Canada Oil and Gas Lands Administration | Administration du pétrole et du gaz des terres du Canada

D.A. #1395

Nova Scotia	☐	West Coast	☐	Exploratory	☒
Newfoundland	☐	Northern	☑	Development	☐
Gulf of St. Lawrence	☐	Hudson Bay	☐	Delineation	☐
				Service	☐

AUTHORITY TO DRILL A WELL

APPLICATION

This application is submitted with Section 82 of the Canada Oil and Gas Drilling Regulations. When approved under Section 83 of the Regulations, it is the requisite authority for the commencement of drilling operations.

Well Name in Full: Conoco et al North Little Bear O-51

Operator: Conoco Canada Limited — Drilling Program No.: N/A

Contractor: Atco/Equtak Drilling — Permit or Lease No.: EL 319

Drilling Rig or Unit: 76 — Estimated Well Cost: $2,300,000

Location-Unit: O — Section: 51 — Grid Area: 64° 50' 125° 45'

Coordinates: Lat.: North 64° 40' 57.4069" — Long.: West 125° 54' 55.1506"

Area: Ft. Norman, N.W.T. — Field/Pool: Wildcat

Elevation-~~KB~~/KB: 320 m (ASL) — Ground ~~Seafloor~~: 314 m (ASL)

Approx. Spud Date: Feb 15, 1989 — Estimated Days on Location: 25

Anticipated Total Depth: 2200 mKB — Target Horizon(s): Fallstone Lake, Kee Scarp

UWI: 3000516450125450

EVALUATION PROGRAM

Ten metre sample intervals: None

Five-metre sample intervals: 20 m to total depth

Canned sample intervals: all

Conventional cores at: Geologists Discretion

Logs and Tests: DLL-MSFL-SONIC-SP-GR, CNL-LDT-GR-CAL, PE, Dipmeter, velocity survey. TD to 600 m. DST's may be run after logging

CASING AND CEMENTING PROGRAM

O.D	Weight	Grade	Setting Depth (MKB) ~~Seafloor~~	Cementing Program (Volumes)
508 mm	139.9 kg/m	H40, STC	0-20 m	Driven
244.5 mm	53.6 kg/m	K55, STC	0-600 m	Cement to surface - 22 tonnes
177.8 mm	38.7 kg/m	K55, STC	0-200 m, 1700 m-TD	As Required
177.8 mm	34.2 kg/m	K55, STC	200 m - 1700 m	As Required

B O P Equipment: Diverter on conductor while drilling surface, hole, 1 annular preventer - 21 MPA. 1 single gate preventer - 21 MPA, 2 single gate preventers - 34 MPA, 1 Choke manifolds - 21 MPA.

Other Information:

Signed: J.C. Schneider — Title: Senior Production Engineer

Date: Jan 3, 1989 — Company: Conoco Canada Limited

APPROVAL

An approved copy of this notice is to be posted at each wellsite

Signed: L.D. Thomas
Engineering Branch

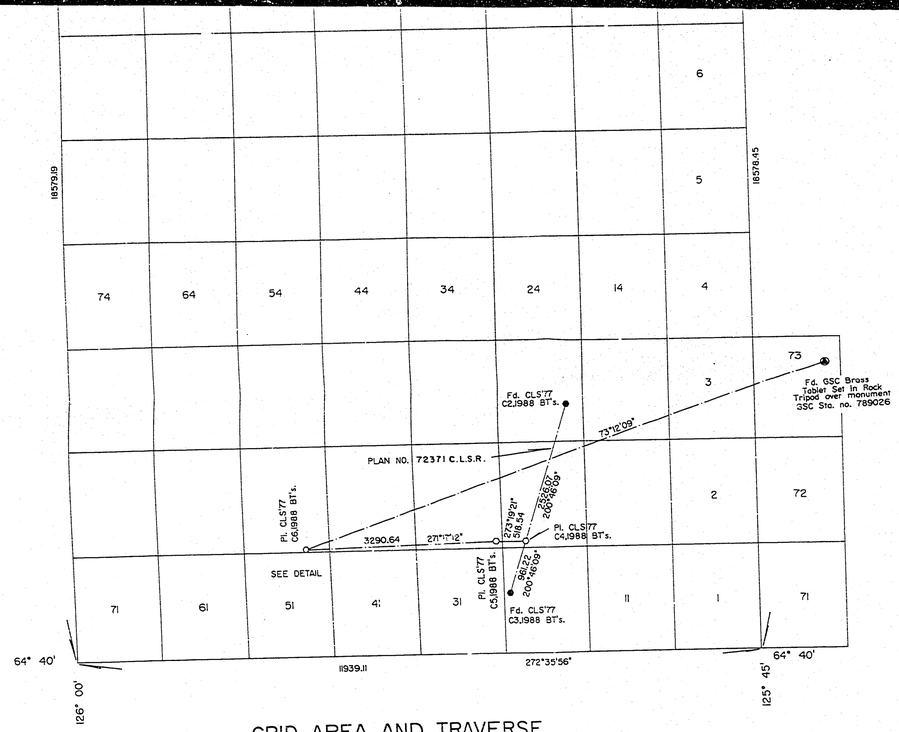
Date: 89-01-24

File: 9211-C90-1-3

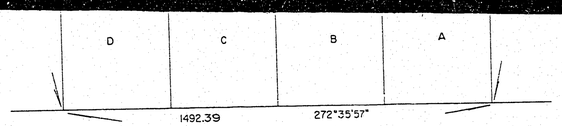
Department of Energy, Mines and Resources
Ministère de l'Énergie des Mines et des Ressources

Department of Indian Affairs and Northern Development
Ministère des Affaires indiennes et du Nord canadien

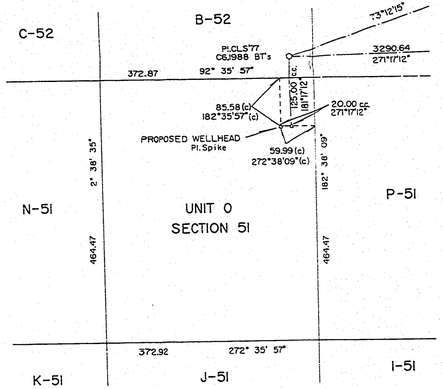
Canada



GRID AREA AND TRAVERSE
SCALE 1:50000



SECTION 51 - GRID
SCALE 1: 10000



DETAIL
UNIT O SECTION 51
SCALE 1:5000

BEARING TREES

C4	0.08 BLACK SPRUCE	9.08	317°36'
	0.08 BLACK SPRUCE	9.24	55°56'
	0.06 BLACK SPRUCE	11.63	157°15'
C5	0.10 BLACK SPRUCE	9.87	171°20'
	0.08 BLACK SPRUCE	9.96	242°39'
	0.06 BLACK SPRUCE	12.45	25°04'
C6	0.06 BLACK SPRUCE	5.17	212°58'
	0.08 BLACK SPRUCE	8.75	321°08'
	C.06 BLACK SPRUCE	11.36	60°35'

GEOGRAPHIC COORDINATES

STATION	LATITUDE	LONGITUDE	STATION	LATITUDE	LONGITUDE
W/S	64° 40' 57.4069"	125° 54' 55.1506"	C2	64° 42' 21.157"	125° 49' 07.097"
789026	64° 42' 44.559"	125° 43' 27.597"	C3	64° 40' 34.197"	125° 50' 29.306"

UTM COORDINATES (123°W.) NAD 1927

STATION	NORTHING	EASTING	ELEVATION	COMBINED FACTOR
789026	7178997.710	370175.557	680.88	0.9996997
C2	7178470.387	365651.593	182.05	0.9997923
C3	7175210.400	364415.247	240.87	0.9997872
C4	7176108.965	364756.027	207.10	0.9997914
C5	7176139.011	361238.468	214.20	0.9997920
C6	7176212.886	360949.353	309.60	0.9997881
W/S	7176088.394	360926.551	314.00	0.9997875

OIL AND GAS GRID COORDINATES, NAD 1927

	CORNER	GEOGRAPHIC		UTM ZONE 10, CM 123° W.	
		LATITUDE,N.	LONGITUDE,W.	NORTHING (m)	EASTING (m)
GRID AREA	NE	64° 50'	125° 45'	7192520.903	369538.318
	NW	64° 50'	126° 00'	7193059.694	357684.800
	SE	64° 40'	125° 45'	7173959.969	368731.955
	SW	64° 40'	126° 00'	7174501.339	356805.124
UNIT O SECTION 51	NE			7176171.168	360990.420
	NW			7176188.077	360617.936
	SE			7175707.187	360969.058
	SW			7175724.098	360596.516

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Distances shown are horizonta
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Geodetic Surveys of Canada (G
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CLS '77 Post placed is shown
Traverse line with station is sh
Bearings and distances of the
to Zone 10, Central Meridian 12

I, William L. Edgerton, of the
Canada Lands Surveyor, make
according to law and the inst
faithfully and correctly execute
and that the said plan and fie
knowledge and belief. SO HEL

Sworn before me at Grande P
in the Province of Alberta, thi
day of December , 1988.

Canada Lands Surveyor

PLAN NO.

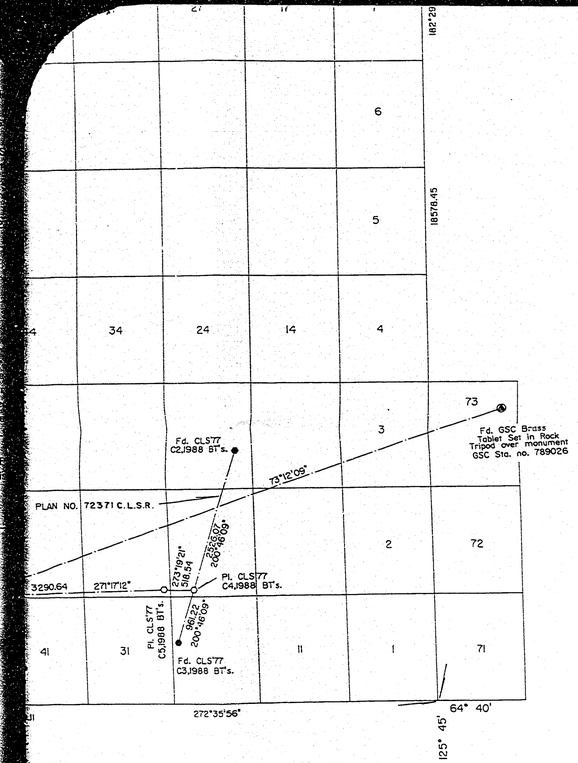
3290.64

41

SCALE 1:50

H I W SURVEYS LTD.
BOX 1409 YELLOWKNIFE NORTHWEST TERRITORIES
PHONE 873-2092 FAX 873-6387
GRANDE PRAIRIE, ALBERTA YELLOWKNIFE, N.W.T.

Drawn by: cla 28/12/88 | FILE NO. 88287
Checked by: cjw



AND TRAVERSE

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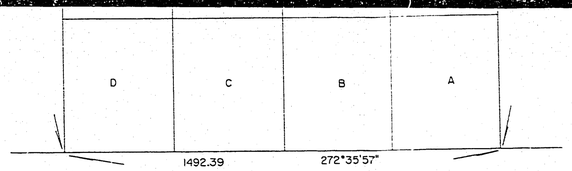
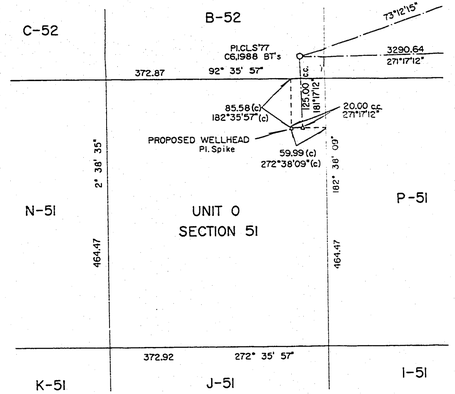


SECTION 51 - GRID

SCALE 1:10000



DETAIL
UNIT 0 SECTION 51

SCALE 1:5000

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LEGEND

Bearings are Grid, derived from the bearing 200°46'09" of the line between found CLS '77 monuments C3 and C2, Plan no. 72371 C.L.S.R. and according to that plan are referred to the Meridian of U.T.M. Zone 10(123° West).

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Geodetic Surveys of Canada (GSC) Monument found is shown thus: ⊕

CLS '77 Post found is shown thus: ●

CLS '77 Post placed is shown thus: ○

Traverse line with station is shown thus: ——o——

Bearings and distances of the Grid Area, Section and Unit are U.T.M. Plane, referred to Zone 10, Central Meridian 123° W.

I, William L. Edgerton, of the City of Grande Prairie, in the Province of Alberta, Canada Lands Surveyor, make oath and say that I have in my own proper person, according to law and the instructions of the Surveyor General of Canada Lands, faithfully and correctly executed the survey shown by this plan and field notes; and that the said plan and field notes are correct and true to the best of my knowledge and belief. SO HELP ME GOD.

Sworn before me at Grande Prairie, in the Province of Alberta, this 29th day of December, 1988.

W.L. Edgerton
Canada Lands Surveyor

Canada Lands Surveyor

CANADA LANDS SURVEYORS RECORDS

Examined by A.A. 87.09.07

87/01/07

CANADA LANDS SURVEY RECORDS
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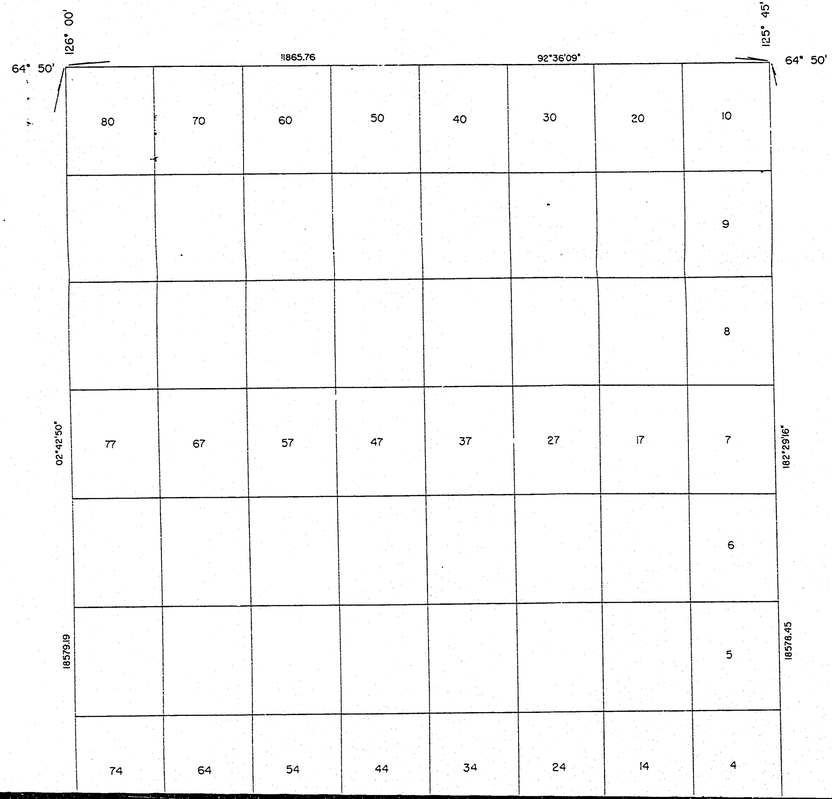
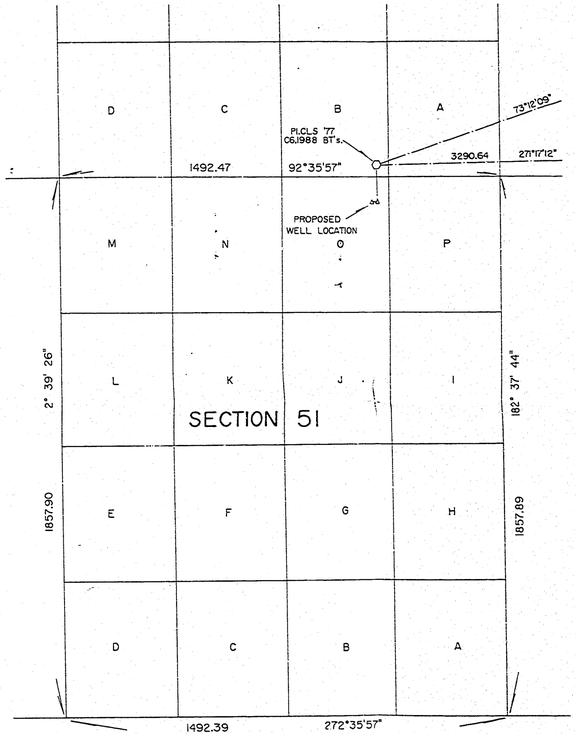
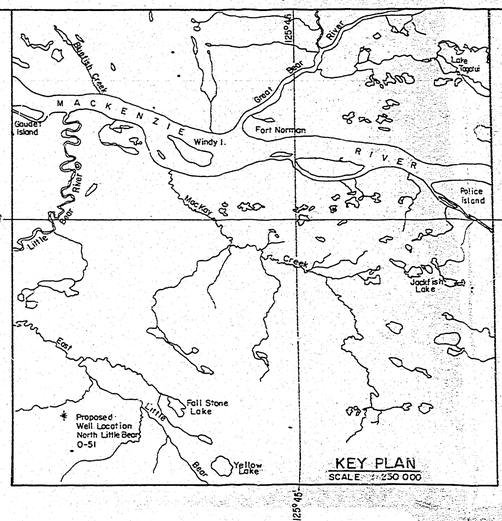


