and 149. The northern edge of the anomaly was explored with DDH 76, 77, 139, 145 and 146; while DDH 69, 75, 89 and 138 tested the southern edge. A small sub-anomaly at 1+00W, 27+50S was tested with DDH 148; and a small sub-anomaly at 8+00W, 38+50S has not yet been tested.

The elliptical anomaly at 43+00S, 0+00E to 41+00S, 6+00E coincides with previously described C.E.M. anomaly "D" (Figure 5).

No further gravity surveys are proposed for the South Zone of Quartz Lake. Attention should perhaps be focussed on resolving this year's survey data through a Bouger filter to clarify anomalous areas.

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DIAMOND DRILLING

The 1981 diamond drill program at Quartz Lake was contracted out to Drilcor Industries Ltd. of Richmond, B.C. Drilcor was represented on the site by Mr. Daryl Fry, a principal in the company. The drill equipment was mobilized from Watson Lake, Y.T. into the property on 03 August, 1981, with a Bell series 205-A-1 helicopter supplied by Frontier Helicopters, Ltd. Drill equipment included the Hydrawink unit with Volkswagen diesel powerpack as detailed in the 1980 diamond drill report, set up for BQ wireline drilling. Two twelve hour shifts of drilling were established, each shift comprising a driller and a helper. Drilcor supplied a camp cook, and supervisory personnel as required.

The Hydrawink drill performed more efficiently this year than in the 1980 season, but minor mechanical problems still plagued the operation. Most of these were due to inadequacies of the driller or helper : the problems included broken starter motors, burst hydraulic lines, burst water lines and an alternator destroyed by being hooked up with reversed polarity. A helicopter slinging mishap confirmed the premise that Sundstrom water pumps in excess of 700 pounds weight have virtually no aerodynamic qualities. (A replacement for the impacted pump was found in Watson Lake).

Six "BQ" holes were completed in 1981 for a total of 2101 feet (Appendix II). Holes 145 to 149 were collared in the South Zone drill area; hole 150 tested the west flank of Little Mountain (Figure 9). The current program brings South Zone drilling to a total of 8804 feet, in 27 holes collared between 1955 and 1981 (Table III). Composite E-W and N-S cross sections are seen in Figures 10 to 23.

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DDH 145 (94.332 N; 99.490 E)

This hole was designed to test the lateral continuity of a mineralzzed zone intersected in 1980 by DDH 139 (Figure 14). Significant intersections include :

82.0 to 87.0	Argillite and grey quartzite with minor galena in fractures and quartz stockwork. Assayed 2.00% Pb, 0.02% Zn and 1.16 OPT Ag over 5.0 feet.
112.0 to 127.0	Green argillite with fine grained galena in quartz stockwork. Assayed 0.71% Pb, 0.06% Zn and 0.43 OPT Ag over 15.0 feet.
127.0 to 147.0	Massive pyrite from 131.5 to 133.5, underlain by a zone of banded grey argillite with galena laminae. Assayed 2.54% Pb, 0.02% Zn, and 1.33 OPT Ag over 20.0 feet.
157.0 to 162.0	Interbanded pale green and pink argillite with laminae pyrite and very fine grained galena. Assayed 0.94% Pb, 0.02 % Zn and 0.60 OPT Ag over 5.0 feet.
204.0 to 215.5	Massive pyrite in a quartzitic breccia. Assayed 0.32% Pb, 0.02% Zn and 5.02 OPT Ag over (207.0 - 212.0) 5.0 feet.

The hole was completed in sheared black argillite and quartzite of the "Black Thrust" footwall at 257.0 feet.

DDH 146 (94.565 N; 99.700 E)

This hole was designed to test the northern extension of the DDH 139 intersection (Figure 20). Of particular note is the first intersection detailed below.

108.0 to 119.0	Dolomitic breccia with galena, boulangerite and tetrahedrite filling interstices. Assayed 5.9% Pb, 0.04% Zn and 3.92 OPT Ag (108.0 - 118.0) over 10.0 feet.
143.0 to 153.0	Grey quartzite with green argillite partings; moderate to heavy pyrite with massive galena sections in quartzitic breccia. Assayed 1.80% Pb, 0.02% Zn and 3.76 OPT Ag over 10.0 feet.
240.5 to 250.0	Massive pyrite with very fine grained disseminated galena. Assayed 0.69% Pb, 0.02% Zn and 7.10 OPT Ag (242.0 - 252.0) over 10.0 feet.

The hole was completed at 317.0 feet in a heavily pyritic quartzite horizon that appears to be the footwall zone. Repetitions of black and grey argillite prior to the quartzite suggest that the footwall transition is gradational or perhaps fault-complicated; the abrupt change to footwall lithology is not seen here.

DDH 147 (94.150 N; 99.700 E)

This hole tested the area immediately south of DDH 139 (Figure 20). The preponderance of massive pyrite in this hole is significant, as this appears to define a crude metal zonation in the South Zone.

68.2 to 106.5	Massive pyrite over 38.3 feet. Assayed 0.35% Pb, 0.02% Zn and 0.20 OPT Ag (67.0 - 107.0) over 40.0 feet.
147.0 to 150.0	Massive pyrite over 3.0 feet. No significant assays.
177.0 to 181.0	Massive pyrite over 4.0 feet. Assayed 0.57% Pb, 0.02% Zn and 0.21 OPT Ag (172.0 to 187.0) over 15.0 feet.

This hole was completed at 305.0 feet in footwall rocks.

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DDH 148 (94,350 N; 99.900 E)

This hole was the last hole to test the immediate area around DDH 139; covering the area to the east of that hole (Figure 11).

76.0 to 125.0	Massive pyrite with minor galena disseminations. Assays: 71.0 to 86.0, 15.0 feet at 0.83% Pb, 0.10% Zn and 1.34 OPT Ag; 86.0 to 116.0, 30.0 feet at 2.88% Pb, 0.06% Zn and 0.35 OPT Ag; 116.0 to 126.0, 10.0 feet at 1.03% Pb, 0.06% Zn and 0.28 OPT Ag.
125.0 to 127.8	Quartzitic breccia with traces of galena (see assays below).
127.8 to 167.8	Green argillite with galena in fractures and disseminated in pyrite laminae. Assayed : 126.0 to 156.0, 30.0 feet at 2.65% Pb, 0.09% Zn and 0.77 OPT Ag.
213.5 to 215.8	Massive pyrite, not assayed.

The hole was completed at 262.0 feet.

DDH 149 (93,955 N; 99,300 E)

This hole tested coincident C.E.M. and gravity anomalies south and west of the South Zone mineralization.

37.0 to 48.0	Massive pyrite with galena in fractures. Assayed 3.80% Pb, 0.18% Zn and 1.38 OPT Ag (37.0 to 51.0) over 14.0 feet.
117.8 to 118.5	Massive pyrite , 0.7 feet
175.0 to 176.0	Massive pyrite , 1.0 feet
202.0 to 205.5	Pyritic mud , 3.5 feet
295.0 to 299.5	Massive pyrite , 4.5 feet
357.0 to 360.0	Pyritic mud , 3.0 feet
442.0 to 445.0	Pyritic silt , 3.0 feet

This hole was terminated under artesian conditions at 460.0 feet.

DDH 150 (96,050 N; 101,600 E)

This hole was designed to test coincident C.E.M. and gravity anomalies on the southwestern flank of Little Mountain and to provide stratigraphical data in the area between Main and South Zones. No sulphides were seen in this hole, which primarily cut green argillite and limestone. The gravity anomaly may be explained by a considerable thickness of limestone in the hole, but no conclusive explanation for the C.E.M. conductor was found. It is conceivable that the limestone block is fault bounded south of DDH 150; in that case, the C.E.M. response could reflect wet or pyritic faulting. The hole was completed at 500.0 feet in footwall rocks; no assays were warranted.

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TABLE III

SOUTH ZONE DRILLING SUMMARY

DDH	LAT(N)	DEP(E)	ELEV(FT)	DEPTH(FT)	DIP°	OVB(FT)	LOGGED BY	YEAR
67	93715	100170	3796	300	-90	22	Coveney	1955
68	93741	99741	3798	405	-90	22	Coveney	1955
69	93732	99410	3810	325	-90	32	Coveney	1955
70	93737	99100	3818	302	-90	46	Coveney	1955
71	94737	99054	3752	250	-90	48	Coveney	1955
72	94752	99350	3769	301	-90	67	Coveney	1955
73	94750	99725	3793	399	-90	117	Coveney	1955
74	93950	99517	3788	299	-90	25	Kenly	1956
75	93324	99890	3837	380	-90	13	Kenly	1956
76	94348	99164	3750	322	-90	50	Kenly	1956
77	94348	100040	3779	309	-90	79	Kenly	1956
78	94750	100420	3845	213	-90	213	Kenly	1956
79	95173	99550	3780	163	-90	163	Kenly	1956
80	95375	98890	3748	318	-90	90	Kenly	1956
89	93739	99891	3790	300	-90	22	Bayley	1968
90	93920	99978	3820	400	-90	56	Bayley	1968
138	93577	99682	3833	347	-90	16	Rogers	1980
139	94329	99688	3776	349	-90	39	Rogers	1980
141	94592	100289	3821	427	-90	154	Rogers	1980
143	94288	100380	3785	297	-90	81	Rogers	1980
144	94132	99887	3781	297	-90	40	Rogers	1980
145	94332	99490	3770	257	-90	26	Rogers	1981
146	94565	99700	3790	317	-90	94	Rogers	1981
147	94150	99700	3770	305	-90	42	Rogers	1981
148	94350	99900	3775	262	-90	61	Rogers	1981
149	93955	99300	3780	460	-90	37	Rogers	1981
150	96050	101600	4200	500	-90	11	Rogers	1981
27				8804				

GEOLOGICAL MAPPING

Mapping at a scale of 1"=500' was done by Mr. P. Vaillancourt, M.Sc. candidate at the University of Western Ontario. Vaillancourt was assisted throughout his project by M. Firko, Noranda Exploration. The final copy of Vaillancourts map is being prepared at this time, and will form part of a later report. Vaillancourt's preliminary comments are seen in Appendix IV.

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DISCUSSION

The genetic history of the Quartz Lake mineralization has been discussed at length by a variety of authors. The two principal schools of thought on the subject involve contrasting models of hydrothermal replacement mineralization and syngenetic (sedimentogenic) mineralization.

The following points are central to the genetic issue and may guide search for further reserves:

1) The ore zone is stratiform but not exclusively stratabound;
2) The ore zone is confined to Mine Group stratigraphy;
3) The ore zone is separated from footwall rocks by a zone of thrusting, shearing or discontinuity known informally as the Black Thrust;
4) Abrupt facies changes occur in strata immediately adjacent to the ore zone - typically the sequence runs from west to east as: purple argillite - massive sulphides - limy quartzite - quartzite - (limestone);
5) Lead-(zinc)-silver mineralization is best developed in limestone or limy quartzites adjacent to relatively pure quartzite horizons. In most places, limy quartzite hosts a lower grade ore (or massive pyrite) adjacent to ore grade material in limestone;
6) The ore zone appears to pinch out to the eastern margin of the South Zone, and is not fault-truncated as previously thought;
7) To the west, the ore zone thins considerably and is still open in some sections;
8) A crude metal zonation is developed in the South Zone: a pyrite halo appears to encircle the lead-(zinc)-silver mineralization; this likely reflects a change in ore solution chemistry in response to facies changes.

The two primary models are summarized below.

The hydrothermal replacement model comprises a hydrothermal mineralization of Pb(Zn)Ag selectively replacing limestone and clacareous quartzite (i.e. host). The mineralizing fluid would be channeled through permeable quartzite or stockworking fractures (i.e. aquifer) overlain by a complex sequence of overlapping nearshore marine sediments (i.e. caprock). In part this model is supported at Quartz Lake by apparent selective replacement of limy units on a large scale, and the extensive development of siderite in limestone may suggest a hydrothermal solution enriched in Fe.

The sedimentogenic (syngenetic) model comprises a hydrothermal type mineralization rich in Pb(Zn)Ag exhaled into a marine environment, with the precipitation of sulphides laterally zoned in response to parameters of density, temperature and turbidity. Penecontemporaneous or epigenetic deformation typically complicates ore zonation in these deposits. At Quartz Lake, evidence for this type of genesis includes: a definite marine environment as evidenced by lithology; the stratiform nature of the ore zone; metal zonation which closely reflects the exhalitive types of Sato; development of sedimentary textures in ore material (i.e. scour and fill structures, slumps, graded bedding); a lack of replacement textures in petrographic work and a lack of igneous rocks in the immediate area.

The hydrothermal type model is strongly suggested by Morin (1981) and compared to the Park City, Utah deposits. The author is a proponent of sedimentogenic origin, (Rogers, 1981a) with comparisons to Mt. Isa, McArthur, Hilton and Broken Hill deposits.

It is expected that the studies currently under way by Pierre Vaillancourt at the University of Western Ontario as part of his M.Sc. program will further illuminate the subject.

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APPENDIX I

The McMillan Deposit - A stratabound lead-zinc-silver deposit in sedimentary rocks of Upper Proterozoic age in Yukon geology and exploratinn 1979-80; D.I.A.N.D, Ottawa; pp. 105-109. J.A. Morin

THE McMILLAN DEPOSIT - A STRATABOUND LEAD-ZINC-SILVER DEPOSIT IN SEDIMENTARY ROCKS OF UPPER PROTEROZOIC AGE

J.A.Morin

Introduction

The McMillan deposit is in the southern portion of the Logan Mountains, 65 km NE of Watson Lake. It is 5 km southwest of Quartz or Hulse Lake and is also referred to as the Quartz Lake deposit. Access is by float plane to Quartz Lake and on a tote trail to the property.

History

History of the deposit is summarized in the following excerpt from D. H. Olson's presentation to the Sixth Geoscience Forum in Whitehorse (Olson, 1978).

"Historically, the first apparent discovery of the McMillan deposit was in 1892 by prospectors from the Cassiar Gold Fields. Re-discovery of the outcrop was by K. E. McMillan who staked the Dorothy claim in 1930 and re-staked the property as South Nahanni and Dorothy claim in 1948. Noranda optioned the property late in 1948, and in turn optioned the property to New Jersey Zinc in 1949 and 1950. During this period, New Jersey Zinc carried out trenching and geologic mapping of the outcrops along Quartz Creek. After termination of the latter option, Noranda and American Smelting and Refining Company entered into a joint venture, and a new Company named the Liard River Mining Company, Limited was later formed. Asarco Incorporated, as the Company is presently named, holds the major interest in this Company. Fringe staking was carried out by Prospectors Airways in 1954 and by Redfort Syndicate in 1965. In 1966 and 1967, Redfort Syndicate carried out airborne mag and EM surveys on the fringing claims, and established several geophysical anomalies which were tested by Fort Reliance Minerals who drilled 6 drill holes during the 1968 season.

Work to date by Liard River Mining Company, Limited includes 93 drill holes totalling 7004.5 m, extensive E.M. surveys during 1953, 1954 and 1955, and I.P. survey during 1967, a geochemical soil survey during 1967 and 1968 and a legal survey in 1972, whereby several key claims were taken to lease in 1973.

Noranda again optioned the property in 1975, staked additional claims and explored the main showing with a gravity survey and 27 drill holes totalling 2530.2 m. During 1976, the line cutting, soil sampling, CEM and VLF and gravity surveys were conducted on the new claims. Two additional holes totalling 265.2 m were drilled to test gravity anomalies east of the main mineral zone in 1977." In 1980, a major drilling program was conducted in the area west and south of the north deposit main zone, holes totalling 1871 m.

The ground south of Quartz Lake held by Liard River Mining Company was allowed to lapse and in 1973 was restaked as the PORKER claims for the Hyland Joint Venture (Sinclair et al, 1976, p. 155-156).

General Geology

Hadrynian rocks occur in a north trending synclinorium up to 50 km wide with a core of Lower Paleozoic sedimentary rocks. The Hadrynian "Grit Unit" includes fine-to coarse-grained siliciclastic rocks with minor intercalated limestone and fine grained argilliclastics and limestone form the Cambrian and Ordovician inlier. Cretaceous granitic rocks intrude the belt (Gabrielse and Blusson, 1969).

A homocline about 7 km thick of the "Grit Unit" is exposed south of Quartz Lake (Figure 1). The rocks strike northwest and dip moderately northeast.

Coarser clastic rocks account for well over half of the "Grit Unit" in the area and form resistant blocky, pale grey, brown and white ledge-forming outcrops. Well rounded quartz grains 1 mm to 2 cm across form most of the rock (40-90%) and they are set in a matrix of similar composition. Differences in grain size and clast mineralogy result in several rock types: quartzose sandstone, argillaceous sandstone, feldspathic sandstone and quartz pebble conglomerate. These clastic rocks occur as beds and channel lenses from 0.3 m to 100 m thick interbedded with argillite.

The argillite is dark grey on fresh surfaces and generally weathers brownish grey. It is commonly phyllitic with well preserved layering of alternate light and dark grey layers less than 1 mm to 1 cm thick. In the northern part of the area, argillite is greenish grey weathering. Fine-grained black limestone occurs in beds a few tens of meters thick which locally contain siderite.

Local Geology

Rocks hosting the deposit at the top of the grit sequence consist of argillite, sandstone, limestone and massive sulphides (Figure 2 a,b,c).

Thin-bedded to laminated creamy buff and maroon argillite makes up Unit A (Figure 3).

Argillite interlayered with sandstone of similar thickness, forms a transitional rock, Unit B.

Medium grey fine-grained quartz sandstone, Unit C, forms layers from one millimetre beds to massive beds that are several tens of centimetres thick.

Unit E consists of grey limestone and limestone breccia in beds from 0.3 to 20 meters thick. The limestone is massive and fine-grained with veinlets of white calcite. It contains beds of intraformational breccia consisting of sandstone, argillite and limestone clasts in a limestone matrix.

Lenses of massive coarse-grained siderite up to 200 meters long occur within the pale grey limestone south of Quartz Lake (Figure 4).

Dark grey to black, commonly graphitic argillite with interlayers and clasts of fine-grained white quartzite forms Unit F, the lowest unit cut in drilling. The rock is sheared and lenticles of white sandstone may indicate an original sequence of alternating thin (several mm to several cm) layers of sandstone and graphitic argillite. Thin (several mm to several cm) layers of fine grained massive pyrite are common throughout the unit.

