

MAR 19660007: WILDMERE

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ECONOMIC MINERALS

FILE REPORT No.

~~POT-AF-002(3)~~

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POT-AF-004(3)

WILDMERE POTASH PROSPECT

Report of Foster Irwin

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ECONOMIC MINERALS

FILE REPORT No.

POT-AF-003(3)

POT-AF-003(3)

POT-AF-004(3)

REPORT ON

WILDMERE PROSPECT

OF

BAYFIELD OIL & GAS LTD.

BY

J. FOSTER IRWIN ENGINEERING
& MANAGEMENT SERVICES LTD.

APRIL 18, 1966

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INDEXING Document No. 700715

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I CONCLUSIONS

- 1) The proposed well to be located at 6-32-48-5 W4M will be drilled primarily to test the potash possibilities of that area.
- 2) Excellent possibilities exist for the intersection of ore grade potash salts in the upper portion of the Elk Point Evaporites.
- 3) Only one hole, Vermillion Consolidated Oil No. 15, was drilled deep enough in this area to intersect the Elk Point Evaporites.
- 4) The salt section was not recognized as having any commercial importance at the time of drilling so that careful coring and logging were not carried out.
- 5) Consequently, the V.C.O. No. 15 intersection shows good possibilities for an ore grade potassium zone but this will have to be confirmed by further drilling.
- 6) It is also entirely possible that pay zones of oil and/or gas will be intersected by the proposed drill hole.
- 7) The presence of a nearby pipeline and feasibility of an immediate gas sale further enhances the value of this prospect.

II RECOMMENDATIONS

- 1) Initial test well as shown on the attached Location Plan (6-32-48-5 W4M), will test both the potash and petroleum and natural gas possibilities.
- 2) It will be necessary to closely assess the results of this initial hole before recommendations for further exploration or development can be made.

III POTASH

1) LAND POSITION

Bayfield has, as shown on the attached location plan, Potash Permit No. 2, Potash Permit No. 3, Potash Permit

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3) HISTORY OF POTASH PRODUCTION FROM THE ELK POINT BASIN

Potash mineralization was first observed in core from the Norcanol Radville No. 1 test drilled by Imperial Oil in 1943, and later the same year in Norcanol Omega No. 1. These findings were of mainly academic interest because they occurred at about 7,500 feet, making development economically impractical.

Of greater impact was discovery of potash at 3,466 feet in the Bata Petroleum Company's Verbata No. 2 test in 1946. Core from the test, drilled in west central Saskatchewan near Unity, graded 21.6 percent K₂O over an 11 foot interval.

In 1948 the Saskatchewan Government announced opening of lands in west central Saskatchewan for potash exploration. Bata took out the first prospecting permit in February, 1951. The company's holdings, near Unity, later were passed on to its successor, Western Potash Corporation Limited, which in 1955 became Continental Potash Corporation Limited.

Western tried a solution mining experiment in 1951, but was unsuccessful. In 1952, the company started sinking a shaft eight miles northwest of Unity.

Work continued intermittently until 1960 when workers broke into the Blairmore formation at 1,800 feet. Blairmore water quickly flooded the shaft to within 360 feet of the surface.

Potash Company of America arrived on the Saskatchewan scene in 1951. An area near Patience Lake was selected for extensive exploration, and in 1954 they announced an exploitation program and started sinking a shaft. Productive activity in the evaporate basin has continued to steadily increase from that date to the present.

So far, potash has not been explored in Alberta as it has been in Saskatchewan.

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4) GEOLOGY OF THE POTASH OCCURANCES

Prairie potash reserves occur in well defined beds and zones near the top of the Prairie Evaporite formation of the Middle Devonian Elk Point group.

The formation was deposited in the northwest trending Elk Point Basin, structurally open to the northwest and extending from the Great Slave Lake area in the north through north central Alberta and southeast across Saskatchewan into North Dakota and southwestern Manitoba.

The Elk Point group consists of (in ascending order) the Ashern formation, predominantly shaly; the Winnipegosis, consisting of dolomitic rocks with sporadic evaporite near the top; and the Prairie Evaporite, consisting of potash, salt and anhydrite.

The group is underlain by Paleozoic formations and overlain by the Second Red Bed of the Dawson Bay formation. The Second Red Bed, an argillaceous shaly layer, forms a clear horizon marker above the Evaporite.

The Prairie Evaporites attain a maximum thickness of about 700 feet. Potash mineralization is found only in the upper 300 feet of the sequence, where the minerals are grouped in three successive stratigraphic levels. They may be correlative across the basin. Occurrence is in lenticular masses of end salts which were precipitated at favoured localities, which means that there was sufficient bottom relief present in the regional basin to form a number of isolated sub-basins. Here salt rich waters collected, separated by sills which are now characterized by impoverished or absent mineralization.

Two main types of potash ore are found in the Prairie Evaporites--Sylvite, a crystalline mixture of Sylvite (KCl) and Halite (NaCl), and Carnallite, which consists of $KClMgCl_2 \times 6H_2O$ and halite.

The V.C.O. #15 and the proposed exploratory drilling are located in the eastern flank of the Elk Point Evaporitic Basin (Fig. 3) and are thus in similar position with respect to the basin at Unity, Saskatoon and Esterhazy. However, from a depositional standpoint the locations are found to be north of the restriction formed by the Meadow Lake Escarpment (Figs. 3 & 7). The restriction may have

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been instrumental in preventing flow of fresh brine into the Saskatchewan sub-basin, thus creating proper environment for the precipitation of potassium, but there is nothing to suggest that similar conditions did not exist in Alberta, due either to the effect of the Chipewan Lake sill (Fig. 3) or to other local conditions such as salt bars that may have permitted complete evaporation of the brine and deposition of potassium. In fact, the presence of carnallite and/or sylvite in the V.C.O. #15 well is a direct indication that conditions necessary for the precipitation of potash salts have prevailed in this area.

