

# MAR 19770025: NORTHEASTERN ALBERTA

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19770025

NORCEN ENERGY RESOURCES LIMITED

YEAR-END REPORT

1977 EXPLORATION PROGRAM

QUARTZ MINERAL EXPLORATION PERMIT  
6876120002

November, 1977

G. McWilliams

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1. Location of Athabasca Type uranium Deposits (Figure 1)
2. Location of Drill Sites (Figure 2 and 3)
3. Athabasca Sandstone Permits. (Map #1)

## SUMMARY

Norcen Energy Resources Limited, on behalf of the uranium joint venture with Campbell Chibougamau Mines Limited, E & B Explorations Limited and Ontario Hydro holds two blocks of Quartz Mineral Exploration Permits in Northeastern Alberta. The Archer permits which cover 179,200 acres include permits 208, 209, 210 and 211 which were acquired on January 28, 1976. The five Richardson Permits totalling 229,600 acres include permits 6 876 120002 to 6 876 120006 acquired on December 23, 1976.

A surface prospecting and geochemical survey conducted over the Archer permits during the summer of 1976 indicated that the edge of the Athabasca Formation was further west than anticipated. This survey also revealed that the pervasive cover of glacial overburden in the area prevented the useful application of any further surface prospecting in the area. In evaluating the situation, the authors felt that present exploration techniques limited the search for unconformity type Athabasca sandstone uranium deposits to areas where the unconformity between the Athabasca Formation and the underlying basement was less than 152.5 metres (500 feet) below the topographic surface. As a result, 2 permits 212 and 213 were surrendered to the Crown and the five Richardson permits were acquired.

The lack of outcrop and the far travelled nature of the overburden in Northeastern Alberta coupled with the importance of locating the margin of the Athabasca Formation indicated to the authors that a reconnaissance stratigraphic drilling program would be required to narrow search area. The 1977 drilling program over the permit areas was designed to:

- a) define the edge of the Athabasca Formation
- b) outline the areas where the combined thickness of Athabasca sandstone and overburden was less than 152.5 metres (500 feet).
- c) examine the unconformity at the base of the Athabasca Formation
- d) determine whether the Athabasca Formation in Norcen permit areas contained a favourable physical and chemical environment for uranium deposition.

- e) examine the basement for its potential as a site for trapping uranium from supergene solutions percolating along the unconformity.

The Richardson permits lying to the west of the Richardson River, lie outside the margin of the Athabasca Formation. Drilling in these areas encountered 27.8 metres (91 feet) to 62.5 metres (205 feet) of overburden and 20.5 metres (74 feet) to 133 feet (70.6 metres) of Lower and Middle Devonian sandstone and mudstone overlying Archaean basement rocks.

On the basis of the above information, no further work is recommended for the Richardson Permits lying to the west of the Richardson River. These areas should be either optioned or returned to the Crown. The 76 sections of permit 6876120002 and the 6 sections of permit 6876120005 should be retained. On the basis of the success of the electromagnetic method in locating conductors associated with the uranium deposits at Key Lake, Maurice Bay either an airborne electromagnetic or reconnaissance ground electromagnetic survey is recommended for this area in 1978.

INTRODUCTIONHistory

Exploration for uranium in northeastern Alberta was sparked by the announcement by Gulf Minerals of their discovery of a uranium deposit at Rabbit Lake, Saskatchewan in 1968. A massive land acquisition covering most of the Athabasca Sandstone Basin attracted various companies to conduct airborne spectrometer surveys in northeastern Alberta. The absence of outcrop in this area produced discouraging results and very little ground follow-up was attempted. The following list of companies were active in the area:

R.H. King, 1969

Pacific Silver Mines & Oil Ltd., 1969

Fort Reliance Limited & Ensign Oils Ltd., 1969

National Nickel

Geo X

Velocity Surveys

Meyers & Paulson, 1970

MacIntyre Mines, 1969

Canada Southern Petroleum, 1969

Anco Exploration Ltd., 1968

North Canadian Oils Ltd., 1969

Leal Mines, 1969

Radex Minerals, 1969

In 1974 Eldorado Nuclear acquired several permits in northeastern Alberta initiating a second phase of uranium exploration and prospecting. Norcen, under the name of its wholly owned subsidiary, Great Plains Development Company Limited, acquired 6 permits in January of 1976. Several other companies acquired permits and by June, 1976 most of the area available for acquisition over the Athabasca Formation in northeastern Alberta was covered by exploration permits. (Consult the accompanying map for details on the land status in northeastern Alberta and northwestern Saskatchewan).