Mineralization includes concordant and discordant types. Concordant mineralization mainly consists of beds of massive sulphides with sphalerite, galena and carbonate (siderite?) with minor sulphosalts. They range in thickness from one centimetre to several meters and are exposed along Mine Creek in the main showing area. They form individual strata within argillite. The lateral continuity of the massive sulphides is limited and locally massive pyrite terminates sharply and the bed continuation is limestone. The limestone may be barren or may contain disseminated galena, sphalerite and pyrite. The massive pyrite beds

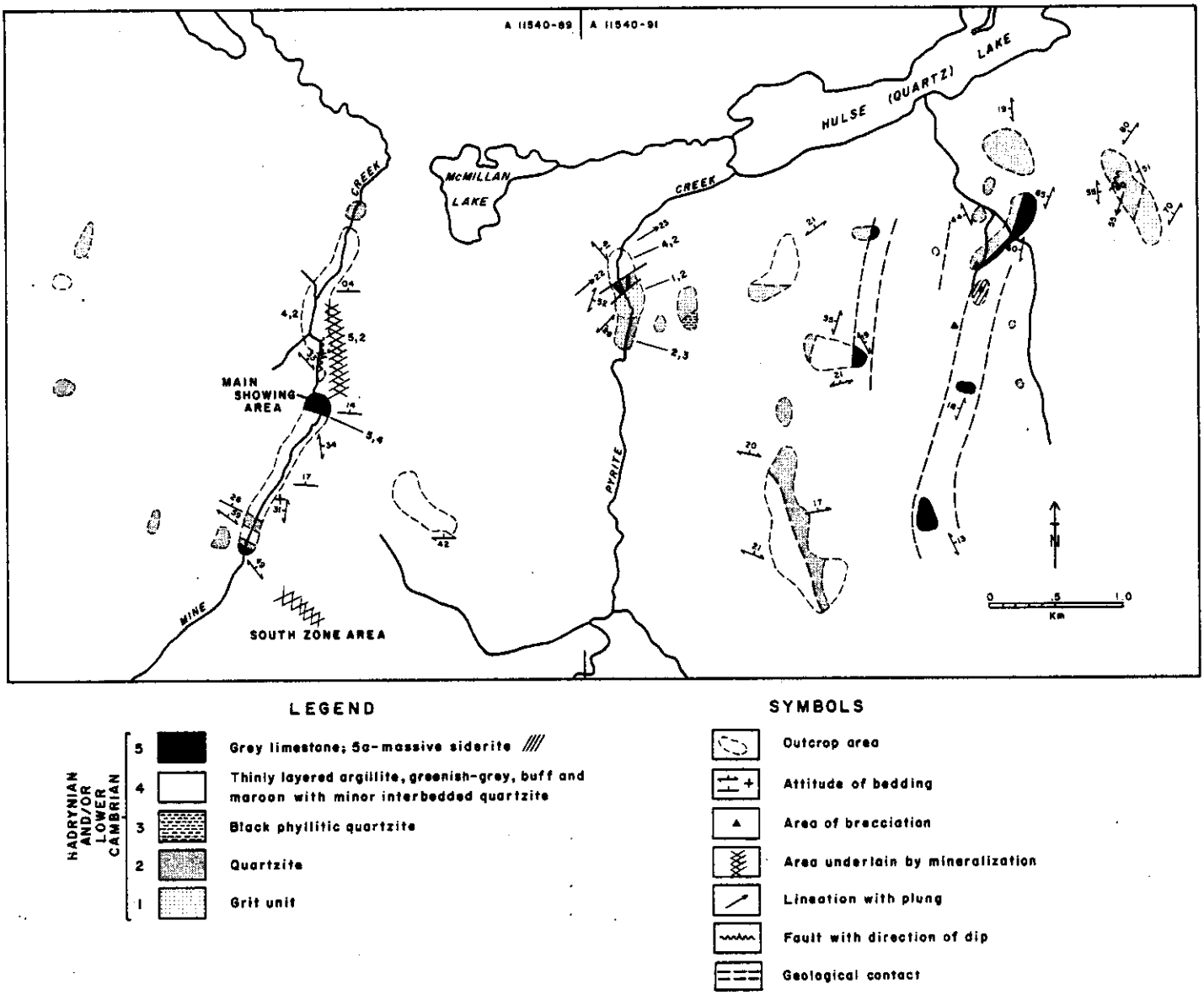

Figure 1
Geological map of Quartz Lake area. Base traced uncorrected from aerial photographs.

are associated with greenish grey argillite, quartzite, limestone and thin beds of massive galena and sphalerite.

Sedimentary structures present in the massive sulphide beds include layering, graded bedding, and possible scour pits. Size and distribution grading is locally exhibited by pyrite grains in sandstone and massive sulphide beds (Figures 5 a,b,c). A large scour pit that may be termed a channel is developed in the surface of a meter thick massive pyrite bed at the main showing. The channel is about 0.3 m deep and 1 m wide and infilled with sandstone (Figure 6).

Massive pyrite also occurs in a chaotic conglomerate with quartzite clasts in a black argillite matrix (Unit F). The conglomerate is deformed and is referred to as breccia. Pyrite is common as fine-grained disseminations, flaser lenses, masssive pyrite clasts and beds of massive pyrite, locally finely laminated and from one to tens of cm thick. Galena and sphalerite are absent.

Discordant mineralization is widespread and consists of veins and veinlets that cut layering and cleavage. Quartz-siderite is the most common vein filling and is abundant south of the main showing. Veins to one meter thick occur within the argillite up to one km south of the deposit. Wall rock alteration in the maroon argillite is a colour transition from maroon to pink to greyish green next to the vein. This transition is seen above the north zone deposit where the greenish grey alteration forms a halo up to 30 m meters thick.

Generally associated with areas of concordant mineralization are veinlets of quartz-pyrite and galena-sphalerite. They are most common at the main showing in the interbedded limestone, argillite and quartzite. East of Pyrite Creek, minor veinlet

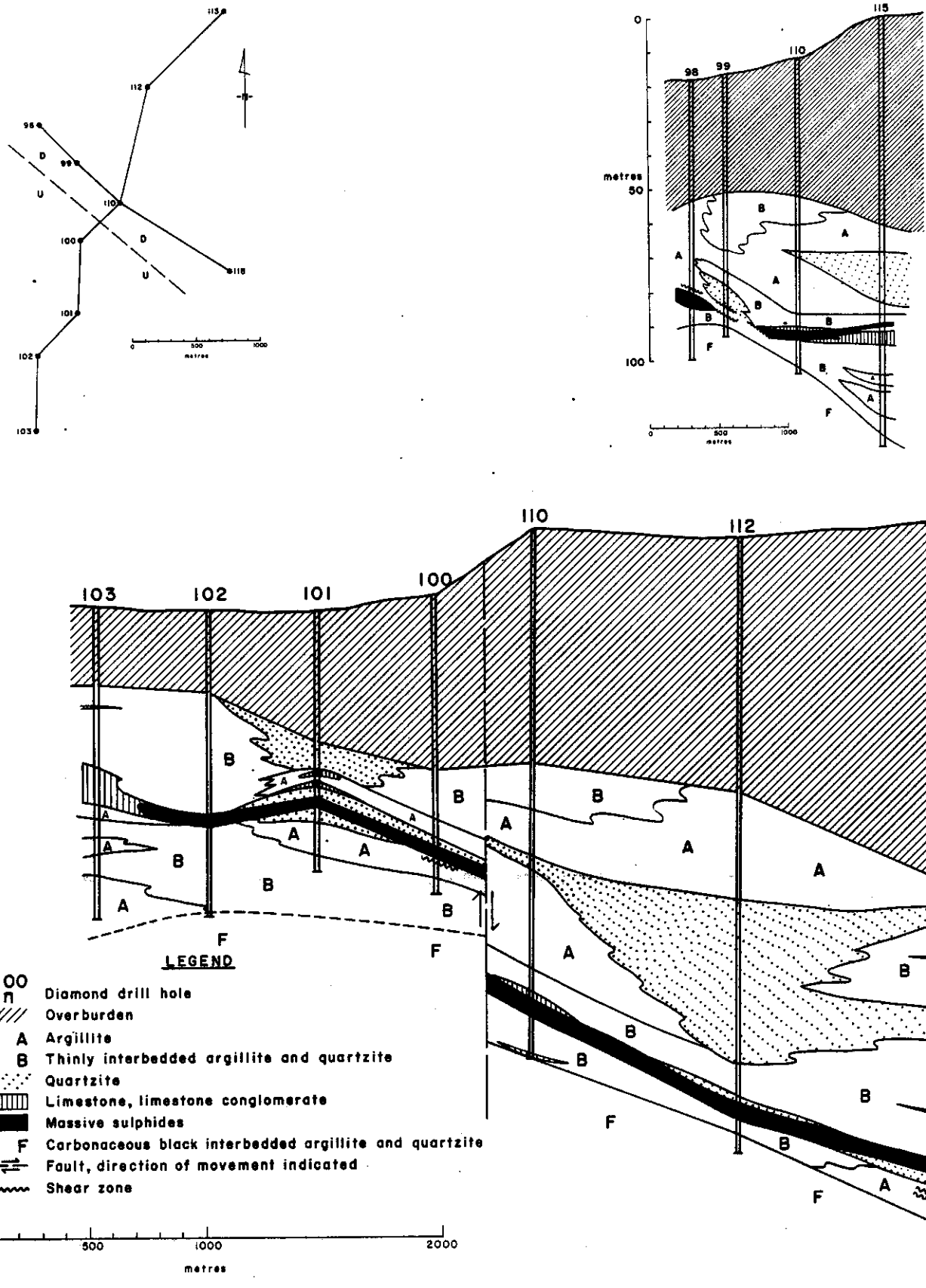

Figure 2
a) Cross section through the North zone of the McMillan deposit b) Longitudinal section c) Plan view showing location of drill holes illustrated in 2 a,b.

Figure 3
Creamy buff to greenish grey, well layered argillite in drill core. Note the loadcasts (indicated by arrows) and absence of sandstone.

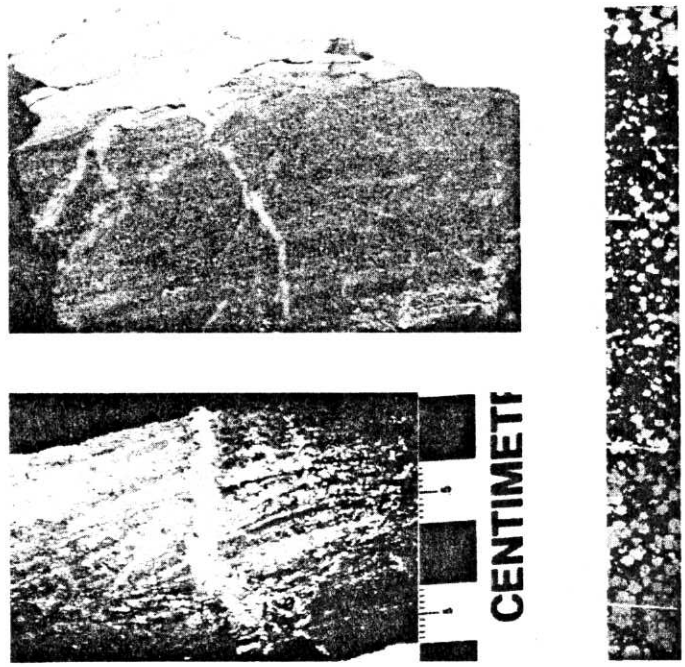

Figure 5a
Specimen of a massive pyrite bed from main showing on Mine Creek. Argillite and massive pyrite are both transected by quartz veinlets. Note the layering and graded bedding.

Figure 5b
A series of photomicrographs across 1cm of massive pyrite illuminated by reflected light. Pyrite grains (light coloured) demonstrate well developed graded bedding. Area shown is from massive pyrite specimen in Figure 5a.

Figure 5c
Massive sulphide horizon with laminated galena and sphalerite cut by veinlet of pyrite.

Figure 4
Southward view of the PORKER property. The hillside is a pale grey limestone bed (LS) which encloses a concordant siderite lens (S).

mineralization occurs in fractured sideritic quartzite. Quartz-siderite breccia is developed in quartzite 2.5 km east of Pyrite Creek.

Mine Creek Main Showing

Mine Creek cuts the top of the McMillan deposit. Barren grey limestone and limestone conglomerate overlie interbedded argillite, limestone, massive sulphides and quartzite (Figure 6).

The interbedded limestone grades laterally to massive pyrite and massive galena and sphalerite or to limestone with disseminated galena and sphalerite. Quartzite is not as common in the Main showing as in the drill core mineralized intersections and limestone predominates at the Main Showing.

Origin

Models for the origin of the McMillan deposit are two - A), the mineralization was hydrothermally introduced into a carbonate-rich post depositional sequence and selected limestone beds were replaced by sulphides and siderite or that B) the mineralization was hydrothermally introduced onto a seafloor and sulphides and siderite were precipitated as lateral facies equivalents of limestone.

The following features are interpreted according to both models:

1) Sedimentary structures in massive sulphides indicate water transport of primary precipitated sulphides or selective replacement of calcite grains of calcarenite and calcilutite so that original structures (layering, graded bedding) are preserved.
2) Restriction of massive sulphides to individual beds indicates primary sedimentary deposition of sulphides or replacement of limestone bounded by relatively impermeable argillite or quartzite beds.

3) Lens-like extension of quartzite into massive pyrite indicates channel erosion of the pyrite horizon or the replacement model would suggest that only the limestone was replaced and the quartzite was left in place with its original channel shape (Figure 6). On Pyrite Creek, lenses of quartzite project into the top of the underlying limestone, suggesting that sandstone deposition commenced with small channels.
4) Proximity of quartz-siderite ± pyrite veining to concordant sulphide horizons suggests that veins and veinlets are pathways of metal solutions to the seafloor surface or to carbonate beds during replacement.
5) Conformable lenses of siderite associated with limestone suggest that a primary sedimentary facies relationship exists between pyrite, siderite and limestone or that iron solutions moving through limestone react with the wallrock to form siderite-rich zones.

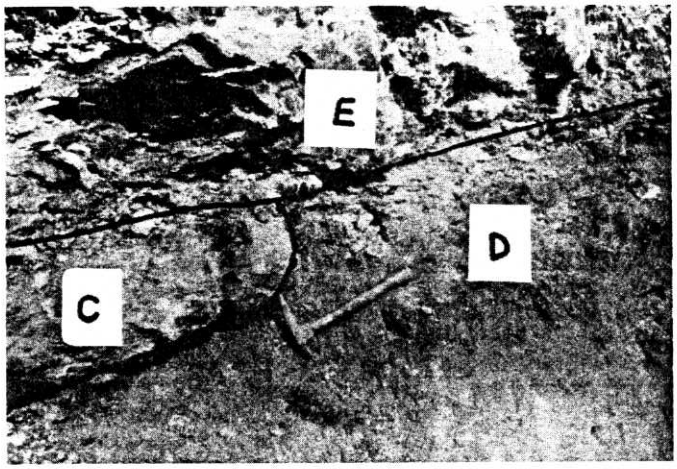

Figure 6
Main showing outcrop on Mine Creek. Massive pyrite (D) is overlain by argillite and limestone (E) and by sandstone (C). The sandstone occupies a concave depression in the massive pyrite. The depression may be a scour pit formed in a primary massive suphide sediment and filled with sandstone or it may be a scour pit formed in a limestone, infilled with sandstone and not replaced by pyrite.

Comparison with Similar Deposits

Most stratabound deposits in Selwyn Basin are attributed to syngenetic origins. However, deposits similar in mineralogy and geologic setting to the McMillan deposit are thought to be of a replacement type origin, e.g. the Park City District, Utah (Barnes and Simos, 1968, Lindgren, 1933). These deposits include an interbedded carbonate-clastic sequence and a nearby igneous intrusion. The carbonate rocks commonly host bedded mineralization and the clastic rocks host veins and breccias thought to be related. Wall rocks are silicified and gangue may be dolomite, quartz, calcite, barite, fluorite and iron-manganese carbonates (Lindgren, 1933). At Park City, free carbon is present

McMILLAN DEPOSIT:
SKETCH OF GEOLOGY AT MAIN SHOWING,
MINE CREEK (Looking East)

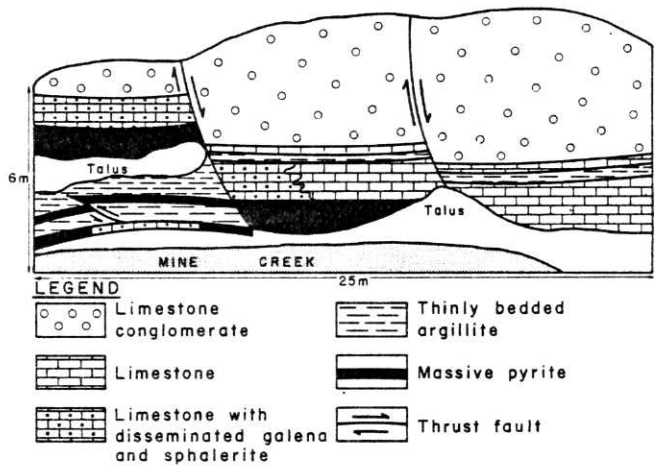

Figure 7
Sketch of geology at the main showing on Mine Creek.

in the limestone and is thought to have been a sulphide precipitating influence. The limestone was replaced by metal-rich hydrothermal solutions emanating from a nearby igneous intrusion or associated hydrothermal system (Proffett, Jr., 1979).

In comparison, at the McMillan deposit, carbonates are interbedded with fine-grained clastics, but no igneous intrusion occurs nearby. However, 2 km east of Quartz Lake, a marmorized limestone of Hadrynian age may indicate the presence of a nearby buried igneous intrusion. Quartz-carbonate veins are common in the clastic rocks near the McMillan deposit and a quartz-siderite matrix breccia pipe occurs on the PORKER claims, 1.5 km south of Quartz Lake. Wall rock alteration is limited to a bleached halo above and below the deposit and gangue minerals are carbonate (siderite?) and quartz. Minor sooty bitumen occurs in the limestone conglomerate at the main showing, but no bitumen was noted in drill core sections of limestone.

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REPORT OF FIELD WORK ON THE UPPER TRIASSIC REEF COMPLEX OF LIME PEAK, LABERGE MAP AREA, YUKON

R. Pamela Reid
University of Miami, Fisher Island Station
Miami Beach, Florida 33139

ABSTRACT

Field study has shown that the Upper Triassic carbonates at Lime Peak are a series of framework reefs which have shed debris into a surrounding basin. The reefs are up to 150 m thick and are dominated by spongiomorphs, tabulozoans and sponges. They bear little resemblance to those previously described in the Triassic of North America.

INTRODUCTION

The Upper Triassic carbonates of the Whitehorse trough are discontinuous, lenticular bodies that stretch northwest-southeast across the Laberge map-area in a belt approximately 30 km wide. Tozer (1958) and Wheeler (1961) attributed the irregular nature of the carbonates to erosional unconformities but Tempelman-Kluit (1978 a) proposed that the irregular carbonates are reefs. Such reefs would be unusual because they are over 100 m thick, whereas previously documented Triassic reefs in North America are generally less than 10 m (Stanley, 1979). The carbonates may, in fact, be unlike others in North America because the Mesozoic sediments of the Whitehorse trough are an allochthonous terrain which formed as a forearc basin and was juxtaposed against North America only in mid-Jurassic time (Tempelman-Kluit, 1979).

The Triassic is a turning point in the history of reef building because it marks the first appearance of scleractinian corals, the major reef builders of the Cenozoic. Most of our knowledge about this period comes from studies in Europe where Triassic reefs are well-developed. Early reports of Triassic reefs in western North America, such as Smith (1912) and Muller (1936) documented the fauna, but gave little information about the nature of the bodies. Stanley (1979) re-examined many of the localities and observed that most of the buildups were thin accumulations dominated by corals and spongiomorphs and which did not attain much relief above the sea floor. An occurrence of thick, well-developed reefs in the Yukon would be a valuable source of new information about the critical Triassic period.

The field study of Lime Peak in the summer of 1980 was the first step in a detailed facies analysis and faunal investigation of the Upper Triassic carbonates of the Laberge map-area. Lime Peak is located near the southeast end of the Lake Laberge, approximately 40 km northeast of Whitehorse (see Figure 1). Eight weeks were spent mapping Lime Peak (access by helicopter from Whitehorse) and four weeks were spent preparing rocks for thin sections and acetate peels at the Department of Indian Affairs and Northern Development. Petrographic study of samples collected is presently underway at the University of Miami. Field examination of other carbonates in the Laberge map-area in the summer of 1981 will test the generality of the depositional model developed at Lime Peak.

