TK - Chisholm Lake 81(1)A

93L13 Dec 15/81

Chisholm Lake
Shell Canada Resources Ltd.

CL #5185, 5190

P Handy
S Cameron

TR-Chisholm Lake 1 of 4

CHISHOLM LAKE COAL PROPERTY *

SHELL CANADA RESOURCES LTD.

OPERATOR: CROWS NEST RESOURCES LTD.

C.L.# 5185-5190

SMITHERS AREA 93 L/3

Work done: May to August 1981

Authors: D. Handy
S. Cameron

Submitted: December 15 1981

* This section taken from a whole (TK-Smithers SI(1)A) which is held in confidential. 'Chisholm Lake' leases 1-4 were surrendered.

1.0 Summary

The Smithers Area Coal Prospects are contained within 58 B.C. Coal Licences which cover 14,236 hectares. In addition Shell/CNRL hold 3,886 hectares under option agreements. The licences are held by Shell Canada Resources Limited and are operated by its wholly-owned subsidiary, Crows Nest Resources Limited.

The area in general, and the Telkwa licences in particular, lie in proximity to the Canada National Railway, 360 km east of the port of Prince Rupert. Existing infrastructure, the proximity of a coal handling port and the good quality of the coal make some of these prospects attractive.

The Chisholm Lake and Thautil River prospects are approximately 10 km from an existing good logging road on the south side of the Morice River which runs east for 50 km to the town of Houston.

The primary objective of the exploration program was to locate and delineate areas of large reserves amenable to mining.

Based on the 1981 exploration the Thautil River and Chisholm Lake licences have been surrendered.

Chisholm Lake	N.Lat.54°14' N.Long.127°13'	-	immediately north of Chisholm Lake ✓ see TK Chisholm Lake SCOA
Thautil River	N.Lat.54°16' N.Long.127°20'	-	along the Thautil River north of its confluence with the Morice River ✓

2/BYa.14

Crows Nest Resources
LIMITED
Eau Claire Place, 525 - 3rd Avenue S.W., Calgary, Alberta (403) 232-4355
P.O. Box 2699, Station M, Calgary, Alberta T2P 2M7 Telex 03-822505

December 8, 1981

Ministry of Energy, Mines and Petroleum Resources
British Columbia

Enclosed please find our report on the Smithers Area Coal Prospects.

This report has been prepared by Mr. D. Handy and Mr. S. Cameron, both of whom are employed by Crows Nest Resources Limited as geologists.

Mr. D. Handy, Honours B.Sc., graduated in Geology from the University of Waterloo in 1977. Prior to his graduation, Mr. Handy worked as an assistant for two geotechnical companies and after graduation as a geologist for a major exploration company in Saskatchewan. Mr. Handy has been employed by Crows Nest Resources Limited as a Project Geologist since 1979.

Mr. S. Cameron, B.Sc., in Geology graduated from the University of Calgary in 1981. Prior to graduation Mr. Cameron worked as an assistant for a major exploration company in the North West Territories. He also worked for Crows Nest Resources Limited as a geological assistant in 1980. Mr. Cameron has been employed by Crows Nest Resources Limited as a Geologist since May 1981.

Their work was carried out under the supervision of our District Manager, British Columbia, Mr. Frank Martonhegyi.

In my opinion, all of these personnel are fully qualified, by training and experience to prepare this report and this account of work done under their direct supervision.

Yours very truly,

H.G. Rushton, P. Geol.
Vice-President - Exploration.

8.0 Chisholm Lake

8.1 Summary of previous Work

During the 1979 field season the following exploration work was performed.

- o 1:10,000 scale geological mapping

No exploration work was performed during 1980.

8.2 Work done in 1981

The 1981 field operations were supervised by Dave Handy of Crows Nest Resoures Limted. The following exploration work was performed.

- o 1:10,000 scale geological mapping
- o diamond drilling
- o drill site reclamation

Field mapping on the Chisholm Lake property in 1981 was limited to the Chisholm Creek area.

One diamond drill hole was completed to a depth of 193.5 metres.

The total cost of the 1981 exploration work was $72,165.

8.3 Chisholm Lake Stratigraphy

General

The basement rocks of the Chisholm Lake property consist of upper Jurassic/lower Cretaceous volcanics of the Hazelton Group. These volcanics consist mainly of basalt, andesite, trachyte, rhyolite and agglomerate.

The volcanics are unconformably overlain by upper Jurassic/lower Cretaceous sediments also of the Hazelton Group. These sediments are composed of conglomerate, sandstone, mudstone, shale and minor coal. The sedimentary section at Chisholm Lake ranges from 0 to over 200 metres.

Younger intrusives in the form of dykes and sills are sometimes present.

Coal Stratigraphy

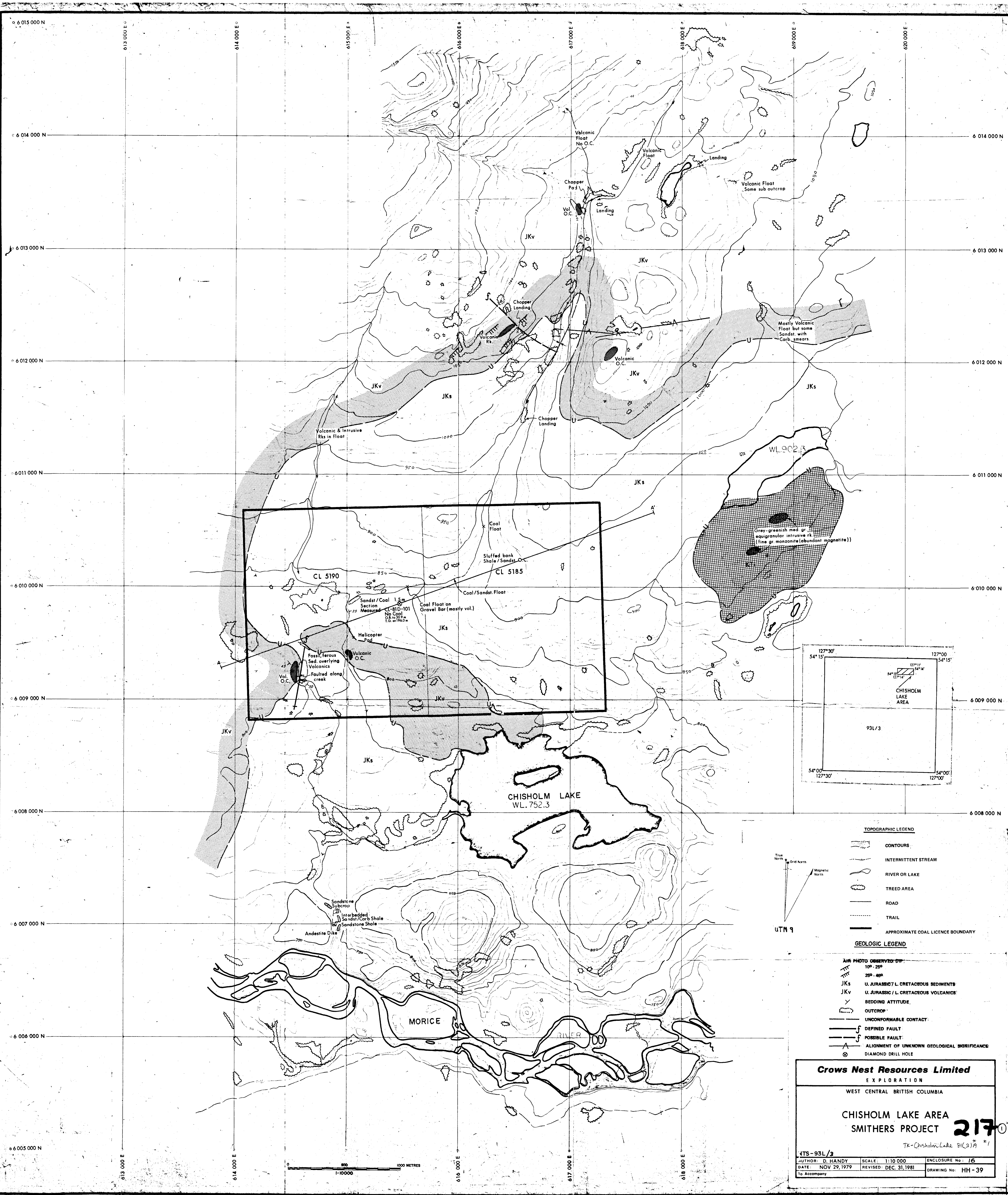
One coal seam of approximately 1.5 metres thickness is seen in outcrop along Chisholm Creek. This seam was not present in drill hole CL-81D-101, which was drilled down dip from the coal outcrop.