SECTION 52



SECTION 51 - GRID
SCALE 1:10000



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CANADA LANDS SURVEY RECORDS
7 2 3
DATE 8 SEPT

PLAN AND FIELD NOTES OF SURVEY OF
PROPOSED
CONOCO ET AL
EXPLORATION
GRID AREA
NORTHWEST T
CANADA OIL A
SCALE 1:5000

THIS SURVEY WAS
NOVEMBER 22nd
BY WILLIAM L. ED
FOR CONOCO CAN

LEGEND

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CLS '77 Post found is
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to Zone 10, Central Mer

FINAL WELL REPORT

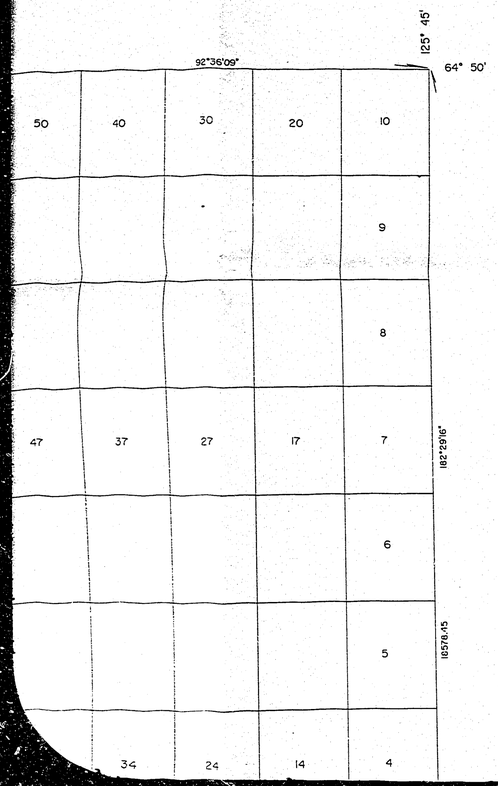
CONOCO ET AL NORTH LITTLE BEAR 0-51

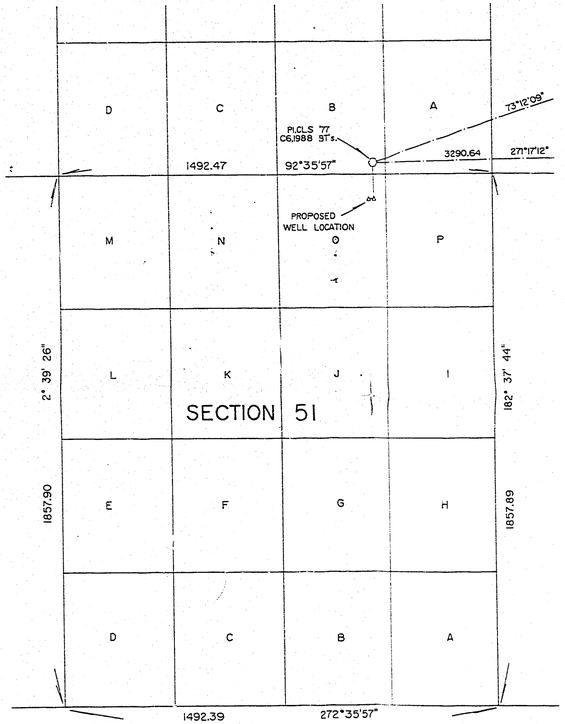
Prepared by John Schneider

February 28, 1989

OTTAWA COPY

9211-C90-1-3





SECTION 51 - GRID

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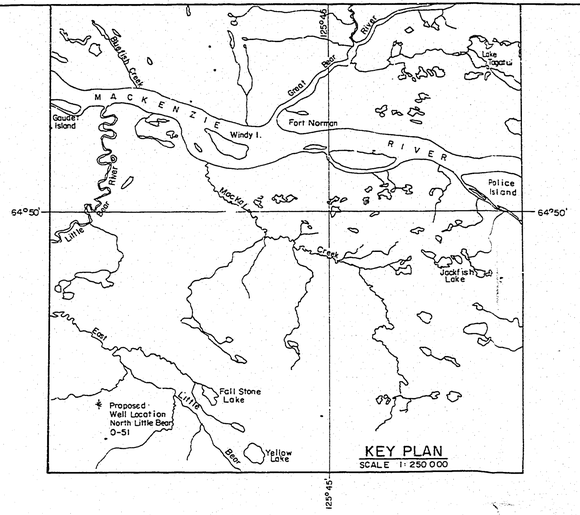

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CANADA LANDS SURVEYS RECORDS
7 2 3 7 2
DATE 8 SEPT. 1989.

PLAN AND FIELD NOTES

OF SURVEY OF

PROPOSED EXPLORATORY WELL

CONOCO ET AL NORTH LITTLE BEAR O-51

EXPLORATION LICENCE NO. 319

GRID AREA 64°50', 125°45' (QUAD.96 C/12)

NORTHWEST TERRITORIES

CANADA OIL AND GAS LAND REGULATIONS

SCALE 1:50000

METRES 0 1000 2000 3000 4000 5000

THIS SURVEY WAS EXECUTED DURING THE PERIOD OF
NOVEMBER 22nd TO NOVEMBER 25th, 1988
BY WILLIAM L. EDGERTON, C.L.S.
FOR CONOCO CANADA LIMITED

LEGEND

Bearings are Grid, derived from the bearing 200°46'09" of the line between found CLS '77 monuments C3 and C2, Plan no. 72371 C.L.S.R. and according to that plan are referred to the Meridian of U.T.M. Zone 10(123° West).

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A. INTRODUCTION

1. Summary

The well Conoco et al North Little Bear O-51 was spudded February [illegible], 1989 and reached a total depth of 2190m on February 21, 1989. This was an exploratory well to evaluate the Cretaceous and Devonian aged formations. The rig Atco/Equatak 76, a conventional land rig, was used to drill this well.

No problems were encountered during the drilling operations. The wireline logs showed no evidence of oil or gas so no DST's were run and the well was plugged and abandoned. The rig was released on February 26, 1989. A map showing the location of the well is attached.

B. GENERAL DATA

WELL NAME : CONOCO ET AL NORTH LITTLE BEAR O-51
UNIT O SECTION 51 GRID AREA 64 50' 125 45'
EXPLORATION AGREEMENT EL319

2. LOCATION : SEOGRAPHIC COORDINATES- NORTH 64 40' 57.4069"
- WEST 125 54' 55.1506"

3. UNIQUE WELL IDENTIFIER :3000516450125450

4. OPERATOR AND DRILLING CONTRACTOR :

CONOCO CANADA LTD	ATCO/EQUATAK DRILLING LTD
3900. 205-5 AVE SW	700, 800-6 AVE SW
CALGARY, ALBERTA	CALGARY, ALBERTA
T2P 2V7	T2P 3G3

5. DRILLING UNIT: ATCO/EQUTAK 76

6. DIFFICULTIES AND DELAYS:NONE

C. SUMMARY OF DRILLING OPERATIONS

320.2

1. ELEVATIONS : GR - 314 M KB - ~~319~~ M

2. TOTAL DEPTH : 2190 M KB

3. DATE AND HOUR SPUDDED : 1989 - 2 - 6 @ 20000 HOURS

4. DRILLING FINISHED : 1989 - 2 - 21 @ 2345 HOURS

5. RIG RELEASE : 1989 - 2 - 26 @ 1200 HOURS

6. WELL STATUS : ABANDONED

7. HOLE SIZES AND DEPTHS :

SIZE	INTERVAL
311 MM	0 - 607 M
222 MM	607 - 2190 M

8. CASING, CEMENT RECORD : SEE TABLE 1

9. SIDETRACKED HOLE : NONE

10.DRILLING FLUID : SEE TABLE 2

11.FISHING OPERATIONS : NONE

12.WELL KICKS : NONE

13.FORMATION LEAKOFF TESTS:

DEPTH (M)	DENSITY (KG/M3)	PRESSURE (KPA)	EMW (KG/M3)	CASING DEPTH (M)
616	1075	3000	1572	607

14.TIME DISTRIBUTION :

ITEM	HOURS
DRILLING	214.75
CIRCULATE	27.75
TRIPS & REAMING	83
REPAIR RIG	18.25
DEVIATION SURVEYS	17.25
LOGGING	16
RUN AND CEMENT CASING	20.25
NIPPLE UP, TEST BOP'S	35
DRILL CEMENT	2.5
FISHING	29
OTHER	5.25
TOTAL	469

15.DEVIATION SURVEY : NONE

16.ABANDONMENT PLUGS :

TYPE	INTERVAL	FLUID BETWEEN PLUG
6.6 TONNES CLASS G	2090-2190	1135 KG/M3 MUD
12.7 TONNES CLASS G	570-730	1135 KG/M3 MUD
0.5 TONNES CLASS G	SURFACE	1135 KG/M3 MUD

17.COMPOSITE WELL RECORD : SUBMITTED EARLIER

D. GEOLOGY
==========

DRILL CUTTINGS, CORES, LITHOLOGY, STRATIGRAPHIC COLUMN, AND BIOSTRATIGRAPHIC COLUMN WERE SUBMITTED EARLIER

E. WELL EVALUATION
==================

1. DOWNHOLE LOGS :

DATE	RUN #	TYPE	INTERVAL	COMPANY
89-2-24	1	DIFL-SONIC-GR-CAL-SP	2190-606	ATLAS WIRELINE
	2	CNL-ZDL-GR-CAL	2190-606	ATLAS WIRELINE
		GR	606-0	ATLAS WIRELINE
	3	VELOCITY SURVEY	2190-606	ATLAS WIRELINE

2. OTHER LOGS : NONE

3. VELOCITY SURVEYS : SUBMITTED EARLIER

4. FORMATION STIMULATION : NONE

TEST RESULTS : NONE

TABLE 1 - CASING AND CEMENT RECORD

TYPE	INTERVAL (M)	SIZE (MM)	WEIGHT (KG/M)	GRADE	MAKE	# OF JTS	THREAD	DATE SET	CEMENT	CEMENT TOP
CONDUCTOR	0 - 18	508	139.9	H40	SUMITOMO	2	STC	89-2-6	2 TONNE ARCTIC	SURFACE
SURFACE	0- 606	244.5	53.6	K55	ALGOMA	50	STC	89-2-11	20 TONNE ARCTIC followed by 16 Tonne "G"	SURFACE

TABLE 2 - DRILLING FLUID

DATE	DAY	DEPTH (M)	MUD TYPE	DENSITY (KG/M3)	VISCOSITY (SEC)	WATER LOSS (CC)
89-2-7	1	80	GEL	1045	34	-
89-2-8	2	325	GEL	1125	43	-
89-2-9	3	485	GEL	1170	44	-
89-2-10	4	607	GEL	1220	57	11
89-2-11	5	607	GEL	1220	57	11
89-2-12	6	707	GEL/CHEM	1070	32	18.4
89-2-13	7	1115	GEL/CHEM	1115	40	14.2
89-2-14	8	1480	GEL/CHEM	1150	46	8.8
89-2-15	9	1660	GEL/CHEM	1160	43	8.4
89-2-16	10	1660	GEL/CHEM	1160	43	8.4
89-2-17	11	1711	GEL/CHEM	1145	49	8.8
89-2-18	12	1802	GEL/CHEM	1145	50	7.8
89-2-19	13	1900	GEL/CHEM	1150	52	7.6
89-2-20	14	1962	GEL/CHEM	1150	48	8.4
89-2-21	15	2099	GEL/CHEM	1155	44	7.6
89-2-22	16	2190	GEL/CHEM	1150	67	8
89-2-23	17	2190	GEL/CHEM	1135	78	7.8
89-2-24	18	2190	GEL/CHEM	1135	76	6.5
89-2-25	19	2190	GEL/CHEM	1135	76	6.5
89-2-26	20	2190	GEL/CHEM	1135	76	6.5

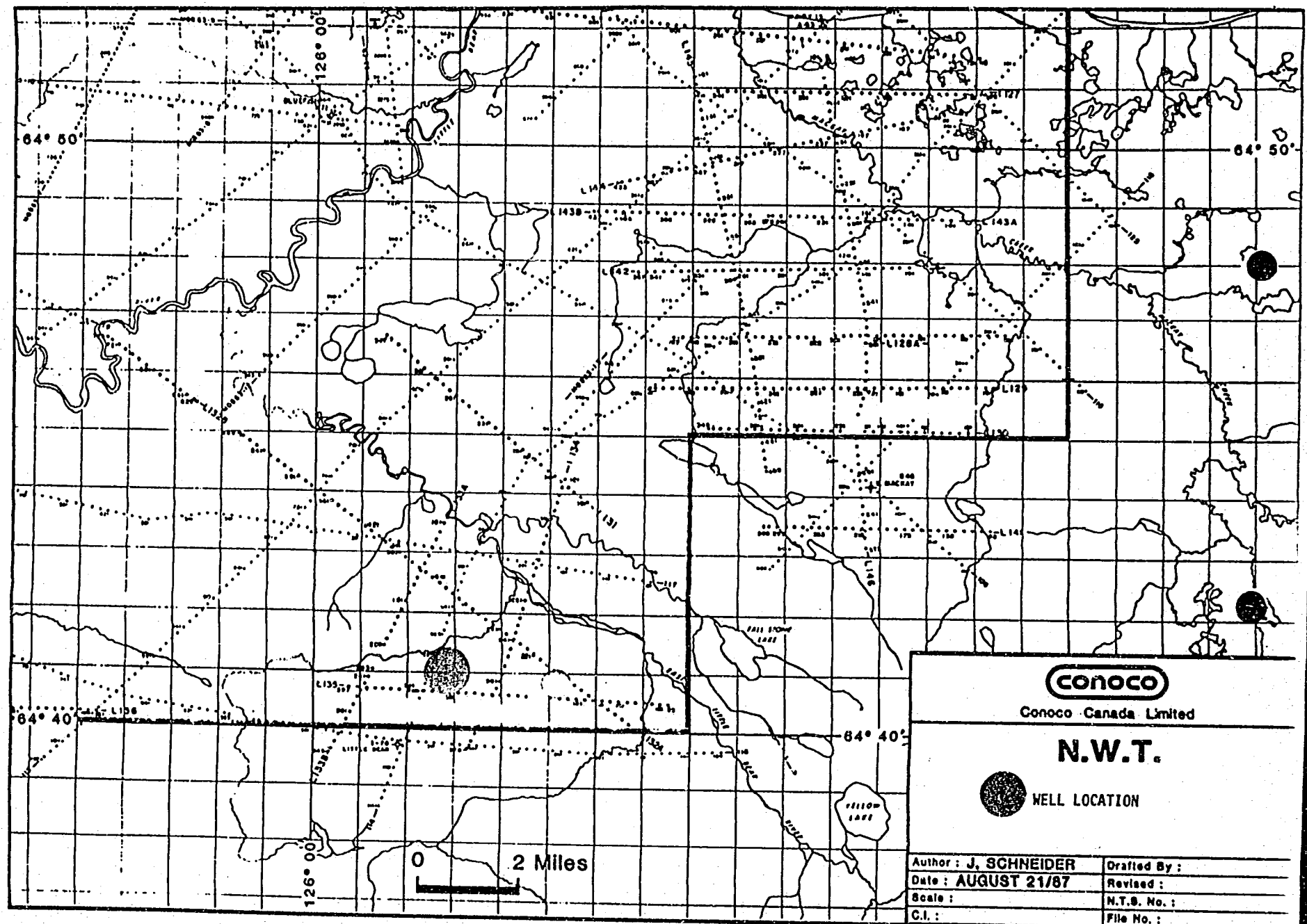
TABLE 3 - DEVIATION SURVEYS

DEPTH (M)	DEVIATION (DEG)	DEPTH (M)	DEVIATION (DEG)	DEPTH (M)	DEVIATION (DEG)	DEPTH (M)	DEVIATION (DEG)
58	1	426	0.75	1106	1.25	1589	1.75
77	0.75	485	0.75	1162	1.5	1644	2.125
104	0.125	535	0.875	1220	1	1674	1.875
132	1	580	0.75	1277	0.75	1709	1.875
160	1	673	1	1334	0.5	1730	1.75
190	1	723	1.25	1391	0.75	1800	1.75
217	0.125	827	1.25	1459	1.5	1895	1.875
335	0.875	923	1.5	1505	1.25	1952	1.625
362	0.875	997	1.5	1533	1.5	2030	1.625
		1054	1.75	1569	1.75	2125	2

TABLE 4 - BIT RECORD

BIT	SIZE (MM)	MAKE	TYPE	JETS (MM)	IN (M)	OUT (M)	METERS	HOURS	MPH	WOB (M DAN)	RPM	CONDITION
1	311	STC	XF8998	3 X 18	23	325	302	23.5	12.9	12	130	3-3-I
2	311	STC	XF9026	3 x 20	325	607	282	23.5	12.0	15	150	3-3-I
3	222	DBS	PD4	3 X 14	607	1660	1053	63.25	16.6	5	120	3-3-I
4	222	ST	F2	3 X 8	1660	1953	293	68.5	4.3	16	100	3-3-I
5	222	DBS	PD5	3 X 8	1953	2190	237	35.5	6.7	13	100	3-3-I

Ft. Norman


64° 50'
128° 00'
64° 40'
126° 00'
0
2 Miles
conoco
Conoco Canada Limited
N.W.T.
WELL LOCATION
Author : J. SCHNEIDER
Drafted By :
Date : AUGUST 21/87
Revised :
Scale :
N.T.S. No. :
C.I. :
File No. :

Stratech Services Ltd.