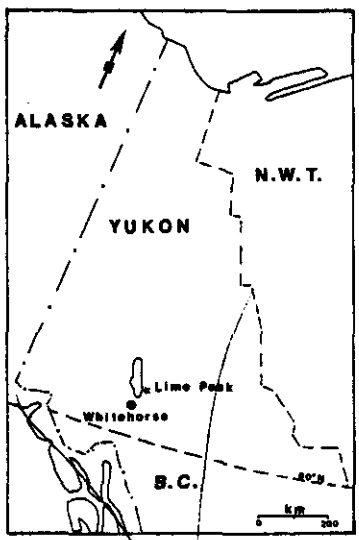

Figure 1
Index map showing the location of Lime Peak, Yukon.

General Geology

The Laberge map-area has been mapped at a reconnaissance scale by Bostock and Lees (1938) and Tempelman-Kluit (1978 b). The Upper Triassic carbonates are included with volcanic-clast conglomerate and greywacke in the Lewes River group, the youngest Mesozoic strata of Whitehorse trough. Tozer (1958) studied the stratigraphy of the Lewes River group and divided the clastic and carbonate rocks into several formations ranging in age from Karnian to Norian. The Lewes River group overlies green Triassic andesite and is succeeded by Lower Jurassic greywacke, shale and granite-clast conglomerate of the Laberge formation and Upper Jurassic-Lower Cretaceous chert-pebble conglomerate of the Tantalus formation.

Results of Field Study

Lime Peak extends northeast along Thomas Lake about 3.5 km and north of the lake about 3 km. The mountain complex was mapped using air photo A10559 - 124 and photographs such as that in Figure 2. A topographic base map is being prepared from the air photo.

The mountain can be divided into an eastern section with a general attitude of 120°/ 40°SW and a western section with an attitude of 175°/ 35°SW. A fault separates the two halves on the north side of the mountain, but the expression of this fault on the south face is not clear; it may die out in a breccia or it may extend as shown in Figure 2. The displacement on this fault is unknown, but other faults show minor displacement. Tertiary feldspathic dikes intrude the Triassic carbonate along many of the narrow gullies in Figure 2.

The four main rock types recognized in the field are 1) a massive light grey-brown limestone, 2) a bedded limestone, 3) a dark, shaly limestone and 4) a limestone breccia. The distribution of these rock types on the south face of the mountain is shown in Figure 2; their main characteristics are summarized below.

The massive limestones vary in thickness fro several meters to 150 m. The lithology of these limestones varies from peloidal mud to organic framestone composed of spongiomorphs, tabulozoans and calcareous

APPENDIX II

1981 Drill Logs

NORANDA EXPLORATION COMPANY, LIMITED

Collared	Completed	Core Size	Property	Project No	NTS No.
04 Aug 81	05 Aug 81	BQ	Quartz lake	1093	95 D 5

FIELD COORDINATES			SURVEYED COORDINATES			Sheet
Lat. 94.332 N	Elev. 3770	Dip -90	Lat.	Elev.	Dip -90	1 of 5
Dep. 94.565 N	Depth 257	Bearing	Dep.	Depth 257	Bearing	Hole No. 145

Footage	Rec'y	Graphic Log	Description	% Sulp.	Est. Grade	Sample No.	Lt.
0-26.0			Overburden, cased				
26.5			Argillite, pale green, finely laminar with bedding 35° to core axis; partings of dark purple argillite at base of this section				
28.0			Argillite, interbanded pink, purple and green, laminae to 1/4" thick, locally discontinuous with suggestion of crossbedding structures				
37.0			Argillaceous limestone, rusty tan color, finely laminar with rare hematitic partings. Some feathering manganese wad along bedding surfaces; the rock has a mottled, weathered appearance. One dominant fracture set at 90° to bedding				
39.0			Limy argillite, pale green to rusty, grading into next section. Some corroded sedimentary pyrite grains conformable to bedding, at 45° to core axis				
53.5			Argillite, finely laminar pale green, with occasional pink patches. Pink color is restricted to fractured surfaces, and appears to be an alteration envelope in this section				
66.1			Argillite as above, becoming increasingly pyritic towards base of section. Pyrite is clean, equant grains scattered at random orientations in the matrix, most likely diagenetic. At 54.2 a heavily pyritized 6" section of fault gouge.	5	-		

DATE 08 August 81 LOGGED BY R.S. Rogers

NORANDA EXPLORATION COMPANY, LIMITED

ollared	Completed	Core Size	Property	Project No 1093	NTS No.
FIELD COORDINATES			SURVEYED COORDINATES		Sheet 2 of 5
at.	Elev.	Dip	Lat.	Elev.	Dip	Hole No. 145
ep.	Depth	Bearing	Dep.	Depth	Bearing	

Footage	Rec'y	Graphic Log	Description	% Sulp.	Est. Grade	Sample No.	Lt.
77.1			Argillite, banded pink and purple with minor calcareous fractures at 90° to bedding. Partings show slickensided grooves which suggest some post lithification offset. ~~Sedimentary features include scour and fill channels,~~ graded bedding and varied sections				
82.0			Argillite, pasty green with pale pink tint, minor limy interbeds with manganese wad on partings				
87.0			Argillite, as above with pods of quartzite at scattered intervals, at 84.8 a siderític fracture and a thin lamina of galena. Stockworking of galena increases ~~towards base of section, but is largely confined to thin~~ fractures and veinlets	5	1.0 Pb		
107.0			Argillite, pale green and minor pink interbands, pink bands increase to 50% to end of section. Fine laminar pyrite throughout. Bedding 60° to core axis	5			
117.2			Argillite as above, rare laminations of fine grained galena increase to base of section, in places crosscut bedding planes	5	1.0 Pb		
131.5			Argillite as above, galens in fractures with clean white quartz increases in this section; Bedding is distorted by small offsets, dominant bedding attitude is 30° to core axis	5	1.5 Pb		

DATE LOGGED BY

NORANDA EXPLORATION COMPANY, LIMITED

Collared	Completed	Core Size	Property	Project No 1093	NTS No.
FIELD COORDINATES			SURVEYED COORDINATES		Sheet 3 of 5
Set.	Elev.	Dip	Lat.	Elev.	Dip	Hole No.
Dep.	Depth	Bearing	Dep.	Depth	Bearing	145

Footage	Rec'y	Graphic Log	Description	% Sulp.	Est. Grade	Sample No.	Lt.				
133.5			Massive pyrite with minor fine grained galena fracture filling	90	1.0 Pb						
142.5			Argillite, dark grey, heavily pyritized, bedding at 45° to core axis. Galena banded parallel to bedding from 138 to 142.5	20	3.0 Pb						
146.0			Argillite, dark grey as above, rare fine grained disseminated galena, abundant laminar pyrite	5	0.5 Pb						
162.0			Argillite, interbanded pale green and pink bedded at 35° to core axis, some laminar pyrite throughout. Fault gouge or shear at 148.0 to 148.8	<5							
163.5			Quartzitic breccia, pebbles to 1/2" diameter, poor recovery								
165.0			Argillite, dark grey to black, heavily pyritic, sheared texture with clasts of quartzitic material. Appears to be reminiscent of footwall rocks	15							
202.0			Argillite, pale green with partings of black argillite, moderately pyritic throughout. Rare quartzite clasts show rims of siderite, minor flecks of galena. Pink alteration increases to base of section	10	Tr. Pb						
204.0			Argillite, pasty green, becoming heavily pyritized to base of section. Bedding 60° to core axis								

DATE _____ LOGGED BY _____

NORANDA EXPLORATION COMPANY, LIMITED

pllared	Completed	Core Size	Property	Project No 1093	NTS No.
FIELD COORDINATES			SURVEYED COORDINATES		Sheet 4 of 5
t.	Elev.	Dip	Lat.	Elev.	Dip
p.	Depth	Bearing	Dep.	Depth	Bearing

Hole No. 145

Footage	Rec'y	Graphic Log	Description	% Sulp.	Est. Grade	Sample No.	Lt.				
13.0			Massive pyrite	90							
15.5			Massive pyrite with coarse angular breccia of white quartz	75							
22.0			Argillite, dark grey and black with heavy pyrite throughout, bedding distorted by interlaminar shears and microfolds	25							
26.5			Massive pyrite	90							
41.8			Argillite, dark grey to black, heavily sheared, coarse pyrite throughout	25							
45.5			Massive pyrite in quartzite matrix with black argillaceous or graphitic partings	90							
50.2			Argillite, dark grey to black, sheared with minor clasts of white quartz; moderate pyrite throughout	25							
51.5			Massive pyrite	95							
57 EOH			Argillite, dark grey to black as above	25							

DATE _____ LOGGED BY R.S. Rogers

NORANDA EXPLORATION COMPANY, LIMITED

Collared	Completed	Core Size	Property	Project No 1093	NTS No.
FIELD COORDINATES			SURVEYED COORDINATES		Sheet 5 of 5
Set.	Elev.	Dip	Lat.	Elev.	Dip	Hole No.
Sup.	Depth	Bearing	Dep.	Depth	Bearing	145

Footage	Rec'y	Graphic Log	Description	% Sulp.	Est. Grade	Sample No.	Lt.				
			Recovery : 257.0 - 26.0 = 231.0 cored								
			220 feet recovered								
			220.0/231.0 = 95.2% Recovery								

DATE _____ LOGGED BY _____

NORANDA EXPLORATION COMPANY, LIMITED

Collared 06 Aug 81	Completed 07 Aug 81	Core Size BQ	Property Quartz Lake	Project No 1093	NTS No. 95 D 15
FIELD COORDINATES			SURVEYED COORDINATES		Sheet 1 of 3
Lat. 94.565 N	Elev. 3790	Dip -90	Lat.	Elev.	Dip -90	Hole No. 146
Dep. 99.700 E	Depth 317.0	Bearing	Dep.	Depth 317.0	Bearing

Footage	Rec'y	Graphic Log	Description	% Sulp.	Est. Grade	Sample No.	Lt.				
-94.0			Overburden, broken grey argillite and one foot of a grano diorite boulder. At 93.8, a 2" plug of massive galena								
100.0			Breccia of grey argillite and angular white quartz pebbles. Pebbles show preferral orientation and flattening at 60° to core axis. Breccia is well cemented and fairly competent.								
108.2			Argillite, banded black and dark grey with stockwork of 1/8" barren quartz veinlets. Bedding is 60° to core axis. Rare quartzitic laminae up to 1/8" thick occur.								
119.0			Breccia of argillaceous dolomite, fragments are angular up to 1" in diameter. Dolomite crystals well developed as enhedral saddle shapes on parting surfaces. Abundant grey metallic mineral fills breccia voids, hardness of 4. Streak black, feathery cleavage developed in places, possibly boulangerite								
121.2			Argillite, pasty green banded at 55° to core axis								
22.5			Argillite, dark grey grading into a coarse, angular breccia of grey argillite and grey quartzite similar to interval at top of hole								
130.0			Argillite, grey and green with bedding 50° to core axis; minor quartzite pods with disseminated pyrite	2							

DATE 08 August 81 LOGGED BY R.S. Rogers

NORANDA EXPLORATION COMPANY, LIMITED

oiiared	Completed	Core Size	Property	Project No 1093	NTS No.
FIELD COORDINATES			SURVEYED COORDINATES		Sheet 2 of 3
t.	Elev.	Dip	Lat.	Elev.	Dip	Hole No.
ep.	Depth	Bearing	Dep.	Depth	Bearing	146

Footage	Rec'y	Graphic Log	Description	% Sulp.	Est. Grade	Sample No.	Lt.				
153.0			Quartzite, light grey with partings of sheared green argillite. Moderate fine grained pyrite occurs as selvage in stockworking quartz veinlets. Pyrite increases towards base of section. At 149.2, 6" of massive galena in a sheared quartzitic matrix	2							
154.5			Breccia of white quartz and pale green argillite. Quartz pebbles are subangular with rims of clean, fine grained pyrite.	2							
234.5			Argillite, dominantly pink with minor green interbeds, banded at 45° to core axis. Quartzitic laminae increase to base of section, and moderate pyrite is associated with these. From 188.0 + 190.5, minor galena in quartz veinlets cross cutting the sediments. At 216.0 a 2" chunk of massive pyrite.	5							
239.0			Quartz, massive and white with minor fine grained pyrite along fractures, grading into :	2							
240.5			Argillite, green and highly sheared, becoming a muddy gouge at 240.0								
250.0			Massive pyrite in a quartzite matrix								

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NORANDA EXPLORATION COMPANY, LIMITED

ollared	Completed	Core Size	Property	Project No 1093	NTS No.
FIELD COORDINATES			SURVEYED COORDINATES		Sheet 3 of 3
st.	Elev.	Dip	Lat.	Elev.	Dip	Hole No.
ep.	Depth	Bearing	Dep.	Depth	Bearing	146

Footage	Rec'y	Graphic Log	Description	% Sulp.	Est. Grade	Sample No.	Lt.
310.0			Argillite, dark grey and black, convoluted bedding at 45° to core axis. Minor quartzitic pods, moderate pyrite throughout. Same unit identified in prior drilling as Black Thrust	5			
312.0			Fault gouge of grey, sheared argillite				
317.0 EOH			Argillite, banded pink and light green at 40° to core axis				
			RECOVERY : 317.0 - 94.0 = 223 feet cored				
			205 feet recovered				
			205/223 = 91.9% Recovery				

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NORANDA EXPLORATION COMPANY, LIMITED

Collared 08 Aug 81	Completed 11 Aug 81	Core Size BQ	Property Quartz Lake	Project No 1093	NTS No. 95 D 5
FIELD COORDINATES			SURVEYED COORDINATES		Sheet 1 of 2
Lat. 94.150 N	Elev. 3770	Dip -90	Lat.	Elev.	Dip -90	Hole No. 147
Dep. 99.700 E	Depth 305.0	Bearing	Dep.	Depth 305.0	Bearing

Footage	Rec'y	Graphic Log	Description	% Sulp.	Est. Grade	Sample No.	Lt.
42.0			Overburden, cased				
60.5			Argillite, interbedded grey and pale green, banded at 40° to core axis; scattered quartzite pods, usually with moderately pyritic selvage rims. Grades into :	5			
68.2			Quartiztie, grey and white, heavily pyritized and with minor sphalerite and galena in crosscutting fractures	20			
106.5			Massive pyrite with patchy galena and sulfosalts, minor black argillite partings and quartzitic pebbles in breccia towards base of interval	90			
125.5			Argillite, highly sheared, black and pyritic; banding indeterminate	5			
132.0			Argillite, pale green, moderately pyritic with black graphitic partings	5			
138.0			Quartzite, banded, black and white with heavy disseminated pyrite				
147.0			Argillite, green interbedded with quartzite; moderate pyrite laminae throughout				
150.0			Massive pyrite in quartzite				

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NORANDA EXPLORATION COMPANY, LIMITED

Collared	Completed	Core Size	Property	Project No. 1093	NTS No.
FIELD COORDINATES			SURVEYED COORDINATES		Sheet 2 of 2
Lat.	Elev.	Dip	Lat.	Elev.	Dip	Hole No. 147
Dep.	Depth	Bearing	Dep.	Depth	Bearing	

Footage	Rec'y	Graphic Log	Description	% Sulp.	Est. Grade	Sample No.	Lt.				
163.0			Argillite, black and minor dark grey. Moderately pyritic, banded 45° to core axis	10							
167.5			Argillite, pale green, light pyrite disseminated and in fractures	5							
177.0			Quartzite, black and grey, with moderately pyritic rims around quartzite grains. Black argillaceous partings	5							
181.0			Massive pyrite and pyritic mud	90							
295.5			Quartizte, dark grey to black, largely brecciated, moderately pyritic; black argillite partings	10							
296.5			Massive pyrite and pyritic mud	90							
305.0			Grey quartizte and grey argillaceous mud								
EOH			Casing left in hole 147								
			RECOVERY : 305.0 - 42.0 = 263.0 Cored								
			220 Recovered								
			220/263 = 83.6% Recovery								

DATE _____ LOGGED BY _____

NORANDA EXPLORATION COMPANY, LIMITED

Collared 11 Aug 81	Completed 13 Aug 81	Core Size BQ	Property Quartz Lake	Project No 1093	NTS No. 95 D 5
FIELD COORDINATES			SURVEYED COORDINATES		Sheet 1 of 2
Lat. 94.350 N	Elev. 3775	Dip -90	Lat.	Elev.	Dip -90	Hole No.
Dep. 99.900 E	Depth 262.0	Bearing	Dep.	Depth 262.0	Bearing	148

Footage	Rec'y	Graphic Log	Description	% Sulp.	Est. Grade	Sample No.	Lt.				
-61.0			Overburden : Chips and rounded pebbles of black limestone, grey quartzite and a distinctive quartz-augen rock at 45.0. Rounded pebbles suggest a fluvial environment here								
76.0			Argillite, grey green; interbanded with grey quartzite with pyritic partings increasing to base of section	2							
125.0			Massive pyrite in quartzite matrix, with minor black argillite. Fracture filling of a soft grey metallic mineral, may be stibnite or a boulangerite relative. Minor galena in places as breccia filling. Possibly ~~ruby silver traces near 78.5 for 6" section.~~ 92.0 to 97.0 no recovery, mislatch	95	1.0%Pb (?)						
127.8			Breccia : grey quartzite with heavy pyrite, minor galena near base	25	(?) 1.0%Pb						
167.8			Argillite, green and pasty, minor fractures filled with galena to 140.5. Pyritic fractures increase past 140.5 to 159.5 with minor galena values	5	(?) 1.0%Pb						

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NORANDA EXPLORATION COMPANY, LIMITED

Collared	Completed	Core Size	Property	Project No 1093	NTS No.
FIELD COORDINATES			SURVEYED COORDINATES		Sheet 2 of 2
Bt.	Elev.	Dip	Lat.	Elev.	Dip	Hole No.
Dep.	Depth	Bearing	Dep.	Depth	Bearing	148

Footage	Rec'y	Graphic Log	Description	% Sulp.	Est. Grade	Sample No.	Lt.				
68.2			Quartzitic breccia with sheared partings of green argillite								
49.5			Argillite, banded pink and purple and green with minor offset fractures filled with pyrite. Banding is 50° to core axis. 213.5 to 215.8 nearly massive pyrite	2							
62.0			Argillite, green and grey, highly sheared, moderate pyrite in fractures throughout	5							

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NORANDA EXPLORATION COMPANY, LIMITED

Collared 13 Aug 81	Completed 18 Aug 81	Core Size BQ	Property Quartz Lake	Project No 1093	NTS No. 95 D 5
FIELD COORDINATES			SURVEYED COORDINATES		Sheet 1 of 3
Lat. 93.955 N	Elev. 3780	Dip -90	Lat.	Elev.	Dip -90	Hole No. 149
Dep. 99.300 E	Depth	Bearing	Dep.	Depth	Bearing	

Footage	Rec'y	Graphic Log	Description	% Sulp.	Est. Grade	Sample No.	Lt.
37.0			Overburden				
38.5			Massive pyrite in black argillite matrix, minor galena in fractures	90%	1.5 Pb		
40.5			Argillite, black banded at 40° to core axis, heavily pyritized in parallel laminae and crosscutting veinlets of quartz	25%			
48.0			Massive pyrite with one 3" band of galena at 47.5	95%	1.07 Pb		
117.8			Argillite, black interbanded with grey quartzite at 45° to core axis, moderate pyrite throughtout	5%			
118.5			Massive pyrite	95%			
175.0			Argillite, black, interbedded with grey quartzite with banding 50° to core axis				
176.0			Massive pyrite	95%			
192.0			Black argillite and quartzite as above				
202.0			Argillite, pasty green with sheared contact at top of section				

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NORANDA EXPLORATION COMPANY, LIMITED

oilared	Completed	Core Size	Property	Project No	NTS No.
FIELD COORDINATES			SURVEYED COORDINATES		Sheet 2 of 3
st.	Elev.	Dip	Lat.	Elev.	Dip	Hole No.
ep.	Depth	Bearing	Dep.	Depth	Bearing	149

Footage	Rec'y	Graphic Log	Description	% Sulp.	Est. Grade	Sample No.	Lt.				
205.5			Pyritic mud	75%							
259.0			Argillite, green and grey interbedded with grey quartzite; all highly sheared								
295.0			Argillite, dark grey with 50% angular clasts of white quartz								
299.5			Massive pyrite with grey quartzitic matrix	95%							
357.0			Argillite, grey; heavily sheared with banding at 45° to core axis. Moderate disseminated pyrite	10%							
360.0			Pyritic mud	90%							
399.0			Argillite, dark grey with mottled white clasts or mylonite of quartzite								
422.0			Quartzite, barren grey and undisturbed								
434.0			Argillite, black with moderate pyrite disseminations	10%							
442.0			Quartzite, barren grey as above								

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NORANDA EXPLORATION COMPANY, LIMITED

ollared	Completed	Core Size	Property	Project No 1093	NTS No.
FIELD COORDINATES			SURVEYED COORDINATES		Sheet 3 of 3
st.	Elev.	Dip	Lat.	Elev.	Dip
ep.	Depth	Bearing	Dep.	Depth	Bearing

Hole No. 149

Footage	Rec'y	Graphic Log	Description	% Sulp.	Est. Grade	Sample No.	Lt.
445.0			Pyritic silt, very fine grained, grading into :				
460.0 EOH			Quartzite, grey and highly sheared				
			Note : Hole encountered artesian conditions at this depth, and drilling was no longer feasible. Hole 149 abandoned, casing left in ground.				

