

**Program ID 9229-P033-005E**

**FINAL REPORT  
for**

**3D Seismic Survey  
Cameron Hills, NT**

**LOCATION:**

**Latitude:** 60° 04' N to 60° 10'      **Longitude:** 117° 35' to 117° 43'

**Start of Operation:** February 11, 2002

**End of Operation:** March 29, 2002

**Primary Contractor:** Trace Energy Services Ltd.

**Operator:** Paramount Resources Ltd.  
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**Submitted to:** Bharat Dixit, Chief Conservation Officer  
National Energy Board

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## **2.0 Introduction**

This is the final report for our 3D Vibroseis seismic acquisition program number 9229-P033-005E conducted in the Cameron Hills area of the NWT during the winter of 2001/2002.

The program is located between 8 and 18 km North of the NWT / Alberta border. Please refer to Encl.1.1 Seismic Program Number Mineral Lease Number Index Map. This map shows the location of 3D seismic acquired as part of this geophysical operation, as well as from our previous operations in the area. The map also shows associated mineral rights lease numbers and existing well control.

Program 9229-P033-005E comprised 146.10km of 4m wide receiver lines and 148.32km of 6m wide source lines. The presence of near surface sands and gravels in the area have historically resulted in difficult dynamite shot hole drilling and poor data quality. The use of Vibroseis as an energy source has resulted in better overall data quality. Refer to Encl.1.95 for a map showing the location of the source and receiver lines and points.

Paramount Resources Ltd. And Lornel Consultants handled the compilation of Mackenzie Land and Water Board land use application. Lornel Consultants, Paramount Resources, Alpine and Golder Associates conducted a detailed Environmental Impact Assessment of the Cameron Hills area which formed part of the land use application.

Trace Energy Services Ltd. was the Prime Acquisition Contractor (Job# 9-529) hired to coordinate and shoot the proposed seismic program as well as a 70km regional 2D program (9229-P33-7E) centered about 14km due north. All parties were working on behalf of Paramount Resources Ltd. Paramount Resources Ltd. acted as the operator and the geophysical survey was for the exclusive use of Paramount Resources Ltd.

Operations began with surveying and seismic line construction and finished with recording, clean-up and reclamation. The advance crew was based out of a PTI Open Camp located at Indian Cabins, AB some 52km south of the project area for the first week of operations before a Travers-Trace camp was set up 3 km east of the 3D near an airstrip. Surveying and line construction began with the 2D and finished with the 3D.

The programs were scheduled to allow the recording crew to acquire the 2D program first, then proceed to the 3D without delay. Recording on the north end of the 3D commenced while line construction and surveying were being finalized at its southern end. The number of personnel on the job and in the camp ranged from about 17 during line construction to a peak of about 45 during the recording phase of the operation.

All operations were conducted in accordance with the applicable legislation, regulations, Land Use Permit conditions (MV2000B0066), and terms and conditions of the NEB Geophysical Operation Authorization dated February 11, 2001 having an Operation Identifier 9229-P33-5E.

Field data was processed at Geo-X Systems Ltd. to produce a migrated data volume having a 30m by 30m bin spacing. See enclosure 1.8 Seismic Processing History.

### **3.0 Data Acquisition**

#### **3.1 Weather and Terrain**

Weather conditions for this program were in the temperature range of -35° to 0° Celsius throughout the course of the operations. Most of the working conditions were from -28° to around -10°.

The Cameron hills region consists of an upland plateau, elevated about 500m above the Northern Alberta Lowlands along the Southern and Eastern flanks and the Great Slave Plain along the Northern flank. The Cameron River flows Southwesterly from its headwaters near the plateau high, and continuous through the middle of the plateau within a comparatively wide, subdued floodplain before turning north, where it forms a significant valley about 300m deep.

The terrain North of the river is rolling and undulating with comparatively steep slopes. The terrain South of the river is generally more subdued, consisting of extensive lakes and lowlands (see Encl. 1.2 Topographic Map). Trembling Aspen-Pine forests (10 to 15m) are present throughout the project area. Trembling Aspen are dominant primarily in the Cameron River valley. Coniferous forests comprise stands of Black Spruce, White Spruce and Pine mixtures. Black Spruce bogs are common throughout the project area.

#### **3.2 Safety, Health & Environment**

Trace Energy Services Ltd. had a complete Health, Safety, and Environmental program in place. A site specific ERP was developed for the program and audited by Mr. Rick Turner, of the National Energy Board based in Calgary. Contingency plans include Injury, Accident and Spill. A First Aid Room (17.13) and Medical Transportation (17.15) were located at the program site along with the correct number of advanced level first aid certified workers (as per requirement as defined in Part 1 and section 17 of the Oil and Gas Occupational Safety and Health Regulations SOR/87-612). A copy of the Oil and Gas Occupational Safety and Health Regulations SOR/87-612 was kept in the field office.