Drilling

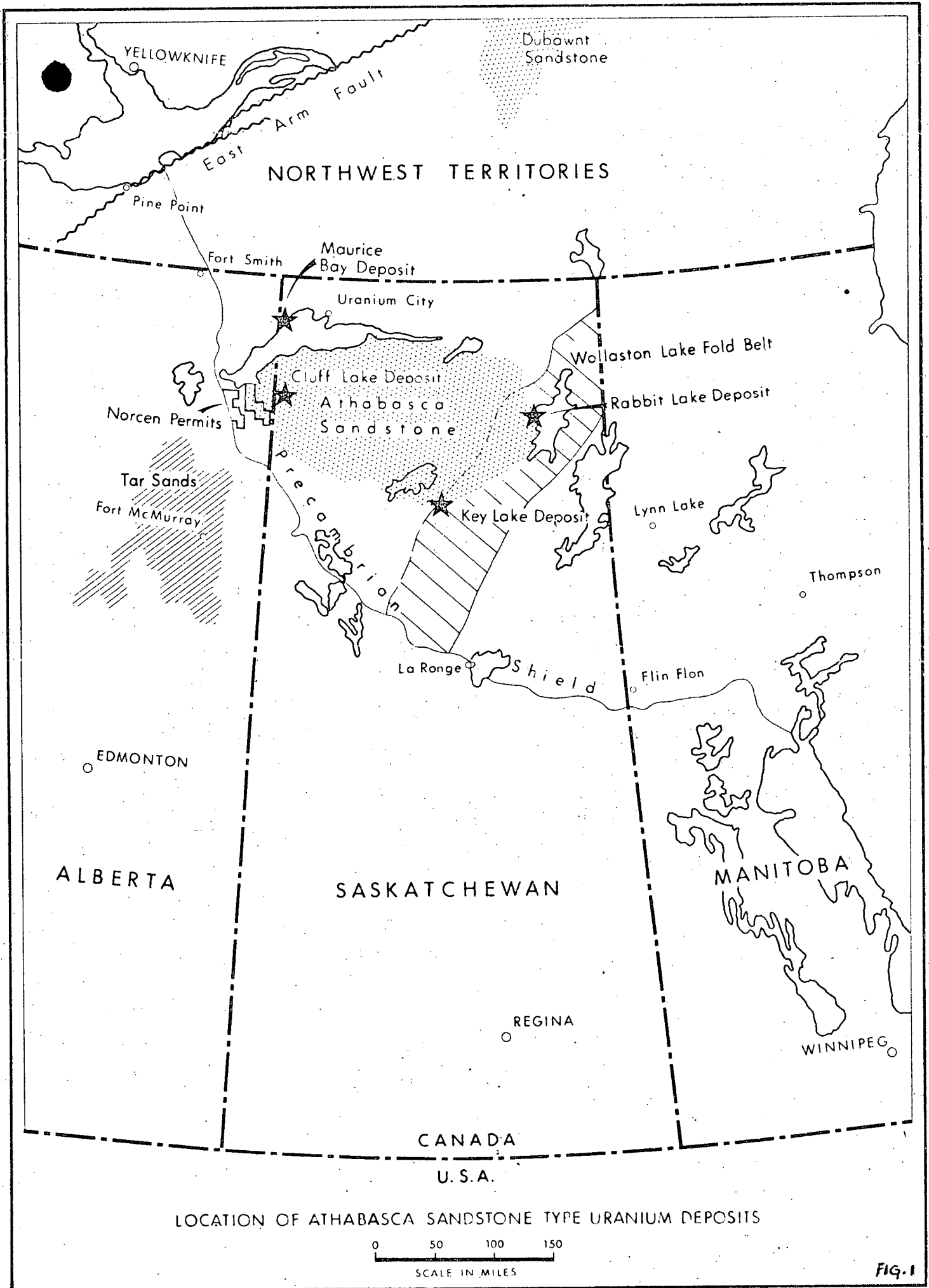
The 1977 exploration program on the Norcen Quartz Mineral Exploration permits consisted of eight diamond drill holes. One hole was drilled on each of the five Richardson Permits and three holes on the four Archer permits. Drilling commenced on August 18 and the last hole completed on September 29, 1977. The drill was mobilized from Leduc to Fort McMurray via truck and from Fort McMurray to Embarras via barge down the Athabasca River. The winter road southeast to Embarras provided good access to the first four drill sites. The drill mounted on a Nodwell trailer and a camp consisting of three 10 x 18 foot tents mounted on trailers provided good mobility. Moves and crew changes to the four holes not accessible by road were carried out with a Bell 206B helicopter from a base camp located at the Embarras air strip.

Hole #6

Location: Tp. 107 R6 Sec. 27 NE West of the 4th Meridian  
 Permit No. 6876120002 N.T.S. 74L

Started: September 13, 1977 Completed: September 19, 1977

0-45 feet	0-12.8 metres	- overburden
45-578 feet	12.8-176.4 metres	- Athabasca sandstone
578-721 feet	176.4-220.1 metres	- coarse Athabasca sandstone
721-767 feet	220.1-233.9 metres	- altered granite.