DATE _____ LOGGED BY _____

NORANDA EXPLORATION COMPANY, LIMITED

Collared	Completed	Core Size	Property	Project No	NTS No.
19 Aug 81		BQ	Quartz Lake	1093	95 D 5

FIELD COORDINATES			SURVEYED COORDINATES			
Lat. 96.050 N	Elev. 4200'	Dip -90	Lat.	Elev.	Dip	Hole No. 150
Dep. 101,600 E	Depth 500	Bearing	Dep.	Depth	Bearing	

Sheet 1 of 2

Footage	Rec'y	Graphic Log	Description	% Sulp.	Est. Grade	Sample No.	Lt.
0-11			Overburden				
37.2			Argillite, green; highly sheared with convoluted banding and microfoliation; dominant bedding is at 40° to core axis				
103.5			Argillite, rusty green and grey with minor quartz stock-working. No visible sulphides in this section. Some minor interlaminar quartzite lenses throughout section				
120.5			Argillite, rusty green and grey, slightly more competent than above section. Banding is at 65° to core axis				
152.0			Limestone, grey to black with crosscutting calcite veinlets. Banding is 65° to core axis, no visible sulphides. Grades into :				
173.5			Argillite, rusty brown and bleached purple with bedding dominantly at 75° to core axis. No sulphides in this section				
279.0			Argillite, green and pasty, monotonous barren section bedded at 70° to core axis. Minor rusty argillite on partings. No sulphides evident.				

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NORANDA EXPLORATION COMPANY, LIMITED

ollared	Completed	Core Size	Property	Project No 1093	NTS No.
FIELD COORDINATES			SURVEYED COORDINATES		Sheet 2 of 2
st.	Elev.	Dip	Lat.	Elev.	Dip	Hole No. 150
ep.	Depth	Bearing	Dep.	Depth	Bearing	

Footage	Rec'y	Graphic Log	Description	% Sulp.	Est. Grade	Sample No.	Lt.				
308.5			Argillite, green interbedded with rusty pink, tight convoluted folds throughout, bedding 60° to core axis. Rusty partings at 285.0 and a small (3 inch) band of rusty quartz. No visible sulphides. At 301.0, minor shear or fault gouge								
392.5			Argillite, pasty green with dark green partings banded 50° to core axis. At 337.5, one inch of grey quartzite with an oolitic texture. Other quartzite bands from 362.0 to 363.5; 368.5 to 369.5; 372.2 to 373.5								
407.0			Argillite, grey and black, highly sheared; graphitic slips, no sulphides. Poor recovery here (less than 50%)								
465.0			Argillite, grey and black with minor green. Banding 45° to core axis; no sulphides. Rare quartzitic pods								
500.0			Argillite, grey and black, highly sheared, mylonitic in places, occasional clasts of pasty green argillite or grey quartzite. "Black Thrust" type stratigraphy								

DATE LOGGED BY

APPENDIX III

1981 Sample Reports

NORANDA EXPLORATION COMPANY, LIMITED

N.T.S. 95D /5

PROPERTY QUARTZ LAKE 1093

DATE August 8, 1981

SAMPLE REPORT

SAMPLE NO.	LOCATION & DESCRIPTION	TYPE	WIDTH Feet	ASSAYS Ag	Pb	Zn					SAMPLED BY
226	DDH 145 82.0 - 87.0 Feet	BQ	5	1.16	2.00	0.02					Rogers
227	" " 107.0 - 112.0 "	"	5	0.30	0.44	0.04					Firko
228	" " 112.0 - 117.0 "	"	"	0.88	1.32	0.04					"
229	" " 117.0 - 122.0 "	"	"	0.24	0.46	0.12					"
230	" " 122.0 - 127.0 "	"	"	0.18	0.34	0.02					"
231	" " 127.0 - 132.0 "	"	"	2.98	4.54	0.02					"
232	" " 132.0 - 137.0 "	"	"	1.26	2.74	0.02					"
233	" " 137.0 - 142.0 "	"	"	0.03	0.08	0.02					"
234	" " 142.0 - 147.0 "	"	"	1.06	2.78	0.02					"
235	" " 147.0 - 152.0 "	"	"	0.06	0.12	0.02					"
236	" " 152.0 - 157.0 "	"	"	0.02	0.02	0.02					"
237	" " 157.0 - 162.0 "	"	"	0.60	0.94	0.02					"
238	" " 162.0 - 167.0 "	"	"	0.10	0.08	0.02					"
239	" " 167.0 - 172.0 "	"	"	0.04	0.06	0.02					"
240	" " 197.0 - 202.0 "	"	"	0.02	0.02	0.02					"
241	" " 202.0 - 207.0 "	"	"	0.42	0.12	0.02					"
242	" " 207.0 - 212.0 "	"	"	5.02	0.32	0.02					"

NORANDA EXPLORATION COMPANY, LIMITED

N.T.S. 95D/5

PROPERTY QUARTZ LAKE 1093

DATE August 8, 1981

DDH 145

SAMPLE REPORT

MPLE NO.	LOCATION & DESCRIPTION	TYPE	WIDTH Feet	ASSAYS							SAMPLE BY
				Ag	Pb	Zn					
243	DDH 145 212.0 - 217.0 Feet	BQ	5	0.44	0.02	0.02					Firko
244	" " 217.0 - 222.0 "	"	"	0.08	0.02	0.02					"
245	" " 222.0 - 227.0 "	"	"	0.30	0.12	0.02					"
246	" " 227.0 - 232.0 "	"	"	0.10	0.02	0.02					"
247	" " 232.0 - 237.0 "	"	"	0.16	0.09	0.02					"
248	" " 237.0 - 242.0 "	"	"	0.24	0.08	0.02					"
249	" " 242.0 - 247.0 "	"	"	0.38	0.18	0.02					"
250	" " 247.0 - 252.0 "	"	"	0.06	0.02	0.02					"
251	" " 252.0 - 257.0 "	"	"	0.06	0.02	0.02					"

NORANDA EXPLORATION COMPANY, LIMITED

N.T.S. 95D/5

PROPERTY QUARTZ LAKE 1093 DATE August 14, 1981

SAMPLE REPORT

DDH 146

SAMPLE NO.	LOCATION & DESCRIPTION	TYPE	WIDTH Feet	ASSAYS Ag	Pb	Zn					SAMPLED BY
0252	DDH 146 103.0 - 108.0 Feet	BQ	5	0.12	0.14	0.06					Rogers
0253	" " 108.0 - 113.0 "	"	"	3.30	4.40	0.06					"
0254	" " 113.0 - 118.0 "	"	"	4.54	7.40	0.02					"
0255	" " 118.0 - 123.0 "	"	"	0.10	0.14	0.02					"
0256	" " 123.0 - 128.0 "	"	"	0.02	0.06	0.02					"
0257	" " 128.0 - 133.0 "	"	"	0.10	0.10	0.04					"
0258	" " 133.0 - 138.0 "	"	"	0.02	0.02	0.02					"
0259	" " 138.0 - 143.0 "	"	"	0.24	0.42	0.02					"
0260	" " 143.0 - 148.0 "	"	"	3.00	0.22	0.02					"
0261	" " 148.0 - 153.0 "	"	"	4.52	3.38	0.02					"
0262	" " 183.0 - 188.0 "	"	"	0.12	0.04	0.02					"
0263	" " 188.0 - 193.0 "	"	"	0.12	0.22	0.02					"
0264	" " 193.0 - 198.0 "	"	"	0.02	0.02	0.02					"
0265	" " 242.0 - 247.0 "	"	"	2.50	0.62	0.02					"
0266	" " 247.0 - 252.0 "	"	"	11.7	0.76	0.02					"

NORANDA EXPLORATION COMPANY, LIMITED

N.T.S. 95D/5

PROPERTY QUARTZ LAKE 1093

DATE August 16, 1981

DDH 147

SAMPLE REPORT

MPLE NO.	LOCATION & DESCRIPTION	TYPE	WIDTH Feet	ASSAYS							SAMPLE BY
				Ag	Pb	Zn					
0267	DDH 147 52.0 - 57.0 Feet	BQ	5	0.04	0.02	0.02					Firko
0268	" " 57.0 - 62.0 "	"	"	0.02	0.02	0.02					"
0269	" " 62.0 - 67.0 "	"	"	0.10	0.02	0.02					"
0270	" " 67.0 - 72.0 "	"	"	0.22	1.48	0.02					"
0271	" " 72.0 - 77.0 "	"	"	0.12	0.26	0.02					"
0272	" " 77.0 - 82.0 "	"	"	0.40	0.68	0.02					"
0273	" " 82.0 - 87.0 "	"	"	0.16	0.20	0.02					"
0274	" " 87.0 - 92.0 "	"	"	0.16	0.02	0.02					"
0275	" " 92.0 - 97.0 "	"	"	0.12	0.02	0.02					"
0276	" " 97.0 - 102.0 "	"	"	0.26	0.12	0.02					"
0277	" " 102.0 - 107.0 "	"	"	0.16	0.04	0.02					"
0278	" " 142.0 - 147.0 "	"	"	0.04	0.02	0.02					"
0279	" " 147.0 - 152.0 "	"	"	0.04	0.02	0.02					"
0280	" " 152.0 - 157.0 "	"	"	0.04	0.02	0.02					"
0281	" " 172.0 - 177.0 "	"	"	0.16	0.64	0.02					"
0282	" " 177.0 - 182.0 "	"	"	0.22	0.34	0.02					"
0283	" " 182.0 - 187.0 "	"	"	0.26	0.74	0.02					"

NORANDA EXPLORATION COMPANY, LIMITED

N.T.S. 95D/5

PROPERTY QUARTZ LAKE 1093 DATE August 22, 1981

SAMPLE REPORT

DDH 149

SAMPLE NO.	LOCATION & DESCRIPTION	TYPE	WIDTH Feet	ASSAYS Ag	Pb	Zn					SAMPLED BY
0304	DDH 149 37.0 - 41.0 Feet	BQ	4	2.24	5.86	0.02					Firko
0305	" " 41.0 - 46.0 "	"	5	0.26	0.36	0.22					"
0306	" " 46.0 - 51.0 "	"	"	1.82	5.60	0.28					"
0307	" " 112.0 - 117.0 "	"	"	0.12	0.14	0.02					"
0308	" " 117.0 - 122.0 "	"	"	0.04	0.08	0.02					"
0309	" " 122.0 - 127.0 "	"	"	0.20	0.68	0.02					"
0310	" " 167.0 - 172.0 "	"	"	0.02	0.02	0.02					"
0311	" " 172.0 - 177.0 "	"	"	0.04	0.02	0.02					"
0312	" " 177.0 - 182.0 "	"	"	0.04	0.02	0.02					"
0313	" " 200.0 - 205.0 "	"	"	0.12	0.02	0.02					"
0314	" " 205.0 - 210.0 "	"	"	0.06	0.02	0.02					"
0315	" " 290.0 - 295.0 "	"	"	0.16	0.02	0.02					"
0316	" " 295.0 - 300.0 "	"	"	0.04	0.02	0.02					"
0317	" " 300.0 - 305.0 "	"	"	0.02	0.02	0.02					"

APPENDIX IV

Preliminary report on the Geology of the Quartz Lake Deposit, Yukon Territory , by Pierre Vaillancourt

PRELIMINARY REPORT ON THE GEOLOGY OF THE QUARTZ LAKE DEPOSIT, YUKON TERRITORY

Pierre Vaillancourt
Noranda Exploration
Whitehorse, Yukon Territory

Introduction

The Quartz Lake property is a sedimentary hosted Ag-Pb-Zn deposit of Proterozoic age, there are no fossils in any rock group on the property. The rocks on the property comprise four groups, three of which are limestone, argillite, and quartzite packages. The fourth and oldest formation contains only limestone. The sediments are fair to well preserved, but sedimentary features are either not present or masked by a very low grade metamorphism. Based on stratigraphy, the property forms a syncline trending in a north-northwest direction.

The purpose of this report is to give a preliminary outline on work done by the author over the summer of 1981 for his M.Sc. thesis at the University of Western Ontario. In the following pages the lithology, structural geology, economic geology and genesis will be reviewed. The treatment of each subject is only meant to be taken as an introductory reference. More careful, detailed study of the property to be undertaken during the 1981-82 academic year will hopefully clarify many unresolved issues brought up in this report.

Location and Access

The Quartz Lake Ag-Pb-Zn property is located approximately 40 miles northeast of Watson Lake, Yukon and immediately

south and west of Quartz Lake. Elevations on the property range from 3000 to 5000 feet above sea level. The terrain is typified by rounded tree covered hills and drift-filled valleys. Good outcrop exposures are rare.

Access to the property is by helicopter or fixed wing aircraft from Watson Lake, Yukon Territory to either Quartz or Noranda lakes or to a number of helicopter pads on the property. Travel around the property and to and from the lake is on a system of cat-trails.

History

The McMillan showing was first discovered in 1892 by prospectors from the Cassiar gold fields. It was re-discovered by Ken McMillan in 1948 and optioned late in that year to Noranda Mines Limited. In 1951, American Smelting and Refining Company (ASARCO) entered into a joint venture agreement with Noranda. The joint venture resulted in the formation of Liard River Mining Company Limited in which ASARCO earned a majority interest by 1974. In 1975 Noranda entered into a new joint venture agreement with ASARCO and Liard River Mining by which Noranda could earn a majority interest through work commitments. In 1980 the joint venture arrangement agreed upon between Noranda Exploration and ASARCO Exploration was formalized.

Previous Geological Work

Geophysics

In 1953 and 1955, ASARCO conducted vertical and horizontal loop EM surveys in the vicinity of the Main Zone mineralization in an attempt to define and extend ore zones developed to that time. Canadian Aero Mineral Surveys, under contract to ASARCO in 1968 produced an I.P. survey of the central part of the property. In 1975, Noranda Exploration conducted an extensive CEM survey of the property. W. Sharpe, as contractor to Noranda Exploration in 1975 and 1976, conducted gravity surveys of much of the Quartz Lake Property. A VLF-Em survey carried out by Noranda Exploration in 1976 indicated numerous northerly trending anomalies. Additional geophysical surveys were carried out during the summer of 1981.

Geological Surveys

Considerable prospecting and geological mapping has been carried out on the Quartz property since the 1950's. Among those who have contributed to the geological knowledge through the years are: B. Brynelsen, R. H. Barker, A. D. Hall, S. N. Kesten, C. J. Conveney, G. A. Dirom, E. P. Bayley, J. Stockwell, G. Belik, G. E. Dirom, D. Olsen, J. Morin and R. Rogers.

Geochemical Surveys

The Quartz Lake property has been extensively tested by geochemical techniques, including biogeochemistry (1952) and silt and soil geochemical surveys (1968, 1975, 1976, 1980). These surveys tend to reflect mineralization presently known or possibly glacially-transported anomalies hydromorphically upgraded.

Drilling

To date 149 diamond drill holes totalling over 40,000 feet have been drilled at the Quartz Lake property. Early drilling in the 1950's was performed with light equipment and small diameter core and encountered considerable difficulty. Later drilling, utilizing modern technology, produced good to excellent penetration rates and recovery.

Physiography and Topography

The Quartz Lake Property lies on the height of land between the Hyland and Coal Rivers and near the northern end of a long ridge running 50 miles north from Irons Creek on the Alaska Highway. Maximum elevations near the property are in the order of 5000 feet with valleys in the order of 2700 to 3000 feet above sea level. The Hyland and Coal Rivers have elevations in this area of approximately 2500 feet. The area has been glaciated extensively and is characterized by subdued mountain ranges and drift-

filled valleys. Bedrock exposures are rare (mostly restricted to incisions by creeks) and total outcrop on the Quartz Lake property is probably less than 5%. Any area with poor drainage is invariably swampy and most larger streams have been dammed by beavers.

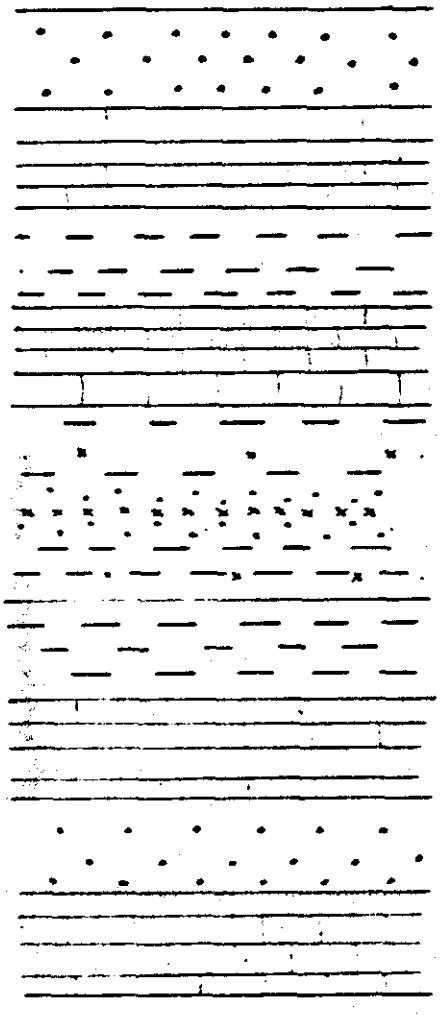
Climate and Vegetation

The Quartz Lake area has a continental climate characterized by low annual precipitation and a wide temperature variance between summer and winter. Winters are cold (minimum temperatures -50 C) and long, while the summers are relatively short and warm. The snow melts between the middle and the end of the month of May. Thundershowers and ground fog are common in the summer months.

