GEOPHYSICAL EXPLORATION REPORT

Geophysical Operation Identifier: 9229-A61-3E

9229-A61-3E

Keele Arch Area

In the

Northwest Territories

by

AEC West - Exploration Licence EL 392

2D Seismic Acquisition Survey, processing and interpretation.

Land Use Permit No.	S99B-017
Area Coodinates:	Latitude $64^0 20' - 64^0 50'$ North
	Longtitude $124^0 55' - 125^0 40'$ West
Seismic Data Acquisition:	Trace Explorations Ltd.
Field Work Period:	February – March 2000

Submitted by:

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CONTENTS

LIST OF FIGURES

REFERENCES

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SECTION ONE

INTRODUCTION

During the 1999 – 2000 winter season Alberta Energy Company Ltd. conducted a 226.3 km seismic survey in Exploration Licence No. 392. (Figure 1.). This survey covered the area west of the Mackenzie River, north of the Keele River and east of the MacKay Range from the vicinity of Police Island to Stewart Lake. This regional survey was designed to infill and extend the survey conducted the previous year in order to map better the subcrop pattern of Paleozoic strata by the sub Cretaceous unconformity and to map the extent of a possible basal Cambrian structural closure.

This report, submitted to the National Energy Board to partially fulfill the requirements of the Exploration Agreements, summarizes the procedures of data acquisition and processing of these 1999-2000 data. The included interpretation section encompasses an integrated interpretation of these data, data shot in winter 1999 – 1999, purchased / reprocessed seismic and High Resolution Aeromagnetic data recorded by the GSC. These data together with information from wells, surface geology and literature were used to create a consistent geological model for early Paleozoic sediment distribution in the Mackenzie Corridor, and especially for the "Mackenzie depression" located S and SE of Tulita (Fort Norman).

SECTION TWO

FIELD ACQUISITION

FIELD OPERATIONS

Field operations were conducted by Trace Explorations Ltd. as prime contractor. Work started on Febrary 5, 2000 with mobilization of the line preparation crew and advance camp to the project area. An ice road crossing of the Mackenzie River southeast of Norman Wells at Gaudet Island and extending along the shore line eastward to a point just east of the Little Bear River, had already been prepared by Northrock for their drilling and seismic operations on an adjacent exploration licence.

Prior to the arrival of the recording crew, line clearing was carried out with cats and slashers. Surveying, bulldozing, slashing and catering operations were subcontracted by Trace. The recording crew was mobilized to the project upon completion of a seismic program on the immediately adjoining exploration licence. Recording operations, which commenced on February 13th, were carried out without any major problems. A total of 226.3 km of data, distributed over thirteen lines, were recorded (Fig.2). Recording was completed on March 14 and the crew was demobilized to Norman Wells on March 15-16th.

Terrain in the area was quite significant, ranging in elevation from 75 – 410 meters. On the whole this didn't cause significant difficulty except where larger coulees were encountered. At the north end of the project the presence of many small lakes necessitated numerous diversions on line 00TUL-01 and 00TUL-02. Lines 00TUL-09, 00TUL-10 and 00TUL-11 required an

access diversion to accommodate their track down the steep bank into the Mackenzie River flood plain. Temperatures ranged from –14 to –40 degrees Celcius, which was mostly very good weather for the field operations. No down time was incurred due to weather.

Recording by the Trace crew utilized three FN 240 tracked Litton 315 vibrators and one backup, all equipped with Pelton Advance II electronics. Six 10 – 90 Hz sweeps were utilized per vibe point shooting into a 242 channel split spread. The group interval was 25 meters with each group constructed of six L-210 10 Hz geophones grouped over 1 meter. Source interval for the program was 50 meters, the recording sample interval was 2 msec. and 4 seconds of correlated data were recorded using an I/O System Two using a Low cut 3 Hz field filter. These parameters result in a nominal fold of 6075%. Field data quality was in general very good with strong reflections visible on the field monitor records.

TRACE	1	121	x	123	243
DISTANCE	3025	25	*	25	3025 M

Surveying was done by Mercedes Surveys utilizing GPS equipment.

Trace Explorations Ltd. Recording Crew:

A typical crew complement totaled 42 people, except in the early stages during line preparation when the crew reached a high of 55 people including slashers, ice checkers and cat operators.