First Aid supplies, a field radio, satellite telephone and/or mobile radio-telephones were available to the crew at all times to permit crew to crew communication as well as to permit the crew to communicate with offsite emergency personnel. Radio check-in was required on a regular basis. A site specific Hazard Awareness program was developed and daily safety meetings were held.

Field operations were inspected by Mr. Rick Turner, of the National Energy Board based in Calgary, and several times by Mr. Norm McCowan, a Resource Management Officer from DIAND, Hay River sub-District. Their concerns were addressed in a timely manner and assisted Trace Energy employees in the running of an efficient program.

Environmental concerns were addressed by Lornel Consultants, Paramount Resources, Alpine and Golder Associates who conducted a detailed Environmental Impact Assessment of the Cameron Hills area. Local Elders were also hired as Environmental Monitors during the line clearing operation.

### **3.3 Logistics & Summary**

Operations commenced out of the PTI Open Camp Indian Cabins located 43 to 52km south of the project area in Alberta, but were moved in about a week to a Travers –Trace base camp located 3km due east of the 3D near an airstrip.

Prior to going to the field, tender requests were sent to out to the local NWT based businesses to secure the sub-contractors needed to work on the program. The majority of sub-contractors hired were local NWT based businesses. The majority of personnel were local community hires involved in line construction (cat operators, slashers, and monitors), the dragging of source lines, recording (vib operators and line crew), and in any reclamation operations required at the end of the program.

Some of Trace Energy's personnel came from the South (i.e. Calgary – point of hire and from other communities in the NWT) and were mostly involved in supervisory, surveying, and recording aspects of the program.

### **3.4 Surveying Operations**

Mercedes Surveys located in Alberta provided chaining, survey and quality control services on this project. A Lidar survey was flown over the program area for pre-planning and vertical survey control. The Lidar data showed where existing cleared lines and water bodies were located. This information was used to maximize the amount of existing cleared lines used in the survey design.

The coordinates for all source and receiver line locations were loaded into GPS navigation systems on the cats used to clear the lines. This allowed the cat operators to stay on track while avoiding large stands of timber, keep away from hazards, maintaining set-backs from water bodies and allowing lines to meander.

A survey crew placed flagging at the geophone station intervals and identified the source points. Chaining notes were prepared every evening for the field operations and a final copy forwarded to survey audit company and seismic data processor at the completion of the project.

A survey crew recorded the point locations by GPS. A Novatel RTK-GPS system was used to establish the control and survey the locations of lines and access. Control was based upon Geodetic Survey of Canada benchmarks.

### **3.5 Line Clearing Operations**

Aided by Lidar data and use of GPS on cats, avoidance cutting techniques were employed. Line of sight was also reduced by meandering the lines. Source lines were cat cut to a width of 6m to allow both windrow and safe passage of the Vibroseis units. Receiver lines were cat cut to a width of 4m to allow both windrow and safe passage of recording vehicles.

Debris and brush was disposed of by windrowing to the side of the line. Hand slashers followed the cats to remove all leaners from the seismic lines, ensure windrow was flat by cutting branches and bucking debris to suitable lengths. Lines were dragged to compact snow to improve ground coupling of the vibroseis energy source.

### **3.6 Acquisition Parameters / Recording Operations**

<b>CLIENT:</b>	<b>Paramount Resources Ltd.</b>	<b>JOB NUMBER:</b>	<b>9-529</b>	
<b>GEO NUMBER</b>	<b>9229-P33-005E</b>	<b>LOCATION:</b>	<b>Cameron Hills , NT</b>	
<b>SUPERVISOR</b>	<b>Stewart Gall</b>	<b>CREW</b>	<b>202</b>	
<b>PROJECT MANAGER</b>	<b>Gary Boyer</b>	<b>Adv.CLERK</b>	<b>Tammy Nicholson</b>	
<b>PARTY MANAGER</b>	<b>D. Donovan / P.Armstrong</b>	<b>CLERK</b>	<b>Judy Silver</b>	