Vegetation in this region consists mainly of small (to 8 inches diameter) jackpine, poplar and various scrub brush (alder, dwarf birch, willow, etc.). Stunted black spruce is the common tree on the north-facing slopes, where discontinuous permafrost may be encountered. Timberline is approximately 4500 feet above sea level.

Lithology

The Quartz Lake property is covered by extensive glacial drift ranging from 0 to over 250 feet in thickness.



LIGHT GREY QUARTZITE

GREY LIMESTONE

TURQUOISE TO GREEN ARGILLITE.

RIDGE GROUP

GREY LIMESTONE
SILICEOUS IN PLACES

* ORE HORIZON : CORE OF MASSIVE PYRITE GRADING OUT TO SULFIDE HOSTING QUARTZITE, THEN TO SULFIDE HOSTING ARGILLITE WHICH GOES INTO BARREN ARGILLITE.

MINE GROUP

LIGHT GREEN ARGILLITE
BLACK AND SHEARED IN PLACES

GREY LIMESTONE

QUARTZITE
TAN TO BROWN COLOR

RANGE GROUP

CANYON FORMATION LIMESTONE

CANYON FORMATION

- STRATIGRAPHY IN THE QUARTZ LAKE AREA

* x DENOTES SULFIDES

Rock exposures are rare. The property is underlain by Proterozoic (Hadrynian) and/or Lower Cambrian weakly metamorphosed sediments that have been divided locally into four units. The four units, in stratigraphic succession, are: the oldest Canyon Formation, overlain by the Range group, followed by the ore-hosting Mine group and the youngest Ridge group. The three younger groups have many similarities between them, making rock identification difficult at times, however, distinguishing features exist for most units.

Canyon Formation

The Canyon Formation is the oldest lithologic unit. It is located to the west of the property and consists primarily of buff to grey platy limestone. The limestone is typically thin bedded (1-3 cm), but well consolidated and often forms ridges. The composition is very uniform, the limestone is fine grained and grey with no notable variations in the rock. No textures or discernable sedimentologic features are observable.

Range Group

The Range group overlies the Canyon Formation and contains three units: argillite, quartzite and limestone. The most common unit is the Range group quartzite. The Range quartzite is very resistant, usually massive and is generally a light coloured rock (light grey, beige or

tan). The grain size varies but typical Range group quartzite is medium to coarse grained with rounded grains. Fine grained Range group quartzites do occur, however. Range group quartzites can take on different distinguishing characteristics according to where they are located. In some places, the quartzites have iron staining to the point where the rock resembles a gossan, in other areas the quartzites have distinctive quartz eyes, taking on a tuffitic appearance. In some localities, the Range quartzite can be almost like a sandstone instead of its usual crystalline texture.

The Range group argillite can be divided in two members. One member consists of green-grey to brown argillite while the other member is a grey black argillite which is heavily sheared and may be associated with thrusting.

The green-grey argillite member is most often a light green to aquamarine coloured rock. This argillite is a very thin bedded (a few mm to 1 cm generally) unit which is fine grained and very uniform in composition. The rock is fissile and there are no distinguishing textural features. In a few localities, the Range group argillite forms thin interbeds within the massive Range group quartzite, most often however, it is a continuous argillite body.

The grey-black argillite is very convoluted and irregular. This member is a result of shear associated with thrusting or folding between units of different competence.

The rock often contains graphitic partings. This member consists mostly of very soft to loosely consolidated argillite with quartzitic clasts and stringers distributed throughout. Grey to light grey quartzite intervals are common. Disseminated to massive pyritic sections occur within the black argillite.

The Range group limestone is a grey weathering, dark grey unit which is usually massive in appearance and can be very hard and resistant. The limestone contains calcite stringers but otherwise is uniformly grey and fine grained throughout. Rarely, the Range group limestone contains fissile, thin bedded members.

Mine Group

The Mine group lies above the Range group and like the preceding unit, has a quartzite, a limestone and an argillite.

The Mine group limestone is a buff to grey weathering, grey rock which can be very siliceous at times. Like the Range group limestone, the Mine limestone has calcite veinlets and stringers, however, the calcite is more pervasive in the Mine limestone. Composition and appearance are not as homogeneous as for the Range group. The Mine limestone can be fine grained in the more calcareous sections, to cryptocrystalline for the siliceous intervals. Although the Mine limestone is best characterized as massive, there are many sections of medium to thin bedded, platy

limestone. The distinguishing characteristic remains the light grey shade and the pervasive calcite veinlets.

The Mine group argillite is a light green, thin bedded, fissile unit. It is present mostly in the Mine Creek area of the map sheet. The argillite can be altered to pink, red or purple.

The Mine group quartzite occurs mostly interbedded with the Mine argillite. This quartzite is commonly white to light grey, has yellow sulfur staining and is fine to medium grained. The quartzite is massive to blocky and is uniform in composition.

The Mine group argillite and quartzite host the economic mineralization of the Quartz Lake property. Sulfides include pyrite, sphalerite, galena; in addition, sulfosalts and silver are present in some localities. Economic geology will be treated in more detail later in the report.

Ridge Group

The Ridge group is the youngest group of rocks on the property. Once again, the group contains a sequence of argillite, limestone and quartzite. The argillite is turquoise green, thin bedded and phyllitic on occasion. The composition is very uniform and fine grained throughout all sections. The rock is fissile and the beds are usually continuous unless disrupted structurally. The limestone of the Ridge group is generally grey, mottled, and thin to

medium bedded. The composition of this limestone is uniform, there are no calcite veinlets as in the other groups.

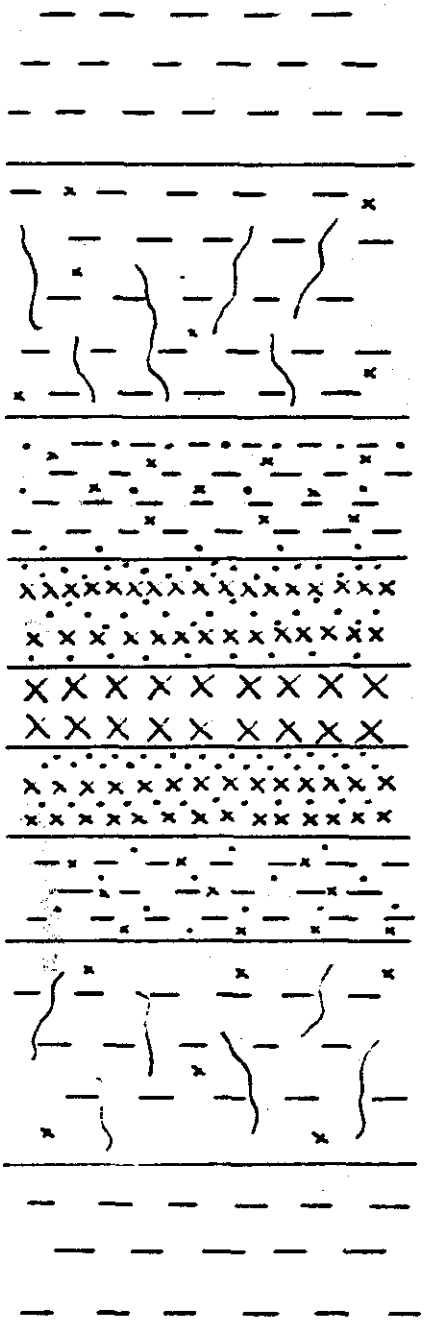
The quartzite of the Ridge group is variable in composition but is distinguished by being very light grey and sulfur stained for the Mine group quartzite. However, the Ridge group quartzite can also be tan and devoid of sulfur staining. The Ridge group quartzite is not economic but does contain sections of disseminated and massive pyrite.

In general, this quartzite is resistant and ridge forming. It also is interlayered occasionally with Ridge group argillite.

Economic Geology

The Quartz Lake property is comprised of two zones of economic mineralization, contained within Mine group quartzites and argillites: the Main Zone located along Mine Creek to the north and the South Zone to the south.

The Main zone deposit (or the McMillan deposit) is a northwest trending, gently east dipping lenticular body of massive sulphide mineralization. The thickness and highest grade section of the McMillan deposit is coincident with a small antiform structure which trends northwesterly. The Main zone has a maximum width of 500 feet, a length of 2000 feet, and a variable thickness of 5 to 80 feet. Mineralization consists of pyrite, sphalerite, galena,



LIGHT GREEN ARGILLITE DEVOID OF ANY SULPHIDES

LIGHT GREEN ARGILLITE HOSTING SPHALERITE GALENA AND PYRITE VEINLETS. MINOR DISSEMINATED SULPHIDES PRESENT ALSO

CALCAREOUS QUARTZITE INTERBEDDED WITH LIGHT GREEN ARGILLITE HOSTING DISSEMINATED SPHALERITE GALENA AND PYRITE

CALCAREOUS QUARTZITE HOSTING LAYERS OF SPHALERITE GALENA AND PYRITE

MASSIVE FINE TO MEDIUM GRAIN PYRITE GALENA AND SPHALERITE MAY ALSO BE PRESENT

* - IDEALIZED SEQUENCE OF ECONOMIC MINERALIZATION IN THE MINE GROUP AT THE QUARTZ LAKE DEPOSIT, YUKON TERRITORY.

* x DENOTES SULFIDES

arsenopyrite, boulangerite, meneghinite, tetrahedrite, stibnite, and ankerite. There are several modes of mineralization. The most widely distributed mode is with a core of massive pyrite grading outward (up and down) into quartzite hosting disseminated pyrite, galena and sphalerite to a zone of vein type and disseminated mineralization within interbedded light green argillite and white to light grey quartzite. The massive pyrite layers and the quartzite bodies are generally continuous and consistent in thickness. The economic zone eventually grades outward to a light green argillitic section which hosts discordant and crosscutting veins of sphalerite and galena. Very often, these veins of sphalerite and galena occur in argillite which is separate from any massive pyrite or sulfide hosting quartzite bodies. This occurrence of sulfides is suggestive that the vein type of mineralization may be a different mode of mineralization from the tabular massive type.

The third mode of mineralization (and the least well understood) consists of predominantly galena occurring in a dolomitic breccia matrix. The breccia zones vary in thickness from less than a foot to 12 feet at times. This breccia mineralization is not common but when present contains significant amounts of Pb.

The South zone of the property has the same modes of mineralization as the Main zone, however there are important

differences between the two. The South zone has a higher proportion of galena bearing dolomite breccia intervals, this may help explain why the South zone has a high galena/sphalerite ratio while the Main zone has a high sphalerite/galena ratio. Stratigraphically, the ore horizons in the South zone are not equivalent with those of the Main zone, which suggests a structural offset may have affected the continuity of the orebody between the North and South zones.

The presence of sulphosalts and antimony in the Main and South zones does not define any clear pattern which can fit into the sequence of mineralization or a zonation within the ore horizon.

Structural Geology

Because of poor exposure throughout the property, very little definitive information could be obtained from the structure. Two notable features can be observed from the structural geology on the property.

1. To the west of the property along Mine Creek, the rocks are in a tensional environment; where there is good enough outcrop, faults with normal offsets and tensional fractures can be seen. The faults have a north to northeast strike and dip steeply (60 -85) to the east. In the case of the faults, the offset usually is no greater than a few feet. It is suspected that there may be more significant

displacements which are hidden by overburden.

2. To the east of the property, reverse faulting and thrust faulting is most apparent. Particularly to the northeast along Pyrite Creek, thrusting in a northwest direction appears to have affected the rocks. Along Pyrite Creek the Ridge group argillites display chevron folds as a result of the tectonic activity.

The most contentious point on the structural geology concerns the Black Fault, a zone made up of Range group black argillites interbedded occasionally with quartzites which, as mentioned previously, are strongly affected by shear. Based on this lithological evidence, it is suggested that the Black fault is a zone of thrusting parallel to subparallel to stratigraphy which trends north to northwest with an average dip of 30 to the east.

Alteration

Alteration is visible in the Mine group argillites. The argillites can be grey, green, pink, red or purple depending on their stratigraphic position as well as their lateral position from the ore zone. Along Mine Creek, moving away from the highest sulfide content area, the argillites grade from light green to pink to brick red to purple, furthest away to the south. It is not as clearly visible, but alteration intensity seems to increase with depth.

The alteration is caused possibly by fine hematite which imparts a purple to red colour to the Mine group argillites. Belik (1976) states that during mineralization, hematite was altered to pyrite resulting in a bleaching of the host rocks. This bleaching may be responsible for the light green colour of the Mine argillites. The bleaching process was widespread since most of the argillite in the other units has a light green colour as well.

Genesis

The Quartz Lake property presents many incongruities relating to the genesis of the orebodies. On the subject of ore morphology, the ore is present in the form of tabular layers, appearing as stratiform bodies. Contour interval maps done for the Main and South zones indicate a general dip to the east for most of the ore horizon. The zoning is consistent in that it gradually grades out from a massive pyrite layer to mineralized quartzite horizons to low grade argillite hosted sulfides. There is no mineralization along any faults. In contrast, sulfides are present in discordant veins to a sufficient degree that this mode of mineralization may represent a different ore forming event. Finally, dolomite breccia hosted galena is different again from the two other mineralizing events.

From megascopic observations by the author, the sul-

fides are present mostly in quartzite or argillite intervals when they are not in massive form (dolomite breccias hosting galena are relatively minor in comparison to the quartz or vein hosted type). The wide assortment of sulfides along with the presence of anomalous sulfosalts and antimony also bring into question the timing of mineralization at Quartz Lake. Previous workers have identified the sulfides occurring as partial to complete replacement of calcareous horizons within the Mine group. It is likely that sulfides occur in all these rock types, but the prevailing mode of mineralization is yet to be determined.

The age of mineralization is also questionable. The rocks on the property are accepted as being of Proterozoic to Lower Cambrian in age (there are no fossils in the rocks of the area), however, lead isotopes from the Main zone indicate an age of mineralization of 100 million years. This age of mineralization is contemporaneous with Cretaceous granodiorite stocks in the region.

From this contradictory evidence, the deposit could be syngenetic or epigenetic. Did the source of sulphides come from the Proterozoic rocks of the area or could they have been derived from a granodiorite at depth or within the region? Could the ore fluids have been transported along the supposed thrust sheets of the area? Alternatively, could the normal faulting in the Mine Creek area indicate

that a basinal environment controlled the migration of ore fluids?

Because of the Proterozoic age of the rocks, as well as the stratiform nature of the orebody, it is possible that the deposit is syngenetic and that the mineralizing solutions travelled along favourable horizons and then dissipated into the overlying and underlying rocks in the form of disseminations and veinlets.

On the other hand, Pb-isotope data shows that the galena is 100 million years old. This evidence favours the ore forming event as being epigenetic. The cross-cutting veinlets which do not conform to any bedding and the presence of sulfosalts are evidence that there is an epigenetic imprint. Furthermore, although the tabular zones of mineralization maintain a constant thickness, they are not continuous over long distances and so may just be favourable areas for the epigenetic reduction of sulfides and their precipitation.

In keeping with the 100 million year date of mineralization, and the calcareous nature of the host rocks, another theory may be that Quartz Lake is a manto deposit caused by replacement of carbonate above a granite body which must be deep seated. This idea is hard to document since there is no known granite body within any proximity to the ore zone at Quartz Lake.

Reviewing the geology of the property, it is likely

that the Main and South zones were influenced by both syngenetic and epigenetic parameters, there is no single mechanism that governed the formation of ore. It is possible that a sequence of events from the Proterozoic to the Cretaceous lead to the existence of the Quartz Lake orebody as it is now known. Beginning in the Proterozoic, ore fluids were exhaled and then transported, possibly into a basinal environment. Because ore horizons are repetitious, sulfides were probably generated in pulses, giving rise to several ore sequences with massive pyrite in the core. The source for the sulfides may have been the country rocks in the area. As with many Precambrian sedimentary rocks (particularly Canadian Shield rocks), the metals may have been removed from uraniferous rocks, the Pb and Zn, once removed from the uranium, are transported until they come into contact with reducing solutions. Once reduced, the metals are deposited and their composition remains fixed. Following deposition and lithification of the sediments, little happened until Cretaceous time when a second phase acted on the ore zone to remobilize sulfides and deposit them in veins and possibly breccia zones. Because of the 100 million year age, it is suspected that the mechanism which gave rise to the second mineralizing event may have been the occurrence of granodiorite plutons in the region. Plutons initiated a thermal convection system which affected the existing ore deposit to open fractures and recirculate

sulfides discordantly. If this process was active, the thermal source is uncertain. If the pluton were underlying the sediments of the property, it would have to be at great depth since no drilling to date has turned up any supportive evidence. If the pluton is from the region, the thermal effect would have to be widespread since there are no granodiorites that are within reasonable proximity to the Quartz Lake deposit. At this time, it is difficult to assess the relative importance of the Cretaceous mineralizing event with respect to the Proterozoic one. More careful study of lead isotope data needs to be undertaken. The fact that the lead isotope aging indicates 100 million years old does not preclude that the second phase of mineralization may be unrelated to the emplacement of granodiorite plutons. Instead, later thrusting may have been responsible for causing a remobilization of sulfides.

Discussion

This report has only taken a superficial view of the geology in the Quartz Lake area; many subjects need better definition. However, it is possible to see where further study is needed.

Beginning with the lithological examination, petrographic work is required for each rock group, particularly the ore hosting Mine group. With respect to the economic

geology, petrology is necessary in identifying the composition of the ore bearing rocks and assessing their relative importance in the genetic process. The petrography would not only help identify the mineralogy but would also give an indication on the nature of mineralization; what is the diagenetic influence on the formation of pyrite? How many generations of mineralization are there? How significant is the epigenetic phase in forming the orebody? Can replacement textures be observed in the sulfides or sulfide hosting rocks? Finally, petrographic work would be helpful in assessing the nature of alteration and the relationship, if any, to the formation of sulfides.

The structural geology also needs clarification. Can the rapid variations in lithology and ore zones between holes be attributed to lateral facies changes or to structural displacement? How is the orebody affected by faulting? The property may be a series of en echelon normal faults or even a small basin. On the other hand, thrusting may have been the controlling structural feature. These problems can best be addressed by reviewing drilling data and correlating the geology between holes. In addition, the interpretation of mapping done on the property is incomplete at this point.

Finally, the genesis contains many unresolved questions. One of the least well understood points is the syngenetic versus epigenetic character of the deposit. Although some

lead isotope work has identified the age of mineralization at 100 million years, more extensive work is needed on more samples from representative parts of the ore zone to determine the extent of replacement in the deposit. Oxygen isotopes may be helpful in determining the nature of transporting fluids. If time allows, microprobe analyses should be conducted on samples from the Main and South zones to find out what metals and elements are present in what proportions in the hope of giving better definition to the zonation in the Quartz Lake deposit.

APPENDIX V

Quartz Lake Inventory

APPENDIX V

INVENTORY - QUARTZ LAKE CAMP

Core Shack	8'X12'	C/W drawing table, core splitter stand, shelves, airtight stove
Bunk House	16'X20'	8 bunks, 1 work table, 1 drawing table
Bunk House	10'X12'	3 bunks, airtight heater
Wash House	8'X12'	Shower stall, double stainless sink
Cook Shack	16'X20'	C/W cook's quarters, dinner table and benches, shelves, double sink, counters, airtight heater, coleman oil heater

Lumber	90'X2"X12"	Fir	48'X16"X16" Beams
	200'X2"X 4"	Fir	
	200'X2"X 2"	Fir	

Assorted plywood pieces. About 200 square feet 1/4" to 3/4" "D" grade.

Tent Pad	10'X12'	One only
Core Rack	With space for 2100 feet of BQ core.	