Party Manger	1	Observer	2
Clerk	1	Vibrator technician	2
Vibrator Operators	4	Line truck drivers	4
Recording Helpers	15	Mechanic	1
Cable Repair Technician	1		
Cat Push	1	Cat Operators	4
Fuel supply driver	1	Medic	1
Water supply driver	1	Surveyors	4

SECTION THREE

DATA PROCESSING

The recorded seismic data were processed during March 2000 by Exploration Innovations Ltd. using the following processing sequence:

1. Demultiplex & reformat IEEE to SEG-D
2. Exponential Gain Correction
3. Line Geometry
4. Surface Consistent Deconvolution & Scaling

Operator Length:	100 ms
Prewhitening:	0.1 %
Design Gate:	0.200 – 3.500sec at 25 M
	1.600 – 3.700 sec. at 3025 M

5. Zero Phase Frequency Deconvolution
6. Trace Balance
7. Elevation & Drift Corrections

Replacement Velocity:	3047 M / SEC.
Datum Elevation:	305 M A.S.L.

8. Velocity Analysis coherency spectra
9. Automatic Residual Statics

Window:	0.300 – 4.000 sec.
Maximum static:	+ / - 30 msec.
Iterations:	4

10. Repeat Steps 7. and 8.
11. NMO
12. Mute:

Offset	Mute Time
325 M	0.000 sec.
400 M	0.185 sec.
775 M	0.385 sec.
3025 M	1.650 sec.

13. Spectral Whitening 10 – 115 Hz.

14.Trim Statics	Window:	0.300 – 3.000sec.
	Maximum Static:	+/- 12 msec.
15.Stack		6075 %
16.Filter		12 / 16 – 75 / 85 HZ

17.AGC Scaling: Window = 500 msec.

18.F – X Deconvolution:Addback = 50 %

19.Finite Difference Migration (90 % stacking velocities)

20.Display to film and Write Stack & Migration to EXOBYTE tape.

****NOTE**** The first breaks were picked but were very noisy and inconsistent over many portions of these lines, which resulted in static busts in the refraction static calculations. Consequently, only elevation and datum static corrections were used leaving long wavelength weathering statics in the data. However, the line intersections tie very well within this data set.

The resulting data exhibited good band width and signal / noise ratio which allowed interpretation of the structure and stratigraphy of the area. The three dimensional structural complexity of the area, however, has resulted in somewhat ambiguous 2D migration imaging in some areas. A copy of a typical section label is included (Fig. 4).

N -- S

A.E.C. WEST LTD

LINE: 00-TUL-01

AREA: KEELE 2000

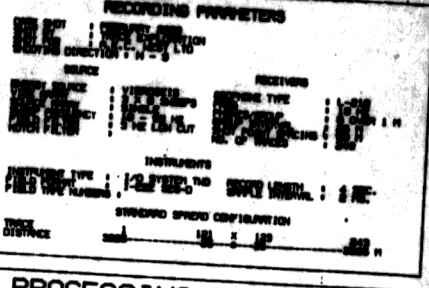
LOCATION: N.W.T.

6075% MIGRATION STACK

NORMAL POLARITY

SHOT POINTS: 101 - 901 (N - S)

RECORDING PARAMETERS



PROCESSING SEQUENCE

DATE PROCESSED: MARCH, 2000

1) REFORMAT FROM I-EEE SEG-D
2) GAIN CORRECTION - TYPE: EXPONENTIAL
3) SURFACE CONSISTENT DECONVOLUTION & SCALING
   OPERATOR LENGTH: 160 MS
   PREWHITENING: 0.1 %
   DESIGN GATE: 0.000 - 3.900 SEC. AT 25 M
   1.000 - 3.700 SEC. AT 3825 M
4) ZERO PHASE FREQUENCY DECONVOLUTION
5) TRACE BALANCE
6) ELEVATION & DRIFT CORRECTIONS
   REPLACEMENT VELOCITY: 3047 M./SEC.
   DATUM ELEVATION: 366 M. A.S.L.
7) VELOCITY ANALYSIS
   TYPE: COHERENCY SPECTRA
8) AUTOMATIC RESIDUAL STATICS
   WINDOW: 0.300 - 4.000 SEC.
   MAXIMUM STATIC: +/- 30 MSEC.
   ITERATIONS: 4
9) REPEAT STEPS 7 & 8
10) AMO
11) MUTE:

OFFSET	MUTE TIME
300 M.	0.000 SEC.
450 M.	0.100 SEC.
775 M.	0.300 SEC.
3825 M.	1.000 SEC.

