

PROGRAM NUMBER: #N96B579
OPERATING LICENSE: #855

KOTANELEE, N.W.T.

9 2 2 9 - H 6 - 1 E - 17

SURVEY TYPE: SEISMIC GEOPHYSICAL SURVEY

SURVEY LOCALITY: KOTANELEE, N.W.T.
FT. SIMPSON, ADMIN. AREA
124°15'00"E, 60°40'0"N

YEAR OF FIELD WORK: 1996

PROGRAM OPERATOR: HUSKY OIL OPERATIONS
100% INTEREST

PRIME CONTRACTOR: GECO-PRAKLA

SPECIFIC INTEREST: FIELD DATA ACQUISITION

SEPTEMBER 15, 1997

July 01/97

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I. INTRODUCTION

Husky Oil's Kotaneelee 1996 seismic program consisted of 89.7 km of helicopter supported seismic. The program consisted of six (6) lines of lengths varying from 13.7 km to 16.8 km.

The program was designed to gather information over Husky's exploration block at the southern end of the Kotaneelee Range, by utilizing the existing resources, equipment, manpower and infrastructure available in Fort Liard/Kotaneelee area of the Northwest Territories.

Field operations began June 27, 1996. The first field operations were made by local aboriginal crews in clearing/slashing the proposed lines. Approximately 68 km required slashing a one (1) metre wide path. The remaining 22 km were over barren land where no clearing was required. This was preplanned from detailed review of topographical maps and aerial photos.

Shot hole drilling commenced on July 11, 1996 with detailed GPS control, for the program, starting on July 12, 1996. The conventional survey followed on July 17, 1996.

Line clearing and surveying were completed on August 14, 1996 with shot hole drilling finalized on August 16, 1996. The recording of the data was started on July 24, 1996 and was finalized on August 28, 1996. An average of 3.7 km/day was recorded. Operations were completed on August 29, 1997.

The data was processed using pre-stack time migration algorithms with data quality being considered fair to good.

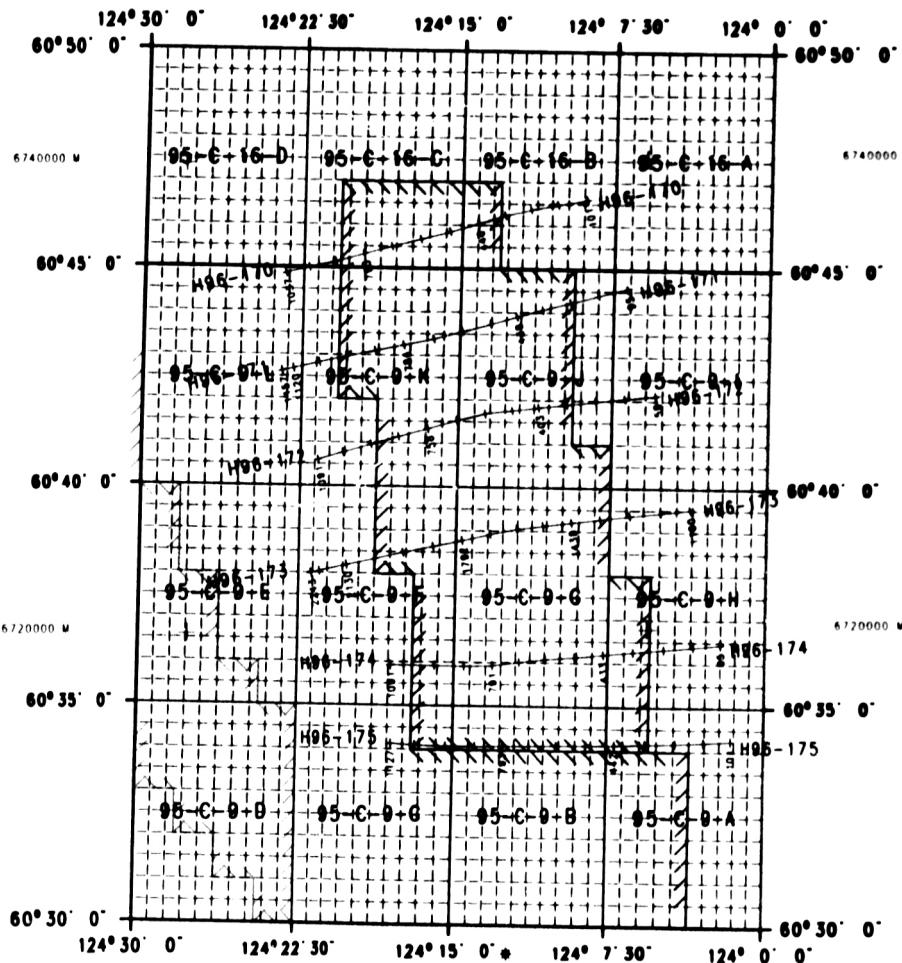
The interpretation of the data is summarized in the attached map. Both time and depth interpretations of the Nahanni formation are supplied (Fig. 20 & 21)

The depth maps were generated from time interpretation sections (Fig. 8 - 13) Depths were then calculated using a modeling program. From this a depth section is generated (Fig. 14 - 19) and a final depth interpretation map generated and displayed in Fig. 20.