Assorted tools including axe, swede saw, hammer.

Nails	20 lbs.	Assorted 1" to 2 1/2" common
Buckets	6	Standard Galvanized, 1 laundry tub
Core Boxes	44	Routed BQ type
	12	Plywood BQ type

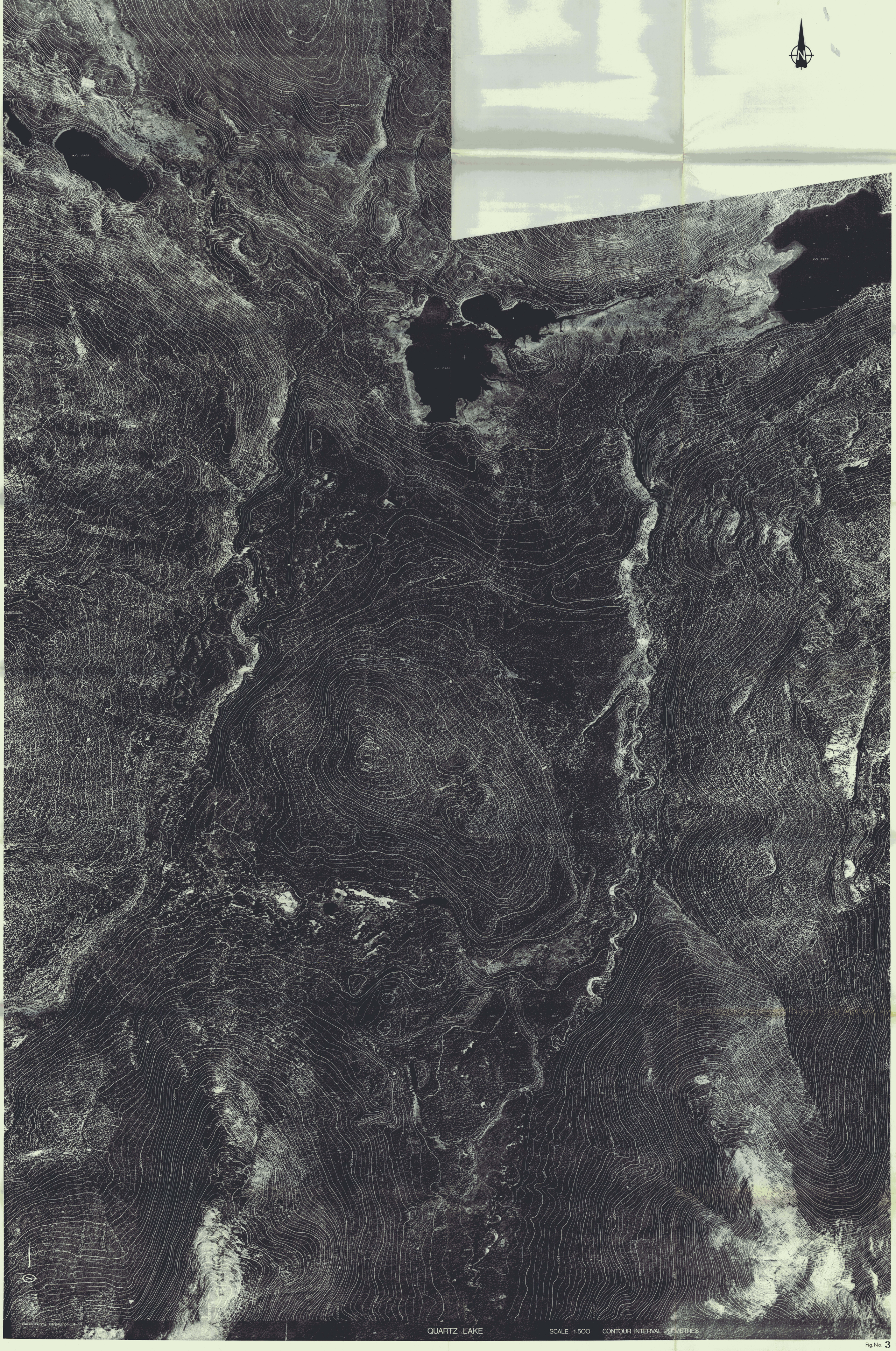

W/L 2925
W/L 2967
W/L 2965
Pacific Survey Corporation 81-91
QUARTZ LAKE
SCALE 1:500
CONTOUR INTERVAL 20 METRES

Fig. No. 3

L 20+00W
L 16+00W
L 12+00W
L 8+00W
L 4+00W
0+00 Baseline
L 4+00E
L 8+00E
L 12+00E
L 16+00E
L 20+00E
L 24+00E
L 28+00E
L 32+00E
L 36+00E
L 40+00E
44+00E Baseline
L 48+00E
L 52+00E
L 56+00E
L 60+00E
L 64+00E
L 68+00E
L 72+00E
L 76+00E
L 80+00E
84+00E Baseline
L 88+00E
L 92+00E

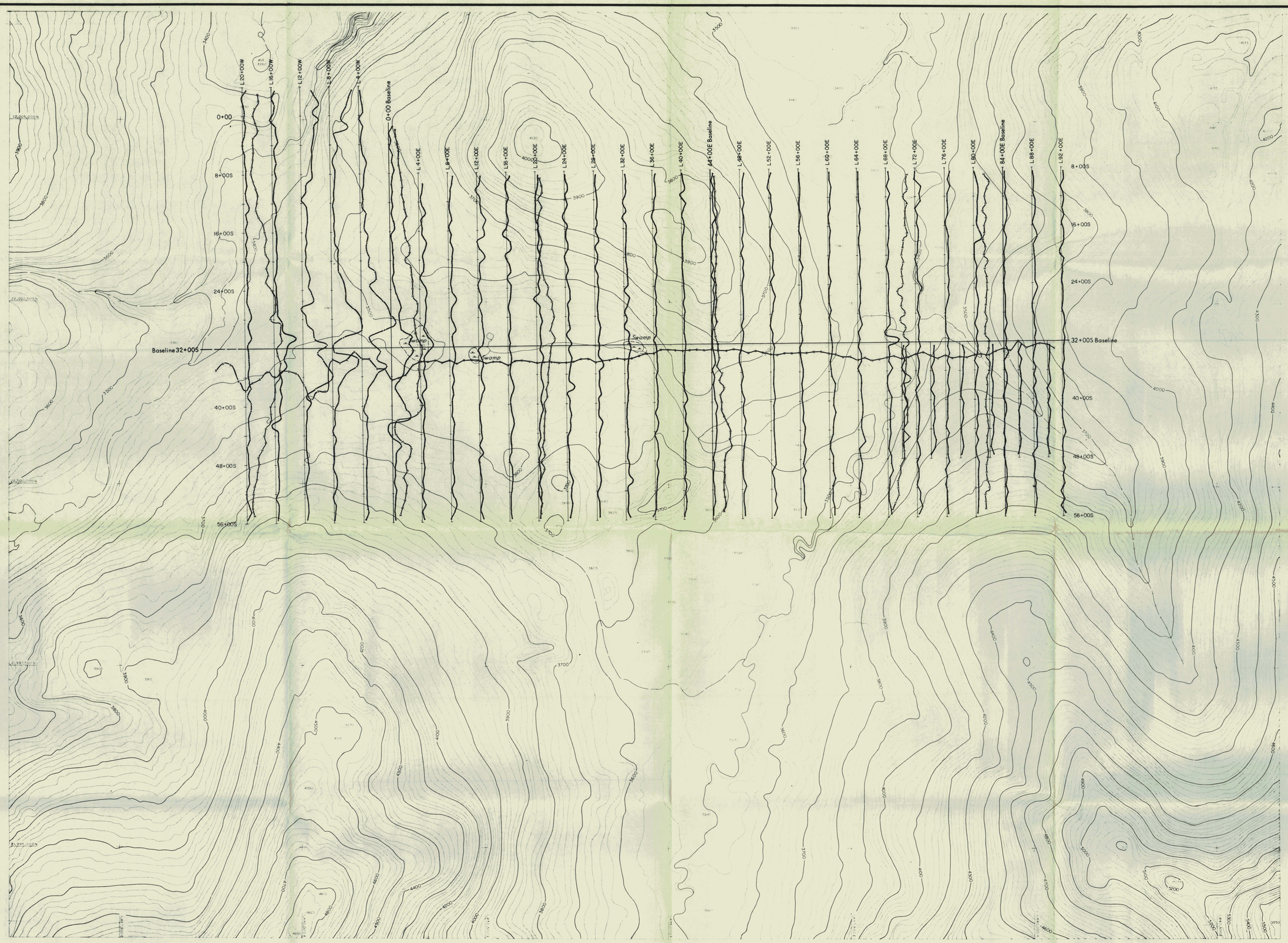
0+00
8+00S
16+00S
24+00S
32+00S Baseline
40+00S
48+00S
56+00S

Baseline 32+00S

Swamp
Swamp
Swamp

N

REVISED	QUARTZ LAKE - 1981
	SOUTH ZONE GRID
PROJ. No. 1093	SURVEY BY: ..... DATE: July/81
N.T.S. 95-D/12	DRAWN BY: Barton SCALE: 1" = 500'
FIG. No. 4	NORANDA EXPLORATION
	OFFICE: Vancouver



LEGEND

C.E.M. Plot Convention

Medium Frequency (300ft. Coil Sep.) 1830 Hz

High Frequency (400ft. Coil Sep.) 5010 Hz

1 inch = 40°

REVISED	QUARTZ LAKE - 1981
	C.E.M. CO-AXIAL SHOOTBACK SURVEY
PROJ. No. 1093	SURVEY BY: J. Moore & R. Kaatz DATE: July/81
N.T.S. 95-D/12	DRAWN BY: Kathy SCALE: 1/500
FIG. No. 5	NORANDA EXPLORATION OFFICE: Vancouver

L20+00W L16+00W L12+00W L10+00W L8+00W L7+00W L6+00W L5+00W L4+00W L3+00W L2+00W L1+00W B/L 0+00 L2+00E L4+00E L8+00E L12+00E L16+00E

20+00S

24+00S

28+00S

32+00S BASELINE

36+00S

40+00S

N

REVISED	QUARTZ LAKE - 1981
	C.E.M. CO-AXIAL SHOOTBACK SURVEY
	CONTOUR PLAN
	CONTOUR INTERVAL - 5 UNITS
PROJ. No. 1093	SURVEY BY: J. Moore & R. Kaatz DATE: July/81
N.T.S. 95-D/12	DRAWN BY: SCALE: 1" = 100'
FIG. No. 6	NORANDA EXPLORATION
	OFFICE: Vancouver

L20+00W L16+00W L12+00W L10+00W L8+00W L7+00W L6+00W L5+00W L4+00W L3+00W L2+00W L1+00W 0+00 B/L L2+00E L4+00E L8+00E L12+00E L16+00E

20+00S

24+00S

28+00S

32+00S BASELINE

36+00S

N

L20+00W L16+00W L12+00W L8+00W L4+00W B/L 0+00 L4+00E L8+00E L12+00E

L16+00E

LEGEND

C.E.M. Plot Convention

Medium Frequency (300ft. Coil Sep.) 1830 Hz o——o

High Frequency (400ft. Coil Sep.) 5010 Hz x——x

1 inch = 20°

Metres 25 0 25 50 75 100 Metres

Feet 100 0 100 200 300 Feet

REVISED

QUARTZ LAKE - 1981

C.E.M. CO-AXIAL SHOOTBACK SURVEY

PROJ. No. 1093

N.T.S. 95-D/12

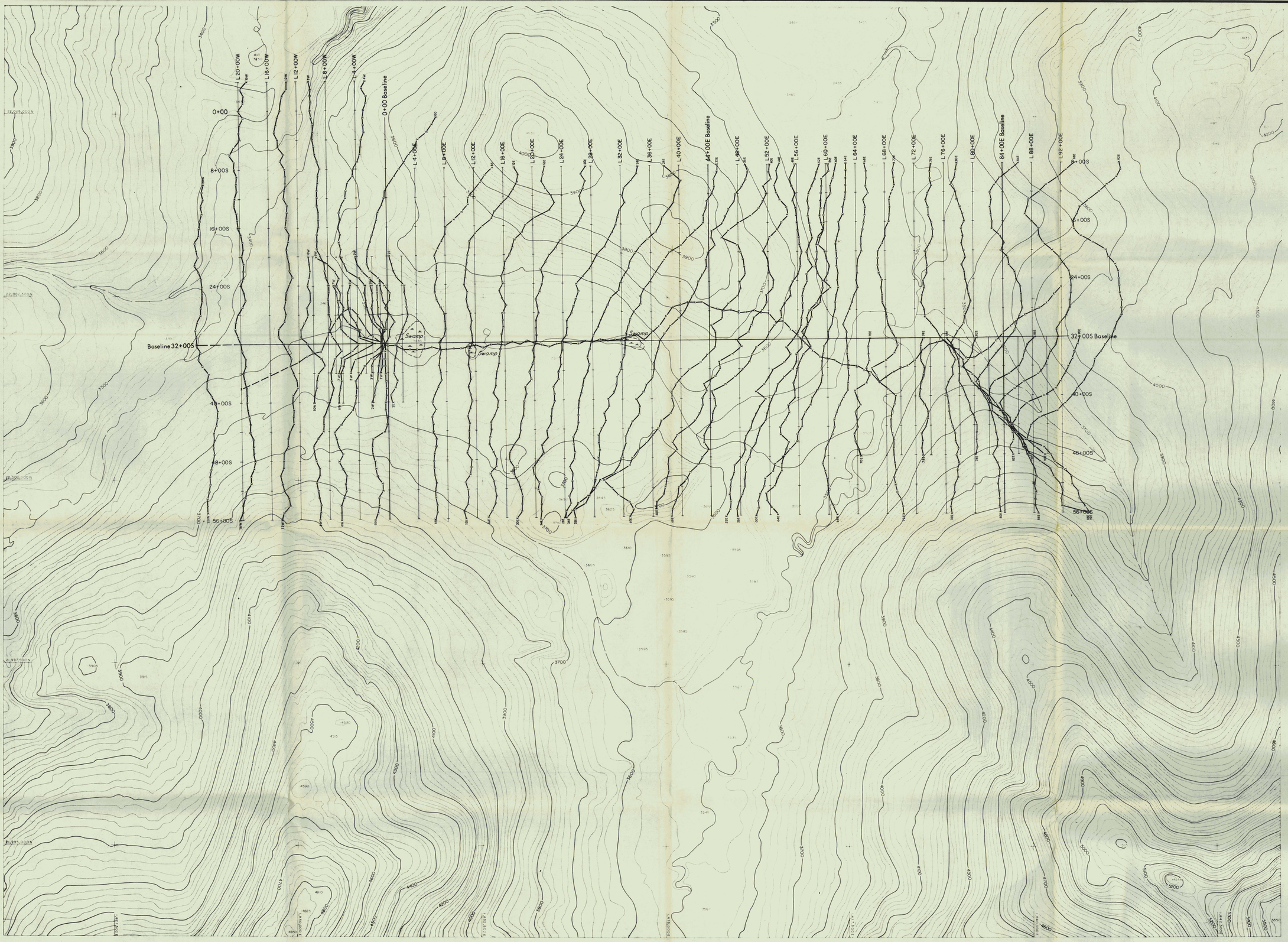
FIG. No. 6a

SURVEY BY: J. Moore & R. Kaatz DATE: July/81

DRAWN BY: Duffy SCALE: 1" = 100'

NORANDA EXPLORATION

OFFICE: Vancouver



LEGEND

82 mgls.

82 mgls.

GRAVITY Plot Convention

Bouger Factor:
0.064 mgls /Foot Elevation

REVISED	QUARTZ LAKE - 1981
	BOUGER GRAVITY
PROJ. No. 1093	SURVEY BY: Sharpe Geophysical DATE: July/81
N.T.S. 95 : D/12	DRAWN BY: SCALE: 1" = 500'/1" = 1.0mgls.
FIG. No. 7	NORANDA EXPLORATION
	OFFICE: Vancouver

L20+00W L16+00W L12+00W L10+00W L8+00W L7+00W L6+00W L5+00W L4+00W L3+00W L2+00W L1+00W 0+00 B/L L2+00E L4+00E L8+00E L12+00E L16+00E

20+00S

24+00S

28+00S

32+00S BASELINE

36+00S

40+00S

N

L20+00W L16+00W L12+00W L8+00W L4+00W B/L 0+00 L4+00E L8+00E L12+00E L16+00E

REVISED	QUARTZ LAKE - 1981
	BOUGER GRAVITY
	CONTOUR PLAN
	CONTOUR INTERVAL - 0.10 mgal.
PROJ. No. 1093	SURVEY BY: Sharpe Geophysical DATE: July/81
N.T.S. 95-D/12	DRAWN BY: Darthur SCALE: 1" = 100'
FIG. No. 8	NORANDA EXPLORATION
	OFFICE: Vancouver

80 (747.8), (90')
45% REC'Y

79 (163'+)
(NO BEDROCK)

95,000 N

99,100 E | 99,300 E | 99,500 E | 99,700 E | 99,900 E | 100,100 E | 100,300 E | 100,500 E

71 (752) (48')
42.1% REC'Y

72 (769) (67')
56% REC'Y

73 (793) (117')
57% REC'Y
209 – 221, – 12' MASSIVE PYRITE
225.5 – 232, – 6.5' 2.0% Pb

78 (213')
(NO BEDROCK)

~ 245
SECTION 94,750 N

146 (790)

141 (818) (154')

94,550 N

148 (775)

76 (750) (50')
49.7% REC'Y
50 – 63' 1.98, 3.6, 13'

145 (770)

139 (773) (39')
110 – 135', 6.70, 10.68, 2.06, 25'

77 (779) (79')
29.4 % REC'Y
181 – 189' 0.30, 5.3, 8'

SECTION 94,350 N

143 (782) (81')

147 (770)

94,150 N

144 (777) (40')

94,000 N

149 (780)

74 (788) (25')
63 – 78' 0.94, 4.26, 15'

~ 325
93, 950 N

90 (822) (56')
75.9% REC'Y
111 – 127' 0.40, 6.7, 16'

SECTION 93,925 N

~ 345
93,750 N

70 (818) (46')
58 % REC'Y

69 (810) (32')
60.8 % REC'Y

68 (798) (25')
64.7% REC'Y
103 – 113' 46.45, 0.7, 10'
231.5 – 282', 50.5' MASSIVE PYRITE
290 – 300', 10.0' —"— —"—
192 – 202', 1.55 Oz / T Ag

89 (789) (22')

67 (796) (22')
48 % REC'Y

SECTION 93,725 N

138 (830) (16')

93,550 N

75 (837) (13')
46.8% REC'Y
MOD. PYRITE

99,000 E

93,000 N

100,000 E

PROPOSED HOLES

APPROXIMATE LOCATION

(818) Elevation, (25') OVERBURDEN
63 – 78' 0.94, 4.26, 2.06, 15'
Oz/T Ag, % Pb, % Zn, Ft.

