MAR 19790005: NORTHEASTERN ALBERTA

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SUMMARY OF EXPLORATION ON QUARTZ MINERAL EXPLORATION PERMITS IN NORTHEASTERN ALBERTA

G. McWilliams
L. Cool

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INTRODUCTION

Norcen Energy Resources Limited, on behalf of the Norcen Uranium Joint Venture (participants include Norcen, E & B Explorations Ltd., Ontario Hydro, and Campbell Chibougamau Mines Ltd.) hold title to three Quartz Mineral Permits in northeastern Alberta. These 3 permits covering 76,800 acres represent the remaining land holdings out of an original 11 permits covering 483,707 acres. For simplicity the permits are referred to as Richardson North (permit #6876120002-48,640 acres) and Richardson South (permit #6876120004-3,200 acres and #6876120005-24,960 acres).

During 1979 BP and Utah have entered into a joint venture with the Norcen Group on these Permits.

The exploration target in this area is the Athabasca Formation - basement unconformity type uranium deposit. The Key Lake, Midwest Lake, Collins Bay, Maurice Bay, and the recent Canadian Occidental - Inco discovery are all examples of this type of deposit. The deposits are typified by high-grade ore, proximity to a major structure, occur near the Precambrian-Athabasca unconformity, are associated with metasedimentary rock types within the basement complexes, and frequently occur near magnetic highs. Chlorite and graphite schists are thought to be important pathfinder rock types.

The exploration philosophy of the Norcen Joint Venture group is to pursue a systematic exploration approach which will result in the discovery of economic uranium deposits.

1976 Archer Lake Permits #208, #209, #210, #211, #212, #213

Summary of Work

Norcen Energy Resources Limited applied for six quartz mineral exploration permits on September 10, 1975. A helicopter supported exploration program conducted during the months of May through September carried out the following surveys:

a) scintillometer prospecting,
b) reconnaissance geological mapping,
c) lake sediment sampling,
d) surficial deposits study.

A detailed report entitled Norcen Energy Resources Limited 1976 Yearend Report, Quartz Mineral Exploration Permits Northeastern Alberta, containing a description of the work, geochemical and geological maps, assay certificates and a breakdown of expenditures was submitted to the Alberta Government.

Conclusions

Those areas containing anomalous concentrations of uranium in the lake bottom sediments appear to be in the down ice direction from known uranium deposits at Cluff Lake.

The granite boulders which occur in the vicinity of the anomalous lakes occur in far travelled glacial deposits.

The Norcen permits are covered by thick outwash plains and end moraines of distant origin.

The margin of the Athabasca Formation occurs a considerable distance to the west of the Norcen Quartz Mineral Exploration Permits #208, #209, #210, #211, #212, #213.

Recommendations

Apply for additional permits covering available land to the west.

Stratigraphic drilling should be carried out to determine the thickness of the Athabasca Formation underlying the Archer Lake Permits.

Permits #212 and #213 should be surrendered to the Crown due to the presence of a thick cover of overburden which forms a barrier to future exploration in this area.

Total expenditures during 1976 on permits #208, #209, #210, #212, #213 = $188,067 or $.73 per acre.

1977 Archer Lake Permits #208, #209, #210, #211

Summary of Work

- Diamond drilling 3 holes totalling 2,178 ft. or 663.9 m.
- Depth to basement study of magnetic anomaly at Archer Lake.
- Sieve analysis of surficial deposits.

Conclusions and Recommendations

The pre Athabasca Formation unconformity underlies the Archer Lake Permits at depths in excess of 153 metres (500 feet). It is the understanding of the author that the present geochemical and geophysical tools are unable to detect blind uranium mineralization below this depth. Since the primary exploration target in the Athabasca Basin is uranium mineralization located along the unconformity, the chance of discovering uranium deposits in this area is remote. These permits should be surrendered to the Crown.

Total expenditures during 1977 on permits #208, #209, #210, #211 = $87,038 or $.49 per acre.

Two detailed reports entitled Norcen Energy Resources Limited Final Report, 1977 Exploration Program, Quartz Mineral Exploration Permits Northeastern Alberta #208, #210, #210; and Norcen Energy Resources Limited Final Report 1977 Exploration Program Quartz Mineral Exploration Permit #209 Northeastern Alberta, were submitted to the Alberta Government. These reports contained a detailed description of the work done, complete drill logs, location maps of the drill holes, and a breakdown of costs incurred.