2612 - 13 Avenue N.W., Calgary, Alberta T2N 1L9 Telephone (403) 282-9804

9211- C90-1-3

CONOCO CANADA LIMITED
GEOLOGICAL REPORT
CONOCO ET AL NORTH LITTLE BEAR O-51
O-51-64-50-125-45

Kory Koke, M. Sc., P. Geol.

CONOCO ET AL NORTH LITTLE BEAR 0-51
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CONOCO ET AL NORTH LITTLE BEAR O-51
WELL DATA SUMMARY

WELL NAME:	Conoco et al North Little Bear O-51	
LOCATION:	Longitude:	125 degrees, 54 minutes, 55.1506 seconds West.
	Latitude:	64 degrees, 40 Minutes, 57.4069 seconds North.
GRID AREA:	64-50-125-45	
WELL LICENCE:	C.O.G.L.A. Drilling Authority #1395 to Conoco Canada Limited.	
ELEVATIONS:	Ground:	314.0m
	Kelly bushing:	320.2m
SPUD DATE:	6 February, 1989, 20:00 hrs	
TOTAL DEPTH:	Drillers: 2190m (Hume) 21 Feb/89 23:30	
	Loggers: 2181.8m	
CONTRACTOR:	ATCO/EQUTAK Drilling Ltd., Rig No. 76	
SUPERVISION:	Drilling:	Rick Jones
	Geological:	Kory Koke
HOLE SIZE:	Surface:	311mm
	Main:	222mm
CASING:	Conductor:	508.0mm set at 24.0m KB
	Surface:	244.5mm set at 606m KB
DRILLING FLUIDS:	0-2190m:	gel-chemical
SAMPLE STUDY:	CCL:	30m to TD, 5m interval.
	C.O.G.L.A.:	30m to TD, 5m interval.
OPEN HOLE LOGS:	Western-Atlas	
	DIFL-SP-AC-GR-	- 2182-606m
	CD/CN-GR	- 2182-606m
	CN-GR	- 606-24m
	Check shot	- TD to 606m (100m)

CONOCO ET AL NORTH LITTLE BEAR O-51
DAILY WELL HISTORY

DATE (m/d/y)	DAY NUMBER	DEPTH (06:00)	MUD WT.	PROPERTIES VIS.	W.L.	pH	DAILY OPERATIONS
02/07/89	1	80m	1045	34	n/a	n/a	Rig up, tag conductor cement, spud 20:00 hrs (6 Feb).
02/08/89	2	325	1125	43	n/a	9.5	Drill ahead, trip out bit #1, inspect crown.
02/09/89	3	485	1170	44	n/a	n/a	Run bit #2 at 325m, drill ahead.
02/10/89	4	607	1220	52	10.6	9.5	Drill ahead to 607m, trip out and begin to run casing.
02/11/89	5	607	n/a	n/a	n/a	n/a	Run 244mm casing to 606m, 36T cement, nipple up BOP's.
02/12/89	6	707	1070	32	18.4	9.0	Drill out cement and drill ahead with bit #3.
02/13/89	7	1115	1115	40	14.2	9.5	Drill ahead with bit #3.
02/14/89	8	1480	1150	46	8.8	9.0	Drill ahead with bit #3.
02/15/89	9	1660	1160	43	8.4	9.3	Drill ahead with bit #3, trip out bit #3.
02/16/89	10	1660	1160	43	8.4	9.3	Trip in with bit #4, circulate and wait on orders.
02/17/89	11	1711	1145	49	8.8	9.5	Circulate and wait on orders, drill ahead with bit #4.
02/18/89	12	1802	1145	50	7.3	9.0	Drill ahead with bit #4.
02/19/89	13	1900	1150	52	7.6	9.0	Drill ahead with bit #4.
02/20/89	14	1962	1150	48	8.4	9.0	Drill and trip bit #4 (3-4-I), run and drill with bit #5 (PDS).
02/21/89	15	2099	1155	44	7.6	9.3	Drill ahead with bit #5.
02/22/89	16	2190	1150	67	8.0	9.5	Drill to 2190m (TD), work stuck pipe for 5 hours.
02/23/89	17	2190	1135	78	7.8	9.5	Work stuck pipe, spot oil, determine free point.
02/24/89	18	2190	1135	76	6.5	9.5	Back off fish, chain out, RIH, catch fish & POOH.
02/25/89	19	2190	-	-	-	-	Recover fish, log hole, RIH open ended.

CONOCO ET AL NORTH LITTLE BEAR 0-51
BIT RECORD

BIT NO.	SIZE (mm)	TYPE	RPM	DEPTH OUT	METERS	HOURS	CONDITION (t-b-g)	FOB /1000
1	311	SDT	130	325	302	23.5	(x-x-x)	12
2	311	SDT	150	607	282	24.25	(3-3-I)	15
3	222	PD4	120	1660	1053	63.25	(good)	4-10
4	222	F2	90	1953	293	68.5	(3-4-I)	16
5	222	PD5	100	2190	237	35.5	(good)	10-13

CONOCO ET AL NORTH LITTLE BEAR O-51
DEVIATION RECORD

DEPTH (m)	INCLINATION (degrees)	AZIMUTH (degrees)	DEPTH (m)	INCLINATION (degrees)	AZIMUTH (degrees)
58	1		1106	1&1/4	N53W
77	3/4		1162	1&1/2	N50W
104	1/8		1220	1	N48W
132	1		1277	3/4	N46W
160	1		1334	1/2	N60W
190	1		1391	3/4	N57W
217	1/8		1459	1&1/2	N47W
244	3/4		1503	1&1/4	N61WW
274	3/4		1533	1&1/2	N58W
302	1/2		1560	1&3/4	N50W
335	7/8		1589	1&3/4	N44W
362	7/8		1644	2&1/8	N32W
426	3/4		1674	1&7/8	N42W
485	3/4		1703	1&7/8	N49W
535	7/8		1730	1&3/4	N52W
580	3/4		1800	1&3/4	N70W
673	1		1895	1&7/8	N79W
723	1&1/4	N46W	1982	1&5/8	N89W
827	1&1/4	N58WW	2030	1&5/8	N90W
923	1&1/2	N47W	2190	misrun	
997	1&1/2	N40W			
1054	1&3/4	N45W			

CONOCO ET AL NORTH LITTLE BEAR O-51
FORMATION TOPS

FORMATION TOPS	DEPTH (KB)	DEPTH SUBSEA
Kelly Bushing	0m	+320.2m
East Fork	surface	+314.0
Little Bear	701	-380.8
Slater River	1165.5	-845.3
Slater Source Shales	1406.5	-1086.3
Sans Sault	1530.5	-1210.3
Upper Imperial	1542.5	-1222.3
"Fall Stone Lake"	1653.5	-1333.3
Lower Imperial	1667	-1346.8
"Canol"	1969	-1648.8
Kee Scarp	-	-
"Hare Indian"	2035	-1714.8
Hume	2159.5	-1839.3
Total Depth	2181.8	-1861.6

CONOCO ET AL NORTH LITTLE BEAR O-51
GEOLOGICAL SUMMARY

General

The Conoco et al North Little Bear O-51 well was drilled in early 1989 to evaluate apparent thickening within the Devonian Jungle Ridge reflector in the Imperial shale. This hypothetical bioherm was termed the "Fallstone Lake" complex by Conoco geologists. Unfortunately, the features seen on seismic appear to be thin tight limestone and siltstone stringers within the Imperial shale. The "Fallstone Lake" as used within this report may be equivalent to the Jungle Ridge limestone lens known in this area.

A secondary target was apparent structural closure on the Cretaceous Sans Sault basal clastic sediments draped over the structures below. There appears to be no question that hydrocarbons are present in this unit as numerous shale and siltstone samples show oil cut in solvent. The problem is the delineation of a suitable reservoir. No porous rock was noted in this interval of the North Little Bear O-51.

A third potential horizon was the Kee Scarp, seen on seismic sections as a weak reflector above the Canol shale. This Formation produces oil at Norman Wells, and is adjacent and partially equivalent to the enclosing petroliferous Canol and Hare Indian shales. Although good source is present in this well, no reservoir was noted.

It appears to the writer that both source and reservoir are present in this well, but never in the same strata. The sands of the Little Bear Formation have good porosity, but are charged with relatively fresh water which indicates that they communicate with the surface nearby. All rocks below the Slater River Source Shales (1406.5m) may show anomalous gas detector responses and/or light oil cut in solvent. A few thin stringers of tight very fine grained sandstone, siltstone, and tight limestone were present within this hydrocarbon window in the O-51. No porosity or permeability was observed in samples. Although disappointing, the results of this well do not condemn the hydrocarbon potential of the Little Bear area.

Summary of Formations

East Fork

In the North Little Bear O-51 well, the East Fork outcrops at the surface (a medium grey marine clay) and is bounded below by the Little Bear arenaceous beds. The lithology is

primarily unconsolidated grey-brown to medium grey marine shale interrupted by minor pulses of poorly consolidated sandstone and siltstone. The upper 80 meters or so contains some unconsolidated gravels of Cretaceous age that include carbonate fragments from the Devonian and sandstone and igneous rock fragments from the Precambrian. The argillaceous fraction of the East Fork (>85%) disperses conpletely into the mud system making sampling difficult. No hydrocarbon shows or significant gas readings were recorded from this unit.

Little Bear

The Little Bear Formation at the O-51 location is a non-marine to marine fluvio-deltaic complex of interbedded sandstone, siltstone, shale, and minor conglomerate. Four or five coal seams of less than 1 meter each were logged. The sands are light to medium grey, fine to coarse grained, subangular to subrounded, and commonly contain chert pebbles. Sand grains and chert pebbles are also observed floating in silty and argillaceous parts of the section. In general the sediments are poorly consolidated resulting in the dispersal of clays into the mud system. Although many of the sands and conglomerate beds within the Little Bear would serve as good reservoir, the absence of a source rock or closure has reduced the hydrocarbon potential here. No oil shows or gas kicks were recorded.

Slater River

The Cretaceous Slater River Formation is a Cretaceous marine shale package underlying the primarily clastic Little Bear package. The uppermost 50 meters or so is interbedded with abundant light to medium grey siltstone and very fine grained sandstone that gives way below to a relatively consistent medium grey silty shale. A good log marker at 1406.5m corresponds to flaky dark grey micromicaceous shale. This material is rich in hydrocarbons and may serve as a source rock to adjacent reservoirs. It gives anomalously high gas detector readings and may show a faint cut in solvent. This formation does not contain any reservoir rock in the O-51 well.

Sans Sault

The Sans Sault in the O-51 well represents the wedge edge of a clastic package that thickens to the north and west. It is here rather thin bedded and argillaceous with up to 30%

siltstone and sandstone stringers. The shales are medium to dark grey, micromicaceous, flaky, and very petroliferous in part. The sandstone (only 2 or 3 beds from 1 to 2 meters thick) is light grey to grey-green, very fine grained, silty, and has poor to no visible porosity. The siltstone stringers represent the same facies but are finer and very tight. Gas detector readings ranged up to 390 units in the Sans Sault section and were erratic and variable. One sample (1540-1545m) is 10% of a very fine grained sandstone that has about 6% porosity with even light oil stain and poor to fair cut with streaming. Some of the gas readings in this unit are undoubtedly due to thin petroliferous shale units which seem to be interbedded with the siltstone and sandstone. In general, the Formation has potential in this area as closure and source can be demonstrated. However, in the O-51 well, no reservoir rock was observed in samples.

Imperial shale

The Imperial Formation is a thick sequence of medium to dark grey to grey-green shales with abundant grey to grey-green siltstone interbeds. There are a few stringers of tight grey bioclastic limestone that may be associated with shoaling as they are interbedded with fine clastics. Some phases of the Imperial will cut oil in solvent after a long soak, but no reservoir quality rock was noted. Refer to the strip log (in pocket) for details on the locations of clastic and carbonate stringers.

"Fallstone Lake (Jungle ridge)

The "Fallstone Lake" (Jungle Ridge) limestone/siltstone lentil is the thickest competent unit within the Imperial. It is composed of about 13m of tight grey to brown argillaceous and silty limestone and interbedded calcareous siltstone. The material is clearly not prospective, but the facies indicates that clastic/carbonate buildups of Imperial age probably exist elsewhere in the area.

Lower Imperial

Below the Jungle Ridge, the argillaceous facies of the Lower Imperial continue essentially unchanged except for an increase in siltstone content toward the base. The base of the Imperial can be arbitrarily defined as the base of the lowest siltstone bed (1969m).

"Canol" Shale

Dark grey to black petroliferous shales below the silty beds of the lower Imperial are referred to herein as the "Canol" shales. This material may serve as source rock, but has no commercial potential. Note that this usage of the term "Canol" may not be consistent with that of other writers.

"Hare Indian"

In the report, the dark brown earthy to dull shales immediately above the Hume Formation are referred to as the "Hare Indian" unit. This shale is the most petroliferous material encountered in the O-51 well, and would serve as an excellent source rock. It contains tiny pyritized rods and a few white tubular microfossils mostly within calcareous and marly stringers near the base. Very high gas background readings (up to 450 units) were obtained from this shale, but no porosity of any kind was evident in the samples.

Hume

The North Little Bear O-51 well bottomed in the Hume Formation, a Devonian platform carbonate. In this well the Hume is a buff to brown mottled clean carbonate of probable bioclastic origin. It contains stylolites and is rather fetid, but has no porosity. It is not considered prospective in this area.

CONOCO ET AL NORTH LITTLE BEAR O-51
SAMPLE DESCRIPTIONS

Sample study begins in East Fork Formation (on surface).

25-30m	75%	Shale: medium grey, micromicaceous, soft, slightly carbonaceous in part.
	15	Siltstone: medium to light grey, argillaceous, micaceous, slightly carbonaceous.
	10	Unconsolidated Sands and Gravels: limestone and sandstone fragments, medium to very coarse grained angular to subangular chert and minor quartz grains, some may float in shale.
30-35	60	Shale: as above.
	10	Siltstone: as above.
	30	Unconsolidated Sands and Gravels: as above.
35-40	65	Shale: as above.
	25	Unconsolidated Sands and Gravels: as above
	10	Siltstone: as above, becoming sandy in part.
40-45	70	Unconsolidated Sands and Gravels: dark grey angular to subangular medium to very coarse grained chert/quartz sand, angular limestone and dolomite fragments and cobbles, some tight white to light grey sandstone and metamorphic rock fragments, basically immature sandy gravels, unconsolidated, no shows.
	20	Shale: light grey-brown to medium grey, micromicaceous in part, some silty, common grey-brown sideritic nodules, trace pelecypod fragments, abundant Haplophragmoides sp. cf. gigas.
	10	Siltstone: light to medium grey, argillaceous, sandy, micaceous.
45-50	40	Unconsolidated Sands and Gravels: as above, abundant dark grey very coarse grained chert sand.
	30	Shale: as above, foraminifera.
	20	Sideritic Shale: tan to light brown, stringers in softer shale.
	10	Siltstone: as above.

CONOCO ET AL NORTH LITTLE BEAR 0-51
SAMPLE DESCRIPTIONS

50-55m	50%	Unconsolidated Sands and Gravels: as above, abundant dark grey chert sand.
	20	Shale: as above.
	20	Sideritic Shale: as above.
	10	Siltstone: as above.
55-60	60	Shale: dark to medium grey, tan to medium brown, micromicaceous in part, some silty, some sideritic, hard, thin bedded, pyritic, pelecypod fragments.
	30	Unconsolidated Sands and Gravels: dark grey medium to very coarse grained subangular chert/quartz sand, brown to tan limestone and dolomite fragments and angular cobbles.
	10	Siltstone: light to medium grey, argillaceous, sandy, carbonaceous, micaceous, thin stringers.
60-65	50	Shale: as above, some brown sideritic nodules.
	35	Unconsolidated Sands and Gravels: as above.
	15	Siltstone: as above, grading in part to very fine grained sandstone, tight, no shows.
65-70	55	Shale: as above, abundant p[illegible]ite, common sideritic stringers and nodules.
	25	Unconsolidated Sands and Gravels: as above.
	20	Siltstone: as above.
70-75	75	Shale: most light grey-brown, blocky, sideritic, some medium to dark grey, earthy, micromicaceous, most dissolves in mud system, abundant pyrite and white gypsum coxcomb vein or void fillings.
	15	Unconsolidated Sands and Gravels: mostly light to dark grey, medium to very coarse grained, angular to subrounded chert/quartz sand, some dark grey chert pebbles, minor carbonate rock fragments.
	10	Siltstone: light grey, sandy, argillaceous, micaceous, thin stringers.