LOCATION OF ATHABASCA SANDSTONE TYPE URANIUM DEPOSITS

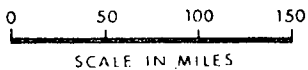
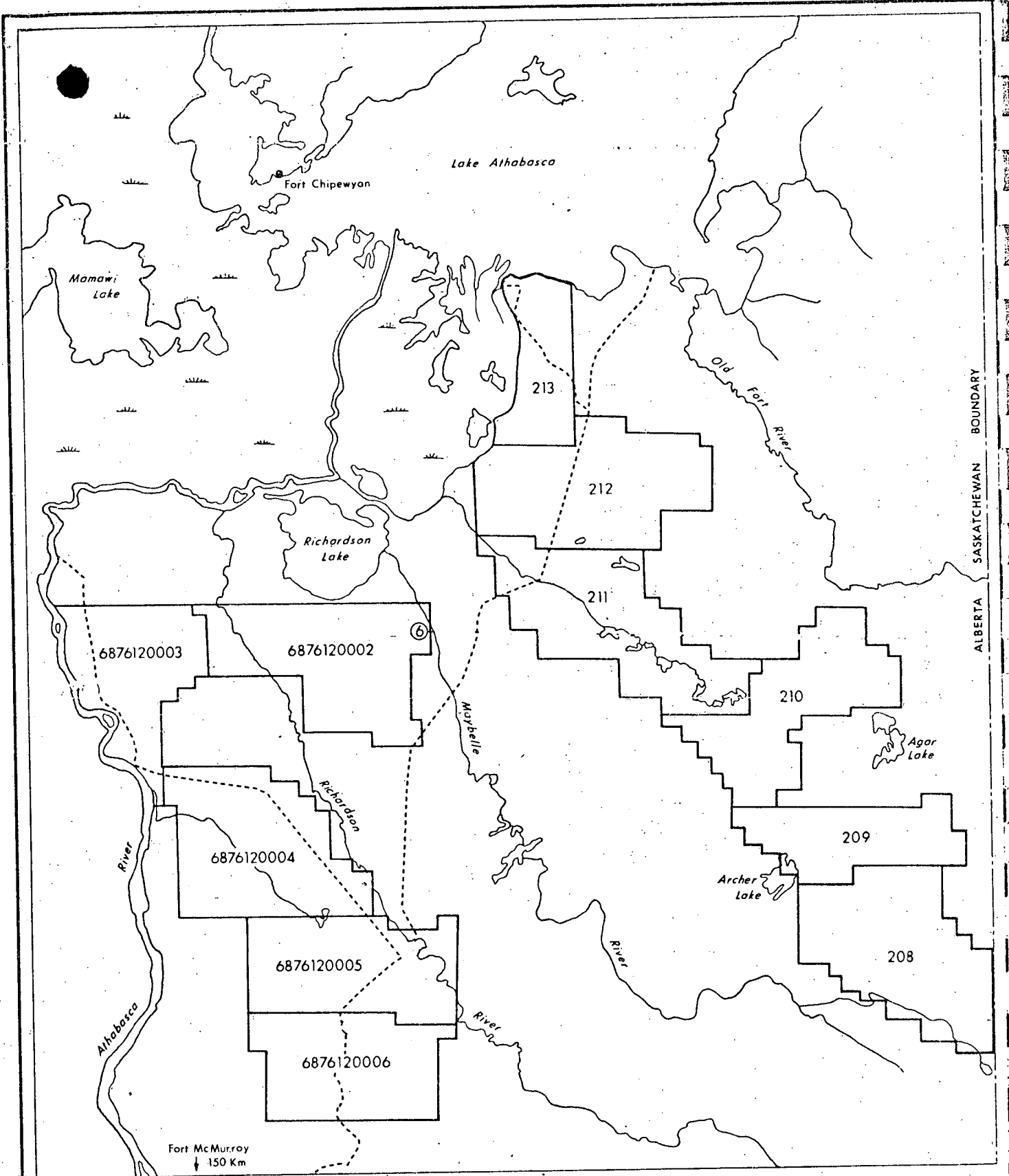


FIG. 1

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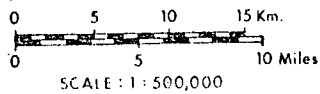