Chisholm Structure

On the Chisholm Lake area one reverse fault was found which forms a fault contact between the volcanic basement and the sediment. The strata generally dip to the east at 20° to 50°.

On the basis of the results of the 1979 and 1981 exploration programs the Chisholm Lake licences have been surrendered.

ENCL 17



Crows Nest Resources Limited
EXPLORATION

WEST CENTRAL BRITISH COLUMBIA

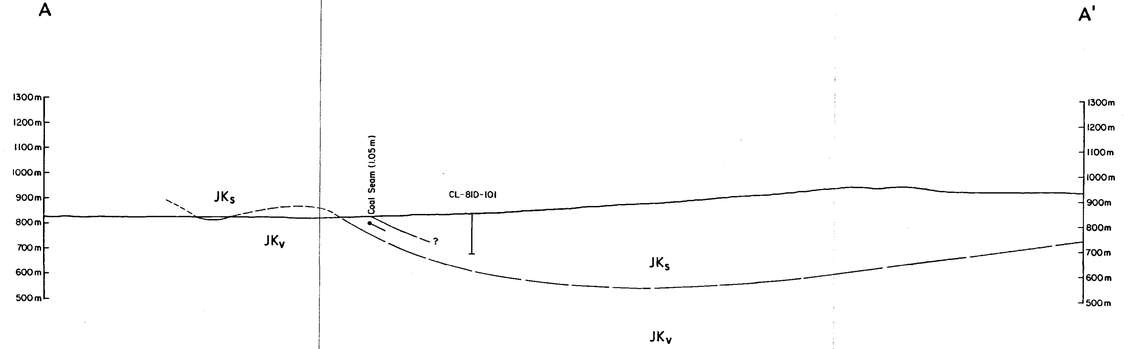
CHISHOLM LAKE AREA
SMITHERS PROJECT 217 ①

TK-Chisholm Lake 81(2)A *1

NTS-93L/3

AUTHOR: D. HANDY	SCALE: 1:10 000	ENCLOSURE No: 16
DATE: NOV 29, 1979	REVISED: DEC. 31, 1981	DRAWING No: HH-39
To Accompany		

ENCL 16



217 (2) TK-Chisholm Lake 81(2-7)A #1

GEOLOGICAL LEGEND

JKs	- U. Jurassic/L. Cretaceous Sediments
JKv	- U. Jurassic/L. Cretaceous Volcanics
——	- Unconformable contact
\	- Apparent dip in line of section
|	- Drill hole
⟋⟋	- Fault (arrows indicate relative of movement)

Crows Nest Resources Limited
EXPLORATION

CHISHOLM LAKE AREA (SMITHERS PROJECT)
WEST CENTRAL, B.C.

CROSS SECTION A-A'

AUTHOR: S. Cameron	SCALE: 1:10,000	ENCLOSURE No: 17
DATE: Dec. 15, 1981	REVISED:	DRAWING No: HK-908
To Accompany 1981 Smithers Geological Report		

ENCL 18

CROWS ! RESOURCES LIMITED

CORE & COAL CORE DESCRIPTION

PROJECT	CHISHOLM LAKE
AREA	SMITHERS, B.C.

DATE		
BEGIN	06/14/81	
END	06/17/81	

HOLE No. CL 101

PAGE 1 OF 13

HOLE PARTICULARS

LOCATION	Northing 6,009.849		
	Easting 615,469		
ELEVATION	839 metres	HOLE BEARING (AZ°)	-
TOTAL DEPTH	193.51	HOLE ANGLE (°)*	-90°

LOGGING

LOGS RUN	GRN - No open hole logs
LOGGED BY	ROKE
OTHER TESTS	

COAL CORING PERFORMANCE

CORE DIAMETER		NQ -1 7/8"
TOTAL	CORE RECOVERED	-
	LENGTH CORED	-
	CORE RECOVERY	- %

EXAMINATION

LOG USED	GRN
No. OF SEAMS SAMPLED	None
EXAMINER (S)	Patenaude Hartmann
DATE	06/27/81