REVISED
SEP. 1980

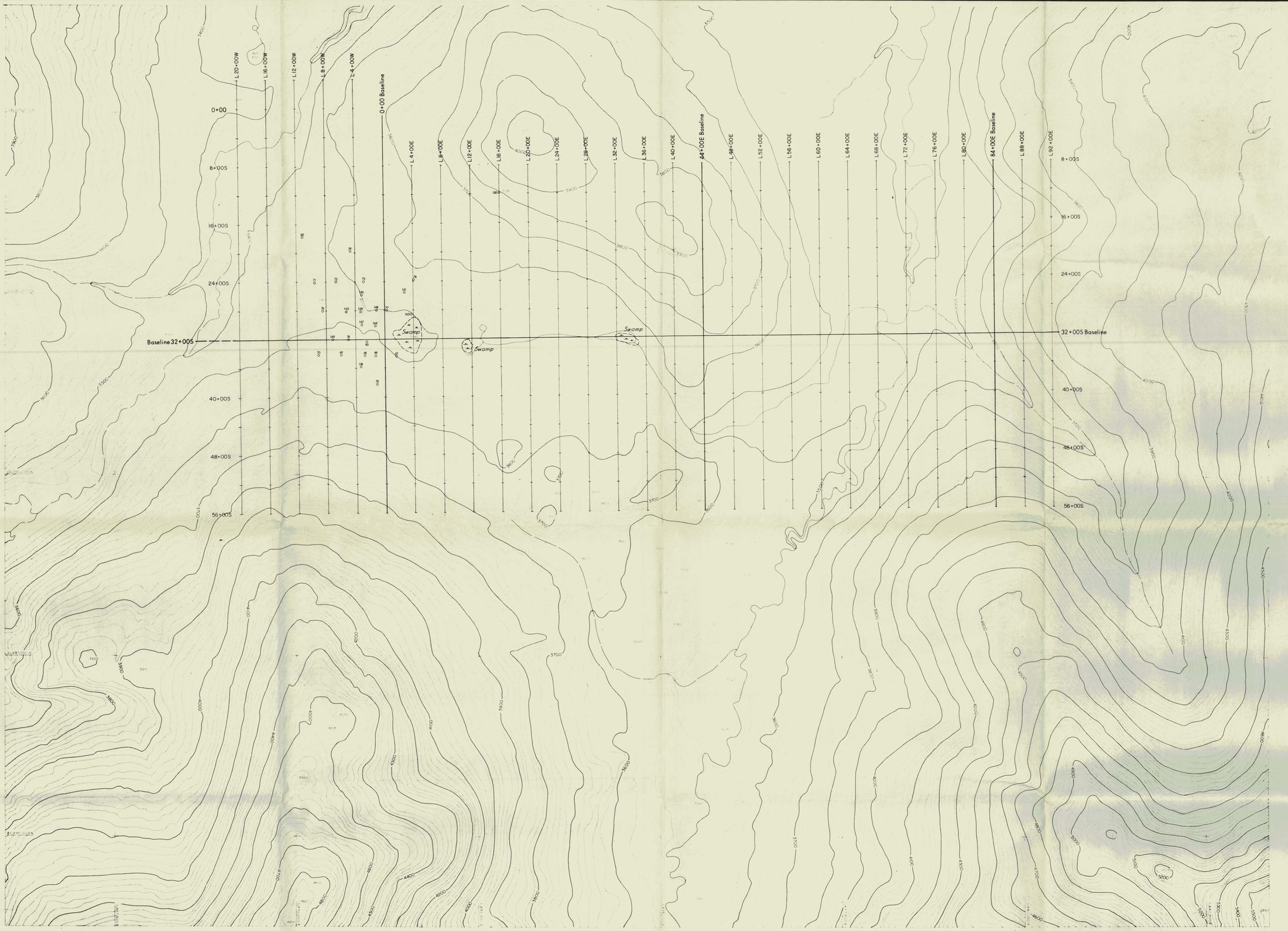
PROJ. No. 942
N.T.S. 95 D/12
FIG. No. 9

QUARTZ LAKE PROJECT

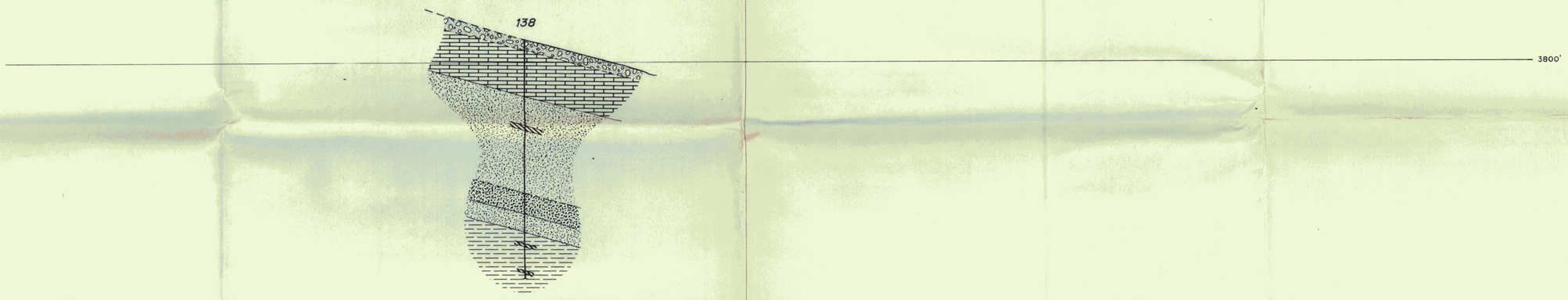
PRELIMINARY SOUTH ZONE
DRILL PLAN

SURVEY BY: G.E.D. DATE: 1/25/80
DRAWN BY: J.V.V. SCALE: 1" = 100'

NORANDA EXPLORATION
OFFICE: Vancouver



REVISED	QUARTZ LAKE - 1981
	SOUTH ZONE GRID & D.D.H. PLAN
PROJ. No. 1093	SURVEY BY: ..... DATE: July / 81
N.T.S. 95 : D/12	DRAWN BY: Barthe SCALE: 1" = 500'
FIG. No. 9a	NORANDA EXPLORATION
	OFFICE: Vancouver



100,000 E

LEGEND

- Overburden
- Massive sulphides
- Limestone
- Pink to purple argillite
- Grey to green argillite
- Quartzite
- Black Thrust (Footwall)

ASSAY ORDER: ..... Ag-oz/t., Pb-%, Zn-%

REVISED

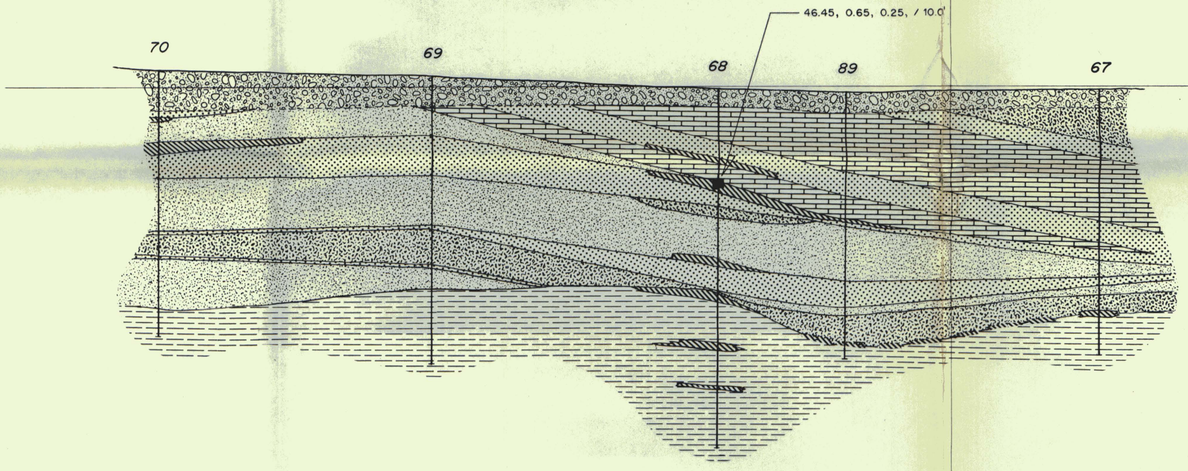
PROJ. No. 1093
N.T.S. 95 D/12
DWG. No. 10

QUARTZ LAKE PROJECT

SOUTH ZONE
SECTION 93,550 N
(Looking North)

SURVEY BY: R.S. ROGERS DATE: Nov., 1981
DRAWN BY: S. NEP SCALE: 1" = 100'

NORANDA EXPLORATION
OFFICE: VANCOUVER, B.C.



100,000 E

LEGEND

- Overburden
- Massive sulphides
- Limestone
- Pink to purple argillite
- Grey to green argillite
- Quartzite
- Black Thrust (Footwall)

ASSAY ORDER: ..... Ag-oz/T, Pb-%, Zn-%

REVISED

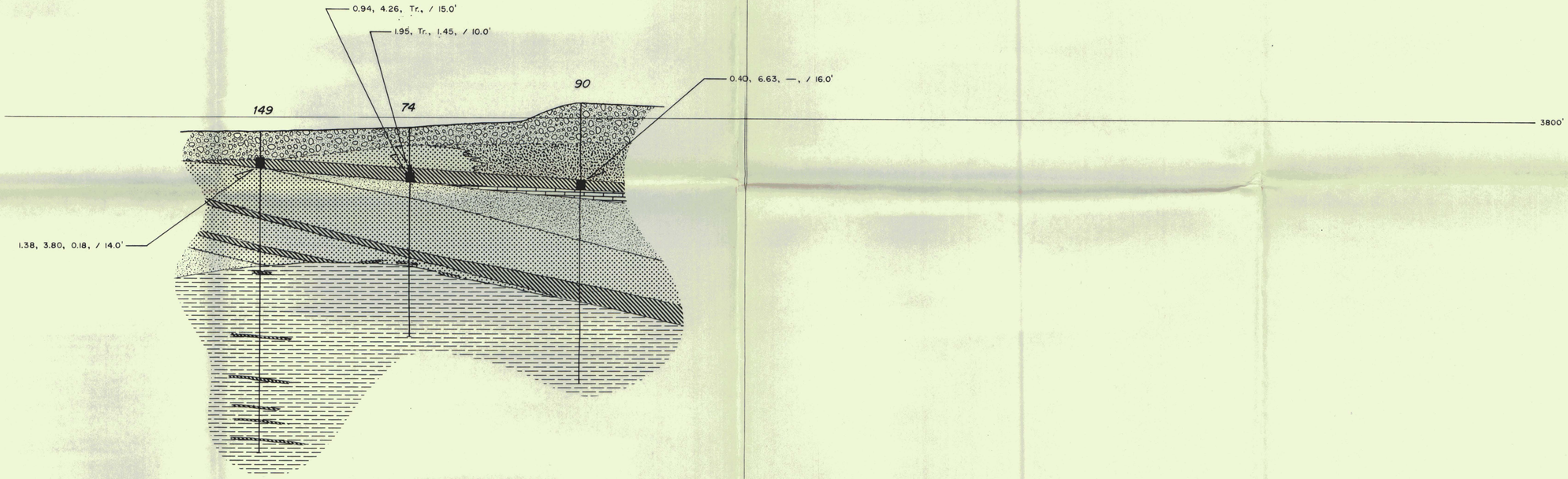
QUARTZ LAKE PROJECT

SOUTH ZONE
SECTION 93,750 N
(Looking North)

PROJ. No. 1093
N.T.S. 95 D/12
DWG. No. 11

SURVEY BY: R.S. ROGERS DATE: Nov., 1981
DRAWN BY: S. NEP SCALE: 1" = 100'

NORANDA EXPLORATION
OFFICE: VANCOUVER, B.C.



100,000 E

LEGEND

- Overburden
- Massive sulphides
- Limestone
- Pink to purple argillite
- Grey to green argillite
- Quartzite
- Black Thrust (Footwall)

ASSAY ORDER: ..... Ag-oz/T., Pb-%, Zn-%

REVISED

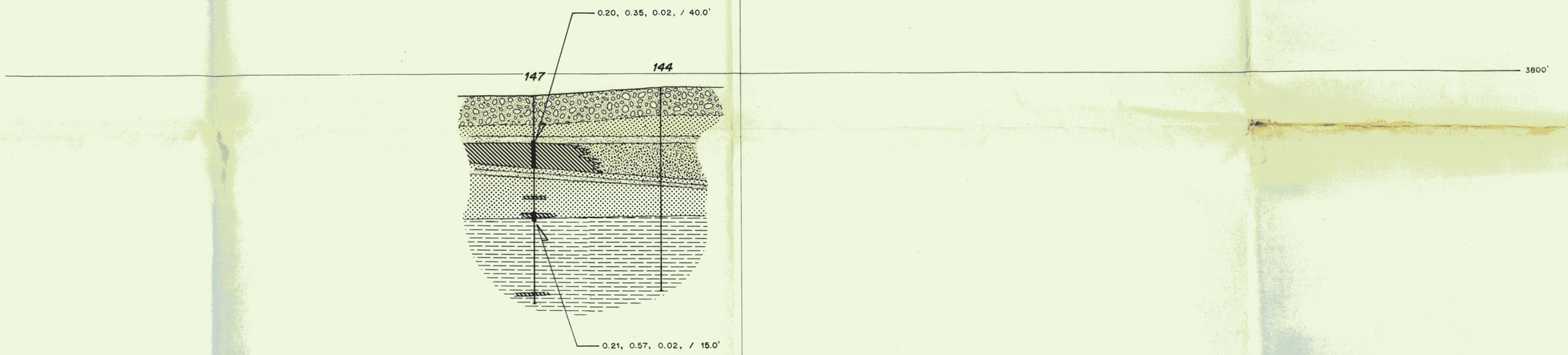
QUARTZ LAKE PROJECT

SOUTH ZONE
SECTION 93,950 N
(Looking North)

PROJ. No. 1093
N.T.S. 95 D/12
DWG. No. 12

SURVEY BY: R.S. ROGERS DATE: Nov., 1981
DRAWN BY: S. NEP SCALE: 1" = 100'

NORANDA EXPLORATION
OFFICE: VANCOUVER, B.C.



100,000 E

LEGEND

- Overburden
- Massive sulphides
- Limestone
- Pink to purple argillite
- Grey to green argillite
- Quartzite
- Black Thrust (Footwall)

ASSAY ORDER: ..... Ag-oz/T, Pb-%, Zn-%

REVISED

QUARTZ LAKE PROJECT

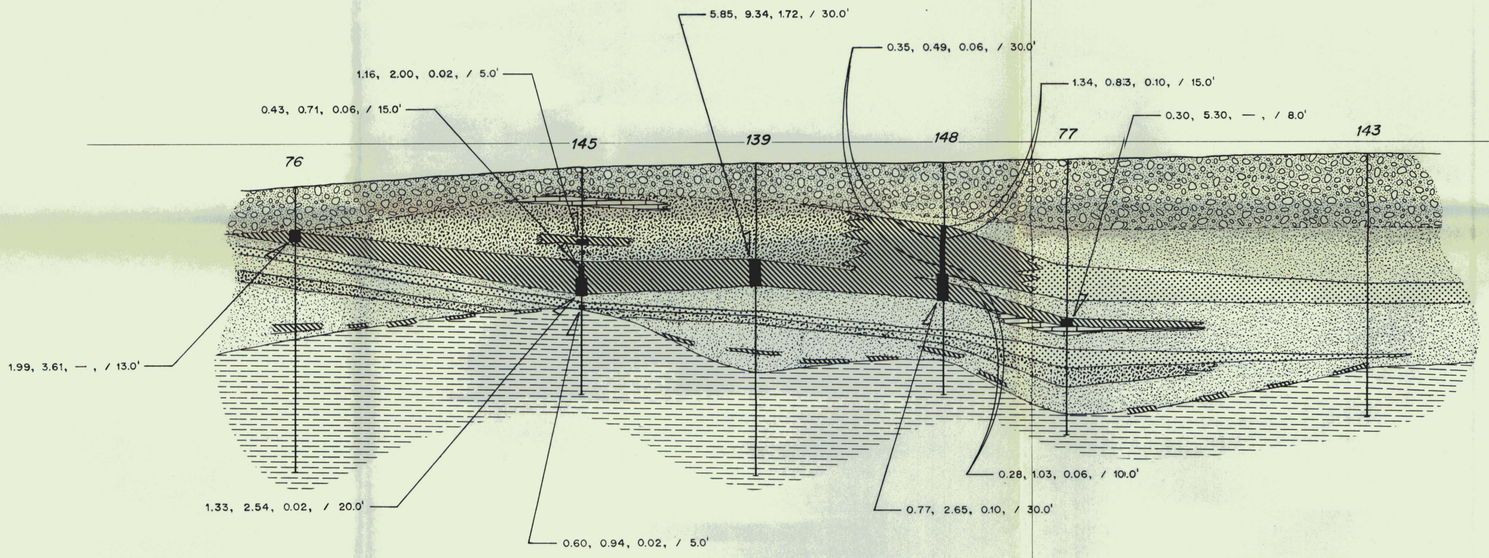
SOUTH ZONE
SECTION 94,150 N
(Looking North)

PROJ. No. 1093
N.T.S. 95 D/12
DWG. No. 13

SURVEY BY: R.S. ROGERS DATE: Nov., 1981
DRAWN BY: S. NEP SCALE: 1" = 100'

NORANDA EXPLORATION

OFFICE: VANCOUVER, B.C.



LEGEND

- Overburden
- Massive sulphides
- Limestone
- Pink to purple argillite
- Grey to green argillite
- Quartzite
- Black Thrust (Footwall)

ASSAY ORDER: ····· Ag-oz/T., Pb-%, Zn-%

REVISED

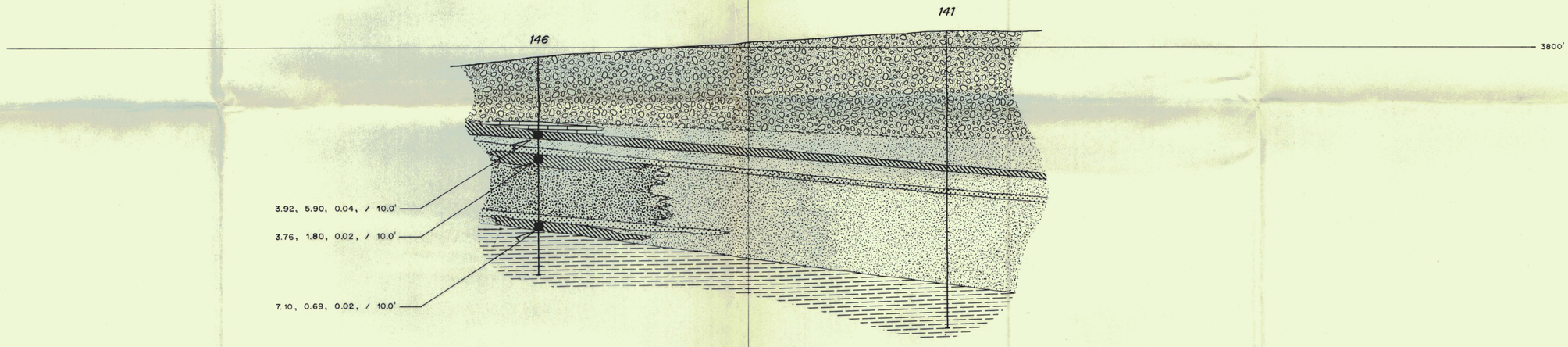
QUARTZ LAKE PROJECT

SOUTH ZONE
SECTION 94,350 N
(Looking North)

PROJ. No. 1093
N.T.S. 95 D/12
DWG. No 14

SURVEY BY: R.S. ROGERS DATE: Nov., 1981
DRAWN BY: S. NEP SCALE: 1" = 100'

NORANDA EXPLORATION
OFFICE: VANCOUVER, B.C.