CONOCO ET AL NORTH LITTLE BEAR O-51
SAMPLE DESCRIPTIONS

75-80m	70%	Shale: as above, abundant gypsum as above.
	20	Unconsolidated Sands and Gravels: as above.
	10	Siltstone: as above, grading in part to very fine grained sandstone, tight, no shows.
80-85	95	Shale: light to medium grey-brown, soft, blocky, most disintegrates to clay in mud system.
	5	Unconsolidated Sands and Gravels: as above.
85-90	100	Shale: as above, rarely micromicaceous, most soft, earthy, becomes suspended in mud system.
90-95	100	Shale: light to medium grey-brown, rarely micromicaceous, most earthy, blocky, soft, most suspended in mud.
95-100	100	Shale: as above.
100-105	100	Shale: as above, some silty, sandy, trace pelecypod fragments.
105-110	80	Silt and Sand: light grey-brown, sand is unconsolidated, residual material floating in unconsolidated shale.
	20	Shale: as above.
110-115	90	Silt: light grey-brown, some very fine grained sand, unconsolidated, residual material floating in clay that has dissolved in mud system.
	10	Shale: light to medium grey-brown, earthy, unconsolidated (clay), some sandy or silty, decomposes in mud system.
115-120	75	Silt: as above.
	25	Shale: as above.
120-125	95	Silt: as above.
	5	Shale: as above.

CONOCO ET AL NORTH LITTLE BEAR O-51
SAMPLE DESCRIPTIONS

125-130m	75%	Silt: as above.
	25	Shale: as above.
130-135	70	Silt: light grey-brown, residue from silty clay.
	20	Shale: light to medium grey-brown, earthy, unconsolidated (clay), silty to sandy, most ends up suspended in mud system.
	10	Sand: medium grey, medium to very coarse grained, angular, medium sorting, dark grey chert with minor quartz, scattered small pebbles.
135-140	75	Silt: as above.
	20	Shale: as above.
	2	Sand: as above.
140-145	80	Silt: as above.
	15	Shale: as above.
	5	Sand: as above.
145-150	90	Silt: as above.
	5	Shale: as above.
	5	Sand: as above.
150-155	75	Silt: light grey, some very fine grained sand, redidue from liquified silty clay.
	20	Shale: light grey-brown, earthy, soft, unconsolidated, decomposes in mud system, some sandy to silty.
	5	Sand: medium grey, coarse grained chert with minor quartz.
155-160	80	Silt: as above.
	20	Shale: as above.
160-165	85	Silt: as above.
	10	Shale: as above.
	5	Sand: as above.
165-170	90	Silt: as above.
	10	Shale: as above.
170-175	85	Silt: light grey-brown, some very fine grained sand, all unconsolidated, residue from breakdown of clay.

CONOCO ET AL NORTH LITTLE BEAR O-51
SAMPLE DESCRIPTIONS

Sample continued from previous page.

170-175m	15%	Shale: light grey-brown, earthy, soft, silty in part, some unconsolidated and turns to clay in mud system.
175-180	80	Silt: as above.
	20	Shale: as above.
180-185	65	Silt: as above.
	35	Shale: as above.
185-190	55	Silt: as above.
	30	Shale: as above.
	10	Sand: medium grey, fine to coarse grained, poor sorting, subangular, grey chert with minor clear quartz, residue from shale.
	5	Bentonitic Shale: light blue-grey, waxy.
190-195	70	Silt: light grey-brown, sandy in part, unconsolidated, residue from dissolved shale.
	25	Shale: light grey-brown, soft, unconsolidated, silty in part, decomposes in mud system.
	5	Sand: as above.
	tr	Bentonitic Shale: as above.
195-200	65	Silt: as above.
	25	Sand: as above but most very fine to fine grained.
	10	Shale: as above.
200-205	75	Silt: as above.
	15	Shale: as above.
	10	Sand: as above, most very fine to fine grained.
205-210	90	Silt: as above, grading to very fine grained sand, residue after clay has washed away.
	10	Shale: as above.
210-215	60	Shale: light grey-brown, soft, earthy, decomposes to clay in mud system.
	40	Silt: light grey-brown, some very fine grained sand, residue from clays.

CONOCO ET AL NORTH LITTLE BEAR O-51
SAMPLE DESCRIPTIONS

215-220m	70%	Shale: as above, some silty.
	30	Siltstone: as above.
220-225	80	Silt: as above, residual.
	20	Shale: as above.
225-230	90	Silt: as above, some sandy.
	10	Shale: as above.
230-235	50	Silt: light grey-brown, sandy in part, residual.
	40	Sand: light grey-brown, very fine grained, medium sorting, subangular, dark grey chert with abundant clear quartz, residue remaining after clay washed away by drilling mud.
	10	Shale: light grey-brown, soft, unconsolidated, silty and sandy in part, decomposes in mud.
235-240	80	Silt: as above.
	20	Shale: as above.
240-245	40	Shale: as above, silty.
	40	Silt: as above.
	20	Sand: as above but very fine to fine grained, partly consolidated in stringers, partly residue from breakdown of clays.
245-250	70	Silt: light grey-brown, unconsolidated, sandy in part, residue from desomposed clays.
	30	Shale: light grey-brown, soft, earthy, sandy to silty in part, most decomposes in mud system.
250-255	55	Silt: as above.
	30	Shale: as above.
	15	Sand: medium to dark grey, very coarse grained, medium sorting, angular, dark grey chert and shale clasts.
255-260	65	Shale: as above.
	30	Silt: as above.
	5	Sand: as above.

CONOCO ET AL NORTH LITTLE BEAR O-51
SAMPLE DESCRIPTIONS

260–265m	90%	Shale: as above.
	10	Silt: as above.
	tr	Sand: as above.
265–270	100	Shale: light grey-brown, soft, unconsolidated, silty in part, most becomes suspended in mud system.
270–275	100	Shale: as above.
275–280	100	Shale: as above.
280–285	100	Shale: as above, a few floating dark grey chert grains up to 2mm.
285–290	100	Shale: light grey-brown, unconsolidated, soft, rarely silty, scattered floating dark grey chert grains, most decomposes in mud system.
290–295	100	Shale: as above, no sand.
295–300	100	Shale: as above.
300–305	100	Shale: as above, trace tan sideritic nodules.
305–310	85	Shale: light grey-brown, soft, unconsolidated to poorly consolidated, sandy to silty in part, scattered tan sideritic nodules, some decomposes in mud system.
	15	Sand: light grey, fine grained, medium sorting, subangular, dark chert with clear quartz, scattered small pebbles, may be floating in clay.
310–315	60	Shale: as above.
	40	Sand: as above, may be residue after clays wash away, or may be discrete beds of unconsolidated sand.
315–320	50	Shale: as above, minor tan sideritic nodules.
	50	Sand: as above, residue in part.
320–325	85	Shale: as above.
	15	Sand: as above, residue.

CONOCO ET AL NORTH LITTLE BEAR O-51
SAMPLE DESCRIPTIONS

325-330m	95%	Shale: light grey-brown, unconsolidated, silty in part, most decomposes in mud system.
	5	Silt: light grey-brown, unconsolidated.
330-335	100	Shale: as above, some silty, some floating medium chert grains.
335-340	100	Shale: as above, some slightly carbonaceous, trace tan sideritic nodules.
340-345	100	Shale: as above, trace becoming medium grey.
345-350	100	Shale: light grey-brown, soft, unconsolidated, silty in part, trace medium grained medium to dark grey chert, carbonaceous in part, turns to clay in mud system.
350-355	85	Shale: as above, some consolidated, becoming very silty and sandy.
	15	Sandstone: light to medium grey, very fine to coarse grained, scattered chert pebbles, subangular, poor sorting, dark grey chert with minor quartz, clay and siliceous cement, tight to unconsolidated, no shows.
355-360	90	Shale: as above,trace foraminifera, floating chert pebbles.
	10	Sandstone: as above, tight to unconsolidated, no shows.
360-365	65	Shale: as above, better consolidated, most very silty.
	20	Siltstone: light to medium grey-brown, argillaceous, sandy, thin bedded.
	15	Sandstone: generally as above, most very fine to fine grained with common chert pebbles, unconsolidated to moderately well indurated, poor to fair porosity, no shows.

CONOCO ET AL NORTH LITTLE BEAR O-51
SAMPLE DESCRIPTIONS

365-370m	65%	Shale: medium to light grey-brown, moderately well consolidated, most silty and sandy, scattered floating chert pebbles.
	25	Conglomeratic Sandstone: light to medium grey-brown, very fine to medium grained, poor sorting, subangular to subrounded, dark chert with frosted to clear quartz, abundant 1 to 10mm chert pebbles, moderately well indurated, poor to fair porosity, no shows.
	10	Siltstone: as above.
370-375	50	Shale: as above.
	35	Conglomeratic Sandstone: as above, some light grey, yellow, green but most dark grey chert pebbles, poor to fair porosity,no shows.
	15	Siltstone: as above.
375-380	40	Conglomeratic Sandstone: as above, poor to good? porosity, no shows.
	40	Shale: as above.
	20	Siltstone: as above.
380-385	70	Shale: light to medium grey-brown, earthy, blocky, silty and sandy, moderately well consolidated, some tan sideritic stringers, trace pyrite.
	20	Siltstone: medium to light grey-brown, argillaceous, sandy, moderately well consolidated.
	10	Conglomeratic Sandstone: as above, poor to fair porosity, no shows.
385-390	60	Shale: as above.
	20	Siltstone: as above.
	20	Conglomeratic Sandstone: medium to light grey-brown, very fine to medium grained, abundant chert pebbles from 1 to 10mm embedded, poor sorting, subangular to subrounded, light to dark grey, some tan chert with frosted to clear quartz, moderately well consolidated, clay and siliceous cement, poor to fair porosity, no shows.

CONOCO ET AL NORTH LITTLE BEAR O-51
SAMPLE DESCRIPTIONS

390-395m	50%	Shale: as above, very silty, sideritic stringers.
	30	Siltstone: as above.
	20	Conglomeratic Sandstone: as above, poor to fair porosity, no shows.
395-400	45	Shale: as above, very silty, sideritic.
	30	Siltstone: as above.
	25	Conglomeratic Sandstone: as above, poor porosity, no shows.
400-405	80	Shale: generally as above but less silty, becoming unconsolidated clay in part.
	10	Conglomeratic Sandstone: as above, poor porosity, no shows.
	10	Siltstone: as above.
405-410	100	Shale: light grey to light brown, earthy, soft, some silty, some embedded chert grains and pebbles, unconsolidated in part, most decomposing to clay in mud system.
410-415	100	Shale: as above.
415-420	100	Shale: as above, rarely light grey, pyritic, bentonitic.
420-425	100	Shale: as above, trace becoming dark grey.
425-430	100	Shale: light grey-brown, soft, earthy, slightly carbonaceous, slightly silty, unconsolidated, most decomposes to clay in mud system.
430-435	100	Shale: as above.
435-440	100	Shale: as above.
440-445	100	Shale: as above, trace pyrite.
445-450	100	Shale: light to medium grey-brown, soft, earthy, slightly silty, slightly carbonaceous, decomposes to clay in mud system.

CONOCO ET AL NORTH LITTLE BEAR O-51
SAMPLE DESCRIPTIONS

450-455m	90%	Shale: as above, commonly pyritic.
	10	Conglomeratic Sandstone: light grey, very fine to medium grained, abundant 1 to 10mm chert pebbles, subangular to subrounded, poor sorting, clay and siliceous cement, poor consolidation, poor to fair porosity, no shows.
455-460	85	Shale: as above.
	15	Conglomeratic Sandstone: as above, no shows.
460-465	80	Shale: as above, becoming very silty and better consolidated.
	10	Conglomeratic Sandstone: as above, no shows.
	10	Siltstone: light grey-brown, argillaceous, sandy, thin bedded.
465-470	70	Shale: light to medium grey-brown, blocky, silty and sandy in part, moderately well consolidated, carbonaceous in part.
	15	Conglomeratic Sandstone: medium to light grey, very fine to fine grained, abundant chert pebbles from 1 to 10mm, subangular, poor sorting, light to dark grey chert with minor frosted quartz, siliceous and clay cement, poor to fair porosity, no shows.
	15	Siltstone: medium to light grey-brown, argillaceous, sandy, micaceous, carbonaceous in part.
470-475	75	Shale: as above, trace medium to dark grey, micromicaceous, thin stringers.
	15	Siltstone: as above.
	10	Conglomeratic Sandstone: as above, no shows.
475-480	85	Shale: as above, some medium grey micromicaceous type also.
	10	Siltstone: as above.
	5	Conglomeratic Sandstone: as above, no shows.

CONOCO ET AL NORTH LITTLE BEAR O-51
SAMPLE DESCRIPTIONS

480-485m	75%	Shale: light to medium grey-brown, micromicaceous to earthy, most silty or sandy, becoming better consolidated, a few floating small chert pebbles.
	25	Siltstone: light grey-brown, very sandy and argillaceous, carbonaceous in part, a few floating chert pebbles.
485-490	60	Shale: as above, very silty, a few foraminifers.
	20	Siltstone: as above.
	20	Sandstone: light to medium grey-brown, very fine to fine grained, abundant small chert pebbles, poor sorting, subangular to subrounded, silty to argillaceous in part, carbonaceous in part, poor porosity to tight, no shows.
490-495	60	Sandstone: medium grey, very fine to medium grained, common small pebbles, subangular, poor sorting, clear quartz with white and light to dark grey chert, carbonaceous in part, some silty, clay and siliceous cement, friable in part, fair to good porosity, no shows.
	30	Shale: as above.
	10	Siltstone: as above.
495-500	80	Shale: light to medium grey-brown, earthy, soft, carbonaceous in part, silty and sandy in part, most unconsolidated and turns to clay in mud system, some better consolidated.
	20	Sandstone: light grey, fine to coarse grained, scattered small pebbles, medium sorting, subangular, dark to light grey chert with clear quartz, unconsolidated to moderately well indurated, clay and siliceous cement, poor to fair porosity, no shows.
500-505	85	Sandstone: light grey salt and pepper, fine grained, well sorted, subangular, clear quartz with minor light to dark grey and white chert, friable, silica overgrowth cement, good to fair porosity, no shows.
	15	Shale: as above, most well consolidated.

CONOCO ET AL NORTH LITTLE BEAR O-51
SAMPLE DESCRIPTIONS

505-510m	90%	Shale: as above.
	10	Sandstone: light grey fine grained type as above, good porosity, no shows.
510-515	90	Sandstone: light grey fine grained type as above, scattered chert pebbles, fair to good porosity, no shows.
	10	Shale: as above.
515-520	75	Sandstone: as above, common chert pebbles, some becoming very fine grained and silty, poor to fair porosity, no shows.
	15	Siltstone: medium grey, sandy, argillaceous, slightly carbonaceous in part.
	10	Shale: medium grey-brown, blocky, silty, carbonaceous in part.
520-525	40	Sandstone: light grey-brown, very fine to fine grained, scattered small pebbles and coarse grains, medium sorting, subangular, clear to frosted quartz with white and light to dark grey chert, moderately well indurated, clay and siliceous cement, poor porosity, no shows.
	35	Shale: as above, common foraminifera (Haplophragmoides sp.)
	25	Siltstone: as above.
525-530	50	Shale: as above, very silty.
	30	Sandstone: as above, common small chert pebbles, poor porosity to tight, no shows.
	20	Siltstone: as above.
530-535	50	Shale: medium to light grey-brown, blocky, most silty to sandy, carbonaceous in part.
	25	Sandstone: light grey-brown, very fine to fine grained, scattered small chert pebbles and coarse grains, clear to frosted quartz with white and light to dark grey chert, moderately well indurated, silty to argillaceous in part, clay and siliceous cement, poor porosity to tight, no shows.

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SAMPLE DESCRIPTIONS

Sample continued from previous page.

530-535m	25%	Siltstone: medium grey-brown, blocky, sandy, argillaceous, carbonaceous in part.
535-540	40	Shale: as above, foraminifera (a small Haplophragmoides sp.)
	30	Sandstone: generally as above, common small pebbles and lots of medium to coarse chert grains, poor porosity to tight, no shows.
	30	Siltstone: as above.
540-545	50	Shale: as above.
	25	Sandstone: as above, common small pebbles, poor porosity, no shows.
	25	Siltstone: as above, abundant pyrite.
545-550	60	Shale: as above.
	20	Sandstone: as above, poor porosity to tight, no shows.
	20	Siltstone: as above.
550-555	70	Shale: most medium grey-brown, blocky, silty to sandy, some light to medium grey-green, waxy, bentonitic.
	15	Sandstone: light to medium grey, very fine to fine grained, scattered small chert pebbles, subangular to subrounded, poor sorting, most silty to argillaceous, carbonaceous, siliceous and clay cement, well indurated, poor porosity to tight, no shows.
	15	Siltstone: light to medium grey-brown, argillaceous, sandy, carbonaceous, pyritic.
555-560	75	Shale: as above, commonly bentonitic.
	15	Siltstone: as above.
	10	Sandstone: as above, poor porosity to tight, no shows.
560-565	80	Shale: as above, commonly sandy to silty, floating small chert pebbles.
	10	Sandstone: as above, grading to siltstone, tight, no shows.
	10	Siltstone: as above.