12) SPECTRAL WHITENING: 10 - 115 HZ
13) TRIM STATICS
   WINDOW: 0.300 - 3.000 SEC.
   MAXIMUM STATIC: +/- 12 MSEC.
14) STACK 6075 %
15) FILTER
16) AGC SCALING: 12/10 - 75/65 HZ
17) F-K DECONVOLUTION: WINDOW = 000 MS
18) FINITE DIFFERENCE MIGRATION: 000 STACKING VELOCITIES

NOTE 1) THE FINAL MIGRATION USED 100 NOISY AND INCONSISTENT TO ACCURATELY PICK. CONSEQUENTLY, ONLY ELEVATION AND DATUM STATIC CORRECTIONS WERE USED, LEAVING LONG WAVELENGTH MX STATICS IN THE DATA.

DISPLAY PARAMETERS

HORIZONTAL SCALE: 20 TRACES/INCH
VERTICAL SCALE: 6 IPSEC

EI PROCESSING INC.

Fig. 4

SECTION FOUR

INTERPRETATION OF RESULTS

4.1 REGIONAL GEOLOGY

The stratigraphy and structural geology of the Keele Arch area has been previously been published by Cook (1975), Williams (1987 & 1989), Cecile, Morrow and Williams (1997), Dixon and Stasiuk (1998), and MacLean and Cook (1999).

The Mackenzie Corridor, during late Proterozoic and early Paleozoic times, was adjacent to the "proto-Pacific" spreading center. So it should be kept in mind that its position is in a tectonically weakened, unstable zone, oriented parallel to the position of the plate edge, with an oceanic realm to the west and a stable granitic craton to the east. N-S trending Proterozoic dike swarms confirm this E-W extension. (Hagen, 1988). The weakened, tectonically thinned and rifted portion of the crust was subject to vertical movement as the sediment load increased or shifted and tectonic regimes changed.

Two sets of orientation of weakness zones can thus be expected in the Proterozoic substrate: one parallel to the paleo-crust edge and quite likely containing inherited fault orientations, and another direction roughly perpendicular to that (Cecile, Morrow and Williams, 1997). The latter direction occurs along the length of the western edge of the North American plate and likely represents remnants of transform faults and aulacogens associated with plate breakup. These two directions seem to have influenced the geological development of the western margin of the North American

plate including the Mackenzie Corridor throughout geological time. Locations of detachment horizons, rift orientations, orientation of Laramide, craton-ward thrusting and of strike-slip zones were partly predisposed by these old directions.

The stratigraphy of the area is as follows:

- Undifferentiated Tertiary and Cretaceous clastics
- Sub-Cretaceous unconformity (angular)
- Imperial Fm (U. Devonian)
- Canol Fm, source beds. Includes Ramparts (Kee Scarp) Fm
- Hare Indian Fm, including the organic-rich Bluefish Member at the base (M. Devonian)
- Hume Fm (M Devonian)
- Bear Rock Fm, including Delorme, Ft. Norman, Arnica, Landry carbonates (L. Devonian)
- Mount Kindle Fm, chert-rich carbonates of Siluro-Ordovician age
- Unconformity (at least locally, not visible on seismic)
- Franklin Mountain Fm, divided into a cherty, a rhythmic and cyclic unit (U. Cambrian),
- Saline River Fm, composing of an upper clastic unit overlying thick halites (M. Cambrian)
- Mount Cap Fm, a fine grained sequence with the informal upper '*Glossopleura* unit' at the top, underlain by an evaporitic sequence (L-M Cambrian)
- Mount Clark Fm, basal Cambrian sandstones unconformably overlying a

- folded Proterozoic sequence.

Seismic data in the area consistently show (interpreted) Cambrian deposits resting on Proterozoic beds through an angular unconformity. Excellent seismic resolution of bedding in the Proterozoic section clearly shows its sedimentary nature.