BOX No.	DEPTH AT TOP OF BOX	DEPTH FROM	DEPTH TO	TH.	LITHO DESCRIPTION MAIN	LITHO DESCRIPTION AMPLIFIED (INCLUDE COAL RECOVERY FOR EACH SEAM)	SEAM DESIG	▲ BEDDING ANGLE (°)	SUMMARY GEOTECH HARDNESS	SUMMARY GEOTECH FRAC. FREQ.	SUMMARY GEOTECH RQD	SAMPLE NO.	ANALYTICAL DATA MOIST % a.r.b.	MOIST % residual	ASH %	V.M. %	F.C. %	F.S.I.	C.V.
		0	30.90			- Overburden													
		30.90			MDST/	- Medium to dark grey shaley. Contains some			R2										
					SLST.	volcanic beds and is rich in calcite													
1		30.90		.11		- Broken up rounded gouged rock fragments			R2										
						could be pebbles from overburden, red and													
			31.01			green in colour													
		31.01		.51		- Cracked dark grey mudstone, easily broken			R2										
			31.56			up, uniform													
		31.56		.47		- Medium grey, uniform siltstone, several			R2										
	32		32.03			cracks. More lithified then previous													
						interval.													
						MARKERS % RECOVERY													
						32 - 35 2.91 - 97%													
						35 - 38 3.07 - 102%													
						38 - 41 3.06 - 102%													
		32.03		2.78		- Medium grey siltstone grading into dark grey			R2										
						to black mudstone with calcite filled fracture													
						at 33.86. Otherwise uniform. Intensively													
			34.81			cracked.													
		34.81		.13		- Medium brown very hard siltstone. Numerous			R3										
						calcite filled fractures. Band of coaly				.34	13								
			34.94			fractures.													
2		34.94		3.07		- Broken sticks to rubble. Dark grey mudstone			R2										
						as described previously. 2cm calcite band				0	40								
	38		38.01			at 36.68													
		38.01		3.06		- Same as previous interval, grading into			R2										
	41		41.07			siltstone at bottom				.65	57								
						MARKERS % RECOVERY													
						41 - 44 3.22 - 107%													
						44 - 47 2.93 - 98%													
						47 - 50 2.82 - 94%													
						50 - 53 2.94 - 98%													

ALL LINEAR UNITS IN METRES

* : MEASURED FROM THE HORIZONTAL PLANE

† : • R &/OR S — GOLDER ASSOCIATES HARDNESS CODE

• ROD — ROCK QUALITY DESIGNATION (%)

FF — FRACTURE FREQUENCY

▲ ANGLE MEASURED FROM CORE AXIS

HOLE No. CL 101

BCb.

FILE No. BA-267
REVISED Feb 1981
FORMERLY FILE No. BA-211A

CROWS NEST RESOURCES LIMITED

CORE & COAL CORE DESCRIPTION

PROJECT	CHISHOLM LAKE
AREA	SMITHERS, B.C.

HOLE No. CL 101 CONTINUED

BOX No.	DEPTH AT TOP OF BOX	DEPTH FROM	DEPTH TO	TH.	LITHO DESCRIPTION MAIN	LITHO DESCRIPTION AMPLIFIED (INCLUDE COAL RECOVERY FOR EACH SEAM)	SEAM DESIG	▲ BEDDING ANGLE (°)	SUMMARY GEOTECH HARDNESS	SUMMARY GEOTECH FRAC FREQ	SUMMARY GEOTECH RQD	SAMPLE NO.	ANALYTICAL DATA MOIST % a.r.b.	MOIST % residual	ASH %	V.M.%	F.C.%	F.S.I.	C.V.
3	44	41.07	44.29	3.22		- muddy siltstone as above.			R2	.35	66								
		44.29		2.97		- same as above. Numerous slickensided broken surfaces. Broken sticks. Calcite vein at 44.73. Some cracks			R2-R3										
	47		47.26							2.39	39								
		47.26		2.82		- Medium grey mudstone, somewhat cracked. Frequent slickenside fractures. Occasional round siltstone clasts.			R2										
4										2.12	67								
	50		50.08																
		50.08		2.94		- Same as previous interval without clasts, some rubbly parts			R2	.34	53								
	53		53.02																
						MARKERS 53 - 56 — % RECOVERY 3.11 - 103%													
						56 - 59 — 2.78 - 92%													
						59 - 62 — 3.07 - 102%													
5		53.02		3.11	SLST.	- As above (siltstone no slickensided fracture, lighter in colour), grading into siltstone			R3	.32	52								
	56		56.13																
		56.13		2.78		- Medium to light grey siltstone, frequent calcite filled fracture, almost vertical extremely slickensided, calcite filled													
6																			
	59		58.91			fracture.													
		58.91		3.07		- As above. Broken slickensided surface, calcite filled fracture, weathered section at 59.97, 14cm thick. Fractured zone in middle of interval. The last 63cm is black shiny shaley mudstone. Couple of siltstone			R3 R1 R2										
	62		61.98			clasts in it. Grading into dark mudstone			R3	2.6	5								
						MARKERS 62 - 65 — % RECOVERY 2.96 - 98%													
						65 - 68 — 2.76 - 92%													
						68 - 71 — 3.09 - 103%													
		61.98		2.96	MDST.	- Dark grey mudstone. Uniform in size, occasional calcite filled veined, somewhat			R3										
	65		64.94			cracked.				1.01	39								

ALL LINEAR UNITS IN METRES

* MEASURED FROM THE HORIZONTAL PLANE

† :=R &/OR S — GOLDER ASSOCIATES HARDNESS CODE

*RQD — ROCK QUALITY DESIGNATION (%)

FF — FRACTURE FREQUENCY

▲ ANGLE MEASURED FROM CORE AXIS

HOLE No. CL 101

FILE No. BA-267
REVISED Feb. 1981
FORMERLY FILE No. BA-212A

CROWS NEST RESOURCES LIMITED

CORE & COAL CORE DESCRIPTION

PROJECT	CHISHOLM LAKE
AREA	SMITHERS, B.C.

HOLE No. CL 101 CONTINUED

BOX No.	DEPTH AT TOP OF BOX	DEPTH FROM	DEPTH TO	TH.	LITHO DESCRIPTION MAIN	LITHO DESCRIPTION AMPLIFIED (INCLUDE COAL RECOVERY FOR EACH SEAM)	SEAM DESIG	▲ BEDDING ANGLE (°)	SUMMARY GEOTECH HARDNESS	SUMMARY GEOTECH FRAC FREQ.	SUMMARY GEOTECH RQD	SAMPLE NO.	ANALYTICAL DATA MOIST % a.r.b.	MOIST % residual	ASH %	V.M.%	F.C.%	F.S.I.	C.V.
7		64.94		2.76		- Same as above. With calcite filled crack and			R2										
						one 2cm band at 66.30 (of calcite). Broken			R3	2.17	34								
	68		67.70			surfaces show sheen probably due to stress.													
8		67.70		3.09		- Same as above. Somewhat less fractured			R3	.97	51								
	71		70.79																
						MARKERS % RECOVERY													
						71 - 74 3.03 - 101%													
						74 - 77 3.06 - 102%													
						77 - 80 2.91 - 97%													
		70.79		3.03		- Dark grey mudstone as above. Fracture zone			R3	1.98	16								
	74		73.82			at 73.19			R2										
		73.82		3.06		- Dark grey mudstone as above. Slickensided			R3										
9						fracture as above. 20cm of black shiny													
						broken up shale, with calcite veins at top													
						and bottom at 74.69. At 76.23, 47cm,			R4										
						intermised white volcanics (igneous -													
						probably a branching silt of a larger dyke)													
	77		76.88			and mudstone. Top 4cm very pyrite rich.				.64	12								
		76.88		1.65	SLST.	- Dark grey siltstone, uniform, pyrite rich,			R2										
						very broken up. At 77.11 there is a joint,													
						angle 13° from core axis. Another at 77.44													
			78.53			angle 17°.													
		78.53		1.30	VLC.	- Sharp contact with white volcanic rock as			R4										
						described above. Contact 35° angle from core													
						axis. Volcanics very pyrite rich. Vuggy													
	80		79.83			porosity porphoritic. Probably a dyke				.34	46.3								
						MARKERS % RECOVERY													
						80 - 83 2.92m - 97.3%													
						83 - 86 2.93m - 97.7%													
						86 - 89 2.88m - 96%													
		79.83	79.92	.09	VLC	- White volcanics as previous interval			R4										
		79.92		1.24		- Intermised dark grey siltstone and light			R3										
			81.16			grey volcanics. Numerous calcite filled													
						fractures, pyrite rich.													

