

9229 N 46 1E NW

**EXCLUSIVE 2D SEISMIC REFLECTION SURVEY**

**N.E.B. Authorization # 9229-N46-1E  
Sahtu Land & Water Board Land Use Permit # S99B-016**

**Report Date: January 21<sup>st</sup>, 2001**

**Work Period: January 6<sup>th</sup> to February 12<sup>th</sup>, 2000**

**FINAL REPORT  
for  
MACKAY AREA  
Block EL-391 & Open Federal Lands  
Northwest Territories**

**LOCATION:**

**Latitude: 64° 20' to 64° 40'      Longitude: -125° 15' to -126° 00'**

**EL-391 Block Operator:  
International Frontier Resources Ltd.**

**Project Operator:  
Northrock Resources Ltd.  
3500, 700 - 2 Street S.W.  
Calgary, AB  
T2P 2W2**

**Acquisition Contractor:  
Trace Explorations Ltd.**

**Project Supervisor:  
NBK Oilfield Services Ltd.  
on behalf of Northrock Resources Ltd.**

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## ENCLOSURES

- 1      **Final 1:50,000 scale seismic shotpoint base map.**
- 2      **Area access map, illustrating existing, new cut, and hand cut lines.**
- 3      **Interpreted 90 degree Phase rotated Seismic Migrated stack sections for lines J99YN292 to J99YN296**
- 4      **Interpreted 1:100,000 scale seismic maps for:-**
  - Cretaceous Radioactive Shale Marker Time Structure**
  - Devonian Hume Time Structure**
  - PreCambrian Unconformity Time Structure**
  - Cretaceous Radioactive Shale Marker to Devonian Hume Isochron**
  - Devonian Hume Isochron to Cambrian Saline River Isochron**

## **1. INTRODUCTION**

**The MacKay project site is referred to at Northrock Resources Ltd. as Tertiary Creek. This program is located in the Mackenzie River Valley of Northwest Territories. The project area is south of the community of Tulita (Fort Norman). The Tertiary Creek Seismic program was conducted in the winter of 1999 – 2000. Golder Associates Ltd. conducted the applications and environmental study. Trace Explorations Ltd. conducted the vibroseis geophysical field acquisition. All the parties were working on behalf of Northrock Resources Ltd, the project operator. This geophysical survey is for the exclusive use of Northrock Resources Ltd., and partners.**

**The work period was from January 2<sup>nd</sup>, 2000 to February 12<sup>th</sup>, 2000. There were between 40 and 60 people involved in all phases of the operation.**

**Mr. Doug Schmidt, of Trace Explorations Ltd., was the Project Manager. He was situated in the base camp in Norman Wells. Mr. Jeff Hadford, of Mercedes Surveys, directed the establishment of line locations and line clearing operations. Mr. Bill Busby, of Trace Explorations Ltd., was the Party Manager, who co-ordinated the vibroseis recording operations. Both Mr. Hadford and Mr. Busby were situated on site in the Advance Camp and Recording Camp respectively.**

**This project was submitted for Land Use approval to the SAHTU Land and Water Board on November 12<sup>th</sup>, 1999 and approval was granted on January 4<sup>th</sup>, 2000. Application to the National Energy Board was submitted on November 8<sup>th</sup>, 1999 and granted on January 4<sup>th</sup>, 2000.**

## **2. FINAL PLAN (Reference Enclosed Map)**

### **3. WEATHER & TERRAIN**

Weather conditions for the duration of the program were in the temperature range of -22° to +10° Celsius. Working up on the high tops of the Flint Stone Range provided relatively mild conditions due to the wind flow over this area. Down in the lower terrain areas the temperature was between 5 to 15 degrees cooler.

Lack of snow in this area made it difficult to move the camps. Hence, camps were in one site longer than normally expected. Given this complication, the majority of the program was supported by helicopter assist.

The project area was primarily on the plateau, surrounding the Flint Stone Range, between Tertiary and Summit Creeks. The lowest areas on the program were south of Yellow Lake and again on the south side of Rusty Lake. Surface conditions in the areas on the plateau consisted of spruce timber and fairly flat terrain. The Flint Stone Range itself consisted of steep, barren, graveled hills. Particular concern and attention were given to this area to mitigate potential damage to lichen growth, given that lichen has a fairly long recovery time if damaged. For this reason no dragging of line was carried out in the areas above the tree line.