4.2 RESERVOIR OBJECTIVES and PLAY DESCRIPTION

Regional geologic evaluation of well results in the area suggests that the main objectives in the Keele area should be Ordovician Franklin Mountain Fm porous dolomites, which flowed oil in the B-45 East McKay well, and Middle Devonian Hume Formation dolomite, which flowed water at the J-65 Tate well. The Tate G-18 well was being drilled, based on the Keele 1999 seismic data, concurrent with the shooting of the Keele 2000 seismic program. This well was drilled to test a subcrop trap of the Hume in a updip position from the J-65 well. The Franklin Mountain Fm potential reservoirs should also be developed in a trapping configuration at the pre-Cretaceous angular unconformity. In the early stages of the integrated interpretation the potential for structured Cambrian Mt. Clark sandstone gas play was recognized and this interpretation was done especially with Mt. Clark in mind.

4.3 SURFACE GEOLOGY

Surface geology has been mapped on a reconnaissance basis (1:250,000) by GSC field teams during the 70's and 80's (sheet 96C, Fort Norman; sheet 96B, Blackwater Lake). In the Mackenzie depression south of Tulita (Fort Norman), it shows lowlands along the Mackenzie River exposing

predominantly Upper Cretaceous and Lower Tertiary beds, surrounded by outcrops of Middle and Lower Paleozoic units at higher elevations. Glaciation has left its marks through elongated strings of lakes and rivers reflecting northwesterly ice flow. A geologically recent deflection of the Mackenzie River from a course swinging around the northern front of the Norman Range (through Brackett- Kelly- Lenny lakes) to one south of the Norman Range is evident through surface patterns. Alluvial and glacial sediments obstruct detailed mapping of bedrock in low-lying areas, and outcrops of Paleozoic beds in the Mackenzie River floodplain, such as the Police Island Anticline, have no surface expression.

From a geomorphological perspective, confluences and orientations of tributaries to the Mackenzie River seem be controlled by NE-SW lineaments: the Redstone and Saline rivers join the Mackenzie at the same point. So do the Keele and Little Smith rivers and the Little Birch and an unnamed creek.

Immediately obvious from the surface maps are the Devonian to Cretaceous hiatus, post - Paleocene thrusting, a general NW-SE structural grain and suggestions of dextral offsets along NE-SW trends.

4.4 WELL INFORMATION

There are eight pre 2000 wells located on EL 392: Stewart B-30, Keele N-62, Keele River I-01, Keele L-04, Tate J-65, Police Island L-66, East Mackay B-45 and East Mackay I-55. Most wells targeted structural traps in Devonian carbonates, and a few tested deeper stratigraphic zones in antiforms. The best hydrocarbon show was recovery of 1830' of 20.4 API

oil from an antiform at the subcrop of the Ronning Fm at East Mackay B-45. This oil has been traced to a Cretaceous Slater River source rock (AGAT, 1977; Feinstein, 1988).

Similarly positioned porous and oil-stained Hume dolomite at the J-65 well triggered AEC / Renaissance's Tate G-18 offset location which was drilled in 2000 based on seismic data acquired in the 1998 – 1999 field season.. Approx. 4.5m of bitumen stained, water bearing, 4-8% porosity dolomite was encountered by G-18. No DST or perforations were conducted.

In the Norman Wells area, Kee Scarp and potential Hume reefs are the preferred targets. Outside of the Keele blocks, the K'Alo B-62 and Nota Creek C-17 wells reached Proterozoic basement in order to test the basal sands of the Cambrian Mount Clark Formation but encountered poor reservoir quality. There was a bitumen show, however, in the Mount Clark in C-17.

4.5 SEISMIC COVERAGE (Fig. 3)

AEC's seismic database in EL 392 consists of various vintages of reflection data:

- scanned and reprocessed low-fold dynamite data (early 1970's)
- trade dynamite data (up to 30-fold?),
- 60-fold Vibroseis data (1999 and 2000 vintages, acquired by AEC).

Coverage is good; dip lines are 3-8 miles apart with several tie lines, and all wells are tied. In case of duplicate or re-shot lines, only one was selected for interpretation. Static adjustments were referenced to the long line composed of 00-TUL-01, 00-TUL-03, 99-TUL-10, DQN-14. This reference was

selected because of its subdued dip content in order to reduce migration-related mis-ties. Most of the remaining strike lines tie reasonably well. The worst mis-ties occur where dip-lines DQN2 and 00-TUL-04 intersect the ends of strike lines 00-TUL-02, 00-TUL-2B and 00-TUL-13.