CONOCO ET AL NORTH LITTLE BEAR O-51
SAMPLE DESCRIPTIONS

565-570m	70%	Shale: as above, some bentonitic, trace pyrite.
	15	Conglomeratic Sandstone: medium grey, very fine to fine grained, common chert pebbles to 10mm, subangular to subrounded, poor sorting, varicolored chert with frosted to clear quartz, clay and siliceous cement, poor to fair porosity, no shows.
	15	Siltstone: as above.
570-575	60	Shale: light to medium grey-brown, blocky, silty, carbonaceous, grading to argillaceous siltstone, some pyrite, a few foraminifera (Haplophragmoides sp.).
	25	Siltstone: light to medium grey-brown, argillaceous, sandy, carbonaceous.
	15	Conglomeratic Sandstone: as above, becoming more conglomeratic, poor porosity, no shows.
575-580	70	Shale: as above, very silty, some medium green, waxy, bentonitic.
	20	Conglomeratic Sandstone: generally as above but very fine to mostly very coarse grained, abundant pebbles, poor porosity, no shows.
	10	Siltstone: as above.
580-585	75	Shale: as above, very silty, pyrite.
	15	Siltstone: as above.
	10	Conglomerate: subrounded varicolored chert pebbles up to 10mm, poor porosity (silt and clay matrix), no shows.
585-590	70	Shale: as above, commonly pyritic, some bentonitic,trace foraminifera (Ammobaculites sp.).
	20	Siltstone: as above.
	10	Conglomerate: generally as above but most pebbles 1 to 2mm across, grading to very coarse grained sandstone, poor porosity, no shows.
590-595	70	Shale: medium to light grey-brown, blocky, silty to sandy, pyrite, carbonaceous in part.

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SAMPLE DESCRIPTIONS

Sample continued from previous page.

590-595m	20%	Siltstone: light to medium grey-brown, blocky, silty to sandy, pyritic, carbonaceous in part.
	10	Sandstone: light to medium grey, very fine to coarse grained, scattered chert pebbles, subangular to subrounded, poor sorting, varicolored chert with frosted quartz, silty to argillaceous, carbonaceous in part, clay and siliceous cement, poor porosity to tight, no shows.
595-600	50	Shale: as above, commonly pyritic, tan sideritic nodules.
	40	Siltstone: as above.
	10	Conglomeratic Sandstone: as above, abundant chert pebbles, poor porosity to tight, no shows.
600-605	60	Shale: as above, very silty, abundant pyrite, some sideritic nodules.
	25	Siltstone: as above.
	15	Conglomeratic Sandstone: as above, becoming very conglomeratic (50% chert pebbles), poor porosity to tight, no shows.

<u>244mm Surface Casing set at 606m KB</u>

605-610	85	Shale: medium grey-brown to medium grey, blocky, soft, carbonaceous in part, floating sand grains and small chert pebbles.
	15	Casing Cement: light grey, sandy, associated with quartz/chert sandstone and unconsolidated grains.
610-615	95	Shale: as above, some very sandy.
	5	Casing Cement.
615-620	90	Shale: as above, common floating small chert pebbles.
	10	Casing Cement: very sandy.

CONOCO ET AL NORTH LITTLE BEAR O-51
SAMPLE DESCRIPTIONS

620-625m	95%	Shale: as above.
	5	Casing Cement.
625-630	90	Shale: medium grey to medium grey-brown, blocky, soft, some silty to sandy, carbonaceous in part.
	10	Casing Cement: light grey, common embedded pieces of quartz sandstone and quartz sand grains.
630-635	95	Shale: as above.
	5	Casing Cement.
635-640	95	Shale: as above, common pyrite.
	5	Casing Cement.
640-645	85	Shale: as above.
	10	Sand: medium grey, fine to very coarse grained, subangular to subrounded, poor sorting, varicolored chert with frosted quartz, may have shale matrix, no shows.
	5	Casing Cement.
645-650	80	Shale: medium grey to medium grey-brown, blocky, soft, carbonaceous in part, most sandy to silty, scattered floating small pebbles, trace pyrite.
	15	Sand: as above, most unconsolidated in sample, may have shale matrix, no shows.
	5	Casing Cement: light grey, sandy with quartz grains.
650-655	85	Shale: as above.
	10	Sand: as above, grading to consolidated argillaceous sandstone, tight, no shows.
	5	Casing Cement.
655-660	80	Shale: as above, most very silty and sandy.
	15	Sand: as above, grading to argillaceous sandstone, tight, no shows.
	5	Casing Cement.
660-665	85	Shale: as above, very silty to sandy.
	15	Sand: as above, grading to consolidated argillaceous sandstone, tight, no shows.
	tr	Casing Cement.

CONOCO ET AL NORTH LITTLE BEAR O-51
SAMPLE DESCRIPTIONS

665-670m	90%	Shale: medium grey, becoming relatively firm, blocky, most silty, some sandy, carbonaceous in part, trace pyrite.
	10	Sand: medium grey, very fine to medium grained, subangular, poor sorting, varicolored chert with frosted quartz, very argillaceous and silty, grading to sandy shale, carbonaceous in part, tight, no shows.
	tr	Casing Cement: light grey, embedded clear to yellow quartz sand.
670-675	70	Shale: as above.
	20	Sand: as sandstone above but unconsolidated, subrounded, medium sorting, likely has shale matrix, poor porosity to tight, no shows.
	10	Casing Cement: as above.
675-680	75	Shale: as above, becoming very silty.
	10	Sandstone: as above, some appears unconsolidated, poor porosity to tight, no shows.
	15	Casing Cement.

Little Bear 682m (-362m Subsea)

680-685	50	Sandstone: medium to light grey, fine to medium grained, subangular, well sorted, light to dark grey chert with frosted quartz, carbonaceous in part, some shale and siltstone matrix, unconsolidated in sample, good to poor porosity, no shows.
	30	Shale: as above, most very silty, trace Haplophragmoides sp.
	20	Siltstone: medium grey, sandy, argillaceous, carbonaceous.
685-690	40	Sandstone: as above, poor to good porosity, no shows.
	40	Shale: medium grey, blocky, sandy, silty, carbonaceous.
	20	Siltstone: as above, very sandy.

CONOCO ET AL NORTH LITTLE BEAR O-51
SAMPLE DESCRIPTIONS

690–695m	50%	Sandstone: as above, a few chert pebbles, poor to good porosity, no shows.
	40	Shale: as above, very sandy.
	10	Siltstone: as above.
695–700	65	Conglomeratic Sandstone: medium to light grey, very fine to very coarse grained, abundant varicolored chert pebbles to 10mm, subangular to subrounded, poor sorting, varicolored chert with frosted to clear quartz, carbonaceous in part, some silt and shale matrix, friable to well indurated, some siliceous cement, poor to fair porosity, no shows.
	35	Shale: medium grey, micromicaceous, and flaky to silty, sandy, and blocky, most carbonaceous, light brown sideritic nodules.
700–705	80	Conglomeratic Sandstone: as above, most medium to coarse grained, all sorted, most unconsolidated in sample, good? porosity, no shows.
	20	Shale: as above, sideritic nodules.
705–710	70	Conglomeratic Sandstone: as above, good porosity,no shows.
	20	Shale: as above, most very sandy, sideritic stringers.
	10	Siltstone: medium grey, sandy, argillaceous, carbonaceous.
710–715	80	Sandstone: medium to dark grey, medium to coarse grained, subangular to subrounded, well sorted, varicolored chert with minor frosted quartz, scattered varicolored chert pebbles, most unconsolidated, some argillaceous and silty matrix, poor to good porosity, no shows.
	10	Siltstone: medium grey, sandy, argillaceous, carbonaceous.
	10	Shale: medium grey, blocky, sandy, carbonaceous, sideritic nodules.

CONOCO ET AL NORTH LITTLE BEAR O-51
SAMPLE DESCRIPTIONS

715-720m	70%	Sandstone: generally as above but most medium grey, trace glauconite, good porosity, no shows.
	20	Siltstone: as above.
	10	Shale: as above.
720-725		Sample missed.
725-730	75	Siltstone: light to medium grey, carbonaceous, sandy.
	15	Sandstone: light grey, very fine to fine grained, subangular, medium sorting, carbonaceous in part, silty, friable to unconsolidated, fair to good porosity, no shows.
	10	Shale: medium to dark grey, micromicaceous, carbonaceous.
730-735	70	Siltstone: as above.
	20	Sandstone: as above, trace glauconite, some coarse chert grains, poor to good porosity, no shows.
	10	Shale: as above, very silty.
735-740	65	Shale: light grey-brown, soft, earthy, silty in part, most unconsolidated, decomposes to clay in mud system.
	25	Siltstone: as above.
	10	Sandstone: as above, poor to fair porosity, no shows.
740-745	55	Siltstone: light grey, carbonaceous.
	25	Shale: generally as above but better consolidated, blocky, and becoming very silty.
	5	Sandstone: as above, poor to fair porosity, no shows, cavings in part.
	15	Casing Cement.
745-750	50	Siltstone: light grey, argillaceous, sandy, carbonaceous.
	40	Shale: medium to light grey, some blocky, silty, some micromicaceous, fissile, most carbonaceous.
	10	Sand: light grey, very fine to coarse grained, subangular, poor sorting, dark chert with mostly clear quartz, this

CONOCO ET AL NORTH LITTLE BEAR O-51
SAMPLE DESCRIPTIONS

Sample continued from previous page.

745-750m		sand in part may float in shale or siltstone, no shows.
750-755	60%	Sand: medium to light grey, fine grained, subangular to subrounded, well sorted, rare small chert pebbles, frosted quartz with varicolored chert, may have clay matrix, poor to good? porosity, no shows.
	20	Shale: as above.
	15	Siltstone: as above.
	5	Casing Cement.
755-760	60	Siltstone: light grey, sandy, carbonaceous.
	20	Sand: as above, grading to well indurated sandstone, tight to good? porosity, no shows.
	15	Shale: as above, most carbonaceous, very silty.
	5	Coal: argillaceous, thin bedded.
760-765	50	Siltstone: as above, becoming very sandy.
	25	Shale: dark grey, micromicaceous, very carbonaceous, fissile.
	20	Coal: thin stringers, very argillaceous.
	5	Sand: as above, no shows, cavings.
765-770	55	Siltstone: as above, becoming argillaceous.
	25	Sand: as above, no shows.
	15	Shale: as above, most very silty.
	5	Coal: very argillaceous, cavings in part.
770-775	50	Siltstone: light grey, sandy, carbonaceous, argillaceous in part.
	30	Shale: dark grey, micromicaceous, very carbonaceous, grading to argillaceous coal.
	20	Coal: very argillaceous, thin stringers.
775-780	50	Siltstone: as above.
	40	Shale: as above, and some light grey, blocky, silty, tan sideritic nodules.

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SAMPLE DESCRIPTIONS

Sample continued from previous page.

775-580m	10%	Coal: as above.
780-785	50	Shale: as above, very carbonaceous, sideritic nodules.
	40	Siltstone: as above.
	10	Coal: very argillaceous, thin stringers.
785-790	55	Siltstone: as above.
	30	Shale: as above.
	10	Sandstone: light grey, very fine to fine grained, subangular, poor sorting, silty, grading to siltstone, carbonaceous, poor porosity, no shows.
	5	Coal: very argillaceous.
790-795	50	Siltstone: light to medium grey, argillaceous to clean, sandy, carbonaceous.
	30	Shale: dark to light grey, micromicaceous in part, some blocky, silty, most carbonaceous.
	10	Sandstone: as above, may be cavings in part, no shows.
	10	Coal: argillaceous, thin stringers.
795-800	60	Siltstone: as above, grading in part to very fine grained sandstone, tight, no shows.
	35	Shale: as above, trace tan sideritic nodules.
	5	Coal: as above.
800-805	40	Siltstone: as above.
	35	Sandstone: light grey, very fine grained, subangular, poor sorting, silty, carbonaceous, moderately well indurated, poor porosity to tight, no shows.
	15	Coal: very argillaceous, thin stringers.
	10	Shale: as above, trace sideritic nodules.

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SAMPLE DESCRIPTIONS

805-810m	55%	Siltstone: light to medium grey, sandy, argillaceous, carbonaceous in part.
	30	Sandstone: generally as above, a few floating coarse grains, poor to fair porosity, no shows.
	10	Shale: dark to light grey, micromicaceous, carbonaceous, thin partings.
	5	Coal: very argillaceous, thin stringers.
810-815	60	Sand: light grey, fine to medium grained, well sorted, subrounded to subangular, frosted quartz with light to medium grey and varicolored chert, may have silt or clay matrix, good? porosity, no shows.
	30	Siltstone: as above, becoming very sandy.
	10	Shale: as above, sideritic nodules.
	tr	Coal.
815-820	30	Sand: generally as above but most medium to coarse grained, common small pebbles, some consolidated with sideritic cement, most good? porosity, no shows.
	30	Siltstone: as above.
	25	Shale: as above.
	15	Siderite: light to medium brown, argillaceous nodules and stringers in shale.
820-825	90	Shale: medium grey, micromicaceous, blocky, scattered tan sideritic nodules.
	5	Sand: as above, no shows.
	5	Siltstone: as above.
825-830	50	Sandstone: light to medium grey, medium grained, medium sorting to well sorted, subangular, scattered small pebbles, white with light to dark grey and brown chert, frosted quartz, most unconsolidated, good porosity, no shows.
	30	Siltstone: light grey, clean to argillaceous, carbonaceous.
	20	Shale: as above, common tan to brown sideritic nodules.

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SAMPLE DESCRIPTIONS

830–835m	85%	Shale: medium grey, micromicaceous, blocky, some silty, glauconitic.
	10	Sand: as above, no shows.
	5	Siltstone: as above.
835–840	65	Sand: medium grey, fine grained, well sorted, subangular, frosted quartz with minor dark chert, common glauconitic grains, good porosity, no shows.
	25	Shale: as above.
	10	Siltstone: as above.
840–845	60	Sand: as above, fine to medium grained, well sorted, good porosity, no shows.
	30	Shale: as above, commonly glauconitic.
	10	Siltstone: as above.
845–850	55	Sand: generally as above but very fine to very coarse grained, subangular, poor sorting, glauconitic, poor to good porosity, no shows.
	35	Siltstone: as above.
	10	Shale: as above.
850–855	70	Sand: medium grey salt and pepper, fine to coarse grained, medium sorting, subangular, white and light to dark grey and brown chert with clear to frosted quartz, unconsolidated, good? porosity, no shows.
	25	Siltstone: light grey, sandy, carbonaceous.
	5	Shale: medium grey, micromicaceous, blocky, likely cavings.
855–860	45	Sand: generally as above, becoming consolidated in part, no shows.
	35	Siltstone: as above, becoming very sandy.
	20	Shale: as above.
860–865	70	Sandstone: light to medium grey, very fine to fine grained, silty, subangular, poor sorting, frosted quartz, minor dark chert, carbonaceous, glauconitic, argillaceous matrix, poor porosity, no shows.
	15	Sand: as above.

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SAMPLE DESCRIPTIONS

Sample continued from previous page.

860-865m	10%	Siltstone: as above.
	5	Shale: as above.
865-870	40	Sand: as above, fine to coarse grained, scattered small pebbles, good porosity, no shows.
	25	Shale: as above, trace glauconite.
	25	Sandstone: as above, poor porosity, no shows.
	10	Siltstone: as above.
870-875	75	Sandstone: medium grey, very fine to fine grained, subangular, medium sorting, frosted quartz with light to dark grey or brown chert, glauconite, carbonaceous, some argillaceous matrix and kaolin cement, silty in part, poor porosity, no shows.
	10	Sand: as above, likely cavings.
	10	Siltstone: light grey, sandy, carbonaceous.
	5	Shale: medium grey, micromicaceous, carbonaceous, blocky.
875-880	95	Sandstone: as above, poor porosity, no shows.
	5	Shale: as above.
880-885	70	Sandstone: generally as above, becoming very silty and argillaceous, poor porosity to tight, no shows.
	15	Siltstone: as above, becoming argillaceous.
	15	Shale: as above.
885-890	75	Sandstone: medium grey, fine to medium grained, medium sorting, subangular to subrounded, frosted to clear quartz with light to dark brown and grey chert, unconsolidated in sample, carbonaceous in part, silt matrix, poor to fair porosity, no shows.
	20	Siltstone: medium grey, sandy, argillaceous, carbonaceous.
	5	Shale: medium grey, micromicaceous in part, carbonaceous, silty in part.