② DRILL SITES

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FIGURE 2

LOCATION OF DRILL SITES



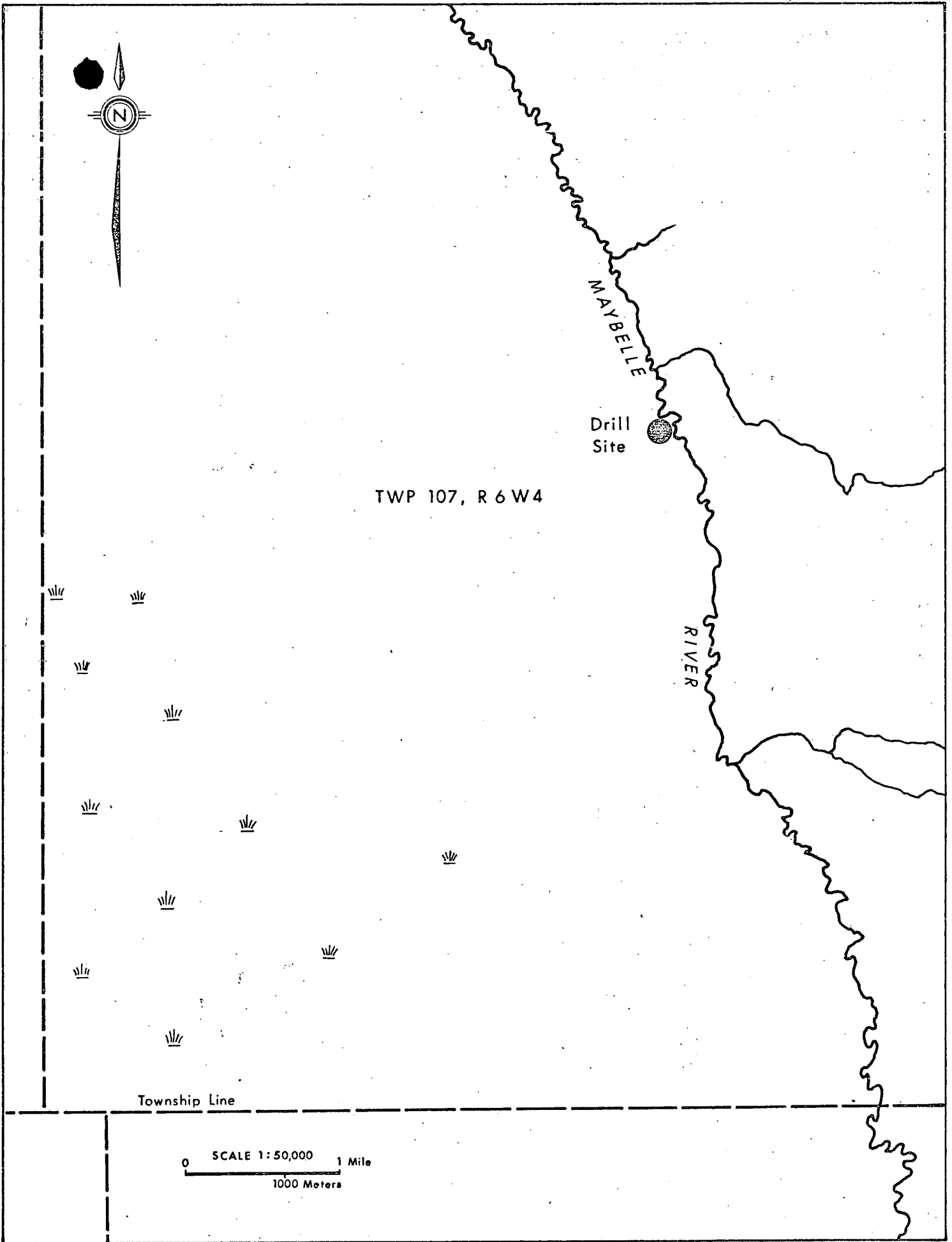


FIGURE 3

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## REGIONAL GEOLOGY

The northeast corner of Alberta is occupied by 6,000 square miles of the Canadian Shield, consisting of a complex of igneous, metamorphic and sedimentary rocks ranging in age from 1.7 to 2.3 billion years and forming part of the Churchill Structural Province.

South of Lake Athabasca lie rocks of the Athabasca Formation within the Athabasca intracratonic basin. This Formation covers an area of 40,000 square miles mainly in Saskatchewan and reaches a thickness of 6,000 feet. However, approximately 1,200 square miles of this Athabasca Sandstone occurs in Alberta and appears on islands in Lake Athabasca as well as small peninsulas located as Shelter Point and Fidler Point on the north shore of Lake Athabasca.

The Athabasca Formation is considered to belong to the Paleohelikian Era (1.3 - 1.7 billion years).

### DESCRIPTION OF THE ATHABASCA FORMATION

The formation consists of quartz sandstone with minor interbeds of shale and siltstone and a basal gritty sandstone conglomerate unit. The formation lies in an oval shaped basin covering in excess of 98,800 square kilometres (38,000 square miles) in northwestern Saskatchewan and approximately 31,000 square kilometres (12,000 square miles) in northeastern Alberta. The formation dips toward the centre of the basin where it reaches a thickness of 1,800 metres (6,000 feet). A pronounced unconformity underlies the Athabasca Formation and in some localities probably depending on the composition of the Archaean basement rocks a regolith is developed.

### DESCRIPTION OF THE ATHABASCA FORMATION IN THE NORCEN CORE

#### Composition

The sandstone is composed almost entirely of quartz grains bound together by silica and/or clay cement. Shale and argillaceous siltstone beds occur as minor interbeds of 1 to 20 centimetres (0.5 to 8 inches).

#### Colour

The sandstone ranges in colour from a white buff colour to a dark maroon colour with light buff and pink, the most common. Colour banding is common with alternating pink

white and maroon. Red and pink colours are due to a surface coating of hematite on the sand grains and on the cementing clay minerals. The dark maroon colour appears to be caused by a concentration of fine specular hematite grains in the matrix of the sand. There would appear to be an increase in hematite content with depth. In hole number 6, there was a distinct concentration of hematite in the sandstone above and at the basement unconformity. Dark grey colours are caused by tar and bitumen coating the sand grains. Dark grey coloured sand occurs in porous horizons adjacent to fractures.

The siltstone beds occur in tan buff colour, chlorite green colour or deep hematite red colour. Locally these beds are laminated with fine millimetre thick alternating laminations of dark red and light green.