LEGEND

- Overburden
- Massive sulphides
- Limestone
- Pink to purple argillite
- Grey to green argillite
- Quartzite
- Black Thrust (Footwall)

ASSAY ORDER: ····· Ag-oz/T, Pb-%, Zn-%

REVISED

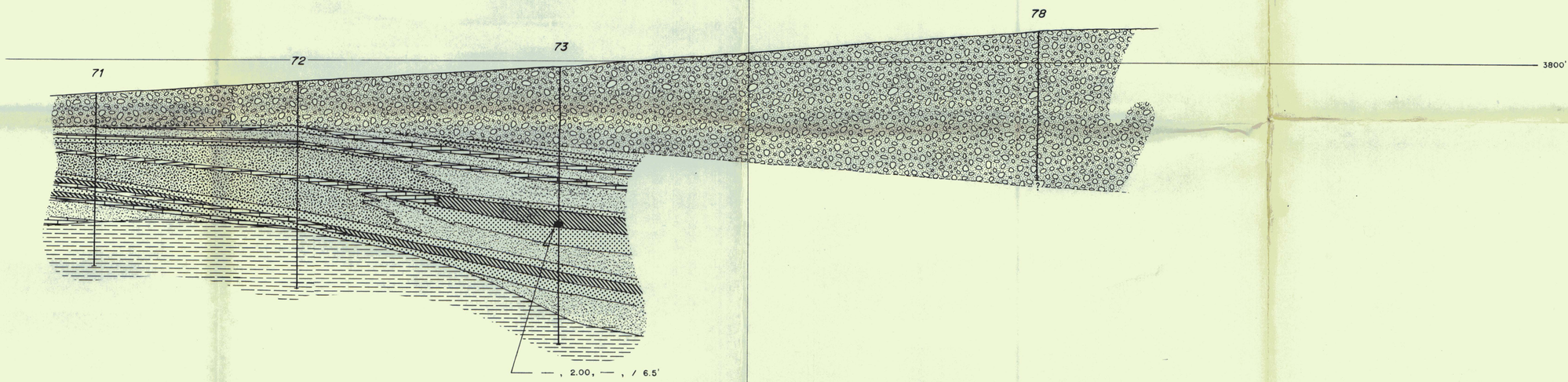
PROJ. No. 1093
N.T.S. 95 D/12
DWG. No. 15

QUARTZ LAKE PROJECT

SOUTH ZONE
SECTION 94,550 N
(Looking North)

SURVEY BY: R.S. ROGERS DATE: Nov., 1981
DRAWN BY: S. NEP SCALE: 1" = 100'

NORANDA EXPLORATION
OFFICE: VANCOUVER, B.C.



100,000 E

LEGEND

- Overburden
- Massive sulphides
- Limestone
- Pink to purple argillite
- Grey to green argillite
- Quartzite
- Black Thrust (Footwall)

ASSAY ORDER: ····· Ag-oz/T, Pb-%, Zn-%

REVISED

QUARTZ LAKE PROJECT

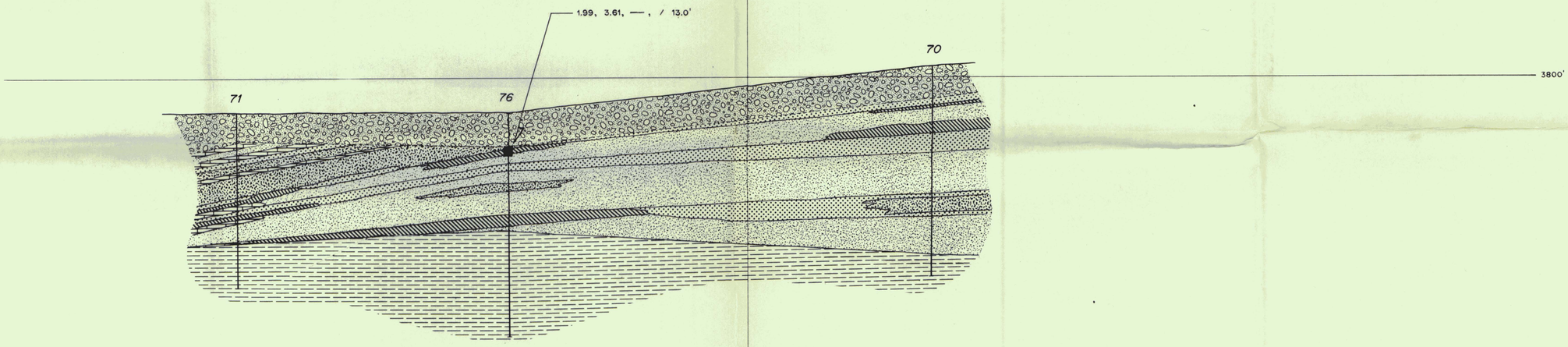
SOUTH ZONE
SECTION 94,750 N
(Looking North)

PROJ. No. 1093
N.T.S. 95 D/12
DWG. No. 16

SURVEY BY: R.S. ROGERS DATE: Nov., 1981
DRAWN BY: S. NEP SCALE: 1" = 100'

NORANDA EXPLORATION
OFFICE: VANCOUVER, B.C.

94,000 N



LEGEND

- Overburden
- Massive sulphides
- Limestone
- Pink to purple argillite
- Grey to green argillite
- Quartzite
- Black Thrust (Footwall)

ASSAY ORDER: ..... Ag-oz/T., Pb-%, Zn-%

REVISED

QUARTZ LAKE PROJECT

SOUTH ZONE
SECTION 99,100 E
(Looking East)

PROJ. No. 1093
N.T.S. 95 D/12
DWG. No. 17

SURVEY BY: R.S. ROGERS DATE: Nov., 1981
DRAWN BY: S. NEP SCALE: 1" = 100'

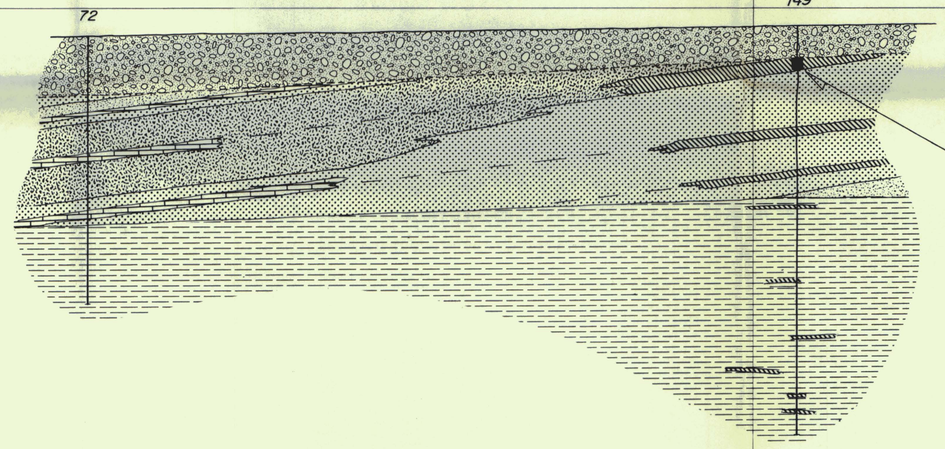
NORANDA EXPLORATION
OFFICE: VANCOUVER, B.C.

94,000 N

3800'

72

149



1.38, 3.80, 0.18, / 14.0'

LEGEND

- Overburden
- Massive sulphides
- Limestone
- Pink to purple argillite
- Grey to green argillite
- Quartzite
- Black Thrust (Footwall)

ASSAY ORDER: Ag-oz/t., Pb-%, Zn-%

REVISED

QUARTZ LAKE PROJECT

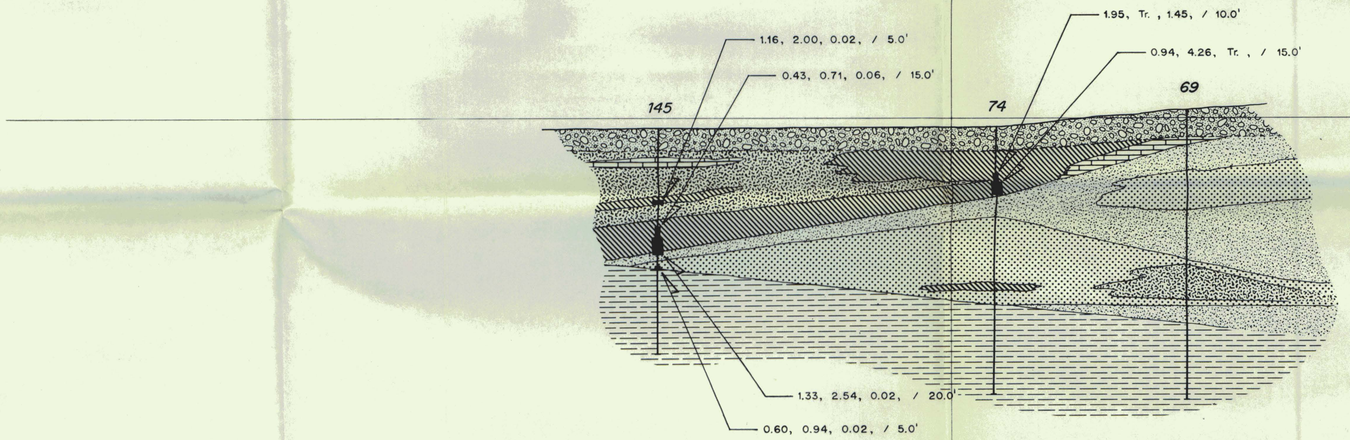
SOUTH ZONE
SECTION 99,300 E
(Looking East)

PROJ. No. 1093
N.T.S. 95 D/12
DWG. No. 18

SURVEY BY: R.S. ROGERS DATE: Nov., 1981
DRAWN BY: S. NEP SCALE: 1" = 100'

NORANDA EXPLORATION
OFFICE: VANCOUVER, B.C.

94,000 N



LEGEND

- Overburden
- Massive sulphides
- Limestone
- Pink to purple argillite
- Grey to green argillite
- Quartzite
- Black Thrust (Footwall)

ASSAY ORDER: ..... Ag-oz/T, Pb-%, Zn-%

REVISED

QUARTZ LAKE PROJECT

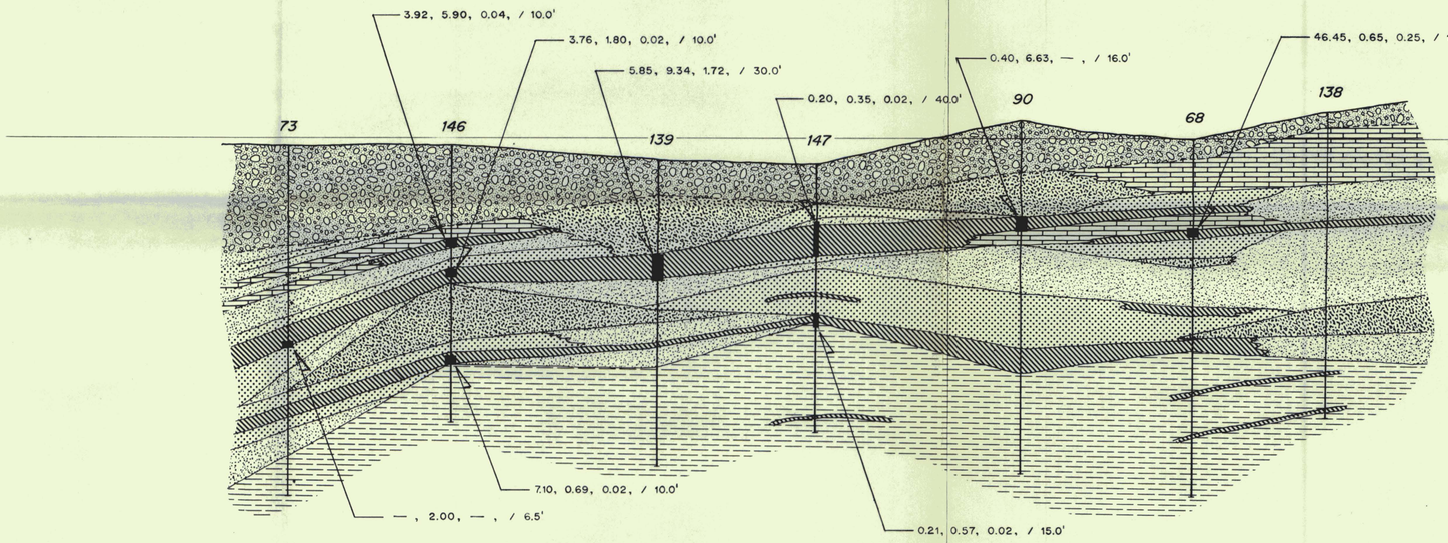
SOUTH ZONE
SECTION 99,500 E
(Looking East)

PROJ. No. 1093
N.T.S. 95 D/12
DWG. No. 19

SURVEY BY: R.S. ROGERS DATE: Nov., 1981
DRAWN BY: S. NEP SCALE: 1" = 100'

NORANDA EXPLORATION
OFFICE: VANCOUVER, B.C.

94,000 N



LEGEND

- Overburden
- Massive sulphides
- Limestone
- Pink to purple argillite
- Grey to green argillite
- Quartzite
- Black Thrust (Footwall)

ASSAY ORDER: Ag-oz/T, Pb-%, Zn-%

REVISED

QUARTZ LAKE PROJECT

SOUTH ZONE
SECTION 99,700 E
(Looking East)

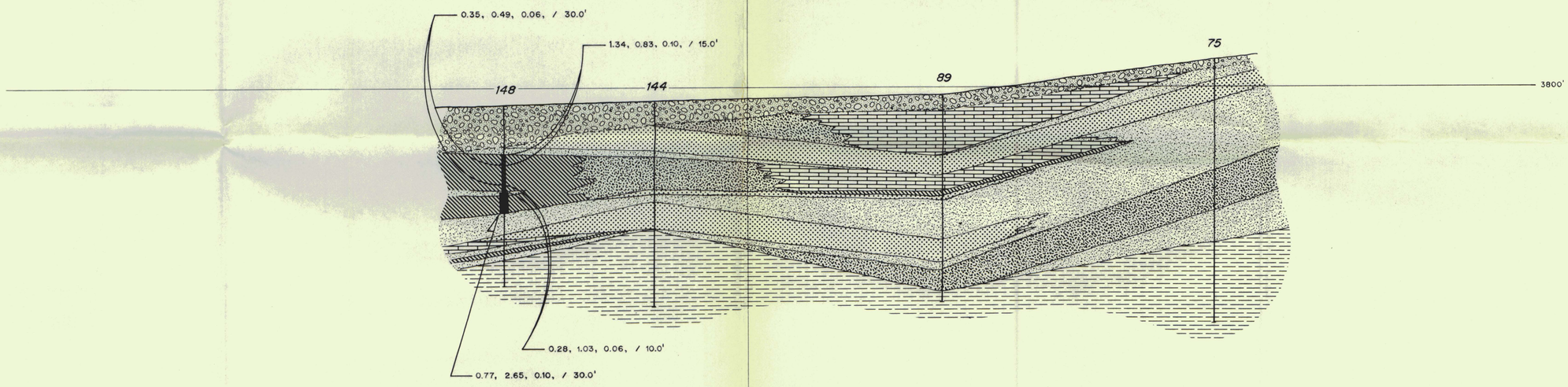
PROJ. No. 1093
N.T.S. 95 D/12
DWG. No. 20

SURVEY BY: R.S. ROGERS DATE: Nov., 1981
DRAWN BY: S. NEP SCALE: 1" = 100'

NORANDA EXPLORATION

OFFICE VANCOUVER, B.C.

94,000 N



LEGEND

- Overburden
- Massive sulphides
- Limestone
- Pink to purple argillite
- Grey to green argillite
- Quartzite
- Black Thrust (Footwall)

ASSAY ORDER ..... Ag-oz/T., Pb-%, Zn-%

REVISED

QUARTZ LAKE PROJECT

SOUTH ZONE
SECTION 99,900 E
(Looking East)

PROJ. No. 1093
N.T.S. 95 D/12
DWG. No. 21

SURVEY BY: R.S. ROGERS DATE: Nov., 1981
DRAWN BY: S. NEP SCALE: 1" = 100'

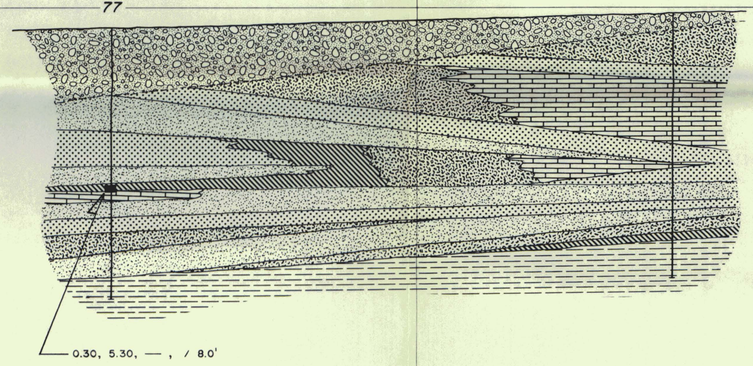
NORANDA EXPLORATION
OFFICE VANCOUVER, B.C.

94,000 N

77

67

3800'



0.30, 5.30, —, / 8.0'

LEGEND

- Overburden
- Massive sulphides
- Limestone
- Pink to purple argillite
- Grey to green argillite
- Quartzite
- Black Thrust (Footwall)

ASSAY ORDER: ····· Ag-oz/T, Pb-%, Zn-%

REVISED

QUARTZ LAKE PROJECT

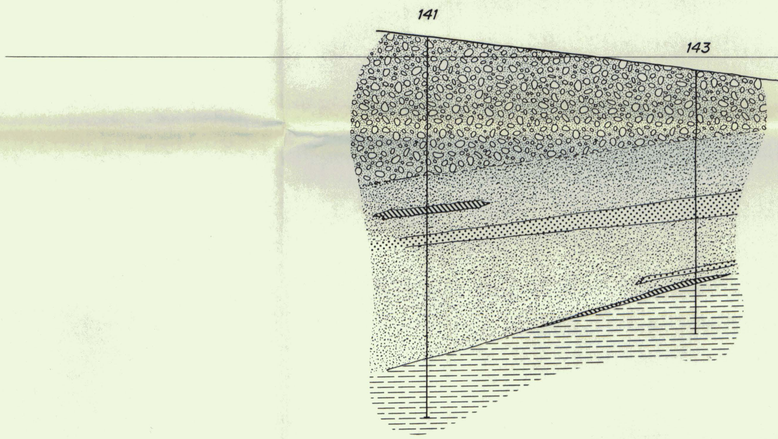
SOUTH ZONE
SECTION 100,100 E
(Looking East)

PROJ. No. 1093
N.T.S. 95 D/12
DWG. No. 22

SURVEY BY: R.S. ROGERS DATE: Nov., 1981
DRAWN BY: S. NEP SCALE: 1" = 100'

NORANDA EXPLORATION
OFFICE: VANCOUVER, B.C.

94,000 N



LEGEND

- Overburden
- Massive sulphides
- Limestone
- Pink to purple argillite
- Grey to green argillite
- Quartzite
- Black Thrust (Footwall)

ASSAY ORDER: ..... Ag-oz/T., Pb-%, Zn-%

REVISED

QUARTZ LAKE PROJECT

SOUTH ZONE
SECTION 100 300 E
(Looking East)

PROJ. No. 1093
N.T.S. 95 D/12
DWG. No. 23

SURVEY BY: R.S. ROGERS DATE: Nov., 1981
DRAWN BY: S. NEP SCALE: 1" = 100'

NORANDA EXPLORATION
OFFICE: VANCOUVER, B.C.