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SAMPLE DESCRIPTIONS

890-895m	90%	Sandstone: light grey salt and pepper, medium grained, minor small pebbles, well sorted, subangular, white and light to dark grey chert with clear quartz, friable to unconsolidated, clay and silica overgrowth cement, good porosity, no shows.
	5	Siltstone: as above.
	5	Shale: as above.
895-900	50	Sandstone: medium grey, very fine to fine grained, subangular, poor sorting, silty, frosted quartz with dark chert, carbonaceous in part, clay and siliceous cement, poor to minor fair porosity, no shows.
	35	Sandstone: medium grey well sorted type as above, good porosity, no shows.
	10	Siltstone: as above.
	5	Shale: as above.
900-905	60	Sandstone: as above, but up to medium grained, poor sorting, poor porosity, no shows.
	20	Siltstone: medium grey, sandy, argillaceous, carbonaceous.
	20	Shale: medium grey, silty, blocky, carbonaceous.
905-910	60	Siltstone: as above, very sandy.
	25	Sandstone: as above, very silty to argillaceous, poor porosity, no shows.
	15	Shale: as above, very silty.
910-915	75	Siltstone: as above, very sandy, grading in part to very fine grained sandstone, tight, no shows.
	15	Shale: medium to dark grey, micromicaceous in part, carbonaceous, some blocky, silty.
	10	Sandstone: as above, all very fine grained, tight, no shows.
	tr	Coal: clean to argillaceous.
915-920	40	Siltstone: as above.
	25	Shale: dark grey to black, micromicaceous, very carbonaceous.

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SAMPLE DESCRIPTIONS

Sample continued from previous page.

915-920m	20%	Sandstone: as above, grading to siltstone, tight, no shows.
	15	Coal: argillaceous to rarely very clean, likely one thin bed.
920-925	50	Siltstone: light to medium grey, sandy, argillaceous in part, carbonaceous.
	35	Sandstone: light to medium grey, very fine grained, subangular, poor sorting, silty, frosted to clear quartz with minor dark chert, clay and siliceous cement, poor porosity, no shows.
	10	Shale: as above.
	5	Coal: as above.
925-930	75	Sandstone: light grey salt and pepper, medium to fine grained, subangular, well sorted, clear to frosted quartz with light grey to light brown chert, most unconsolidated, minor clay and silica overgrowth cement, good porosity, no shows.
	15	Siltstone: as above.
	10	Shale: as above.
930-935	90	Sandstone: medium grey, very fine to fine grained, subangular, medium sorting, frosted quartz with minor dark chert, friable, unconsolidated in part, some silty, clay cement, poor to fair porosity, no shows.
	10	Shale: medium to dark grey, micromicaceous, carbonaceous.
935-940	95	Sandstone: as above, common kaolin cement, poor porosity, no shows.
	5	Shale: as above, thin partings.
940-945	95	Sandstone: generally as above, most fine grained, subangular, well sorted, most unconsolidated, fair to good? porosity, no shows.
	5	Shale: as above.

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SAMPLE DESCRIPTIONS

945-950m	60%	Sandstone: light to medium grey, fine to very fine grained, subangular, medium sorting, frosted quartz with minor dark chert, friable to unconsolidated, clay and silica cement, fair porosity, no shows.
	25	Siltstone: light to medium grey, clean to argillaceous, carbonaceous, sandy.
	15	Shale: medium to dark grey, micromicaceous, carbonaceous in part, trace pyrite.
950-955	60	Sandstone: as above, poor to fair porosity, no shows.
	30	Siltstone: as above.
	10	Shale: as above.
955-960	75	Sandstone: light grey, fine to medium grained, a few small pebbles, subangular, medium sorting, clear to frosted quartz with light to dark grey chert, silica overgrowth with minor clay cement, most unconsolidated, good porosity, no shows.
	20	Siltstone: as above.
	5	Shale: as above.
960-965	70	Sandstone: medium to light grey, very fine to medium grained, subangular, poor sorting, frosted quartz with minor varicolored chert, silty in part, carbonaceous in part, clay and silica overgrowth cement, poor to fair porosity, no shows.
	20	Siltstone: light to medium grey, clean to argillaceous, sandy, carbonaceous.
	10	Shale: medium grey, micromicaceous, flaky, carbonaceous.
965-970	80	Sandstone: as above, scattered chert pebbles, poor to fair porosity, no shows.
	10	Siltstone: as above.
	10	Shale: as above.
970-975	75	Sandstone: generally as above, very fine to fine grained, medium sorting, poor porosity, no shows.

CONOCO ET AL NORTH LITTLE BEAR O-51
SAMPLE DESCRIPTIONS

Sample continued from previous page.

970–975m	20%	Siltstone: as above.
	5	Shale: as above.
975–980	50	Siltstone: light to medium grey-brown, light to medium grey, sandy, argillaceous to clean, carbonaceous in part.
	30	Sandstone: light to medium grey, very fine grained, subangular, poor sorting, clear to frosted quartz with minor dark chert, silty, carbonaceous, friable in part, clay and siliceous cement, poor porosity, no shows.
	20	Shale: medium to dark grey, grey-brown, micromicaceous to blocky, some silty, sideritic in part, carbonaceous in part.
980–985	40	Shale: as above.
	40	Siltstone: as above.
	20	Sandstone: as above, poor porosity, no shows.
985–990	55	Shale: as above.
	25	Siltstone: as above.
	20	Sandstone: as above, trace ferruginous and sideritic cement, tight, no shows.
990–995	60	Shale: as above.
	25	Siltstone: as above.
	15	Sandstone: as above, some ferruginous cement as above, tight, no shows.
995–1000	60	Shale: as above.
	20	Sandstone: as above, tight, no shows.
	20	Siltstone: as above, trace ferruginous and sideritic cement, tight, no shows.
1000–1005	40	Sandstone: light to medium grey-brown, very fine to fine grained, subangular, poor sorting, silty, frosted quartz with minor dark chert, carbonaceous, argillaceous in part, clay and siliceous cement, poor porosity to tight, no shows.
	30	Siltstone: light to medium grey-brown, argillaceous, carbonaceous, sandy.

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SAMPLE DESCRIPTIONS

Sample continued from previous page.

1000-1005m	30%	Shale: medium to dark grey, micromicaceous, carbonaceous in part, silty in part.
1005-1010	60	Siltstone: as above.
	20	Sandstone: as above, very silty, tight, no shows.
	20	Shale: as above.
1010-1015	65	Siltstone: as above.
	25	Shale: as above.
	10	Sandstone: as above, grading to siltstone, tight, no shows.
1015-1020	75	Siltstone: as above.
	25	Shale: as above.
1020-1025	60	Siltstone: medium to light grey, clean to slightly argillaceous, carbonaceous, some sandy.
	40	Shale: medium grey, micromicaceous, blocky, some silty, some carbonaceous.
1025-1030	45	Siltstone: as above.
	40	Shale: as above.
	15	Sandstone: medium to light grey, very fine grained, silty, subangular, poor sorting, argillaceous in part, carbonaceous, tight, no shows.
1030-1035	40	Shale: as above.
	35	Siltstone: as above.
	25	Sandstone: as above, tight, no shows.
1035-1040	55	Siltstone: as above.
	30	Shale: as above, very silty in part.
	15	Sandstone: as above, a few embedded medium to coarse chert and quartz grains, tight, no shows.
1040-1045	50	Siltstone: medium grey, sandy, argillaceous in part, carbonaceous, trace pyrite.
	50	Shale: medium grey, micromicaceous in part, some silty, blocky to flaky.

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SAMPLE DESCRIPTIONS

1045-1050m	60%	Shale: as above, becoming very silty in part.
	40	Siltstone: as above, some grading to very fine grained sandstone, tight, no shows.
1050-1055	65	Shale: as above.
	35	Siltstone: as above.
1055-1060	70	Shale: as above, very silty.
	30	Siltstone: as above.
1060-1065	60	Shale: medium to dark grey, micromicaceous, flaky, scattered medium brown sideritic nodules.
	20	Sandstone: light grey, very fine grained, subangular, poor sorting, silty to argillaceous, carbonaceous, clay and siliceous cement, tight, no shows.
	20	Siltstone: light to medium grey, sandy, argillaceous, carbonaceous.
1065-1070	70	Shale: as above, sideritic nodules.
	25	Siltstone: as above.
	5	Sandstone: as above, tight, no shows.
1070-1075	70	Shale: as above, sideritic nodules.
	15	Sandstone: as above, very silty, tight, no shows.
	15	Siltstone: as above.
1075-1080	40	Shale: as above.
	40	Siltstone: as above.
	20	Sandstone: as above, very silty, tight, no shows.
1080-1085	50	Siltstone: medium to light grey, carbonaceous, argillaceous, sandy in part.
	35	Shale: medium grey, micromicaceous, carbonaceous in part, silty in part.
	15	Sandstone: medium to light grey, very fine grained, subangular, poor sorting, silty to argillaceous, carbonaceous, thin bedded, tight, no shows.

CONOCO ET AL NORTH LITTLE BEAR O-51
SAMPLE DESCRIPTIONS

1085-1090m	60%	Siltstone: as above.
	30	Shale: as above.
	10	Sandstone: as above, very silty, tight, no shows.
1090-1095	50	Shale: as above.
	30	Siltstone: as above.
	20	Sandstone: as above, tight, no shows.
1095-1100	60	Shale: as above.
	20	Siltstone: as above.
	20	Sandstone: as above, trace light grey to light brown chert pebbles, tight, no shows.
1100-1105	50	Sandstone: light grey, very fine to fine grained, subangular, medium sorting, frosted quartz with light to minor dark grey chert, carbonaceous in part, a few light grey to light brown chert pebbles, clay, silt, and sideritic cement, moderately well indurated, tight to poor porosity, no shows.
	40	Shale: medium to dark grey, micromicaceous, carbonaceous, abundant light to medium brown sideritic stringers and nodules.
	10	Siltstone: light to medium grey, sandy, clean to argillaceous, carbonaceous.
1105-1110	50	Siltstone: as above.
	25	Sandstone: as above, tight, no shows.
	25	Shale: as above, sideritic nodules and stringers.
1110-1115	65	Shale: as above, becoming very silty.
	35	Siltstone: as above, sandy in part.
1115-1120	70	Shale: as above, very silty in part.
	30	Siltstone: as above, very argillaceous in part.
1120-1125	50	Shale: medium grey, micromicaceous, carbonaceous, some silty, common sideritic nodules.
	25	Sandstone: light to medium grey, very fine grained, subangular, poor sorting, silty, carbonaceous, clay, siliceous,

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SAMPLE DESCRIPTIONS

Sample continued from previous page.

1120-1125m		and trace sideritic cement, tight, no shows.
	25%	Siltstone: light to medium grey, sandy, argillaceous, carbonaceous.
1125-1130	85	Shale: as above, no siderite.
	15	Siltstone: as above.
1130-1135	90	Shale: as above, rather blocky, not sideritic.
	10	Siltstone: as above.
1135-1140	80	Shale: as above, no siderite.
	10	Sandstone: as above, grading to siltstone, thin bedded, tight, no shows.
	10	Siltstone: as above.
1140-1145	70	Sandstone: light grey, medium to coarse grained, well sorted, subangular to subrounded, clear to grey quartz with light brown, light grey, black, and white chert, scattered small pebbles, unconsolidated in sample, minor chert and clay cement, good porosity, no shows.
	20	Shale: medium to dark grey, micromicaceous in part, flaky to blocky, some silty, carbonaceous in part.
	10	Siltstone: medium grey, argillaceous, sandy, carbonaceous in part.
1145-1150	55	Sandstone: light grey, very fine to fine grained, subangular, poor sorting, clear quartz with minor dark chert, silty, carbonaceous in part, clay and silica cement, poor porosity to tight, no shows.
	25	Shale: as above.
	10	Siltstone: as above.
	10	Sandstone: unconsolidated medium to coarse grained type as above, good porosity, no shows, cavings in part.

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SAMPLE DESCRIPTIONS

1150-1155m	50%	Sandstone: coarse grained unconsolidated type to very fine grained tight type as above, good porosity to tight, no shows, cavings in part.
	25	Siltstone: light to medium grey, sandy, argillaceous, carbonaceous in part.
	25	Shale: as above.
1155-1160	50	Siltstone: light to medium grey, sandy, carbonaceous.
	40	Sandstone: light grey, very fine grained, subangular, poor sorting, silty, clear quartz with minor dark chert, carbonaceous, siliceous and clay cement, poor porosity to tight, no shows.
	10	Shale: dark grey, micromicaceous, carbonaceous, sideritic nodules.

<u>Slater River 1165m (-845m Subsea)</u>

1160-1165	45	Siltstone: as above, very sandy, grading in part to silty sandstone, tight, no shows.
	30	Sandstone: as above, poor porosity to tight, no shows.
	25	Shale: as above, sideritic nodules.
1165-1170	40	Siltstone: as above.
	40	Shale: as above.
	20	Sandstone: as above, tight, no shows.
1170-1175	40	Siltstone: light to medium grey, sandy, argillaceous to clean, carbonaceous in part.
	40	Shale: medium to dark grey, micromicaceous, flaky, carbonaceous in part.
	20	Sandstone: as above, becoming very silty, tight, no shows.
1175-1180	40	Siltstone: as above.
	30	Sandstone: light grey, very fine grained, subangular, poor sorting, silty in part, clear quartz with minor dark chert, carbonaceous in part, clay and

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SAMPLE DESCRIPTIONS

Sample continued from previous page.

1175-1180m		siliceous cement, poor porosity to tight, no shows.
	30%	Shale: as above.
1180-1185	60	Shale: as above.
	25	Siltstone: as above.
	15	Sandstone: as above, very silty, tight, no shows.
1185-1190	85	Shale: medium to dark grey, micromicaceous in part, blocky to flaky, carbonaceous in part, some silty.
	15	Siltstone: light to medium grey, sandy, argillaceous, carbonaceous, cavings in part.
1190-1195	90	Shale: as above, trace pyrite.
	10	Siltstone: as above.
1195-1200	90	Shale: as above, a few sandy stringers.
	10	Siltstone: as above, some grading to very fine grained sandstone, tight, no shows, cavings in part.
1200-1205	85	Shale: as above.
	15	Siltstone: as above, grading to very fine grained sandstone, tight, no shows, thin stringers.
1205-1210	90	Shale: medium to dark grey, micromicaceous in part, some silty to sandy, trace tan sideritic stringers.
	10	Siltstone: medium grey-brown, argillaceous, carbonaceous, sandy, grading in part to very fine grained sandstone, tight, no shows, thin stringers.
1210-1215	75	Shale: as above.
	25	Siltstone: as above, grading to very fine grained sandstone, tight, no shows, thin stringers.

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SAMPLE DESCRIPTIONS

1215-1220m	70%	Shale: as above, most very sandy, carbonaceous.
	15	Sandstone: medium grey-brown, very fine grained, subangular, poor sorting, silty, carbonaceous, pyrite, thin stringers in shale, tight, no shows.
	15	Siltstone: as above.
1220-1225	85	Shale: as above, sideritic nodules.
	10	Siltstone: as above.
	5	Sandstone: as above, tight, no shows.
1225-1230	90	Shale: medium to dark grey, micromicaceous in part, blocky, some silty to sandy, some medium brown sideritic stringers.
	10	Siltstone: medium to light grey, argillaceous, sandy, carbonaceous.
1230-1235	90	Shale: as above, common sandy stringers.
	10	Siltstone: as above, sandy, thin stringers.
1235-1240	Sample missed.	
1240-1245	85	Shale: generally as above, becoming very silty, grading to argillaceous siltstone.
	15	Siltstone: as above.
1245-1250	85	Shale: medium to dark grey, micromicaceous in part, some silty, some slightly carbonaceous.
	15	Siltstone: light to medium grey, argillaceous, carbonaceous, sandy.
1250-1255	90	Shale: as above, some silty to sandy.
	10	Siltstone: becoming very sandy, thin stringers.
1255-1260	90	Shale: as above.
	10	Siltstone: as above, very sandy.
1260-1265	85	Shale: as above.
	15	Siltstone: as above.

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SAMPLE DESCRIPTIONS

1265-1270m	85%	Shale: medium grey, micromicaceous in part, blocky, some silty to sandy, thin bedded.
	15	Siltstone: medium grey, argillaceous, sandy, carbonaceous, thin bedded.
1270-1275	95	Shale: as above.
	5	Siltstone: as above.
1275-1280	90	Shale: as above, scattered brown sideritic nodules.
	10	Siltstone: as above.
1280-1285	95	Shale: as above.
	5	Siltstone: as above, thin stringers.
1285-1290	95	Shale: medium to dark grey, micromicaceous in part, firm, most blocky, silty, carbonaceous in part.
	5	Siltstone: medium grey, sandy, argillaceous, carbonaceous, thin stringers in shale.
1290-1295	90	Shale: as above.
	10	Siltstone: as above, very sandy.
1295-1300	95	Shale: as above.
	5	Siltstone: as above, thin stringers.
1300-1305	95	Shale: as above.
	5	Siltstone: as above.
1305-1310	95	Shale: medium to dark grey, micromicaceous in part, most silty.
	5	Siltstone: medium grey, argillaceous, sandy, carbonaceous, thin stringers.
1310-1315	95	Shale: as above, becoming less silty.
	5	Siltstone: as above, thin stringers.
1315-1320	98	Shale: as above, not silty.
	2	Siltstone: as above.
1320-1325	95	Shale: as above, some silty.
	5	Siltstone: as above, thin stringers.