#### CEMENT HARDNESS AND PERMEABILITY

Both silica and clay cement occur in varying abundance. Where silica cement is present the sandstone is hard and non-friable, when clay minerals form the cement the sandstone is moderately friable and when little of either is present the sandstone is extremely friable or as in a short section of hole number 8, unconsolidated. The permeability of the sandstone is affected by the amount of cement present, the presence of impermeable siltstone beds and locally by secondary fracturing. Locally permeable horizons are clearly indicated by leaching of the hematite in the sandstone creating colour banding.

#### Grain Size and Sorting

The sediments range from fine sand through fine pebbles, but medium grained sand is the most abundant. In holes 5 and 6 there appeared to be a gradual increase from fine to medium grained at the top to medium to coarse and coarse grained sand at depth. Locally some beds show distinct textural laminations in which there is a marked contrast and grain size in adjacent laminae and layers.

#### Structures

Inclined and truncated laminae are prominent features and occur on a large scale and on a small scale as represented by festoon cross-laminations with individual laminations several millimetres thick.

Fractures in the sandstone are locally a prominent feature and intersect the core axis at 10 to 15 degrees. These fractures are filled with clay, silica or tar.

#### Unconformity

The unconformity underlying the Athabasca Formation was only encountered in hole number 6. The unconformity was outlined by a concentration of hematite in the matrix of the sandstone and in the highly altered basement rock. The upper level of the granitic basement rock is highly altered by insitu chemical alteration of feldspars and micas and replacement by hematite. This zone of alteration and replacement gradually decreases downward over a depth of 10 metres (30 feet).

#### Radioactivity

Background levels of radioactivity as measured with a hand held McPhar TV-1A spectrometer were low, less than 1,000 counts per minute, and no readings above 1.5 times background were over the sandstone or over the granitic basement rock.

DESCRIPTION OF THE PALEOZOIC FORMATIONS OVERLAPPING  
THE PRECAMBRIAN SHIELD IN NORTHEASTERN ALBERTA

A wedge of middle and upper Devonian rock unconformably overlaps the edge of the Precambrian Shield in northeastern Alberta. These rocks are not found in outcroppings due to a thick blanket of glacial outwash which covers all of the Norcen permit areas. The closest exposure of these formations occur on the southwest shore of Lake Claire 25.6 kilometres (16 miles) to the northwest and along the banks of the Firebag River 16 kilometres (10 miles) south of the permit area. The author of this report is unfamiliar with Devonian stratigraphy and with the limited drill hole information available has made no attempt at correlating the Devonian rocks with the established stratigraphy of the area. A comprehensive report on the Devonian stratigraphy of northeastern Alberta and northwestern Saskatchewan has been compiled by A.W. Norris (1963).

## CONCLUSIONS

The primary objective of the 1977 drilling project in northeastern Alberta was to outline the western margin of the Athabasca Formation. Eight holes were drilled in the Norcen permits with the number 6 hole which was drilled in permit 6876120002 intersecting the basement unconformity underlying the Athabasca Formation at a depth of 220.1 metres (721 feet). This hole is located on the eastern margin of the permit, the Athabasca Formation to the west of the drill hole represents a good exploration target.

The unconformity underlying the Athabasca Formation was only observed at one location. The concentration of hematite along the unconformity and the deep chemical insitu weathering of the underlying granite indicate that the unconformity represents a natural channel for supergene solutions. The unconformity at hole number 6 does not contain a favourable physical or chemical environment for uranium deposition and no anomalous radioactivity was recorded. The deposits at Key Lake and Maurice Bay, Saskatchewan, which are found at the base of the Athabasca Formation, can be used as models for the type of structural and chemical trap favourable for uranium deposition. Faulting with graphite concentrations in the shear zone provides the reducing environment for the deposition of uranium in these deposits. These graphite shear zones are excellent conductors readily detectable with an electromagnetic survey. Now that we have narrowed down the location of the margin of Athabasca formation a detailed electromagnetic survey should be implemented to determine whether graphitic shear zones are present in the paragneisses of the Archaean basement complex.

## RECOMMENDATIONS

Permit 6876120002 is located over the margin of the Athabasca Formation with the combined thickness of the overburden and Athabasca Formation less than 152.5 metres (500 feet) in the area west of the Maybelle River. An airborne electromagnetic survey is proposed to evaluate this area. A line spacing of 1/4 mile (402.6 metres) is recommended for the area with fill in lines over any conductors. The cost of flying this electromagnetic survey at \$35.00 per line mile is \$28,000.00.

APPENDIX 1

Drill Logs



NORCEN ENERGY RESOURCES LIMITED  
DIAMOND DRILL RECORD

PROPERTY: RICHARDSON QUARTZ MINERAL PERMIT HOLE NO. 6  
 SHEET NUMBER 1 N.T.S. NO. 74L STARTED Sept. 13, 1977.  
 COLLAR Tp 107 R6 Sec.27 NE CLAIM NO. Permit 687612002 COMPLETED Sept. 19, 1977.  
W of the 4th Meridian BEARING \_\_\_\_\_ ULTIMATE DEPTH 767 feet/233.9 meters  
 ELEVATION 740 feet/226 meters DIP - 90 PROPOSED DEPTH \_\_\_\_\_