ALL LINEAR UNITS IN METRES

: MEASURED FROM THE HORIZONTAL PLANE

† : • R &/OR S — GOLDER ASSOCIATES HARDNESS CODE

• RQD — ROCK QUALITY DESIGNATION (%)

FF — FRACTURE FREQUENCY

▲ ANGLE MEASURED FROM CORE AXIS

HOLE No. CL 101

FILE No BA-267
REVISED Feb.1981
FORMERLY FILE No. BA-212A

CROWS NEST RESOURCES LIMITED

CORE & COAL CORE DESCRIPTION

PROJECT	CHISHOLM LAKE
AREA	SMITHERS, B.C.

HOLE No. CL 101 CONTINUED

BOX No.	DEPTH AT TOP OF BOX	DEPTH FROM	DEPTH TO	TH.	LITHO DESCRIPTION MAIN	LITHO DESCRIPTION AMPLIFIED (INCLUDE COAL RECOVERY FOR EACH SEAM)	SEAM DESIG	▲ BEDDING ANGLE (°)	SUMMARY GEOTECH HARDNESS	SUMMARY GEOTECH FRAC FREQ	SUMMARY GEOTECH RQD	SAMPLE NO.	ANALYTICAL DATA MOIST % a.r.b.	MOIST % residual	ASH %	V.M.%	F.C.%	F.S.I.	C.V.
10		81.16		1.04		- White volcanics as described above.			R4										
						Numerous calcite filled fractures.													
			82.20			Porphoritic. Pyrite rich.													
		82.20	82.50	.30		- Very weathered siltstone			R1										
		82.50	82.97	.47		- White volcanic rock as previously described.			R4	1.37	51								
	83	82.97		.32		- White volcanic rock slowly grading into dark			R3										
			83.29			siltstone													
		83.29	83.33	.04		- Calcite band													
		83.33		2.54	SLST.	- Medium grey siltstone, criss-crossed by			R2										
						calcite filled veins. Broken surfaces													
						covered with calcite film. At 85.84 joint				.68	33.7								
	86		85.87			with angle 24°.													
	89	85.87	88.75	2.88		- Same as previous intense.			R2	1.04	67.3								
						MARKERS % RECOVERY													
						89 - 92 2.85m - 95%													
						92 - 95 3.14m - 104%													
						95 - 98 3.02m - 101%													
11		88.75		2.85		- As previous interval, getting more muddy at			R1	.35	68.3								
	92		91.60			bottom of interval													
		91.60		1.10		- Dark grey siltstone, bottom 56cm slightly			R1										
						weathered, completely broken up. Bottom													
			92.70			rich in calcite veins.													
		92.70		.13		- Band of light grey volcanic rock, very			R4										
			92.83			calcite rich													
		92.83		.95	SST.	- Greenish-gray fine grained sandstone			R2										
12			93.78			becoming medium grained at bottom of interval													
						very brittle													
		93.78		1.25	SLST.	- Dark grey siltstone, as described above.			R1										
	95		95.03							.96	31.7								

ALL LINEAR UNITS IN METRES

: MEASURED FROM THE HORIZONTAL PLANE

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• RQD — ROCK QUALITY DESIGNATION (%)

FF — FRACTURE FREQUENCY

▲ ANGLE MEASURED FROM CORE AXIS

HOLE No. CL 101

FILE No BA-267
REVISED Feb. 1981
FORMERLY FILE No. BA-212A

CROWS NEST RESOURCES LIMITED

CORE & COAL CORE DESCRIPTION

PROJECT	CHISHOLM LAKE
AREA	SMITHERS, B.C.

HOLE No. CL 101 CONTINUED

BOX No.	DEPTH AT TOP OF BOX	DEPTH FROM	DEPTH TO	TH.	LITHO DESCRIPTION MAIN	LITHO DESCRIPTION AMPLIFIED (INCLUDE COAL RECOVERY FOR EACH SEAM)	SEAM DESIG	▲ BEDDING ANGLE (°)	SUMMARY GEOTECH HARDNESS	SUMMARY GEOTECH FRAC FREQ	SUMMARY GEOTECH RQD	SAMPLE NO.	ANALYTICAL DATA MOIST % a.r.b.	MOIST % residual	ASH %	V.M. %	F.C. %	F.S.I.	C.V.
12		95.03		1.77		- Extremely weathered siltstone with calcite throughout. Mostly rubbly. Dark grey and uniform			R1										
			96.80																
		96.80		.68		- White volcanic rock, as described above. pyrite-rich. Makes a sharp contact with overlaying siltstone. Vugs filled with calcite crystals.			R5										
			97.48																
		97.48		.46		- Extremely broken up dark grey siltstone, crossed with calcite and pyrite veins.			R3										
13						Some broken surfaces very shiny and													
	98		97.94			slickensided				1.66	22.3								
						MARKERS % RECOVERY													
						98 - 101 2.74m - 91.3%													
						101 - 104 2.64 88%													
						104 - 107 3.0 100%													
		97.94		2.74		- Muddy siltstone, very weathered calcite veins throughout, mostly rubble, broken surfaces			R2										
						shiny, slickensides. Evidence of sudden													
			100.68			stress. Pyrite throughout.				2.19	14								
	101	100.68		2.64		- Same as previous interval. Last 90cm			R2										
14			103.32			unweathered, very carbonaceous, dark			R3	1.89	9.3								
	104	103.32		1.1		- Very carbonaceous siltstone, broken surfaces													
			104.42			shiny and slickensided. Pyrite bed at 103.68 from the top.													
		104.42		2.03	VLC	- Volcanic igneous rock, very calcite rich,			R3										
						especially first 32cm, very sharp contact													
	107		106.45			with previous interval. Rock could be rhyolite. Some pyrite.				.67	43.6								
						MARKERS % RECOVERY													
						107 - 110 2.91m - 97%													
						110 - 113 3.00m - 100%													
						113 - 116 3.04m - 101%													

ALL LINEAR UNITS IN METRES

* : MEASURED FROM THE HORIZONTAL PLANE

† : • R &/OR S — GOLDER ASSOCIATES HARDNESS CODE

• RQD — ROCK QUALITY DESIGNATION (%)

FF — FRACTURE FREQUENCY

▲ ANGLE MEASURED FROM CORE AXIS

HOLE No. CL 101

FILE No BA-267
REVISED Feb. 1981
FORMERLY FILE No. BA-212A

CROWS NEST RESOURCES LIMITED

CORE & COAL CORE DESCRIPTION

PROJECT	CHISHOLM LAKE
AREA	SMITHERS, B.C.