CONOCO ET AL NORTH LITTLE BEAR O-51
SAMPLE DESCRIPTIONS

1325-1330m	98%	Shale: medium to dark grey, micromicaceous in part, firm, blocky, some silty.
	2	Siltstone: medium grey, argillaceous, sandy, carbonaceous, thin stringers.
1330-1335	98	Shale: as above.
	2	Siltstone: as above.
1335-1340	98	Shale: as above, becoming less silty.
	2	Siltstone: as above, thin stringers.
1340-1345	95	Shale: as above.
	5	Siltstone: as above, thin interbeds.
1345-1350	90	Shale: medium to dark grey, micromicaceous in part, firm, blocky, trace brown sideritic nodules, silty in part.
	10	Siltstone: medium to light grey, argillaceous, sandy, carbonaceous in part, thin stringers.
1350-1355	90	Shale: as above.
	10	Siltstone: as above, very sandy, thin stringers.
1355-1360	85	Shale: as above.
	15	Siltstone: generally as above, very argillaceous, thin bedded.
1360-1365	95	Shale: as above.
	5	Siltstone: as above.
1365-1370	85	Shale: medium to dark grey, micromicaceous in part, firm, blocky, some very silty.
	15	Siltstone: medium grey, argillaceous, carbonaceous, sandy, grading to silty shale.
1370-1375	90	Shale: as above.
	10	Siltstone: as above.
1375-1380	90	Shale: as above.
	10	Siltstone: as above, thin stringers.

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SAMPLE DESCRIPTIONS

1380-1385m	90%	Shale: as above, common light brown sideritic nodules.
	10	Siltstone: as above.
1385-1390	90	Shale: medium to dark grey, micromicaceous in part, firm, blocky, silty in part, trace has reddish tinge.
	10	Siltstone: light to medium grey, sandy, argillaceous, carbonaceous, thin stringers.
1390-1395	85	Shale: as above, common sideritic stringers.
	15	Siltstone: as above.
1395-1400	90	Shale: as above.
	10	Siltstone: as above.
1400-1405	90	Shale: as above, very silty in part, common sideritic stringers or nodules.
	10	Siltstone: as above.

<u>Slater River Source Shale Marker 1405m (-1085m Subsea)</u>

1405-1410	95	Shale: dark grey, fine micromicaceous, flaky, fissile, medium brown sideritic nodules, and some medium grey, blocky, silty as above.
	5	Siltstone: light to medium grey, argillaceous, sandy, thin stringers.
1410-1415	98	Shale: as above, trace reddish-brown.
	2	Siltstone: as above, may be cavings.
1415-1420	98	Shale: as above, most dark grey, fine micromicaceous.
	2	Siltstone: as above..
1420-1425	100	Shale: dark grey, fine micromicaceous, fissile, flaky, rarely black, blocky, bituminous.
1425-1430	100	Shale: as above.
1430-1435	100	Shale: medium grey, fine micromicaceous, fissile, flaky.

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SAMPLE DESCRIPTIONS

1435-1440m	100%	Shale: as above.
	tr	Siltstone: light grey, sandy, thin stringers, likely cavings.
1440-1445	90	Shale: medium grey, fine micromicaceous, flaky, calcareous, a few calcite vein fillings.
	10	Marl: dark to light grey-brown, calcareous, present as nodules or stringers in shale.
1445-1450	98	Shale: generally as above, but becoming dark grey to black in part, some bituminous.
	2	Marl: as above, nodules or stringers.
1450-1455	98	Shale: dark grey to black, fine micromicaceous, flaky, slightly calcareous, trace pelecypod fragments, trace fish remains, some black, blocky, bituminous.
	2	Marl: as above, nodules or stringers.
1455-1460	100	Shale: as above, trace pelecypods.
1460-1465	98	Shale: as above, only very slightly calcareous, trace pelecypods.
	2	Siltstone: medium grey, argillaceous, calcareous, thin stringers.
1465-1470	100	Shale: dark grey, fine micromicaceous, flaky, fissile, very slightly calcareous, trace pelecypod fragments.
1470-1475	98	Shale: as above, trace pyrite.
	2	Siltstone: light to medium grey, argillaceous, may be cavings.
1475-1480	100	Shale: generally as above, most non-calcareous to very slightly calcareous, some black, blocky, calcareous, bituminous.
1480-1485	100	Shale: dark grey, rarely black, most fine micromicaceous, flaky, very slightly calcareous, rarely blocky, bituminous.

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1485-1490m	100%	Shale: as above, trace pelecypods.
1490-1495	No sample.	
1495-1500	100	Shale: as above, trace spores, pelecypod fragments.
1500-1505	98	Shale: dark grey, fine micromicaceous, flaky, very slightly calcareous.
	2	Siltstone: light grey, argillaceous, thin stringers.
1505-1510	95	Shale: generally as above, becoming non-calcareous, some sandy.
	5	Sandstone: medium grey, fine to medium grained, medium sorting, subangular to subrounded, clear quartz with dark grey chert, glauconitic, siliceous cement and abundant clay matrix, pyritic, tight, no shows.

Sans Sault 1512m (-1192m Subsea)

1510-1515	95	Shale: dark grey, micromicaceous in part, flaky to blocky.
	5	Siltstone: light to medium grey, sandy, argillaceous in part, calcareous in part.
	tr	Sandstone: as above, tight, no shows.
1515-1520	98	Shale: as above, common Inoceramus prisms.
	2	Siltstone: as above, thin stringers or cavings.
1520-1525	99	Shale: as above, common Inoceramus prisms.
	1	Siltstone: as above.
1525-1530	98	Shale: dark grey, micromicaceous, fissile, very slightly calcareous, pelecypod fragments, trace pyrite.
	2	Siltstone: light grey, argillaceous to clean, cavings in part.

CONOCO ET AL NORTH LITTLE BEAR O-51
SAMPLE DESCRIPTIONS

1530-1535m	98%	Shale: still slightly calcareous, trace light grey to light grey-green, waxy, bentonitic?, petroliferous with poor milky cut.
	2	Siltstone: as above, cavings in part.
1535-1540	85	Shale: as above, becoming slightly silty in part, still slightly calcareous.
	15	Siltstone: light grey to light grey-green, calcareous, slightly argillaceous in part, thin bedded.
	tr	Shale: light green, waxy, micropyritic.
1540-1545	85	Shale: as above.
	10	Sandstone: light grey-green, very fine grained, silty, subangular, poor sorting, clear quartz, trace glauconite, micaceous, grading to siltstone, tight to poor porosity, yellow dry fluorescence, even light oil stain, poor to fair cut with streaming.
	5	Siltstone: as above.
	tr	Shale: light green, waxy, micropyritic.
1545-1550	80	Shale: dark grey, micromicaceous, flaky, slightly calcareous, some petroliferous with poor milky cut.
	15	Siltstone: light grey to grey-green, sandy, carbonaceous in part, slightly argillaceous in part, slightly calcareous.
	5	Sandstone: as above, tight, no visible oil stain, poor milky cut.

Upper Imperial Shale 1554m (-1234m Subsea)

1550-1555	75	Shale: as above, and some light to medium grey, micromicaceous, flaky.
	25	Siltstone: as above, very poor milky cut.
1555-1560	75	Shale: light to dark grey, micromicaceous, flaky, some slightly calcareous, brown calcareous and sideritic nodules, one possible crinoid fragment.

CONOCO ET AL NORTH LITTLE BEAR O-51
SAMPLE DESCRIPTIONS

Sample continued from previous page.

1555-1560m	25%	Siltstone: light grey to light grey-green, calcareous, micaceous, carbonaceous in part.
1560-1565	90	Shale: as above, most medium to light grey, non-calcareous, fissile.
	10	Siltstone: as above, becoming less calcareous.
1565-1570	95	Shale: as above, non-calcareous, sideritic nodules.
	5	Siltstone: as above.
1570-1575	98	Shale: light to dark grey, micromicaceous, flaky, trace siderite nodules, rarely silty.
	2	Siltstone: light to medium grey, sandy, argillaceous, some slightly carbonaceous.
1575-1580	95	Shale: as above.
	5	Siltstone: as above, thin stringers.
1580-1585	96	Shale: as above.
	2	Limestone: buff to light brown mottled, microcrystalline to coarse crystalline, bioclastic? in part or may be altered fracture fillings, tight, no shows, thin stringers.
	2	Siltstone: as above.
1585-1590	85	Shale: light to dark grey, micromicaceous, flaky, some silty, rarely slightly calcareous.
	10	Limestone: as above but light to dark brown color, some crinoids up to 3 or 4mm, tight, no shows, thin stringers.
	5	Siltstone: light to medium grey, argillaceous, calcareous, thin stringers.
1590-1595	95	Shale: as above.
	4	Siltstone: as above.
	1	Limestone: as above, tight, no shows.

CONOCO ET AL NORTH LITTLE BEAR O-51
SAMPLE DESCRIPTIONS

1595-1600m	75%	Shale: as above, brown sideritic nodules.
	20	Limestone: light to dark brown mottled, microcrystalline matrix, argillaceous and sandy or silty in part, bioclastic with crinoids, brachiopods, framework 60-80%, thin stringers in shale, poor intergranular porosity, patchy to dead heavy? oil stain, slow cut and streaming.
	5	Siltstone: as above.
1600-1605	90	Shale: light to medium grey, micromicaceous, flaky, some silty, slightly calcareous.
	5	Limestone: as above, poor intergranular porosity, no shows.
	5	Siltstone: light to medium grey, argillaceous, calcareous, sandy.
1605-1610	90	Shale: as above.
	10	Siltstone: as above, very sandy in part, calcareous, thin stringers.
	tr	Limestone: as above, poor porosity, no shows, cavings.
1610-1615	90	Shale: as above, slightly calcareous.
	10	Siltstone: as above, most very calcareous, sandy.
1615-1620	80	Shale: as above.
	20	Siltstone: as above.
1620-1625	85	Shale: medium grey, micromicaceous, blocky to flaky, some silty, trace crinoids.
	15	Siltstone: light to medium grey, argillaceous, sandy, calcareous, thin stringers.
1625-1630	90	Shale: as above, some silty, trace brown sideritic nodules.
	10	Siltstone: as above.
1630-1635	85	Shale: most as above, some medium brown, calcareous, silty.
	15	Siltstone: as above, and some medium brown, very calcareous.

CONOCO ET AL NORTH LITTLE BEAR O-51
SAMPLE DESCRIPTIONS

1635-1640m	90%	Shale: medium grey, micromicaceous in part, blocky, some silty.
	10	Siltstone: medium grey, argillaceous, calcareous, sandy, thin stringers.
1640-1645	85	Shale: as above.
	15	Siltstone: as above.
1645-1650	90	Shale: as above, some slightly calcareous.
	10	Siltstone: as above.
1650-1655	90	Shale: medium grey, micromicaceous in part, blocky to flaky, rarely silty.
	10	Siltstone: medium to light grey, argillaceous, calcareous, sandy in part, thin stringers.

Jungle Ridge 1657m (-1337m Subsea)

1655-1660	55	Shale: medium to light grey, micromicaceous in part, blocky, calcareous, some grading to calcareous marl.
	30	Limestone: light grey, microcrystalline, very argillaceous, appears nearly massive, rare ostracods and other very fine grained or smaller fossil fragments, framework less than 10%, tight, no shows.
	10	Marl: light grey, calcareous, silty, thin stringers.
	5	Siltstone: as above.
1660-1662.5	85	Limestone: buff, light to dark brown, mottled in part, cryptocrystalline to microcrystalline matrix, clean to argillaceous, minor crinoid and brachiopod fragments (framework about 20% or less), tight, no shows.
	15	Shale: medium to dark grey, micromicaceous, flaky to splintery, cavings in part.

CONOCO ET AL NORTH LITTLE BEAR O-51
SAMPLE DESCRIPTIONS

1662.5-1665m	60%	Shale: as above, with some grey siltstone, may be cavings totally or in part.
	40	Limestone: as above, becoming more argillaceous and somewhat silty, tight, no shows.
1665-1667.5	40	Shale: as above, likely not totally cavings.
	30	Limestone: as above, becoming very argillaceous and silty, tight, no shows.
	30	Siltstone: light to medium grey-brown, very calcareous, argillaceous in part, grading to silty marl.
1667.5-1670	40	Siltstone: as above, becoming sandy, common crinoids.
	30	Limestone: light to medium brown, microcrystalline, silty, argillaceous, thin bedded, scattered crinoids and brachiopod fragments, grading to calcareous siltstone, tight, no shows.
	30	Shale: as above.
1670-1672.5	85	Shale: medium grey, micromicaceous, flaky.
	10	Siltstone: as above, thin stringers.
	5	Limestone: as above, tight, no shows, cavings.
1672.5-1675	70	Shale: as above, very slightly calcareous.
	20	Marl: light to medium grey-brown, scattered crinoids, silty, thin stringers.
	10	Siltstone: light to medium grey-brown, sandy, calcareous, argillaceous, thin stringers.
1675-1680	80	Shale: as above.
	10	Marl: as above.
	10	Siltstone: as above.
1680-1685	90	Shale: medium to dark grey, micromicaceous, flaky, and medium to dark brown, trace reddish brown, blocky, slightly silty.

CONOCO ET AL NORTH LITTLE BEAR O-51
SAMPLE DESCRIPTIONS

Sample continued from previous page.

1680-1685m	5%	Marl: as above, cavings.
	5	Siltstone: as above.
1685-1690	85	Shale: medium grey, micromicaceous, flaky, slightly calcareous.
	10	Siltstone: light to medium grey-brown, argillaceous, calcareous, thin stringers.
	5	Marl: light to medium grey-brown, calcareous, silty, thin stringers.
1690-1695	90	Shale: as above.
	10	Siltstone: as above, thin stringers.
1695-1700	95	Shale: as above, becoming very flaky, non-calcareous.
	5	Siltstone: as above.
1700-1705	90	Shale: as above.
	10	Siltstone: as above.
1705-1710	95	Shale: medium to dark grey, micromicaceous, flaky to splintery, very slightly calcareous.
	5	Siltstone: light to medium grey, brown, calcareous, argillaceous, sandy, thin stringers.
1710-1715	95	Shale: as above.
	5	Siltstone: generally as above, grading in part to fine grained sandstone, tight, no shows, thin stringers.
1715-1720	95	Shale: as above, becoming very splintery.
	5	Siltstone: as above, cavings in part.
1720-1725	90	Shale: medium grey, micromicaceous, flaky to splintery, some very slightly calcareous.
	10	Siltstone: medium grey, argillaceous, sandy, calcareous, thin stringers, cavings in part.

CONOCO ET AL NORTH LITTLE BEAR O-51
SAMPLE DESCRIPTIONS

1725-1730m	85%	Shale: as above.
	15	Siltstone: as above, may be mostly cavings.
1730-1735	95	Shale: as above.
	5	Siltstone: as above.
1735-1740	90	Shale: medium grey, micromicaceous, flaky to splintery, some very slightly calcareous.
	10	Siltstone: medium grey, argillaceous, micaceous, calcareous, thin stringers.
1740-1745	90	Shale: as above, some dark grey thin beds.
	10	Siltstone: as above.
1745-1750	90	Shale: as above, most non-calcareous.
	10	Siltstone: as above, thin stringers, some limestone and sandstone cavings.
1750-1755	90	Shale: as above, cavings in part.
	10	Siltstone: as above, may be mostly cavings.
1755-1760	90	Shale: medium grey, micromicaceous, flaky to splintery, slightly calcareous.
	5	Siltstone: medium grey, argillaceous, micaceous, calcareous, thin stringers.
	5	Cavings: tan limestone, brown siltstone, sand grains, etc.
1760-1765	90	Shale: as above, some becoming medium grey-green.
	10	Siltstone: as above.
1765-1770	90	Shale: as above, some becoming fairly calcareous.
	10	Siltstone: as above, most very calcareous.
1770-1775	95	Shale: medium to rare dark grey, micromicaceous, flaky to splintery, slightly calcareous.
	5	Siltstone: medium grey, argillaceous, calcareous, thin stringers.

CONOCO ET AL NORTH LITTLE BEAR O-51
SAMPLE DESCRIPTIONS

1775-1780m	90%	Shale: as above.
	10	Siltstone: as above, some very sandy.
1780-1785	90	Shale: as above.
	10	Siltstone: as above.
1785-1790	90	Shale: medium to rarely dark grey, micromicaceous, flaky to splintery, slightly calcareous in part.
	10	Siltstone: medium grey, argillaceous, calcareous, thin stringers.
1790-1795	90	Shale: as above.
	10	Siltstone: as above.
1795-1800	95	Shale: as above, trace slickensides.
	5	Siltstone: as above, some grading to silty marl, thin stringers.
1800-1805	95	Shale: as above, trace brown to reddish brown.
	5	Siltstone: as above.
1805-1810	90	Shale: medium to rarely dark grey, micromicaceous, flaky to splintery, most slightly calcareous.
	10	Siltstone: medium grey, argillaceous, calcareous, trace carbonaceous flecks, micaceous.
1810-1815	90	Shale: as above.
	10	Siltstone: as above.
1815-1820	85	Shale: as above, trace pelecypod fragments.
	15	Siltstone: as above, cavings in part.
1820-1825	80	Shale: as above.
	15	Siltstone: as above.
	5	Marl: light grey-brown, calcareous, silty, thin stringers in shale.
1825-1830	85	Shale: medium to minor dark grey, micromicaceous, flaky to splintery, slightly calcareous, some silty, trace carbonaceous flakes.

CONOCO ET AL NORTH LITTLE BEAR O-51
SAMPLE DESCRIPTIONS

Sample coninued from previous page.