Depth (ft/m)	Description	Mineral- ization	Core Recov.	Assay					
0 -12.8	Overburden - glacial outwash sand and some boulders								
12.8-13.7	Subcropping Boulders - maroon and white sandstone boulders								
13.7-15.6	Sandstone - cross-laminated, purple white well cemented with silica cement		1.9						
15.6-17.8	Sandstone - cross-laminated, white, medium grained well sorted with local beds up to 1 cm thick of coarse sand		2.2						

LOGGED BY \_\_\_\_\_ DRILLED BY \_\_\_\_\_ CORE STORED \_\_\_\_\_



NORCEN ENERGY RESOURCES LIMITED  
DIAMOND DRILL RECORD

SHEET NO. 3 PROPERTY RICHARDSON PERMITS HOLE NO. 6

Depth (ft/m)	Description	Mineral- ization	Core Recov.	Assay				
32.3-41.8	Sandstone - cross-laminated, white with pink or purple bands	9.5						
41.8-50.0	Sandstone - massive, white with pink colour bands	8.2						
50.0-56.7	Sandstone - cross-laminated, pink white 52.9-53.0 black band due to tar	6.7						
56.7-57.8	Sandstone - massive, white	1.1						
57.8-62.1	Sandstone - cross-laminated, white-pink	4.3						
62.1-62.2	Sandstone - massive grey fine-medium grained with clots of pyrite 1% of rock	0.1						
62.2-70.8	Sandstone - massive to weakly banded with local sections of cross-laminations. Bands of tar occur at 66.0 (9 cm), 66.7 (9 cm) 69.6 (3 cm), 70 (3 cm)	8.6						



NORCEN ENERGY RESOURCES LIMITED  
DIAMOND DRILL RECORD

SHEET NO. 5 PROPERTY RICHARDSON PERMITS

HOLE NO. 6

Depth (ft/m)	Description	Mineral- ization	Core Recov.	Assay					
94.1-130.2	Sandstone - cross-laminated, white with pink, purple and green bands, local irregular bands of tar stain occurring along and adjacent to fractures at 100.8, 121.1, 124.8, 125.4, 126.6. Thin green silty horizons at 107.4 (3 cm), 107.6 (6 cm), 115.0 (3 cm)		36.2						
130.2-175.3	Sandstone - massive, medium to coarse grained, angular grains, pink, purple and green colour bands		45.1						
175.3-176.4	Sandstone-Siltstone fine to medium grained sandstone interbedded with purple hematite rich siltstone		1.1						
176.4-181.5	Sandstone - massive coarse grained light green, pink and purple bands		5.1						

NORCEN ENERGY RESOURCES LIMITED  
DIAMOND DRILL RECORD

SHEET NO. 6 PROPERTY RICHARDSON PERMITS HOLE NO. 6

Depth (ft/m)	Description	Mineral- ization	Core Recov.	Assay				
181.5-205.4	Sandstone - massive coarse grained with chert pebbles up to 4 cm in diameter, pebbles vary from round to angular with moderate to high sphericity		24.9					
205.4-207.3	Siltstone-Sandstone - interbedded siltstone and sandstone with beds up to 5 cm thick, the amount of sandstone increases downwards		1.9					
207.3-207.5	Sandstone - very coarse, subangular quartz grains up to 5 mm in a grey brown mudstone matrix		0.2					
207.5-215.6	Sandstone - massive, medium to coarse grained sandstone containing subrounded to angular grains		8.1					
215.6-216.1	Sandstone-Siltstone - interbedded with fine sandstone and red siltstone		0.5					
216.1-216.5	Sandstone - massive, coarse grained		0.5					

NORCEN ENERGY RESOURCES LIMITED  
DIAMOND DRILL RECORD

SHEET NO. 7 PROPERTY RICHARDSON PERMITS HOLE NO. 6

Depth (ft/m)	Description	Mineral- ization	Core Recov.	Assay				
216.6-217.4	Sandstone Siltstone - medium to coarse grained sandstone interbedded with red siltstone		6.8					
217.4-217.8	Sandstone - massive angular coarse grained		0.4					
217.8-218.9	Sandstone Siltstone - fine grey red sandstone interlayered with red silstone		1.1					
218.9-219.9	Sandstone - medium to coarse grained sandstone interbedded with medium to fine grained red sandstone		1.0					
219.9-220.1	Sandstone - fine sandstone in hematite rich matrix		0.2					
220.1-233.9	Regolith-Granite - massive siliceous rock Most minerals have been leached out, leaving intergrowths of quartz inclosed hematite; the amount of hematite decreases down section,		13.8					

tension fractures filled with quartz

APPENDIX 2

Summary of Expenditures



SUMMARY OF EXPENDITURES FOR 1977  
QUARTZ MINERAL EXPLORATION PERMIT 6876120002

Drilling Costs

Mobilization and demobilization	\$ 1,116
Drilling 767 feet/234 metres	\$ 13,088
Additional drilling costs	\$ 4,013