#### **4. LOGISTICS & SUMMARY**

**The Base Staff in Norman Wells arranged all personnel movements, purchased fuel, foods and other essential supplies to ensure ongoing operations of the field crews. Personnel in transit through Norman Wells stayed primarily at the Trace Base Camp facilities in Norman Wells – if no room was available local hotels were utilized.**

**Canadian Airlines was used to transport personnel, equipment and supplies from the south.**

**Local fixed wing support, for chartering local personnel and handling of emergencies, was provided by North Wright out of Norman Wells.**

**Great Slave and Canadian Helicopters provided Bell 206B Jet Rangers for casual rotary wing support for scouting, personnel transfer and crucial supplies. Once it was determined that the Advance Camp could not be moved further into the program, and that there was no way to move the Recording Camp up onto the ridge, a heli-assist mode was initiated. Canadian Helicopters provided a Bell 206B Long Ranger, stationed at the Advance Camp, and a Bell 212, stationed at the Recording Camp, to transfer the crews to the field and provide support to the field operations.**

**Although some specialized personnel were mobilized from the south (i.e. Calgary – point of hire); however at least 60% or greater of the crew compliment was locally employed. Time off periods were determined by self requests given that replacement personnel were readily available.**

**Daily fuel consumption averaged approximately 6700 litres of diesel and 336 litres of gasoline. Fuel and lubricants were purchased from a supplier in Norman Wells. Aviation fuel was purchased in barrels and supplied by Trace Exploration Ltd.**

**Upon completion of the operations all equipment was moved to work for another client in the same vicinity.**

## **5. SAFETY, HEALTH & ENVIRONMENT**

**Environmental concerns were addressed in a report provided by Golder Associates. In the view of the present operator, Northrock Resources Ltd., this issue is addressed in the Access and Benefits package agreed upon by the parties.**

All necessary First Aid supplies plus a field radio, satellite telephone and/or mobile radio telephone were available to communicate with the crew and outside. A snow machine and body sleigh with jump pack and oxygen were available 24 hours a day for any difficult field emergency. Once the helicopters were stationed full time, it took pressure off any emergency due to the quickness of time to be on site. Advance Camp had a medic on site. Recording Camp had a Paramedic on site. A Plus First Aid provided Ken Dover (Medic Advance Camp) and Dave Cain (Paramedic Recording Camp) for the majority of the program. Dave Cain left just prior to completion and was replaced by Mr. Bob Long from Medic North. Assistance was also available from the medic stationed at the Northrock drilling rig.

Field operations were inspected by Mr. Rick Turner, of the National Energy Board based in Calgary, and several times by Mr. Steve Deschene, Resource Management Officer III, of Indian and Northern Affairs Canada based in Norman Wells.

Regular safety meetings were held throughout the program.

Copies of all safety meetings, audits, etc. were forwarded to the National Energy Board and to Northrock Resources Ltd.

Two environmental situations occurred and were handled immediately with all parties notified and involved. The first involved a Delta III fuel hauler, utilizing a dry creek bed, which had turned wet, and dropped its tank off the flat bed. No spill occurred. The second situation occurred when a Canadian Helicopters 212 dropped 7 barrels of JetB fuel, when the barrel sling broke near a creek. This matter was handled immediately in the presence of Mr. Rick Turner and Mr. Steve Deschene, who were visiting camp at the time of the incident. The spill was lit on fire immediately. Mop Miller (Flint Engineering) was hired to evaluate the extent of the spill. The contamination was center-piled by catwork and hauled in side dump trucks to a site in Norman Wells.

## **6. LINE CLEARING OPERATIONS**

**The program largely consisted of existing line, where new cut was required the lines were cat cut to a 6.0 meter width. Hand slashing was utilized to go through ravines in order to minimize any environmental damage and prevent the steep terrain from eroding.**

**All of the cat cut was windrowed to either side of the lines with breaks to allow wildlife access and to eliminate a continuous fire fuse. The debris was bucked and slashed.**

**All slashers had snow machines and were occasionally transferred by helicopter depending upon their location at the end of the day.**

**Creek crossings were constructed of man-made snow fills other than on the access into the project. All crossings were removed before the crew left the area.**

## **7. SURVEYING OPERATIONS**

**Mr. Lorne Kelley, of Mercedes Surveys located in Alberta, was the Base Manager who provided quality control and supplied equipment to the crew on this project. Mr. Jeff Hadford, of Mercedes Surveys, was the Project Manager in the field responsible for the line locations and survey. Mr. James Andrews, of Mercedes Surveys, was the catpush handling the day-to-day field operations of establishing the line locations physically in the field. Mr. Willie Bevin, of Mercedes Surveys, was the head surveyor responsible for the chaining and GPS survey on the prospect.**