The geological and geophysical summary is given in a later portion of this report.

Details of the safety and operational considerations of the seismic programs acquisition are tabulated in an attached report

II. LOCALITY MAP



SCALE 1:250000
KILOMETERS
STATUTE MILES

WELL LEGEND

▼ MISCELLANEOUS/OBSERVATION	◆ ABANDONED RE-ENTERED
■ SERVICE	ABANDONED RE-ENTERED
◆ ABANDONED	ABANDONED
◆ SUSPENDED	SUSPENDED
◆ LOCATION	◆
◆ OIL	◆
◆ GAS	◆
◆ OIL & GAS	◆
◆ DISPOSAL	◆
◆ FARM GAS	◆
◆ INJECTORS: ABANDONED	ABANDONED
◆ OIL	◆
◆ GAS	◆
◆ WATER	◆
◆ STEAM	◆

Postings & Leases as of
AUG 14, 1994

APR. 1995 POSTINGS
 HELD LANDS

HUSKY OIL OPERATIONS LTD.

EXPLORATION & PRODUCTION DEPARTMENT

CALGARY - ALBERTA - CANADA

Ketogenic, B.C.

Seismic Program

Software by DYNAMIC SOLUTIONS LTD

AUTHOR: CLAWS/DFR

DATUM VEL: DATE: 07-05-95

CONTOUR INT:

DATUM: MAD 27

VIEW SCALE: 0.0000

CENTRAL MERIDIAN: 120.00

III. OVERVIEW OF SEISMIC OPERATIONS - SIGNIFICANT DATES

June 13, 1996

Husky Field Representatives, Dave Lochhead and Murray Place traveled to Fort Liard to meet with Chief Harry Deneron

June 27, 1996

Began slashing operation on line H97-173

July 11, 1996

Drilling commenced on line H97-173

July 12, 1996

Commencement of GPS control survey

July 17, 1996

Conventional survey started up.

July 24, 1996

Recording started on line H97-173.

August 14, 1996

Slashing and chaining of program complete

August 16, 1996

Completion of drilling on program

August 28, 1996

Recording and reclamation complete An average of 3.7 km/day for recording production for this program.

August 29, 1996

Final inspection completed by Scott Davidson and Husky Representative, Bert Cowan.

III. SIGNIFICANT DATES - cont'd

COMMENCEMENT AND COMPLETION DATES

Murray Place - Field Representative, Husky - June 27 - Aug. 13
Bert Cowan - Field Representative, Husky - July 24 - Aug. 29
Chaining - July 11 - Aug. 12
Surveying - July 11 - Aug. 16
Slashing - June 27 - Aug. 12
Drilling - July 11 - Aug. 17
Recording - July 24 - Aug. 28

PRE-JOB CONSULTATIONS

May 2, 3 and June 16 - Dave Lochhead, Murray Place, Vern Chocan
Later dates - Jim Wickens, Jeff Tooth

IV. ACQUISITION PARAMETERS & PROCEDURES

HUSKY OIL OPERATIONS LTD.

Prospect: Chinkeh Creek
SOURCE PARAMETERS

• Source type	Dynamite
• Source array interval	90 m
• Source pattern description	
- Holes per shot point	1
- Distance between holes within shot point	n/a
• Charge size	14 kg
• Charge depth	18 m

Date: September 26, 1997

RECEIVER AND CABLE DESCRIPTION

• Spread	Symmetric
• Number of channels	400
• Group interval	15 m
• Fold	3300%
• Near offset distance (centre of source array to centre of near receiver array)	7.5 m
• Far offset distance (centre of source array to centre of far receiver array)	2992.5 m
• Number of groups in gap	0
• Geophones per group	6
• Geophone spacing	2.5 m
• Geophone natural frequency	14 hz
• Geophone damping	70%
• Geophone base	marsh

RECORDING PARAMETERS

• Instrument type and model	IO System II
• Sample rate	2 ms
• Record length	5 s
• High cut filter and slope	to be determined
• Low cut filter and slope	125 hz, 120dB/oct
• SSF	Out
• HPE	Out

SURVEY REQUIREMENTS

- These are according to Husky standards which are provided by David Lochhead

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IV. ACQUISITION PARAMETERS & PROCEDURES - cont'd

EQUIPMENT

SURVEY EQUIPMENT

- Trimble 4000 SSI GPS receivers
- Wild T1010 Electronic Theodolites
- Accuracy was N5 x E3 x V 4 cm