1977 Richardson River Permits 6876120002 to 6876120006

Norcen Energy Resources applied for 5 Quartz Mineral Exploration Permits (Richardson River Permits) on December 23, 1976.

Summary of Work

The 1977 exploration program on the Richardson Permits comprised of a 5 hole stratigraphic drilling program designed to:

a) outline areas where the combined thickness of the Athabasca Formation and overburden is less than 153 metres (500 feet),

b) examine the pre Athabasca unconformity,

c) determine whether a favourable physical and chemical environment for uranium deposition underlies the permit area.

The five drill hole program totalling 557.2 m (1,828 feet) was carried out during the late summer of 1977.

Conclusions

The Richardson Permits located west of the Richardson River, lie outside the margin of the Athabasca Formation. Drilling in these areas encountered 27.8 to 62.5 metres of overburden, and 20.5 to 70.6 metres of Lower and Middle Devonian sandstone and mudstone overlying Archaean basement gneisses. The drill hole located just west of the Maybelle River encountered 12.8 metres of overburden and 207.3 metres of Athabasca sandstone overlying altered Archaean rocks. Thus the target area for basal type uranium deposits occurs west of the Maybelle River and east of the Richardson River.

Recommendations

Those permit areas lying outside the target area should be surrendered to the Crown. Permit 6876120002 and parts of permits 6876120004 and 6876120005 require further assessment. On the basis of the success of airborne magnetic and electromagnetic surveys in locating conductors associated with uranium deposits in Saskatchewan, an airborne survey is recommended for the above areas.

Total expenditure for the 1977 drilling program on Richardson Permits = $61,850 or $.27 per acre.

Norcen Energy Resources Limited submitted to the Alberta Government one report for each permit containing a detailed description of the work, complete diamond drill logs, recommendations, conclusions and a breakdown of costs incurred in December, 1977.

1978 Richardson River Permits 6876120002, 6876120004, 6876120005

Summary of Work

The 1978 exploration program on the Richardson Permits consisted of a airborne magnetic and electromagnetic survey over the permit areas. The Questor Mark IV Input survey was conducted from a Shorts Skyvan using a terrain clearance of 400 feet with the E.M. Bird at approximately 150 feet above the ground. A line spacing of 1,320 feet was used.

Conclusions

The airborne electromagnetic survey located three conductive zones on Permit 6876120005. Permits 6876120002 and 6876120004 were void of any conductive bedrock responses.

Recommendations

Ground electromagnetic, magnetic surveying and followup diamond drilling are recommended for Permit 6876120005. Stratigraphic drilling to further define the margin of the Athabasca Basin is recommended for Permit 6876120004 and 6876120002.

The total expenditure during 1978 on the three Richardson Permits was $22,250 or $.29 per acre.

A copy of the Questor Report and Maps covering the permits flown was submitted to the Alberta Government in December, 1978.

1979 Richardson River Permits 6876120004, 6876120005

SUMMARY OF WORK

Geophysical surveys were designed to locate and detail on the ground those airborne geophysical anomalies outlined in the 1978 Questor Input Survey. During the period March 6, 1979 to April 7, 1979 a combination of horizontal loop EM, vertical loop EM, VLF-EM and magnetics were carried out over the 75 line kilometre grid in order to outline structural and geological features commonly associated with economic concentrations of uranium. Two types of anomalies were outlined in the survey. Weak conductors probably represent faults or shear zones and stronger conductors are due to graphite and or sulphides. The magnetic survey was not completed on the east grid due to severe magnetic storms during the month of March.

Drilling Summary

	Bearing	Dip	Total Depth (metres)	
Permit #6876120004				
RR-1	0°	-90°	79.5	
				79.5
Permit #6876120005				
RR-2	046°	-72°	99.7	
RR-3	0°	-90°	69.2	
RR-4	0°	-90°	35.6	
RR-5	046°	-75°	121.0	
RR-6	046°	-68°	102.7	
RR-7	046°	-75°	117.5	
RR-8	046°	-75°	111.9	
				657.6