Helicopter Bell 206B

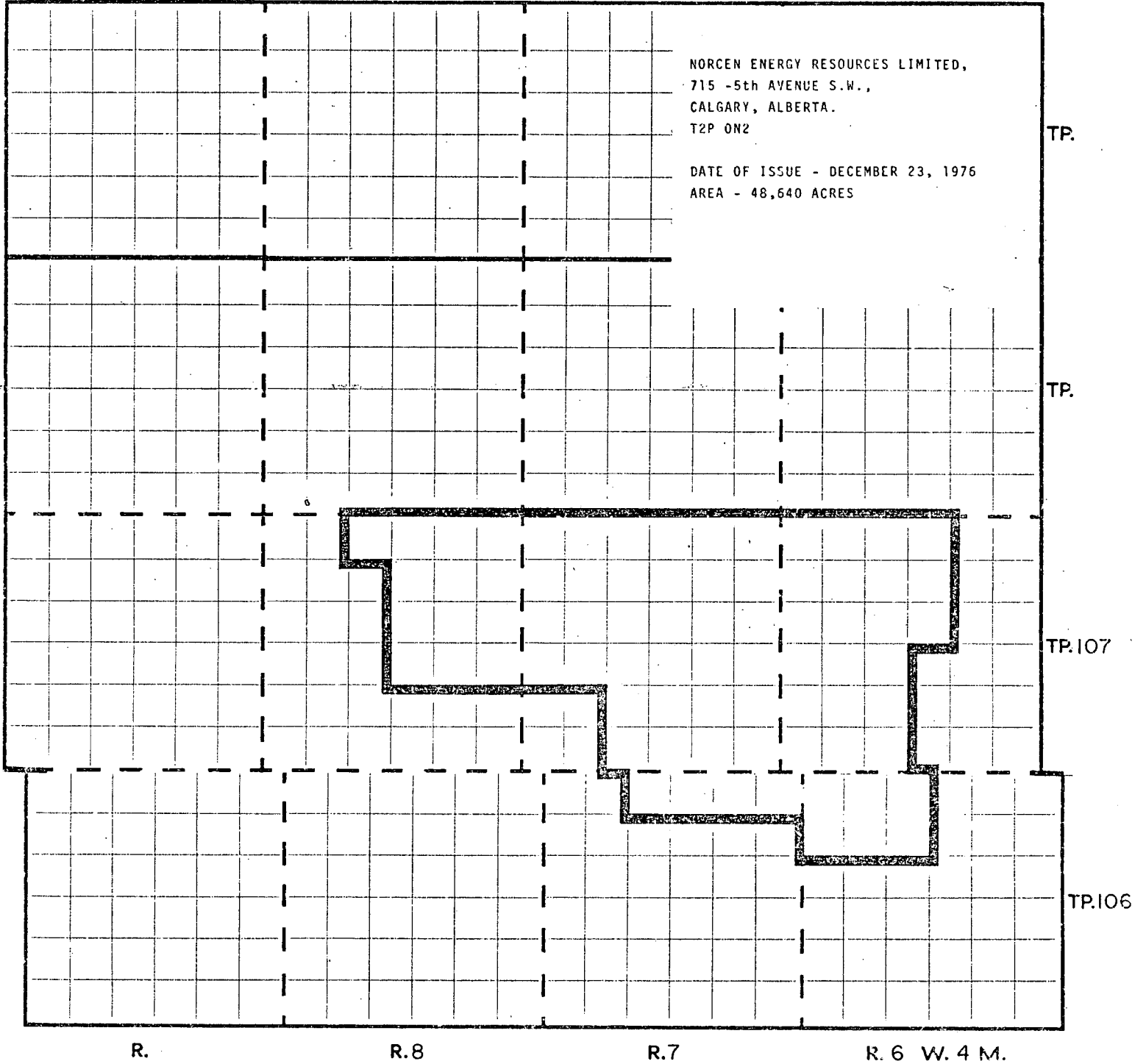
Total hours 27.6 hours	\$ 8,142
Cost of fuel plus transportation of fuel to Embarras	\$ 1,105