<b>OBSERVER</b>	<b>W. MacMillan / J. Wall</b>	<b>HSE REP</b>	<b>Stephen Menduk</b>	
<b>3-D FIELD PARAMETERS</b>				
<b>Source:</b>	<b>Vibroseis</b>	<b>Instrument:</b>	<b>I/O System II</b>	
<b>No. of Receiver Lines</b>	<b>30</b>	<b>Sample Rate</b>	<b>2</b>	<b>ms</b>
<b>No. of Source Lines</b>	<b>24</b>	<b>Sweep</b>	<b>6-130</b>	<b>Hz</b>
<b>Receiver Line Interval</b>	<b>300m</b>	<b>No. of Sweeps</b>	<b>4</b>	
<b>Source Line Interval</b>	<b>300m</b>	<b>Sweep Length</b>	<b>24</b>	<b>Seconds</b>
<b>Station Interval</b>	<b>60m</b>	<b>Source Array</b>	<b>3 Over 20 m</b>	<b>Metres</b>
<b>Source Interval</b>	<b>60m</b>	<b>Record Length</b>	<b>3</b>	<b>Seconds</b>
<b>Total Receiver Kms</b>	<b>146.77 km</b>	<b>Geophone</b>	<b>SENSOR SM-24</b>	
<b>Total Source Kms</b>	<b>156.29 km</b>			
<b>Total Stations</b>	<b>2441</b>			
<b>Total Source Points</b>	<b>2475</b>	<b>LowCut Filter</b>	<b>3 hz 12 db</b>	<b>Hz</b>
<b>Patch Size</b>	<b>11 x 50</b>	<b>High Cut Filter</b>	<b>3/4 Nyquist</b>	<b>Hz</b>
<b>Square Kms.</b>	<b>42.0</b>	<b>Group Array</b>	<b>6 over 20m</b>	<b>Metres</b>

<b>RECEIVER LINES</b>	<b>BOL</b>	<b>EOL</b>	<b>NUM KM.</b>	<b>NUM STAS</b>	<b>SOURCE LINES</b>	<b>BOL</b>	<b>EOL</b>	<b>NUM KM.</b>	<b>NUM STAS</b>
R-1	136	176	2.400	41	S-2	161	246	5.100	86
R-3	136	216	4.800	81	S-4	161	246	5.100	86
R-5	136	216	4.800	81	S-6	161	246	5.100	86
R-7	136	216	4.800	81	S-8	161	246	5.100	86
R-9	136	216	4.800	81	S-10	161	246	5.100	86
R-11	136	215	4.740	80	S-12	151	246	5.700	96
R-13	136	215	4.740	80	S-14	151	246	5.700	96
R-15	136	216	4.800	81	S-16	101	246	8.700	146
R-17	136	216	4.800	81	S-18	101	246	8.700	146
R-19	136	216	4.800	81	S-20	101	246	8.700	146
R-21	126	216	5.400	91	S-22	101	246	8.700	146
R-23	126	216	5.400	91	S-24	101	246	8.700	146
R-25	101	216	6.900	116	S-26	101	236	8.100	136
R-27	101	211	6.600	111	S-28	101	231	7.800	131
R-29	101	206	6.300	106	S-30	101	226	7.500	126
R-31	101	200	5.940	100	S-32	101	216	6.900	116
R-33	101	200	5.940	100	S-34	106	211	6.300	106
R-35	101	196	5.700	96	S-36	106	201	5.700	96
R-37	101	190	5.340	90	S-38	106	196	5.400	91
R-39	101	191	5.400	91	S-40	106	188	4.920	83
R-41	101	186	5.100	86	S-42	106	181	4.500	76
R-43	101	181	4.800	81	S-44	106	171	3.900	66
R-45	101	181	4.800	81	S-46	106	166	3.600	61
R-47	101	176	4.500	76	S-48	106	161	3.300	56
R-49	101	171	4.200	71					
R-51	101	171	4.200	71					
R-53	101	166	3.900	66					
R-55	101	161	3.600	61					



R-57	101	156	3.300	56					
R-59	101	156	3.300	56					
<b>TOTALS</b>			<b>146.10</b>	<b>2465</b>				<b>148.320</b>	<b>2496</b>

The recording crew removed all flagging, lath and survey markers upon completion of their operations on the project.

### **3.7 Dates of Operations**

<b>Line Clearing Commenced</b>		<b>February 11, 2002</b>
<b>Line Clearing Completed</b>		<b>February 28, 2002</b>
<b>Surveying Commenced</b>		<b>February 26, 2002</b>
<b>Surveying Completed</b>		<b>February 28, 2002</b>
<b>Recording Commenced</b>		<b>March 11, 2002</b>
<b>Recording Demobilized</b>		<b>March 28, 2002</b>