Summary of Diamond Drill Logs

	Depth (metres)	Lithology
RR-1	0 - 58.4	Quaternary and Recent Sediments
	58.5- 73.3	Devonian Sediments
	73.3- 73.3	Devonian ? LaLoche Formation (regolith)
	73.5- 79.5	Precambrian basement paragneisses
RR-2	0 - 12.8	Quaternary and Recent Sediments
	12.8- 23.2	Devonian Sediments
	23.2- 23.5	Devonian ? LaLoche Formation (regolith)
	23.5- 99.6	Precambrian basement paragneisses
Note:	Probable Conductor 50.3 - 53.0 metres - biotite (chlorite) gneiss/schist with limonitic blebs and disseminated sulphides (5%)	
RR-3	0 - 28.6	Quaternary and Recent Sediments
	28.6- 69.2	Precambrian basement gneiss
RR-4	0 - 23.7	Quaternary and Recent Sediments
	23.7- 35.6	Precambrian basement gneiss
RR-5	0 - 54.2	Quaternary and Recent Sediments
	54.2- 68.6	Devonian Sediments
	68.6- 121.0	Precambrian basement paragneisses and schists
Note:	Conductor 103.0 - 109.4 metres - graphitic schist.	
RR-6	0 - 29.0	Quaternary and Recent Sediments
	29.0- 33.0	Devonian Sediments
	33.8- 102.7	Precambrian basement paragneisses and schists.
Note:	Probable Conductor 85.3 - 89.0 metres - fault zone with brecciation, clays, and abundant fault gouge.	
RR-7	0 - 59.4	Quaternary and Recent Sediments
	59.4- 78.0	Devonian Sediments
	78.0- 117.5	Precambrian basement paragneisses and minor schists
RR-8	0 - 61.0	Quaternary and Recent Sediments
	61.0- 81.4	Devonian Sediments
	81.4- 83.5	Devonian ? LaLoche Formation (regolith)
	83.5- 111.9	Precambrian basement paragneisses and minor schists

⊗ - no athabasca sds. intersections

Conclusions

Exploration to date on the Richardson River South permits has outlined a favourable structural trap containing a geological and geochemical environment similar to the uranium deposits within the Athabasca Formation in Saskatchewan. This structure has been outlined by ground geophysical surveys and drill testing indicates the presence of faulting, brecciation and an increased background in uranium values associated with chloritic and hematitic alteration. Results from the 1979 exploration program indicate:

1. The presence of a large fault zone with local offsetting faults.

2. Paragneisses similar to those present in the Wollaston Fault Belt in Saskatchewan.

3. The presence of graphite indicating a local reducing environment.

4. Thick chloritic and hematitic alteration zones associated with the Richardson River Fault.

5. An increased uranium background associated with chloritic and hematitic alteration.

6. No Athabasca Formation is present on these permits.

Uranium deposits in Saskatchewan occur at the intersection of similar structures and the pre Athabasca unconformity. The absence of Athabasca Formation on these permits may be the result of erosion by glaciation. The presence of in excess of 30 metres of Athabasca Formation intersected by Eldorado Nuclear in a hole 3 kilometres east of the Norcen Permits would suggest this possibility.

The total expenditure during 1979 on the Richardson River South Permits was $221,466 or $7.86 per acre.

Recommendations for 1980

Results of the 1979 exploration program on the Richardson River South Permits indicate a favourable structural, geological and geochemical environment for uranium deposition. The exploration model for uranium in this area is based on geological, geochemical and geophysical characteristics of the Basement Unconformity Type Uranium Deposits in Saskatchewan. The size and nature of these deposits requires extensive drill testing and a series of holes along the structure with emphasis placed on crosscutting and offsetting structures. Based on the encouraging results from the 1979 exploration program, further drilling is highly recommended for this area. The 1980 exploration program should include the following:

1. Completion of the magnetic survey to aid in the interpretation if the structures outlined by the electromagnetic survey. $ 20,000

2. Drilling of twenty holes to an average depth of 100 metres.

2,000 metres @ $110/metre	$220,000
Total Expenditure for 1980	$240,000

1979 Richardson River North Permit #6876120002

Summary of Work

Geophysical surveys on the north permit centred around a magnetic high approximately 3,000 metres east of the Richardson River. Results of the magnetic survey are almost identical to the airborne survey. The VLF-EM survey encountered very weak conductors which could not be traced due to the wide spacing between the lines.