HOLE No. CL 101 CONTINUED

BOX No.	DEPTH AT TOP OF BOX	DEPTH FROM	DEPTH TO	TH.	LITHO DESCRIPTION MAIN	LITHO DESCRIPTION AMPLIFIED (INCLUDE COAL RECOVERY FOR EACH SEAM)	SEAM DESIG	▲ BEDDING ANGLE (°)	SUMMARY GEOTECH HARDNESS	SUMMARY GEOTECH FRAC FREQ	SUMMARY GEOTECH RQD	SAMPLE NO.	ANALYTICAL DATA MOIST % a.r.b.	MOIST % residual	ASH %	V.M. %	F.C. %	F.S.I.	C.V.
14		106.45		2.91		- Same as previous interval. Broken surfaces covered in calcite film showing stress features. Joint at 107.31, angle of 15° from core axis.			R4										
15																			
	110		109.36							.34	89.3								
		109.36		3.00		- Medium to light grey igneous (volcanic rock). Calcite filled fractures, broken surfaces, planar, smooth to slickensided, fracture zone near bottom.			R4										
	113		112.36						R3	2.33	75.0								
16		112.36		3.04		- As above, small calcite filled holes, broken surfaces planar and smooth			R4	0.33	92.7								
	116		115.40																
						MARKERS % RECOVERY													
						116 - 119 (2.49/3.00)= 83%													
						119 - 122 (2.72/3.00)= 90.7%													
						122 - 125 (3.14/3.00)=104.7%													
						125 - 128 (3.00/3.00)= 100%													
		115.40		3.00		Volcanic - medium grey to white, At 116.90m to end calcite filled amygdules, Abundant pyrite, broken stick to rubble (last 40cm).			R3										
	119		118.40							1.20	10.5								
17		118.40		2.72	SLST.	Sharp contact between volcanics and siltstone. Siltstone - dark gray, calcite threads, broken surfaces rough, rubble, pyrite present, especially in fractures.			R4	1.10	45.2								
	122		121.12						R3										
		121.12		3.14		Siltstone - dark gray, lots of pyrite and fractures, slickensided, calcite and pyrite throughout, broken stick at base. 124.19 - 124.26 - volcanics and siltstone.			R3										
									R2	1.91	46.2								
	125		124.26																
		124.26		1.73		Sharp contact between siltstone and volcanics. (124.30)													
					VLC	- Light gray to white, fractured with numerous calcite filled cracks and amygdules, pyrite throughout. Broken surfaces slickensided.			R4										
18			125.99																

ALL LINEAR UNITS IN METRES

R : MEASURED FROM THE HORIZONTAL PLANE

▲ ANGLE MEASURED FROM CORE AXIS

† : • R &/OR S — GOLDER ASSOCIATES HARDNESS CODE

• RQD — ROCK QUALITY DESIGNATION (%)

FF — FRACTURE FREQUENCY

HOLE No. CL 101

FILE No. BA-267
REVISED Feb. 1981
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CROWS NEST RESOURCES LIMITED

CORE & COAL CORE DESCRIPTION

PROJECT	CHISHOLM LAKE
AREA	SMITHERS, B.C.

HOLE No. CL 101 CONTINUED

BOX No.	DEPTH AT TOP OF BOX	DEPTH FROM	DEPTH TO	TH.	LITHO DESCRIPTION MAIN	LITHO DESCRIPTION AMPLIFIED (INCLUDE COAL RECOVERY FOR EACH SEAM)	SEAM DESIG	▲ BEDDING ANGLE (°)	SUMMARY GEOTECH HARDNESS	SUMMARY GEOTECH FRAC FREQ	SUMMARY GEOTECH RQD	SAMPLE NO.	ANALYTICAL DATA MOIST % a.r.b.	MOIST % residual	ASH %	V.M. %	F.C. %	F.S.I.	C.V.
18		125.99		0.23		Sharp contact between volcanics and mudstone.													
			126.22			Mudstone - dark gray to black, weathered at top.			R2										
		126.22		0.54		Mudstone - dark gray, smooth shiny broken			R3										
			126.76			surfaces.													
		126.76		0.47		Sandstone and mudstone			R3										
						At 126.98 siltstone and sandstone, fine				1.00	51.7								
	128		127.23			grained, pyrite throughout													
						MARKERS % RECOVERY													
						128 - 131 (2.97/3.00) = 99%													
						131 - 134 (2.83/3.00) = 94.3%													
		127.23		2.97	SHALE/ SST.	Shale and sandstone at top		54°	R3										
						Sandstone - fine grained, medium gray		56°											
						Shale - dark gray													
						Bioturbated, slickensided on broken surfaces.													
						At 127.67m - thin bands of sandstone and													
						siltstone. At base, sandstone - light gray													
						with siltstone lenses. Pyrite abundant through													
						interval. At 127.98m, calcite filled fracture													
						with pyrite. At 128.30m, 2cm siltstone band													
						with bioturbation. Platey breakage zones.				2.33	57.9								
	131		130.20			Sandstone - medium gray, fine grained at base.			R4										
19																			
		130.20		1.59	SLST/	- Alternating light coloured sandstone and			R3										
			131.79		SST	darker siltstone bands.													
		131.79	131.94	.15		- As previous interval but weathered.			R2										
		131.94		.40		- Fractured broken up dark grey, pyrite rich													
			132.34			shale with siltstone bands.													
		132.34		.37		- Top is sharp but irregular contact with above			R3										
						interval. It is light grey calcite rich													
			132.71			volcanic rock.													
		132.71		.21		- Top is other contact. Alternating bands of													
						dark grey siltstone and fine grained light													
						sandstone. Broken surfaces, slickensided,													
			132.92			pyrite rich.													