4.6 AEROMAGNETIC DATA

A High Resolution AeroMagnetic survey (HRAM) of the Mackenzie Corridor area was flown for the GSC in 1999 (GEDCO, 1999). Flight line spacing was 800 meter with 2400 meter tie lines. For the Keele EL 392, the survey was infill flown to at 400 meter flight line and 1200 meter tie line spacing exclusive to AEC. The data were processed by GEDCO, and proved an indispensable interpretation tool. Basement-, surface- and intra-sedimentary information can be extracted and cross-referenced to other data sets. The 1st vertical derivative of total field (Fig. 5) and the 0.8-3.2 km Goussev filter *) bandpass (0.4-1.2 km separation) proved particularly useful.

*) *The Goussev filter utilizes total gradient minus horizontal gradient, with the rationale that vertical patterns, e.g. of dikes, faults etc, are enhanced. Common problem: ringing.*

4.7 SEISMIC PICKS and WELL CORRELATIONS

The most critical seismic ties to non-check shot corrected well synthetic seismograms were made at Tate J-65, Keele I-01, East MacKay B-45 and Police Island L-66. Some of these are referenced later in this report.

The sub-Cretaceous unconformity is mostly a good, strong event, probably not always correctly picked as a peak. At this contact, variable lithological contrasts occur that cannot be consistently designated.

The Hume Formation limestone/dolomite provides a very strong acoustic contrast from overlying Hare Indian and Bluefish shale, especially since the immediately overlying organic rich Bluefish is particularly low velocity. Hence the Hume is a readily recognizable and mappable event (Fig. 6, line 64X with J-65 well tie).

The Franklin Mountain Formation and 'Cambrian' are both difficult events to pick. This is further compounded by the suspected occasional presence of the Mount Kindle, which is, even on logs, hard to distinguish from the Franklin Mountain Fm (Fig. 7, line 99TUL-10 with I-01 & L-04 well ties).

The Saline River Fm was not picked as a direct event but is inferred where thickness changes, wavy or convergent events, pull-up, and collapse-or diapiric structures seem to occur.

The (near-top-of) Mount Cap event was picked at the first consistent marker below Saline River salt, often at the top of a bundle of strongly reflective markers. In the absence of Saline River, this marker may become a positive acoustic contrast (peak).

The mid-Mount Cap event was picked as a trough with uncertain correlation to the actual section. Jump correlation with the Nota Creek C-17 well logs

suggests it is a sandy and dolomitic interval within a shale section. The pick is very useful since it marks the base of occasional Mount Cap evaporite.

The Mount Cap evaporite, like the Saline River, is a tentative pick based on circumstantial criteria.

The Mount Clark is interpreted at a bundle of reflectors overlying the Proterozoic with an angular contact. On a local scale, continuity of character is good, but upon correlation between different line vintages there are character changes, and liberties were taken in the identification.

The sub-Cambrian unconformity is often a good pick, especially where angular unconformity exists. As at the sub-Cretaceous unconformity, varying lithological contrasts occur across the unconformity. Extrapolation from good control points generally leads to consistent results.

Within the Proterozoic package, there are consistent, mappable markers. They were considered outside the scope of this report and have not been picked. It is a concern that many well identified faults can be observed in the Lower Cambrian section and at the sub-Cambrian unconformity, but are often untraceable in the Proterozoic section despite the presence of seemingly good markers. This could be the consequence of diminishing resolution at depth or a function of processing. A geological explanation has to invoke bedding-parallel faulting, of which a good example occurs between SP's 469 and 589 of line 00-TUL-03. Still, there appears to be a problem in the majority of cases.