Drilling Summary

Hole	Bearing	Dip	Total Depth Metres
RR-9	0	-90	83.8
RR-9A	0	-90	46.9
RR-10	0	-90	151.5
RR-11	0	-90	276.5
			558.7

	Depth (metres)	Lithology
RR-9	0 - 83.8	Quaternary and Recent Sediments
RR-9A	0 - 46.9	Quaternary and Recent Sediments
RR-10	0 - 58.8	Quaternary and Recent Sediments
	58.8- 151.5	Precambrian Athabasca Formation - (150.5 - 151.5 basal ? conglomerate up to 15% basement paragneiss clasts)
RR-11	0 - 58.2	Quaternary and Recent Sediments
	58.2- 267.3	Precambrian Athabasca Formation
		58.2 - 246 clean sandstone
		246 - 264.2 hematite sandstone siltstone
		264.2 - 267.3 conglomerate, sandstone, siltstone
	267.3- 276.5	Precambrian basement paragneiss.

Conclusions

Exploration on the Richardson River North Permit has progressed at a slower rate than the southern permit due to limiting physical factors in this area. The area is covered by thick sand overburden in excess of 60 metres thick and contains conductive horizons which mask any conductors present within the bedrock. Drilling in 1979 encountered a boulder horizon at the base of the overburden in which two strings of rods were lost prior to abandonment of the hole. This permit has no local water supply except for the Richardson River and seasonal bogs, one of which froze solid, suspending drilling and leading to abandonment of hole number 10.

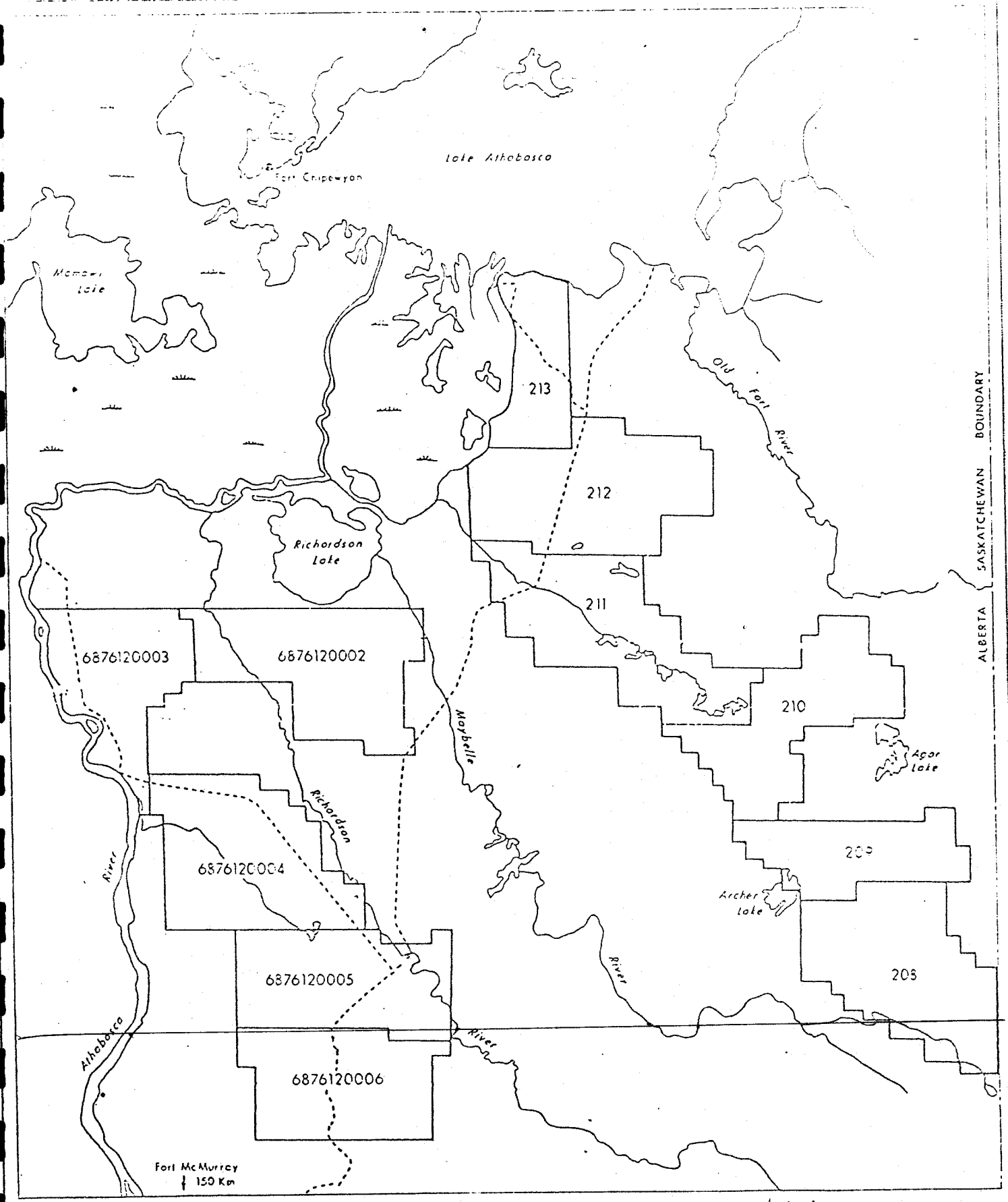
Results of the drilling to basement indicated a uniform thickness of the Athabasca Formation between the 1977 drill hole on the Maybelle River and Drill Hole number 11, 206 metres vs 209 metres. This would appear to indicate that the basin is structurally controlled and not pinching out to the west as previously conceived. Experience from the exploration work in Saskatchewan indicates that major structures of this type represent prime exploration targets. Southwest trending faults associated with the uranium deposits at Uranium City Saskatchewan, if projected along strike, should extend into this permit area.