ALL LINEAR UNITS IN METRES

R - MEASURED FROM THE HORIZONTAL PLANE

▲ ANGLE MEASURED FROM CORE AXIS

† : • R &/OR S — GOLDER ASSOCIATES HARDNESS CODE

• RQD — ROCK QUALITY DESIGNATION (%)

FF — FRACTURE FREQUENCY

HOLE No. CL 101

FILE No. BA-267
REVISED Feb. 1981
FORMERLY FILE No. BA-212A

CROWS NEST RESOURCES LIMITED

CORE & COAL CORE DESCRIPTION

PROJECT	CHISHOLM LAKE
AREA	SMITHERS, B.C.

HOLE No. CL 101 CONTINUED

BOX No.	DEPTH AT TOP OF BOX	DEPTH FROM	DEPTH TO	TH.	LITHO DESCRIPTION MAIN	LITHO DESCRIPTION AMPLIFIED (INCLUDE COAL RECOVERY FOR EACH SEAM)	SEAM DESIG	▲ BEDDING ANGLE (°)	SUMMARY GEOTECH HARDNESS	SUMMARY GEOTECH FRAC FREQ.	SUMMARY GEOTECH RQD	SAMPLE NO.	ANALYTICAL DATA MOIST % a.r.b.	MOIST % residual	ASH %	V.M. %	F.C. %	F.S.I.	C.V.
19		132.92		.09		- Sharp contact with previous interval, light grey, calcite rich volcanic			R4										
	134		133.01							1.76	51.6								
						MARKERS % RECOVERY													
						134 - 137 (2.55/3) = 85%													
						137 - 139 (1.89/2) = 94%													
		133.01		.57		- Medium grey volcanic rock as described at end of previous interval. Calcite filled cracks and pyrite throughout. Carbonaceous shale in cracks.			R4										
			133.58																
		133.58		.07		- Very carbonaceous dark grey silty mudstone with sheen. Extremely pyrite rich.			R2										
			133.65																
		133.65		1.18	VLC	- Medium grey volcanic rock as above. Speckled with calcite, broken surface, shiny. Usually broken along calcite filled fracture. Surfaces are greenish grey pyrite.			R4										
			134.83																
		134.83		.40		- Very dark carbonaceous mudstone, broken, pyrite filled fracture, becoming coaly shale at bottom of interval.			R2										
			135.23																
		135.23		.36		- Medium grey volcanic as above. Very hard, broken surface shows stress, calcite filled fracture.			R3										
20																			
			135.59							1.96	61								
	137	135.59				* NOTE: Lots of core loss in past intervals due to rubble.													
		135.59		1.08		- Volcanic rock as in previous interval with large calcite band at 135.98 which is very white, approximately 4cm thick.			R3										
			136.67																
		136.67		.47		- Very carbonaceous, easily broken, shiny muddy siltstone. Very dark, extremely broken up, slickensided, could be fracture zone.			R2										
			137.14																
		137.14		.49		- Mostly fine grained light coloured sandstone with bands of dark siltstone. 1cm brown clay band at 137.37			R3										
	139		137.63							3.17	42								

ALL LINEAR UNITS IN METRES

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FF — FRACTURE FREQUENCY

▲ ANGLE MEASURED FROM CORE AXIS

HOLE No. CL 101

FILE No BA-267
REVISED Feb. 1981
FORMERLY FILE No. BA-212A

CROWS NEST RESOURCES LIMITED

CORE & COAL CORE DESCRIPTION

PROJECT	CHISHOLM LAKE
AREA	SMITHERS, B.C.

HOLE No. CL 101 CONTINUED

BOX No.	DEPTH AT TOP OF BOX	DEPTH FROM	DEPTH TO	TH.	LITHO DESCRIPTION MAIN	LITHO DESCRIPTION AMPLIFIED (INCLUDE COAL RECOVERY FOR EACH SEAM)	SEAM DESIG	▲ BEDDING ANGLE (°)	SUMMARY GEOTECH HARDNESS	SUMMARY GEOTECH FRAC FREQ	SUMMARY GEOTECH RQD	SAMPLE NO	ANALYTICAL DATA MOIST % a.r.b.	MOIST % residual	ASH %	V M %	F.C. %	F.S.I.	C.V.
20						MARKERS % RECOVERY													
						139 - 142 (3.13/3) - 104%													
						142 - 145 (2.98/3) - 99%													
		137.63		.40	SST/	- Medium grained, light coloured sandstone.			R3										
					SLST	Depositional banding, disturbed in places,													
			138.03			mud and calcite filled cracks at 137.92.													
		138.03		.92		- Shear zone. Broken up pieces, slickensided			R2										
						and shiny. Easy to break. Rock is full of													
						siltstone. Bands alternating with sandstone													
						at bottom. Depositional feature include			R3										
						sandstone lenses and load casts. Bedding is													
						displaced by calcite filled fractures.													
			138.95			Re-healed fracture.													
		138.95		.35		- Medium grey fine grained sandstone, fractures													
						and cracks throughout. Re-healing, mud clasts													
						Broken bottom of interval have a very black													
			139.30			shiny appearance.													
		139.30	139.32	.02		- Brown clay band with siltstone, calcite			R1										
		139.32	139.54	.22		- Medium grained and grey sandstone													
		139.54		.04		- Joint, light greenish grey volcanic													
			139.58			intrusion.													
		139.58	139.72	.14		- Very weathered dark grey shale			R1										
		139.72		1.01		- Medium to light grey, fine to medium grained			R4										
						sandstone, calcite, mud clasts, mud band				4.47	36								
	142		140.73			at 140.56													
21		140.73		1.56	SST/	- As last part of previous interval, large			R3										
			142.29		SLST	calcite bands, some weathered													
		142.29		.18		- Silty sandstone with deeply weathered,			R3										
						slickensided, broken surface, calcite													
			142.47			throughout.													
		142.47		.12		- Cracked calcite filled fine grained sandstone			R3										
			142.59			with large mud clasts.													

ALL LINEAR UNITS IN METRES

* : MEASURED FROM THE HORIZONTAL PLANE

▲ ANGLE MEASURED FROM CORE AXIS

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• RQD — ROCK QUALITY DESIGNATION (%)

FF — FRACTURE FREQUENCY

HOLE No. CL 101

FILE No BA-267
REVISED Feb. 1981
FORMERLY FILE No. BA-212A

CROWS NEST RESOURCES LIMITED

CORE & COAL CORE DESCRIPTION

PROJECT	CHISHOLM LAKE
AREA	SMITHERS, B.C.