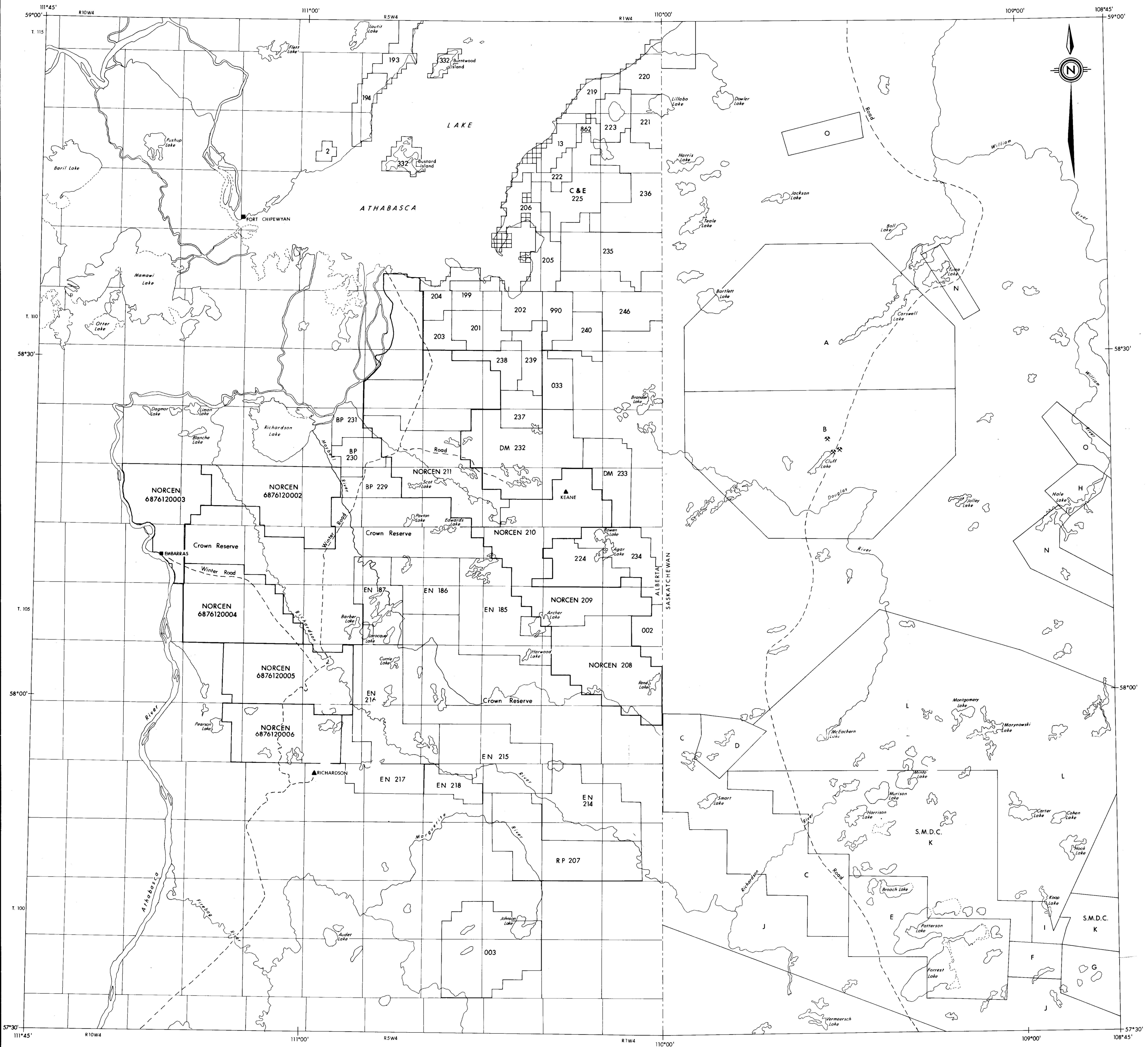
Other Costs

Salaries (geologist in field and report writing)	\$ 1,001
Telephone (mobile radio telephone)	\$ 78
Transportation (Norcen personnel)	\$ 43
Shipping Core	\$ 75
Accommodation	\$ 189
Spectrometer rental	\$ 56
	<hr/>
	\$ 28,906

*Ure...*  
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# QUARTZ MINERAL EXPLORATION PERMIT NO. 6876120002





**ALBERTA QUARTZ MINERAL EXPLORATION PERMIT**

185 - 187	Eldorado Nuclear Limited
188	Urase Corporation Ltd.
189	S.M.D.C.
190	Uranex Exploration & Mining Co. Ltd.
192 - 194	Uranex Exploration & Mining Co. Ltd.
	Inuvco Oil Company
	S.M.D.C.
201 - 206	George Albert Bleiler
207	Kam Petroleum Ltd. & Vipond Oil & Gas Ltd.
208 - 213	Norcen Energy Resources Limited
214 - 218	Eldorado Nuclear Ltd.
219 - 223	Piin Fion Mining Limited
224	Chevron Standard
225	C & E Exploration Limited
226	Enex Resources Limited
229 - 231	B.P. Minerals Limited
232 - 233	Dominion Minerals Limited
234	Chevron Standard
235 - 236	C & E Exploration Limited
237	Emil Kravko
238	Stephen Yanik
239	Albert Alley
240	Milton Patton McDougal
244	C & E Exploration Ltd.
246	C & E Exploration Ltd.
003	Frank Albert Cammell
002 - 003	Talga Consultants Ltd.

**QUARTZ MINERAL LEASE**

1 - 2	North Canadian Oils Ltd.
4	Athabasca Exploration & Mining
13	Pacific Silver Mines & Oils Ltd.

**SASKATCHEWAN PERMITS**

A	Amok
B	Amok
C	Hudson Bay Exploration Uranex
D	Canadian Occidental Petroleum
E	Uranex, Inuvco, SMC
F	Kort Addison
G	W.P. Partridge
H	W.P. Clinch
I	Hudson Bay Oil and Gas
J	S.M.D.C.
K	Imperial Oil
L	Piin Fion Mines
M	Wolfe Exploration

**Norcen**  
Energy Resources Limited

CAMPBELL CHIBOGAMAU MINES LTD. and E&B EXPLORATIONS LTD.  
JOINT VENTURE

**ATHABASCA SANDSTONE PERMITS**  
ALBERTA-SASKATCHEWAN

SCALE: 1:250,000

10 Miles / 10 Kilometers

NTS: 74E, F, K, L

NOVEMBER, 1977