The total expenditure during 1979 on the Richardson River North Permit was $116,569 or $2.40 per acre.

Recommendations for 1980

The primary objective for 1980 in the Richardson River North Permit is to locate major structural features which may be associated with uranium deposits. An audio frequency magnetic system designed to locate large weak conductive zones such as regional faults should be carried out over this area. An aeromagnetic study to delineate magnetic structures and determine the depth to magnetic basement should be carried out. In addition one or two stratigraphic drill holes should be completed along the Richardson Fault. Follow-up diamond drilling will be required to test favourable structures outlined by the AF MAG survey.

AF MAG Survey	
950 line kilometres @ $32/kilometre	$ 30,400
Aeromagnetic study	$ 5,000
Stratigraphic Diamond Drilling 500 metres @ $130/metre	$ 65,000
Follow-up drilling on favourable structures outlined by the AF MAG survey	
2,000 metres @ $130/metre	$260,000
	$365,400



Map #1A

NORTH-EASTERN ALBERTA

1977 NORCEN JOINT VENTURE LAND HOLDING

0 5 10 15 Km
0 5 10 Miles
SCALE 1:500,000

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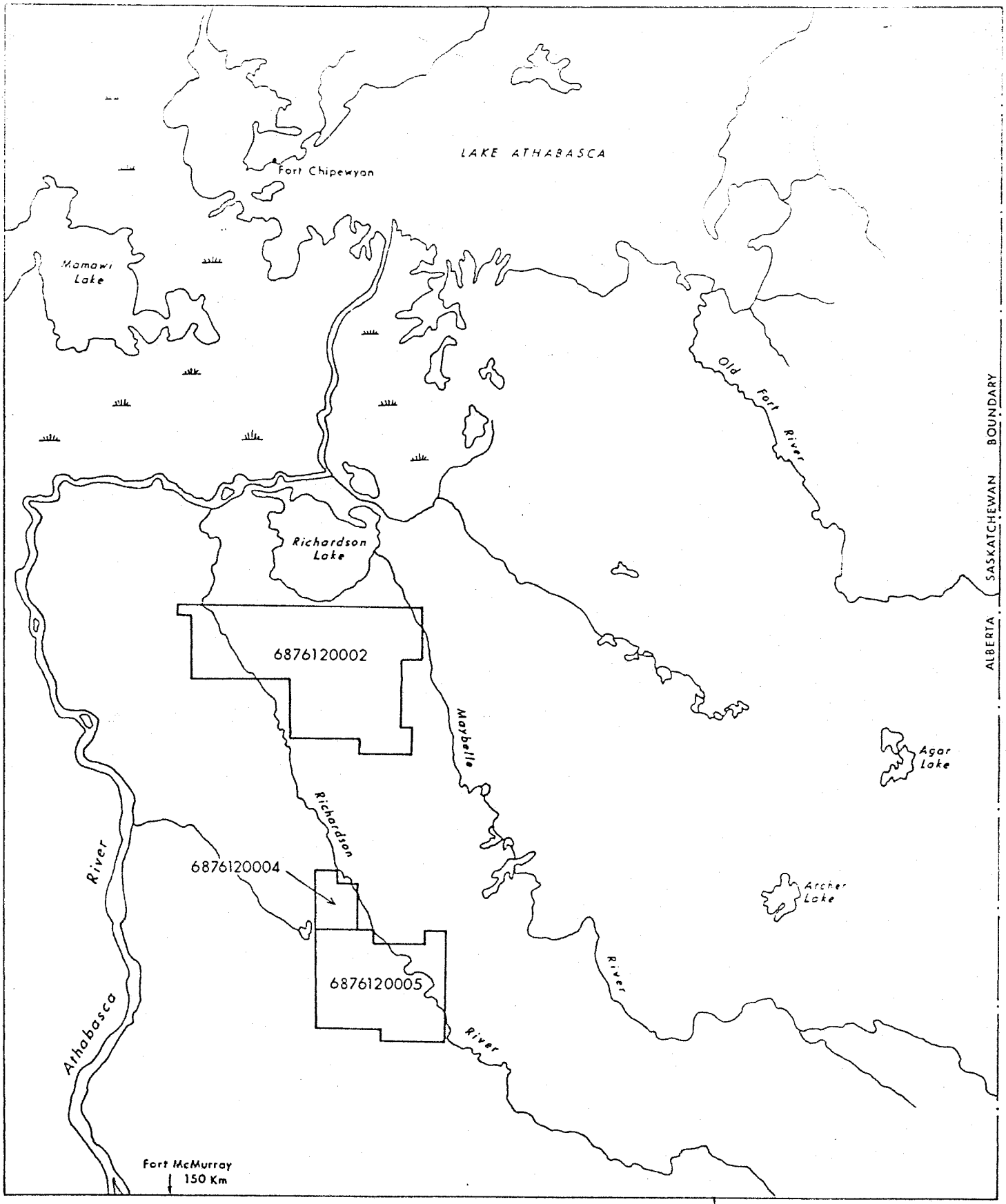

Map# 1B

FIGURE 6

NORTH-EASTERN ALBERTA

1979 NORCEN JOINT VENTURE LAND HOLDING

0 5 10 15 Km

0 5 10 Miles

SCALE 1:[illegible]

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Table 1 NORCEN LAND HOLDINGS

Permit Number	1976	1977	1978	1979