HOLE No. CL 101 CONTINUED

BOX No.	DEPTH AT TOP OF BOX	DEPTH FROM	DEPTH TO	TH.	LITHO DESCRIPTION MAIN	LITHO DESCRIPTION AMPLIFIED (INCLUDE COAL RECOVERY FOR EACH SEAM)	SEAM DESIG	▲ BEDDING ANGLE (°)	SUMMARY GEOTECH HARDNESS	SUMMARY GEOTECH FRAC FREQ	SUMMARY GEOTECH RQD	SAMPLE NO.	ANALYTICAL DATA MOIST % ar.b.	MOIST % residual	ASH %	V.M. %	F.C. %	F.S.I.	C.V.
21		142.59	142.61	.02		- Dark grey mudstone			R3										
		142.61		1.06		- Begins with medium grained sandstone, 3cm mud band at top, becoming interbedded with siltstone at bottom, broken surfaces, very polished, no depositional feature, carbonaceous in place, uldulating plane			R3										
	145		143.67			of breakage.				3.3	33								
						MARKERS % RECOVERY													
						145 - 148 (2.85/3) - 95%													
						148 - 151 (2.79/3) - 93%													
		143.67		2.85		- Light green medium grained sandstone, interbedded with dark siltstone bands. Large calcite filled fracture at 143.92, many flow features. Some cross-bedding, some weathered bands at irregular intervals.		68°											
	148		146.52			Numerous elongated mud lenses at 144.75. Joint at 146.15, angle 10° core axis.			R3	1.1	58.7								
22		146.52		2.79		- Same as previous interval, small coal vein at 148.59. Coal is very shiny, well-cleated. Some pyrite near the coal. Other broken surfaces are black and shiny. Joint at		63°	R3										
								53°											
	151		149.31			147.85, angle 10°.				.72	56.7								
						MARKERS % RECOVERY													
						151 - 154 2.73m - 91%													
						154 - 157 2.65m - 88%													
						157 - 161 4.22m - 105%													
		149.31		2.73		- Same as previous. Sandstone interbedded with siltstone. Joint at 150.51, 30°.		60°	R3										
								61°											
			152.04			Broken surfaces, shaley.				1.83	38.7								
23	154	152.04	153.76	1.72		- Same as previous interval		60°	R4										
		153.76	153.98	.22		- Completely weathered sandstone.			R1										
		153.98		.90		- Greenish medium grained sandstone, only		75°	R4										
	157		154.88			occasionally containing siltstone bands.				.75	25.3								
		154.88	155.13	.25		- Same as above			R3										

ALL LINEAR UNITS IN METRES

: MEASURED FROM THE HORIZONTAL PLANE

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FF — FRACTURE FREQUENCY

▲ ANGLE MEASURED FROM CORE AXIS

HOLE No. CL 101

FILE No BA-267
REVISED Feb. 1981
FORMERLY FILE No. BA-212A

CROWS NEST RESOURCES LIMITED

CORE & COAL CORE DESCRIPTION

PROJECT	CHISHOLM LAKE
AREA	SMITHERS, B.C.

HOLE No. CL 101 CONTINUED

BOX No.	DEPTH AT TOP OF BOX	DEPTH FROM	DEPTH TO	TH.	LITHO DESCRIPTION MAIN	LITHO DESCRIPTION AMPLIFIED (INCLUDE COAL RECOVERY FOR EACH SEAM)	SEAM DESIG	▲ BEDDING ANGLE (°)	SUMMARY GEOTECH HARDNESS	SUMMARY GEOTECH FRAC FREQ	SUMMARY GEOTECH RQD	SAMPLE NO.	ANALYTICAL DATA MOIST % a.r.b.	MOIST % residual	ASH %	V.M. %	F.C. %	F.S.I.	C.V.
23		155.13		2.21		Interbedded green sandstone and black		66°	R3										
						siltstone. More sandstone at top, more		61°											
						siltstone at the bottom. Weathered in places.													
			157.34			Joint at 155.84, 15°													
		157.34		.75		- Clean, greenish sandstone, very shiny			R3										
						probably due to high quartz content.													
24			158.09			Medium grained.													
		158.09		1.08		- Alternating sandstone and siltstone as		61°	R3										
	161		159.17			described previously.				.71	43								
						MARKERS % RECOVERY													
						161 - 167 6.06m - 101%													
		159.17		1.62		- Same as end of previous interval, broken		66°	R3										
						surfaces covered with calcite. Weathered													
			160.79			in places.			R1										
		160.79		.22		- Same as previous, but more carbonaceous			R3										
			161.01			and shaly.													
		161.01		.75		- Alternating sandstone and siltstone as		61°	R3										
			161.76			previously described.													
		161.76	161.91	.15		- Broken-up, very weathered sandstone			R1										
		161.91	162.05	.14		- Unweathered sandstone			R3										
		162.05		1.44		- Calcite and shale - rich, extremely			R3										
			163.49			weathered sandstone													
25		163.49		.35		- Unweathered interbedded sandstone and		65°	R3										
						siltstone. Joint at top, angle at 10° with													
			163.84			core axis.													
		163.84	163.96	.12		- Weathered sandstone.			R2										
		163.96		1.45		- Alternating sandstone and siltstone as			R3										
						described previously. Pyrite rich, band													
	167		165.41			of dark clacite and mudstone at 164.21.				1.65	17.6								

ALL LINEAR UNITS IN METRES

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FF — FRACTURE FREQUENCY

▲ ANGLE MEASURED FROM CORE AXIS

HOLE No. CL 101

FILE No. BA-267
REVISED Feb. 1981
FORMERLY FILE No. BA-212A

CROWS NEST RESOURCES LIMITED

CORE & COAL CORE DESCRIPTION

PROJECT	CHISHOLM LAKE
AREA	SMITHERS, B.C.

