

**Program ID 9229-P033-008E**

**FINAL REPORT  
for**

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

**LOCATION:**

**Latitude:** 60° 04' N to 60° 10'      **Longitude:** 117° 25' to 117° 38'

**Start of Operation:** January 9, 2003

**End of Operation:** February 26, 2003

**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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**Date:** March 31, 2009

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## **2.0 Introduction**

This is the final report for our 3D Vibroseis seismic acquisition program number 9229-P033-008E conducted in the Cameron Hills area of the NWT during the winter of 2002/3.

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-P033-008E comprised 266.7km of 4m wide receiver lines and 265.08km 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.

Synterra Technologies Ltd. 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# 9-571) hired to coordinate and shoot the proposed seismic program. 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. Crew headquarters were based out of PTI Open Camp Indian Cabins, AB. The 3D was approx. 52km North of the camp. The number of personnel on the job and in the camp ranged from about 26 during line construction to a peak of about 47 during the recording phase of the operation.

All operations were conducted in accordance with the applicable legislation, regulations, Land Use Permit conditions (MV2002B0057), and terms and

conditions of the NEB Geophysical Operation Authorization dated January 7, 2003 having an Operation Identifier 9229-P33-8E ( File 9180-P733-8 ).

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 -43° to 1° Celsius throughout the course of the operations. Most of the working conditions were from -27° to around -13°.

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 were based out of the PTI Open Camp Indian Cabins located 43 to 52km south of the project area in Alberta and at a staging area close to the 3D.

Prior to going to the field, tender requests were sent 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>9-571</b>	
<b>GEO NUMBER</b>	<b>9229-P33-008E</b>	<b>LOCATION:</b>	<b>Cameron Hills , NT</b>	
<b>SUPERVISOR</b>	<b>Stewart Gall</b>	<b>CREW</b>	<b>205</b>	
<b>PROJECT MANAGER</b>	<b>Gary Boyer</b>	<b>CLERK</b>	<b>Mike Maguire</b>	
<b>PARTY MANAGER</b>	<b>Al Odnokon</b>	<b>CLERK</b>	<b>Gaylene Reed</b>	

<b>OBSERVER</b>	<b>Neil Gjertsen</b>	<b>HSE REP</b>	<b>S.Menduk / B.Hover</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>31</b>	<b>Sample Rate</b>	<b>2</b>	<b>ms</b>
<b>No. of Source Lines</b>	<b>35</b>	<b>Sweep</b>	<b>6-120</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 25 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>266.7</b>	<b>Geophone</b>	<b>Geo 20DX, 10hz</b>	
<b>Total Source Kms</b>	<b>265.08</b>			
<b>Total Stations</b>	<b>4479</b>			
<b>Total Source Points</b>	<b>4462</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>77.07</b>	<b>Group Array</b>	<b>6 over 25m</b>	<b>Metres</b>

RECEIVER LINES	BOL	EOL	NUM KM.	NUM STAS	SOURCE LINES	BOL	EOL	NUM KM.	NUM STAS
R-223	176	316	8.400	141	S-220	194	296	6.120	103
R-225	176	317	8.460	142	S-222	192	296	6.240	105
R-227	176	317	8.460	142	S-224	192	296	6.240	105
R-229	176	316	8.400	141	S-226	192	296	6.240	105
R-231	176	316	8.400	141	S-228	192	296	6.240	105
R-233	176	316	8.400	141	S-230	192	296	6.240	105
R-235	176	316	8.400	141	S-232	156	303	8.820	148
R-237	151	316	9.900	166	S-234	156	303	8.820	148
R-239	146	316	10.200	171	S-236	155	303	8.880	149
R-241	146	316	10.200	171	S-238	155	303	8.880	149
R-243	146	316	10.200	171	S-240	155	303	8.880	149
R-245	146	309	9.780	164	S-242	155	305	9.000	151
R-247	146	306	9.600	161	S-244	155	306	9.060	152
R-249	146	306	9.600	161	S-246	155	304	8.940	150
R-251	146	286	8.400	141	S-248	155	304	8.940	150
R-253	146	285	8.340	140	S-250	155	304	8.940	150
R-255	146	285	8.340	140	S-252	155	306	9.060	152
R-257	146	285	8.340	140	S-254	155	305	9.000	151
R-259	146	285	8.340	140	S-256	155	305	9.000	151
R-261	146	285	8.340	140	S-258	155	305	9.000	151
R-263	147	285	8.280	139	S-260	155	305	9.000	151
R-265	146	285	8.340	140	S-262	156	308	9.120	153
R-267	146	285	8.340	140	S-264	155	308	9.180	156
R-269	146	285	8.340	140	S-266	157	305	8.880	149
R-271	146	285	8.340	140	S-268	156	305	8.940	150
R-273	146	285	8.340	140	S-270	156	305	8.940	150
R-275	146	285	8.340	140	S-272	156	305	8.940	150
R-277	146	285	8.340	140	S-274	156	305	8.940	150



R-279	146	286	8.400	141	S-276	157	306	8.940	150
R-281	176	285	6.540	110	S-278	156	222	3.960	67
R-283	176	286	6.600	111	S-280	156	221	3.900	66
					S-282	156	221	3.900	66
					S-284	156	221	3.900	66
					S-286	156	206	3.000	51
					S-288	157	207	3.000	51
<b>TOTALS</b>			<b>266.70</b>	<b>4476</b>				<b>256.08</b>	<b>4455</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>January 9, 2003</b>
<b>Line Clearing Completed</b>		<b>January 20, 2003</b>
<b>Surveying Commenced</b>		<b>February 1, 2003</b>
<b>Surveying Completed</b>		<b>February 8, 2003</b>
<b>Recording Commenced</b>		<b>February 5, 2003</b>
<b>Recording Demobilized</b>		<b>February 26, 2003</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>28</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>9</b>	<b>Hand Cutters</b>
	<b>4</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>7</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-L35 to 1.7-L350. 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 2003 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.