In the intra-Devonian interval, only the contact of the Hume and Hare Indian formations seems to be well imaged. A distinct crosscutting event occurs in the sub-Hume section, south of the Tate Lake Zone. Since it can be seen to terminate against the Mount Cap marker, it may be related to Saline River salt mobilization: a local salt-related erosional event cutting into the Mt Kindle and Franklin Mountain section (Fig. 8, line 00TUL-12, SP 457, 1,690 msec.). A possible clue to the identity of this marker is provided by the erosional unconformity (between Arnica and Upper Saline River beds) interpreted in the Tate G-18 well, but the seismic image at this location is poor (Fig. 6, line 64X)

The most suitable events for mapping are the sub-Cretaceous and sub-Cambrian unconformities (Maps: Fig. 9 & Fig. 10). The Mount Cap, mid Mount Cap and Mount Clark events are good interpretation guidelines. Mapping of the Mid-Mount Cap marker and a Lower Mount Cap-to Proterozoic isochron was also carried out.

Faulting occurs with various frequency throughout the section. North of the Tate Lake Zone, some basement involved faults (usually poorly defined) mark the delineation of a Cambrian extensional basin. Of the few remaining faults, most occur in the Mesozoic section and are apparently related to movement along the detachment in Saline River salt. They are therefore interpreted as mostly Laramide.

South of the Tate Lake Zone, the entire section is subject to more intensive deformation. There appears to be an early generation of faults that were active during Cambrian extension: they often terminate at the mid-Mount

Cap. In places, inversions and tilting of these faults occurs. Fault orientation is hard to establish with the present line spacing. Reactivation took place mainly during the Laramide phase. The Saline River Formation is not preserved in the central and eastern portions of this region and alternative, discontinuous and possibly less ductile glide horizons result in more irregular and smaller structures. Backthrusts are common in this area and the frequency of collapsed salt pillows is up. Some of the problematic structures, such as the "G-18 antiform" (line 64X (Fig. 6) & 99-TUL-07), may be decapitated by Laramide-age thrusts oriented obliquely to of the plane of section, and are, for that reason, hard to balance. Still other faults occur in the Mesozoic section, seemingly unrooted. They probably connect with bedding parallel translations in Cretaceous and Devonian shale and are therefore seismically invisible.

Particular density of Cretaceous faulting occurs in a swath above the Tate Lake Zone and appears to be related to transfer of displacement from the Saline River to the Mount Cap evaporites.

At the time of Cretaceous transgression onto the Paleozoic substrate a distinct high existed in the area to the N of the Tate Lake Zone. This is indicated by the strong northward onlap of the basal Cretaceous beds indicated on lines 00-TUL-02B, 00-TUL-13, 00-TUL-03, 99-TUL-10. A weaker eastward onlap component is reflected on the dip lines in the southern area. Dip lines E of the Mackenzie River show westward onlap at the sub-Cretaceous unconformity.

4.8 GEOPHYSICAL MAPPING

Blocks EL 392 and EL 398 are situated over a geological depression confined by the Mackenzie Mountains in the southwest, the Brackett Lake Zone and the Norman Range in the north and the St. Charles and McConnell ranges to the east.

Early Cambrian extension led to a rift basin. This basin was infilled in early Paleozoic times through several sedimentary pulses. Present-day structure is dominated by Laramide compression utilizing pre-existing SW-NE-oriented basement lineaments and detachment horizons located at the Saline River salt the upper Devonian and overlying Cretaceous shale section and to some degree, an occasionally occurring Mount Cap salt. There are also steep thick-skinned reverse faults that juxtapose Proterozoic with Cretaceous rocks.

Salt tectonics played an important role in the area. Formation of salt pillows, diapirs and collapse all have occurred in various phases ranging from Devonian to Tertiary and appear to be triggered by tectonic pulses.

A time structure map on the sub-Cambrian unconformity (Fig. 10) shows gradual rise toward the S and SE and possible normal faults with upthrown western blocks at the westernmost extremities of some longer lines. No closed structures or dip reversals are apparent. A distinct SE-ward rise is apparent across the SW-NE flower structure discussed above. Consistent mapping of faults intersections of the sub-Cambrian unconformity proved elusive with the present data set.

Time structure on the sub-Cretaceous unconformity (Fig. 9) shows a smooth surface north of the Tate Lake Zone only disturbed by late salt tectonics. South of the Tate Lake Zone, the surface is more disrupted, reflecting more intense salt tectonics and more random distribution and nature of salt-relation structures. This map also illustrates a stepwise rise in elevation towards the SE across SW-NE lineaments.