HOLE No. CL 101 CONTINUED

BOX No.	DEPTH AT TOP OF BOX	DEPTH FROM	DEPTH TO	TH.	LITHO DESCRIPTION MAIN	LITHO DESCRIPTION AMPLIFIED (INCLUDE COAL RECOVERY FOR EACH SEAM)	SEAM DESIG	▲ BEDDING ANGLE (°)	SUMMARY GEOTECH HARDNESS†	SUMMARY GEOTECH FRAC FREQ.	SUMMARY GEOTECH RQD	SAMPLE NO.	ANALYTICAL DATA MOIST % a.r.b.	ANALYTICAL DATA MOIST % residual	ASH %	V.M.%	F.C.%	F.S.I.	C.V.
25						MARKERS % RECOVERY													
						167 - 170 2.81m - 93.7%													
						170 - 173 2.99m - 99.7%													
						173 - 176 2.99m - 99.7%													
		165.41		2.81		- Medium to dark grey interbedded, sandstone and siltstone, somewhat carbonaceous in places. Re-healed fractures, calcite filled cracks throughout. Broken surfaces slickensided and covered with calcite.		57°	R3	2.84	52.6								
	170		168.22			Smooth fracture plane intermixed.													
26		168.22		2.99	SLST/SST	- Same as previous interval. Flow features, calcite filled fractures throughout, broken sticks, becoming gradually more siltstone		60°	R3	6.02	26								
	173		171.21			rich at bottom of interval.													
		171.21		2.99		- Predominantly dark grey shaly siltstone with small fine grained light coloured lenses of sandstone throughout. Fracture zone (50cm) at 172.11. (Weathered zone). Broken surfaces are smooth covered with calcite and slickensided. Angle of fractures			R3	5.68	33								
	176		174.20			in fracture zone is 56° with core axis.													
						MARKERS % RECOVERY													
						176 - 179 2.92m - 97%													
						179 - 182 2.84m - 94%													
27		174.20		2.92		- Very dark grey silty mudstone with occasional small light coloured sandstone lenses. Broken planes are smooth. Some calcite, but not as much as in previous			R3	2.05	37								
	179		177.12			interval, broken sticks, shiny surfaces.													
		177.12		2.84		- Same as previous interval, becoming more			R3	2.46	27.3								
28	182		179.96			sandstone rich at bottom.													
						MARKERS % RECOVERY													
						182 - 185 2.90m - 96.7%													
						185 - 188 2.79m - 93%													
						188 - 191 2.84m - 94.6%													

ALL LINEAR UNITS IN METRES

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FF — FRACTURE FREQUENCY

▲ ANGLE MEASURED FROM CORE AXIS

HOLE No. CL 101

FILE No BA-267
REVISED Feb. 1981
FORMERLY FILE No. BA-212A

CROWS NEST RESOURCES LIMITED

CORE & COAL CORE DESCRIPTION

PROJECT	CHISHOLM LAKE
AREA	SMITHERS, B.C.

HOLE No. CL 101 CONTINUED

BOX No.	DEPTH AT TOP OF BOX	DEPTH FROM	DEPTH TO	TH.	LITHO DESCRIPTION MAIN	LITHO DESCRIPTION AMPLIFIED (INCLUDE COAL RECOVERY FOR EACH SEAM)	SEAM DESIG	▲ BEDDING ANGLE (°)	SUMMARY GEOTECH HARDNESS	SUMMARY GEOTECH FRAC FREQ	SUMMARY GEOTECH RQD	SAMPLE NO.	ANALYTICAL DATA MOIST % a.r.b.	MOIST % residual	ASH %	V.M. %	F.C. %	F.S.I.	C.V.
28		179.96		2.90		- Dark carbonaceous siltstone with lenses of green sandstone and brown mudstone throughout. Two major calcite veins, at 180.06 and 180.64. Joint at 181.11, angle 5°, most broken		71°	R3										
	185		182.86			surfaces, rough and irregular.				1.03	84.7								
		182.86		2.79		- Same as previous interval, with a major calcite vein at 183.35. Broken surfaces (more than previous interval) covered with calcite, shiny and slickensided. No			R3										
29			185.65			sandstone or mudstone.				2.51	41								
						MARKERS % RECOVERY													
						191 - 194 3.09m - 103%													
						194 - 196 1.94m - 97%													
		185.65		2.84		- Uniform carbonaceous siltstone, only one band of intermixed sandstone and calcite			R3										
	191		188.49			at 186.04.				.35	81.3								
		188.49	189.64	1.15		- Same as previous interval.			R3										
		189.64		.37		- Intermixed green sandstone and dark			R3										
			190.01			siltstone.													
		190.01		.63		- Interbedded green sandstone and dark		70°	R3										
			190.64			siltstone with a big calcite vein at 190.30.													
30		190.64		.93		- Same as previous interval, but very weathered, mostly broken pieces with shiny,			R3										
	194		191.57			slickensided surfaces.				1.29	49.7								
		191.57		1.94		- Interbedded sandstone and siltstone as described above, many flow features, broken			R3										
			193.51			surfaces, shiny and slickensided, stress features.				1.03	12.4								
						T.D. 193.51m													

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HOLE No. CL 101

FILE No BA-267
REVISED Feb.1981
FORMERLY FILE No. BA-212A

Tk-Chisholm Lake 81(3)A * 1

ROKE OIL ENTERPRISES LTD. CALGARY, ALBERTA

GAMMA RAY NEUTRON LOG

FILE NO.	
LSD	
SEC	
TWP	
RGE	
W M	
COMPANY	CROWSNEST RESOURCES LTD.
WELL	CL - 81 D - 101
LOCATION	CHISHOLM LAKE
FIELD	SMITHERS PROJECT
PROVINCE	BRITISH COLUMBIA
Other Services:	

217 LOG 01

Permanent Datum	GROUND LEVEL	Elev.	K.B.
Log Measured from	GROUND LEVEL	Above Perm. Datum	CSG
Well Depths Measured from	GROUND LEVEL		G.L.
			METRIC

Run. No.	ONE
Date	17 JUNE 1981
First Reading	195.0 m
Last Reading	0
Footage Logged	195.0
Depth Reached	195.5
Depth Driller	196
Casing Roke	30.48
Casing Driller	30.48
Fluid Type	WATER/MUD
Liquid Level	
Min. Diam.	NQ
Rm @	
Operating Time	1 HOUR
Truck No.	FU - 3
Recorded By	FAGERNESS
Witnessed By	HANDY

EQUIPMENT DATA

GAMMA RAY		NEUTRON	
RUN NO.	ONE	RUN NO.	ONE
TOOL MODEL NO.		LOG TYPE	NEUTRON/NEUTRON
DIAMETER	3.18 cm	TOOL MODEL NO.	
DETECTOR MODEL NO.		DIAMETER	3.18 cm
TYPE	SCINTILLATION	DETECTOR MODEL NO.	
LENGTH	10.24 cm	TYPE	PROPORTIONAL
DISTANCE TO N. SOURCE	2.0 m	LENGTH	15.24 cm
		SOURCE MODEL NO.	MRC-N-SS-W
GENERAL		SERIAL NO.	
HOIST TRUCK NO.	FU - 3	SPACING	38.1 cm
INSTRUMENT TRUCK NO.	FU - 3	TYPE	AmBe
TOOL SERIAL NO.	RGRN 125 A 006	STRENGTH	3 CURIES

LOGGING DATA

GENERAL				GAMMA RAY				NEUTRON			
RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED M/MIN	T.C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	API G. R. UNITS PER LOG DIV.	T. C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	API N. UNITS PER LOG DIV.
1	0	195.0	4	3	500	0	12	3	500	0	50

REMARKS LOGGED THROUGH NQ DRILL RODS

GAMMA RAY	DEPTHS	NEUTRON
GAMMA RAY INCREASES → API 12; 0 – 120		NEUTRON INCREASES → API 50; 0 – 500 – 1000