**A chaining crew placed flagging at the station intervals and identified the vibrator points. Shotpoint and geophone intervals were established by using a surveyor's steel chain. Chaining notes were prepared every evening for the field operations and a final copy forwarded to the client at the completion.**

**A survey crew recorded the point locations by GPS. A Novatel 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.**

**All survey work was performed in the metric system.**

## 8. RECORDING OPERATIONS

<b>Shooting &amp; Recording Parameters</b>	
<b>Instruments</b>	I/O System II
<b>Number of Traces</b>	240 channels
<b>Geophone Type</b>	Mark L210
<b>Geophone Frequency</b>	10 Hz
<b>Geophone Array</b>	6 geophones over 25 metres (spacing)
<b>Sample Rate</b>	2 milliseconds
<b>Record Length</b>	4 seconds
<b>Anti-Alias Filter (high cut)</b>	½ Nyquist
<b>Low Cut Filter</b>	Out
<b>Receiver Interval (group interval)</b>	25 metres
<b>Source Interval (vibrator shot point)</b>	25 metres – stack array
<b>Extra Source Points</b>	5 VP's beginning & ends of each line
<b>Fold</b>	12000%
<b>Spread</b>	2987.5 – 12.5 X 37.5 – 3012.5
<b>Roll in</b>	120 traces live
<b>Source</b>	Vibroseis
<b>Source Array</b>	3 Vibrators in line.
<b>Number of Sweeps</b>	2 sweeps
<b>Length of Sweeps</b>	16 seconds

The recording parameters were established following a field testing evaluation completed by Norm Cooper of Mustagh Resources Ltd. The evaluation was required due to the surface gravel conditions encountered by the forward chaining and line cutting crews. The conclusion was to shoot every group with less overall effort.

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

Recording personnel were based in a camp situated on the prospect. Recording camp was moved to position the crew close to the area of work. However, once the advance camp encountered difficulty moving camp, the Recording Camp was stationed just below the ridge and the crew was transported via helicopter to the field to complete approximately 2/3 of the program.

## 9. DATES OF OPERATIONS

Advance Camp Mobilized	January 6 <sup>th</sup> , 2000
Advance Camp Demobilized	January 31 <sup>st</sup> , 2000
Line Clearing Commenced	January 11 <sup>th</sup> , 2000
Line Clearing Demobilized	January 31 <sup>st</sup> , 2000
Slashing Mobilized	January 11 <sup>th</sup> , 2000
Slashing Demobilized	February 4 <sup>th</sup> , 2000
Chaining Mobilized	January 14 <sup>th</sup> , 2000
Chaining Demobilized	February 4 <sup>th</sup> , 2000
Surveying Commenced	January 15 <sup>th</sup> , 2000
Surveying Demobilized	February 4 <sup>th</sup> , 2000
Gravity Commenced	January 11 <sup>th</sup> , 2000
Gravity Demobilized	February 7 <sup>th</sup> , 2000
Recording Camp Mobilized	January 16 <sup>th</sup> , 2000
Recording Camp Demobilized	February 12 <sup>th</sup> , 2000
Recording Commenced	January 22 <sup>nd</sup> , 2000
Recording Demobilized	February 12 <sup>th</sup> , 2000

## 10. RECORDING PRODUCTION SUMMARY

Total Kilometers Surveyed	70.775
Number of Vibrator Source points	2694
Number of Stations	2831
Number of Recording Days	17
Kilometers Recorded per Day	*4.16
Days Mobilized / Demobilized	5/0
Days Lost Due to Weather	1
Days Lost Due to Equipment Failure	2
Down Time per Day	N/A

\*Does not include down days i.e. average calculated based on 17 days, not 20 days. This number is based on actual recording days.