208	49,920	49,920	--	--
209	29,440	29,440	--	--
210	49,920	49,920	--	--
211	49,920	49,920	--	--
212	49,918	--	--	--
213	26,954	--	--	--
6876120002		48,640	48,640	48,640
6876120003		39,488	--	--
6876120004		49,920	3,200	3,200
6876120005		49,920	24,960	24,960
6876120006		39,667	--	--
	256,072	406,835	76,800	76,800

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Table 2

SUMMARY OF EXPENDITURES

Permit Number	Total Expenditure (not including land rentals) 1976	1977	1978	1979	Total
208	36,663	27,011	--	--	63,674
209	21,621	3,503	--	--	25,124
210	36,663	24,176	--	--	60,839
211	36,663	32,348	--	--	69,011
212	36,661	--	--	--	36,661
213	19,796	--	--	--	19,796
6876120002	--	28,960	14,091	116,569	159,620
6876120003	--	8,926	--	--	8,926
6876120004	--	10,884.22	927.28	17,938.50	29,749
6876120005	--	6,193	7,231	203,528	216,952
6876120006	--	6,887	--	--	6,887
	$188,067	$148,888	$22,249	$338,035	$697,239

Total expenditure on Quartz Mineral Permits $697,239.00
Total expenditure per acre presently held in Alberta $ 9.08

Richardson River North Permit #6876120002

Total expenditure $159,620.00
Expenditure per acre $ 3.28

Richardson River South Permit #6876120004

Total expenditure $29,749.00
Expenditure per acre $ 9.30

Richardson River South Permit #6876120005

Total expenditure $216,952.00
Expenditure per acre $ 8.69

Richardson River North and South Permits

Total expenditure $406,321.00
Expenditure per acre $ 5.29

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