1825-1830m	15%	Siltstone: medium grey, argillaceous, micaceous, carbonaceous, thin stringers in shale.
1830-1835	85	Shale: as above, becoming silty, trace pelecypod fragments.
	15	Siltstone: as above, thin bedded.
1835-1840	90	Shale: as above.
	10	Siltstone: as above, thin stringers.
1840-1845	90	Shale: medium grey, micromicaceous, flaky, very slightly calcareous, flaky to splintery, some silty.
	10	Siltstone: medium grey, argillaceous, micaceous, calcareous, thin stringers in shale.
1845-1850	95	Shale: as above, trace pelecypod fragments.
	5	Siltstone: as above.
1850-1855	95	Shale: as above.
	5	Siltstone: as above, thin stringers.
1855-1860	95	Shale: medium grey, micromicaceous, flaky to splintery, some silty.
	5	Siltstone: medium grey, argillaceous, micaceous, carbonaceous, thin stringers in shale.
1860-1865	95	Shale: as above.
	5	Siltstone: as above.
1865-1870	90	Shale: as above, trace medium brown.
	10	Siltstone: as above, thin stringers.
1870-1875	95	Shale: as above.
	5	Siltstone: as above.
1875-1880	95	Shale: medium grey, micromicaceous, flaky to splintery, very slightly calcareous.
	5	Siltstone: medium grey, argillaceous, calcareous, thin stringers.

CONOCO ET AL NORTH LITTLE BEAR O-51
SAMPLE DESCRIPTIONS

1880-1885m	90%	Shale: as above.
	10	Siltstone: as above.
1885-1890	85	Shale: as above, and some dark grey, medium grey-brown, pelecypod fragments.
	15	Siltstone: as above but light to medium grey, some medium brown.
1890-1895	75	Shale: medium to dark grey, micromicaceous, very slightly calcareous, flaky to splintery to blocky, some silty, some sandy.
	25	Siltstone: light to medium grey, argillaceous, micaceous, calcareous, sandy in part, thinly interbedded with shale.

Silt Marker 1898m (-1578m Subsea)

1895-1900	90	Shale: as above, becoming less dark grey.
	10	Siltstone: as above.
1900-1905	65	Shale: as above, cavings in part.
	35	Siltstone: medium to light grey-brown, calcareous, argillaceous in part, micaceous, carbonaceous in part, thinly interbedded with shale, tight, even light oil stain with poor to fair slow cut and streaming.
1905-1910	70	Shale: medium grey, micromicaceous, flaky to splintery, some silty.
	30	Siltstone: as above, tight, poor slow cut with streaming.
1910-1915	80	Shale: as above.
	20	Siltstone: as above, tight, very poor milky cut with no streaming.
1915-1920	80	Shale: as above, some to dark grey.
	20	Siltstone: light to medium grey, some grey-brown, argillaceous, carbonaceous, calcareous, thin bedded.

CONOCO ET AL NORTH LITTLE BEAR O-51
SAMPLE DESCRIPTIONS

1920-1925m	75%	Shale: as above, some dark grey.
	25	Siltstone: as above.
1925-1930	60	Shale: medium to partly dark grey, some micromicaceous and flaky to splintery, some blocky and silty.
	40	Siltstone: light to medium grey or grey-brown, argillaceous, micaceous, carbonaceous, sandy in part, slightly calcareous.
1930-1935	60	Siltstone: as above.
	40	Shale: as above.
1935-1940	70	Siltstone: light to medium grey-brown, argillaceous, sandy, carbonaceous, calcareous, thin bedded, tight, even light oil stain with slow poor to fair cut and streaming.
	30	Shale: as above, some dark grey, splintery.

"Canol" 1944m (-1624m Subsea)

1940-1945	60	Siltstone: as above, some becoming very calcareous, even light oil stain with slow cut and streaming.
	40	Shale: some as above, and some dark grey to black, micromicaceous, bituminous, slightly calcareous.
1945-1950	70	Shale: as above, most dark grey to black.
	20	Siltstone: as above, becoming more argillaceous, poor milky cut.
	10	Sand: light grey, medium grained, subrounded to subangular, clear quartz with minor pink to yellow rock fragments, unconsolidated, no shows.
1950-1955	85	Shale: medium to dark grey, black, micromicaceous, flaky to splintery, rarely silty.

CONOCO ET AL NORTH LITTLE BEAR O-51
SAMPLE DESCRIPTIONS

Sample continued from previous page.

1950-1955m	15%	Siltstone: light to medium grey, argillaceous, micaceous, calcareous, carbonaceous, no visible oil stain, very poor milky cut.
1955-1960	80	Shale: as above, most dark grey.
	20	Siltstone: as above, very argillaceous, no shows.
1960-1965	80	Shale: as above, most medium grey.
	20	Siltstone: as above.
1965-1970	85	Shale: medium to minor dark grey, micromicaceous, flaky.
	15	Siltstone: light grey-brown, sandy, argillaceous, micaceous, calcareous, tight, thin bedded, even light oil stain with fair cut and streaming.
1970-1975	90	Shale: generally as above, some dark grey to black.
	10	Siltstone: as above, tight, no shows.
1975-1980	95	Shale: medium grey to medium grey-brown, micromicaceous, flaky.
	5	Siltstone: as above, may be cavings.
1980-1985	98	Shale: as above.
	2	Siltstone: as above, cavings.
1985-1990	100	Shale: as above, some grading to dark grey.
1990-1995	100	Shale: dark grey to black, micromicaceous, flaky, trace dark brown calcareous nodules.
1995-2000	100	Shale: as above.
2000-2005	100	Shale: dark grey-brown to black, micromicaceous, flaky, slightly dolomitic to calcareous, trace brown calcareous nodules, faint milky cut.

CONOCO ET AL NORTH LITTLE BEAR O-51
SAMPLE DESCRIPTIONS

2005-2010m	90%	Shale: medium grey-brown to medium greenish brown mottled, fine micromicaceous, flaky, dolomitic, faint milky cut.
	10	Shale: as above sample, cavings in part.
2010-2015	100	Shale: medium grey-brown to medium greenish brown mottled type as above, some slickensides, faint slow cut.
2015-2020	100	Shale: as above, still dolomitic, some becoming dark grey, slickensides?, no cut.
2020-2025	100	Shale: medium grey-brown to medium greyish greenish brown, fine micromicaceous, flaky, thin bedded.
2025-2030	100	Shale: as above.
2030-2035	100	Shale: as above.

"Hare Indian" 2035m (-1715m Subsea)

2035-2040	60	Shale: dark brown to black, micromicaceous to earthy, flaky to blocky, bituminous, faint milky cut.
	40	Shale: as above sample, becoming darker grey, cavings in part.
2040-2045	100	Shale: dark brown to black type as above, trace calcareous, trace pyrite, poor cut in solvent.
2045-2050	95	Shale: dark brown, some black, blocky, earthy, dull, bituminous, commonly pyritic, some siliceous, fair cut in solvent.
	5	Marl: dark brown, calcareous, bituminous, thin stringers in shale.
2050-2055	90	Shale: as above.
	5	Marl: as above.
	5	Cavings: medium grey-green micromicaceous shale.

CONOCO ET AL NORTH LITTLE BEAR O-51
SAMPLE DESCRIPTIONS

2055-2060m	90%	Shale: as above.
	5	Marl: as above.
	tr	Chert: dark brown, white specks, thin stringers or nodules in shale.
	5	Cavings: as above.
2060-2065	95	Shale: dark brown, some black, blocky to flaky, earthy, dull, bituminous, commonly pyritic, some siliceous, fair cut in solvent.
	5	Marl: dark brown, calcareous, bituminous, thin stringers in shale.
2065-2070	80	Shale: as above, some slightly calcareous.
	15	Marl: as above.
	tr	Chert: dark brown with white specks, nodules or thin stringers of silicified shale.
	5	Cavings: medium grey-green micromicaceous shale.
2070-2075	90	Shale: as above.
	10	Marl: as above.
2075-2080	90	Shale: as above, most calcareous.
	5	Marl: as above, thin stringers.
	5	Cavings: as above.
2080-2085	100	Shale: dark brown, some black, blocky, earthy, dull, bituminous, most slightly calcareous, fair cut in solvent.
2085-2090	95	Shale: as above, trace pyrite.
	5	Cavings: medium grey flaky micromicaceous shale.
2090-2095	95	Shale: as above.
	5	Cavings: as above.
2095-2100	95	Shale: dark brown, blocky, earthy, dull, calcareous, bituminous, fair cut in solvent.
	tr	Marl: dark brown, calcareous, bituminous, thin stringers.
	5	Cavings: medium grey flaky micromicaceous shale.

CONOCO ET AL NORTH LITTLE BEAR 0-51
SAMPLE DESCRIPTIONS

2100-2105m	90%	Shale: as above.
	5	Marl: as above.
	5	Cavings: as above.
2105-2110	90	Shale: as above, common pyrite.
	5	Marl: as above.
	5	Cavings: as above.
2110-2115	100	Shale: dark brown to black, blocky, earthy, dull, calcareous, very bituminous, fair cut in solvent.
2115-2120	98	Shale: generally as above but becoming flaky, some pyritized rod-shaped microfossils.
	2	Marl: dark brown, calcareous, bituminous, thin stringers.
2120-2125	95	Shale: as above, blocky to flaky.
	5	Marl: as above, light to dark brown, pyrite.
2125-2130	95	Shale: dark brown to black, flaky to blocky, dull, calcareous, bituminous, pyrite, fair cut.
	5	Marl: medium to dark brown, calcareous, bituminous, pyrite.
2130-2135	100	Shale: as above, possible slickensides, commonly pyritic.
	tr	Marl: as above.
2135-2140	100	Shale: as above, trace tiny rod-shaped microfossils, becoming less calcareous.
2140-2145	90	Shale: dark brown to black, flaky to blocky, slightly calcareous, bituminous, dull and earthy, some slickensides?, fair cut in solvent.
	10	Marl: dark brown, calcareous, some white specks, bituminous, thin stringers in shale.
2145-2150	85	Shale: as above, becoming rather calcareous.
	15	Marl: as above.

CONOCO ET AL NORTH LITTLE BEAR O-51
SAMPLE DESCRIPTIONS

2150–2155m	75%	Shale: as above, becoming very calcareous, grading in part to marl.
	25	Marl: generally as above, most dark brown, abundant calcareous white cylindrical microfossiles.
2155–2160	65	Shale: as above, some tubular white calcareous microfossils.
	35	Marl: light to dark brown mottled, calcareous, abundant calcareous white specks and tubular white microfossils, very bituminous, interbedded with shale.

Hume 2160m (-1840m Subsea)

2160–2165	60	Limestone: light to medium brown mottled, microcrystalline matrix, bioclastic with crinoids and other fossil fragments up to 2mm, some interstitial sparite cement, trace pyrobitumen, a few stylolites, tight, no shows.
	40	Cavings: medium grey, brown, and black shale, brown siltstone, etc.
2165–2170	50	Limestone: as above, tight, no shows.
	50	Cavings: as above.
2170–2175	75	Limestone: as above, tight, no shows.
	25	Cavings: as above.
2175–2180	85	Limestone: white, buff to medium brown mottled, microcrystalline to minor cryptocrystalline matrix, bioclastic in part with scattered crinoids and other fossil fragments, stylolites, some sparite vein fillings, trace interstitial pyrobitumen, tight, no shows.
	15	Cavings: grey shale and siltstone.
2180–2185	90	Limestone: as above, some dark brown with bold white mottling, possible stromatoporoids, stylolites, tight, no shows.
	10	Cavings: as above.

CONOCO ET AL NORTH LITTLE BEAR O-51
SAMPLE DESCRIPTIONS

2185-2190m	85%	Limestone: as above.
	15	Cavings: as above.

Total Depth (Hume) 2190m (-1870m Subsea)

9211-C90-1-3

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DATALOG
TECHNOLOGY INC.

Gas C_1 - C_4
Chromatograph Rpt

Conoco Canada Ltd.
Conoco North Little Bear 0-51
64° 40' 57.4"N 125° 54' 55.2"W

7139K 40th STREET S.E., CALGARY, ALBERTA T2C 2H9 TELEPHONE: BUS. (403) 279-5363

Surface Hole 25m-682m

Logging commenced February 6, 1989 at a depth of 25 meters at the base of the conductor barrel. The background gas ranged from 1 unit to 2 units throughout this interval. No gas shows were noted.

Little Bear 682m-1165m

The background gas ranged from 1 unit to 7 units. Numerous coal seams produced gas peaks ranging from 4 units to a maximum of 13 units. Four minor gas shows were noted

Depth	Gas Response	Oil Indicator
817m-818m	4.5 units over 2.4 units	.01
842m-847m	7.6 units over 1.8 units	.01
885m-887m	9.7 units over 4.7 units	.01
952m-955m	13.9units over 5.9 units	.01

No C3's or C4's were noted.

Slater River 1165m-1405m

The background ranged from 8 units to 20 units in the upper interval, gradually increasing to a range of 20 units to 34 units. No gas shows were noted.

Slater River Source Shale 1405m-1512m

The background gas fluctuated between 40 units to 280 units depending on the amount of carbonacous material in the shale. High C3's and C4's were noted as a result of this carbon content.

Sans Sault 1512m-1554m

The background gas varied from 5 units to 30 units throughout the Sans Salt. Two gas shows were noted:

Depth	Gas Response	Oil Indicator
1533m-1535m	390 units over 16 units	.13
1540m-1544m	321 units over 16 units	.15

Imperial 1554m-1944m

The background ranged from 5 units to 50 units throughout this formation. Five gas shows were noted as follows:

Depth	Gas Response	Oil Indicator
1899m-1901m	173 units over 16 units	.07
1903m-1905m	150 units over 16 units	.13
1908m-1909m	155 units over 48 units	.13
1930m-1933m	211 units over 113 units	.14
1935m-1936m	133 units over 77 units	.14

Canol 1944m-2035m

The background gas ranged from 30 units to 90 units with one gas show at a depth of 1966 meters to 1969m of 197 units over 32 units and an oil indicator of .12.

Hare Indian 2035m-2160m

The background gas increased sharply on entering the Hare Indian flutuating between 100 units to 440 units resulting from the carbonaceous and bituminous material in the shale. One large gas increase was seen at 2155m to 2159m of 450 units from 230 units due to the high bitumen content. No gas shows were noted.

Home 2160m-2190m

The background gas remained high in the upper interval of the Home as a result of sloughing shale, ranging from 100 units-280 units, but decrease to an average of 435 units near the bottom of the hole. The well was TD in the Home at 2190m, February 22, 1989 one small gas show at 2172 m to 2173m of 217 units over 149 units with an oil indicator of .07.

Canada Oil and Gas Lands Administration | Administration du pétrole et du gaz des terres du Canada

D.A. 1395

				Well Status	
Nova Scotia	☐	West Coast	☐	Suspended	☐
Newfoundland	☐	Northern	☒	Completed	☐
Gulf of St. Lawrence	☐	Hudson Bay	☐	Abandoned	☒

WELL TERMINATION RECORD

This record is submitted in triplicate in compliance with Section 184 of the Canada Oil and Gas Drilling Regulations.

WELL DATA

Well Name: Conoco et al North Little Bear O-51 Area: Fort Norman

Grid Area: 64° 50' 125° 45' Field/Pool: Wildcat

Permit or Lease No.: EL 319 Final Coordinates. Lat. North 64°40'57.4069" Long: West 125° 54' 55.1506"

Drilling Unit: Atco/Equatak 76 Elevations ~~RT/KB~~: 320.2 m ~~GF/GL~~: 314.0 m

Spud Date: 1989 - 2 - 6 Rig Released: 1989 - 2 - 26 Total Depth: 2190 mKB

CASING AND CEMENTING

O.D.:	Weight:	Grade:	Depth Set:	Cement and Additives:
508 mm	139.9 kg/m	H40	18 m	2 tonnes arctic cement
244.5 mm	53.6 kg/m	K55	606 m	20 tonnes arctic cement + 16 tonnes "G"

PLUGGING PROGRAM

Approval of the following program was obtained by (person) John Schneider from (person) Kem Singh of the Canada Oil and Gas Lands Administration by means of Verbal on February 25, 1989.

Type of Plug:	Interval:	Felt:	Cement and Additives:
#1	2190 - 2090	No	6.6 tonnes Class G
#2	570 - 730	at 552 m (9000 daN)	12.7 tonnes Class G
#3	Surface	No	0.5 tonnes Class G

Lost Circulation/Overpressure Zones: None

Equipment left on Seafloor (Describe): None

Provision for Re-entry (Describe and attach sketch): None

Cores: Type: None Intervals:

Other Downhole Completion/Suspension Equipment: None

CERTIFICATION

I certify on the basis of personal knowledge of operations undertaken at the above named well that the above information is accurate.

Signed: Gary R. Lushington P. Eng. Title: Senior Production Engineer

Name: Gary Lushington Date: 89-2-28

Acknowledged by: Engineering Branch

Date: 89-03-30

File: 9211-C90-1-3

Department of Energy, Mines and Resources | Ministère de l'Énergie, des Mines et des Ressources

Department of Indian Affairs and Northern Development | Ministère des Affaires indiennes et du Nord canadien

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