### **3.8 Personnel**

<b>Supervisory</b>	<b>1</b>	<b>Operations Supervisor</b>
	<b>1</b>	<b>Safety Supervisor</b>
<b>Recording Crew</b>	<b>1</b>	<b>Party Manager</b>
	<b>2</b>	<b>Senior Observers</b>
	<b>1</b>	<b>Junior Observer</b>
	<b>1</b>	<b>Field Administrator</b>
	<b>1</b>	<b>HSE Advisor</b>
	<b>7</b>	<b>Vibe Operators</b>
	<b>5</b>	<b>Line Truck Drivers</b>
	<b>24</b>	<b>Recording Helpers</b>
	<b>3</b>	<b>Mechanic/Vibe Tech</b>
<b>Surveying</b>	<b>1</b>	<b>Survey Manager</b>
	<b>2</b>	<b>Surveyors</b>

	<b>3</b>	<b>Chainers</b>
	<b>1</b>	<b>Mapper</b>
<b>Line Clearing</b>	<b>2</b>	<b>Foreman</b>
	<b>8</b>	<b>Hand Cutters</b>
	<b>3</b>	<b>Cat Operators</b>

### **3.9 Equipment**

<b>Recording</b>	<b>1</b>	<b>I/O II Recording System with</b>
		<b>1500 channels on 4X4 Vehicle</b>
	<b>5</b>	<b>4x4 Line Trucks</b>
	<b>6</b>	<b>Ski-doos for line crew</b>
	<b>1</b>	<b>Personnel Carrier</b>
	<b>1</b>	<b>4x4 Party Manager Vehicle</b>
	<b>2</b>	<b>4x4 Mechanics and Vibe Tech Truck</b>
	<b>4</b>	<b>Mertz 18 buggy vibrators</b>
<b>Surveying</b>	<b>1</b>	<b>GPS equipment</b>
	<b>5</b>	<b>Ski-doos for survey crew</b>
<b>Line Clearing</b>	<b>2</b>	<b>4x4 Cat Push Trucks</b>
	<b>3</b>	<b>4x4 Personnel Trucks</b>

### **4.0 Data Processing**

Field data was processed at Geo-X Systems Ltd. to produce a migrated data volume having a 30m by 30m bin spacing. Processing steps are outlined in Enclosure 1.8 Seismic Processing History. The data from all of the 3D surveys acquired in the area (Encl. 1.1) were processed together to yield a single, continuous migrated data volume for interpretation.

### **5.0 Discussion**

#### **5.1 Background**

For the purposes of this final report a subset of lines were extracted at an interval of 1050m in both the North South and East West directions to generate a representative set of data from across the entire 3D survey area. These seismic sections are displayed at a vertical scale of 5 inches per second and a horizontal scale of 1:50,000. The East West seismic sections are included as enclosures 1.6-T140 to 1.6-T385 and the North South sections are included as enclosures 1.7-L315 to 1.7-L490. The location of these lines can be seen on the Program Outline Index Map ( Encl. 1.3). Interpretive maps (Encl. 1.91 to 1.94) were also

plotted at a scale of 1:50,000 to allow direct comparison with the displayed seismic sections.

## **5.2 Interpretation**

One goal of the seismic interpretation is to identify hydrocarbon charged Middle Devonian Slave Point carbonates in structural closure. Data quality in the area is very good and correlation of key seismic reflections was possible across the survey area. A synthetic seismogram was generated using well logs from the B-06 60°10' 117°30' ( Encl.1.4 ) well which directly ties the East West seismic line T245 ( Encl. 1.5 ). The synthetic was used to correlate key geologic markers from the well log with corresponding reflection events observed on the seismic data. The Wabamun (Upper Devonian carbonate), Fort Simpson (Upper Devonian shale), and Slave Point (Middle Devonian carbonate) are three key geologic markers that were identified and picked across the entire 3D volume. These seismic events were picked utilizing a Sun Unix Workstation and Paradigms' SeisX interpretation software.

Wabamun Time Structure (Encl. 1.91) and Fort Simpson Time Structure (Encl. 1.92) maps were made. These maps show that the Wabamun and Fort Simpson surfaces are generally smooth and planar with a gentle regional NE to SW structural dip. For this reason these two time surfaces are commonly used as datums for isochron maps made with the Slave Point seismic event.

Wabamun to Slave Point (Encl. 1.93) and Fort Simpson to Slave Point (Encl. 1.94) isochron maps were made. For both isochron maps, the red and white colors are associated with the isochron (and corresponding isopach) thins which highlight associated Slave Point structural highs and possible closures. The green colors highlight isochron ( and corresponding isopach) thicks and associated Slave Point structural lows.

These maps are used to identify and target present day closed structures at the Slave Point level. A number of gas wells and oil wells can be seen to be associated with these mapped closed features.

## **5.3 Summary**

A high quality 3-D seismic program was acquired in the winter of 2001/2002 and successfully processed together with prior 3D surveys in the area to yield a single, continuous migrated data volume for interpretation.

Maps were created which will aid in identifying future exploratory and development well locations in the Cameron Hills area.