## 11. RECORDING PRODUCTION

Date	Line Number	Number of VP's	Kilometres	Hours	Comments
Jan. 16 <sup>th</sup>					
Jan. 17 <sup>th</sup>					
Jan. 18 <sup>th</sup>					
Jan. 19 <sup>th</sup>					
Jan. 20 <sup>th</sup>					
Jan. 21 <sup>st</sup>					
Jan. 22 <sup>nd</sup>	J99YN292	283	7.375	13.0	
Jan. 23 <sup>rd</sup>	J99YN292	110	2.775	14.5	
Jan. 24 <sup>th</sup>	J99YN293	60	1.500	13.5	
Jan. 25 <sup>th</sup>	J99YN293	116	3.300	14.5	
Jan. 26 <sup>th</sup>	J99YN293	177	5.400	14.5	
Jan. 27 <sup>th</sup>	J99YN293	177	5.250	13.0	
Jan. 28 <sup>th</sup>	J99YN293	49	1.300	11.0	
Jan. 29 <sup>th</sup>	J99YN293	169	4.950	11.0	
Jan. 30 <sup>th</sup>	J99YN293	214	5.400	10.0	
Jan. 31 <sup>st</sup>	J99YN293	50	1.425	11.0	
Feb. 1 <sup>st</sup>	J99YN294			8.0	Weather
Feb. 2 <sup>nd</sup>	J99YN294	204	3.700	9.5	
Feb. 3 <sup>rd</sup>	J99YN294	70	1.725	10.0	
Feb. 4 <sup>th</sup>	J99YN295	104	2.800	10.0	
Feb. 5 <sup>th</sup>	J99YN294	85	2.200	10.0	
Feb. 6 <sup>th</sup>	J99YN294	241	6.400	10.0	
Feb. 7 <sup>th</sup>				8.0	Weather
Feb. 8 <sup>th</sup>				10.0	Vibrators accessing long detour
Feb. 9 <sup>th</sup>	J99YN295	238	6.600	10.0	
Feb. 10 <sup>th</sup>	J99YN295	49	1.200	10.0	
Feb. 11 <sup>th</sup>	J99YN296	298	7.475	10.0	
Feb. 12 <sup>th</sup>				12.75	

## 12. PERSONNEL

<b>Recording</b>	<b>1</b>	<b>Party Manager</b>
	<b>1</b>	<b>Field Clerk (stationed in Norman Wells)</b>
	<b>1</b>	<b>Observer</b>
	<b>1</b>	<b>Jr. Observer</b>
	<b>1</b>	<b>Cable Repair/Battery Manager</b>
	<b>2</b>	<b>Trouble Shooters</b>
	<b>15</b>	<b>Line Crew Helpers</b>
	<b>4</b>	<b>Mechanics</b>
	<b>4</b>	<b>Recording Camp Cat Operators</b>
	<b>1</b>	<b>Fire Camp Cat Operator</b>
<b>Source Crew</b>	<b>1</b>	<b>Vibrator Mechanic</b>
	<b>1</b>	<b>Jr. Vibrator Mechanic</b>
	<b>4</b>	<b>Vibrator Operators</b>
<b>Recording Camp</b>	<b>1</b>	<b>Cook</b>
	<b>1</b>	<b>Cook's Helper</b>
	<b>2</b>	<b>Camp Staff</b>
	<b>1</b>	<b>Delta III Water Hauler</b>
	<b>1</b>	<b>Delta III Supply / Fuel Hauler</b>
	<b>1</b>	<b>Paramedic</b>
<b>Surveying</b>	<b>1</b>	<b>Project Manager</b>
	<b>1</b>	<b>Catpush</b>
	<b>1</b>	<b>Surveyor</b>
	<b>1</b>	<b>Head Chainer</b>
	<b>2</b>	<b>Survey Helpers</b>
<b>Gravity</b>	<b>1</b>	<b>Gravity Operator</b>
<b>Line Clearing</b>	<b>1</b>	<b>Cat Foreman</b>
	<b>4</b>	<b>Cat Operators</b>
<b>Slashing</b>	<b>4</b>	<b>Hand Cutters</b>
<b>Advance Camp</b>	<b>1</b>	<b>Cook</b>
	<b>1</b>	<b>Cook's Helper / Camp Staff</b>
	<b>1</b>	<b>Camp Water Hauler</b>
	<b>1</b>	<b>Camp Mechanic</b>
	<b>1</b>	<b>Medic</b>
<b>Monitors</b>	<b>2</b>	<b>Monitors</b>
<b>Base Camp Norman Wells</b>	<b>1</b>	<b>Base Manager</b>
	<b>1</b>	<b>Expediter / Technical Support</b>
	<b>1</b>	<b>Supply Driver</b>
	<b>1</b>	<b>Cook</b>
	<b>1</b>	<b>Camp Staff</b>
<b>TOTAL PERSONNEL</b>	<b>72</b>	