DRILLING EQUIPMENT

- Explorer 1500
- Heli: Bell 212, Sikorsky 58T

RECORDING EQUIPMENT

- I/O System II
- 800 Channels
- Geophones: marsh

CHAINSAWS

- As supplied by slashing companies

HELICOPTERS

- AStar-BA
- AStar-B
- AStar B-1
- Bell 205
- Bell 206B
- Bell 212

V. GEOPHYSICAL DATA PROCESSING SUMMARY

PROCESSING SEQUENCE

DEMULITPLEX:
 PROCESS SAMPLE RATE 2.0 MS
 PROCESS RECORD LENGTH 5.0 SEC
AMPLITUDE RECOVERY:
 EXPONENTIAL GAIN CURVE $K(T) = \text{PUREN}(X(\text{EXPAT})) \quad K=1 \text{ AND } N=2$
TRACE EDITING:
PHASE COMPENSATION:
 TYPE GEOPHONE AND INSTRUMENT
DECONVOLUTION:
 TYPE SURFACE CONSISTENT SPREADING
 OPERATOR LENGTH 120 MS
 PREWHITENING 1 PCT
 DESIGN GATE 1000- 3000 MS AT 7.5M OFFSET
 1300- 3000 MS AT 2500M OFFSET
SPECTRAL BALANCING:
 FREQUENCY 10 - 100 Hz
EQUALIZATION:
 DESIGN GATE SAME WINDOW AS DECON
STATICS (REFRACTION)
 METHOD GENERALIZED LINEAR INVERSION
 FREQUENCY SPACING EVERY SHOT
 DATUM ELEVATION 1000 M
 WEATHERING VELOCITY 762 M/SEC
 REPLACEMENT VELOCITY 4000 M/SEC
SORT:
 TO EQUAL CDP INTERVAL
VELOCITY ANALYSIS:
 TYPE CONSTANT PERCENTAGE MOVEOUT
STATICS (RESIDUAL): 1ST PASS
 TYPE AUTOMATIC SURFACE CONSISTENT
 CORRELATION WINDOW 400 - 2700 MS
 MAXIMUM SHIFT +/- 32 MS
 CORRELATIONS PER TRACE 15
 NUMBER OF ITERATIONS 2
VELOCITY ANALYSIS:
 TYPE CONSTANT PERCENTAGE MOVEOUT
STATICS (RESIDUAL): 2ND PASS
 TYPE AUTOMATIC SURFACE CONSISTENT
 CORRELATION WINDOW 400 - 2700 MS
 MAXIMUM SHIFT +/- 16 MS
 CORRELATIONS PER TRACE 15
 NUMBER OF ITERATIONS 2
PRE-STK MIG. VEL. ANALYSIS:
 TYPE CONSTANT PERCENTAGE MOVEOUT
MUTE PATTERN:
 DISTANCE 300 360 3000 M
 TIME -300 300 1000 MS
EQUALIZATION:
 DESIGN WINDOW 400 MS AGC
FULL PRE-STACK MIGRATION:
 TYPE KIRCHOFF SUMMATION
 DATUM REFERENCED, TO PLOTTED WEATHERING REPLACED SURFACE,
 SEPARATELY AT SHOT AND RECEIVER
STACK:
 SPIKE SUPPRESSION 3:1 THRESHOLD
 FOLD 3300 PCT.
OUTPUT STACKED DATA:
 FORMAT SEGY TO CLIENT REEL
FILTER:
 FREQUENCY 10/15-60/70 Hz
EQUALIZATION:
 DESIGN WINDOW 600 MS AGC
OUTPUT STACKED DATA:
 FORMAT SEGY TO CLIENT REEL



VI. INTERPRETATION SUMMARY

KOTANEELEE SEISMIC INTERPRETATION:

Geological field mapping conducted in the summer of 1997 along seismic trails provided accurate seismic marker identification for shallow reflectors, including the Fantasque, Mattson and Besa River Formations. Correlation of deep markers on the Husky 2D data set required a jump correlation from the Kotaneelee O-67 well on Norcen's block to the south to the southern Husky line. Confirmation of this correlation was also possible using BFR's extension of line H93-173 to the east and west crossing the LaBiche and Flett N-19 wells. These correlations were difficult to use as significant stratigraphic changes occur across the synclines both to the east and west of the Kotaneelee block. It was also necessary to make a jump correlation across major thrust faults in both of these cases.

The final interpretation of the Nahanni Formation shows a large east verging detachment fold with a major antithetic fault. The feature forms a large northward plunging anticline, with the crest off the Husky block to the south. The Kotaneelee anticline is developed on a lower, basal detachment interpreted to be within the evaporites of the Lower Devonian Camsell Formation. There is also a more minor detachment in the shales of the Besa River Formation. The Besa River detachment results in a minor divergence of the exposed surface structure and the mapped subsurface structure at the Nahanni Formation level. A depth conversion of the Nahanni time structure map was generated using time interpretations of each seismic line input into the Outrider software package with interval velocities calculated from the O-67 well. The resulting depth structure map breaks out a small independent feature on the north end of the Kotaneelee anticline, with 200 meters independent closure.

Parkeb
Oct 2/97