### 13. EQUIPMENT

<b>Recording</b>	<b>1</b>	<b>FN 110 Recorder Unit</b>
	<b>3</b>	<b>FN 110 Cable Line Truck Units</b>
	<b>2</b>	<b>Trouble Shooters Snow Machines</b>
<b>Source Crew</b>	<b>4</b>	<b>Vibrators</b>
	<b>1</b>	<b>FN 110 Vibrator Technician Unit</b>
<b>Recording Camp</b>	<b>4</b>	<b>Recording Camp Cats</b>
	<b>1</b>	<b>FN 110 Mechanic Unit</b>
	<b>1</b>	<b>Delta III Water Unit</b>
	<b>1</b>	<b>Delta III Supply / Fuel Unit</b>
	<b>1</b>	<b>Party Manager Snow Machine</b>
	<b>1</b>	<b>Paramedic Snow Machine</b>
	<b>1</b>	<b>Paramedic Body Sleigh</b>
<b>Surveying</b>	<b>2</b>	<b>FN 60 Nodwell Units</b>
	<b>2</b>	<b>Snow Machines</b>
<b>Gravity</b>	<b>1</b>	<b>Snow Machine</b>
<b>Line Clearing</b>	<b>4</b>	<b>Cats</b>
	<b>1</b>	<b>Delta II Supply / Fuel Unit</b>
<b>Slashing</b>	<b>4</b>	<b>Snow Machines</b>
<b>Advance Camp</b>	<b>1</b>	<b>FN 110 Nodwell Water Truck</b>
	<b>1</b>	<b>Medic Snow Machine</b>
	<b>1</b>	<b>Medic Body Sleigh</b>
<b>Monitors</b>	<b>2</b>	<b>Snow Machines</b>
<b>Base Camp Norman Wells</b>	<b>1</b>	<b>1 – 4X4 Pickup</b>
	<b>1</b>	<b>4X4 1-ton truck</b>

## **14. SEISMIC PROCESSING**

**The seismic data was processed by Mr. David Sherwood, of Eclipse Seismic Data Processors, Calgary, Alberta, using Paradigm software.**

**Deconvolution of the data was carried out by using a Time variant surface consistent minimum phase operator, followed by a Time variant zero phase decon, to whiten the bandwidth.**

**Due to the varying surface conditions caused by the gravel in the Flintstone Range, a satisfactory weathering correction was difficult to obtain from the Vibroseis records, hence some of the more minor surface structures may be questionable. The data was corrected with both the weathering and elevation statics, to a seismic datum of 1100m asl, using a replacement velocity of 3000 m/sec.**

**Due to the stack array shooting recommended by Norm Cooper the resultant data is stacked to 12000%. The most satisfactory migration for the majority of the lines was obtained with a post stack finite difference algorithm, utilizing 95% of the smoothed stacking velocities; although pre-stack migrations were tested on all lines, there was no significant improvement accept on lines 294 & 296.**

**No post stack noise attenuation was applied to the data.**

**All the lines were rotated by 90 degrees to accommodate the 90-degree phase shift inherent with the Vibroseis recording.**

**For a detailed processing sequence refer to the side labels on the accompanying sections.**

## 15. SEISMIC INTERPRETATION

The program was designed to explore for potential structural complexes identified on the GSC regional aeromagnetic program, acquired in 1999.

The data was interpreted using synthetic seismograms created from the Little Bear wells, and the Tate J-65 and B-30 wells, and extrapolated into the project area using the digitally scanned N.E.B. public file data available from Lynx Information systems. The key seismic reflectors of the Cretaceous Radioactive shale marker, the Devonian Jungle Ridge clinoform, and the Devonian Hume platform, were interpreted from this method. The Cambrian Saline River reflector, and Pre-Cambrian Basement were interpreted from thickness calculations from a selection of wells throughout the MacKenzie Basin.

Three key time structure maps were produced from the Cretaceous Radioactive shale marker, the Devonian Hume platform, and the Pre-Cambrian Unconformity. There was also two isochron maps produced. The first from the Cretaceous Radioactive Shale to the Devonian Hume, to produce an approximate isopach of the Imperial Shale; and the second from the Devonian Hume to the Cambrian Saline River to produce an approximate isopach of the Devonian/Ordovician carbonate section. These are included with the report.

The data did highlight an interesting stacked thrust fault complex on the Eastern Edge of the program, which will require further work to fully evaluate.