The summary of potassium occurrences in the V.C.O. #15 well can be outlined as follows:

<u>Interval</u>	<u>Thickness</u>	<u>Lithology</u>
3480 - 3531	51'	Potassium and salt.
3531 - 3621	90'	Salt with slight indications of potassium.
3621 - 3731	110'	Not cored.
3731 - 3806	75'	Potassium and salt.
3806 - 3903	97'	Salt, shale, dolomite
Total	423'	

Below 3903

Dolomite and shale

The summary shows that within the upper 326 feet of the Prairie Evaporites, at least a total of 126 feet showed potassium mineralization. Grades cannot be arrived at from the work done in the 1940's. The process of evaluating the potential ore horizons, including coring, logging and analyses has been inconclusive. Confirmation of the presence of sylvite in V.C.O. #15 has now been confirmed to verify the presence of favourable conditions for the deposition of potassium salts.

The extent and the economic importance of this potash section may be either wholly or partially answered by the proposed potash test in LSD 6-32-48-5W4, located about two miles southwest of the V.C.O. #15 well.

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5) ECONOMICS

Prices for potassium are as follows:

Bulk, carload, works, unit ton: \$0.32

Bagged, 60% min. K₂O same basis,
ton @ \$0.40 per unit: \$24.00

The commercial grade of the ore which is being extracted by conventional mining methods is in the 25 to 32 percent K₂O range. The grade to be extracted by solution mining methods may be somewhat less.

On bulk ore averaging 25% K₂O content the price will be \$7.50 per ton. About a three to one concentration will bring the price to forty cents per unit per ton or to a value of \$24.00 for 60% minimum K₂O content.

Based on a 1,000,000 ton per year milling operation, the pay-out on \$47 million expenditure for shaft, plant and surface installations is about two years or a maximum of three years considering other possible expenses.

The reserves in the farmout lands can be expected to be upward of 100,000,000 tons and the returns on potash are unquestionably rewarding when one considers that the pay-out even on heavy investments is relatively low. The life of a mine can be expected to be no less than twenty years and the demand for potash is increasing by the year.

IV PETROLEUM AND NATURAL GAS

1) GEOLOGICAL SETTING

There have been sufficient wells drilled in this area to give a clear picture of the geological sequence to be expected:

a) THE VIKING SAND:

The Viking sand is not developed in this area and therefore offers a poor reservoir possibility.

b) THE MANVILLE GROUP:

The Manville group is composed of sand and shale.

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This horizon presents a potential of heavy gravity petroleum and natural gas devoid of sulphides. In the Wildmere gas field, production is obtained from three different sands.

The most extensive and uppermost of the three is the Colony sand (see Structural Plan). This is the sand that produces gas in Sec. 29, Twp. 48, 5W4 and is expected to be productive in the proposed location.

The second, the Sparky sand, equivalent to the Wainwright sand, is found 150 feet below the top of Manville. It is not of great extent but does produce in two or three holes in the area of the test well.

The Lower sand, possibly the Rex or G.P. sand equivalent, is found about 300 feet below the top of Manville and is developed more extensively than the Sparky.

In the Manville group, besides the above-mentioned three sands, numerous other sands exist within the section where pinch out may cause possible accumulation oil and/or gas (see Cross-section).

c) THE UPPER DEVONIAN SECTION:

The Manville group rests unconformably upon the Upper Devonian Woodbend sequence. The Woodbend (Leduc Equivalent), is about 450 feet thick and consists, essentially of grey to buff, vuggy dolomite. Due to lack of suitable depositional conditions, only salt water has been recovered in this interval.

The Cooking Lake, which underlies the Woodbend, is about 214 feet thick and is composed of argillaceous buff to grey, finely crystalline limestone. The Beaverhill Lake below it, about 710 to 790 feet thick, is composed of an alternating sequence of buff argillaceous finely crystalline limestone with grey to green calcareous shale. Both sections appear to have poor porosity and poor reservoir characteristics.

d) MIDDLE DEVONIAN

The Beaverhill Lake formation is underlain by the Elk

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Point Evaporites equivalent to the Prairie Evaporites of Saskatchewan. This series of evaporites was described in detail under the potassium section of this report.

Below the salt section lies the Elk Point carbonate, composed of 242 feet of cream to tan dolomite. Since hole location is near the eastern margin of this unit, it may be reasonable to expect a possible patch reef intersection. If reef is encountered, the intersection could be equivalent to Rainbow Lake discoveries.

Therefore from the hydrocarbon standpoint, the location has two potential horizons to investigate, the sands of the Manville group and possible reefing in the Elk Point.

2) STRUCTURAL SETTING

The structure map drawn on top of the Manville and/or Colony sand shows topographic highs flanked by narrow erosional drainage channels. The channels and highs run in a northeast-southwest direction. Since the accumulation in most pools is due to a combination of structural and stratigraphic conditions, the interpretation of this pattern has a direct bearing on oil and gas exploration in the area. Because the pools are primarily located on highs, the proposed well is located on a possible high which directly offsets the gas production found in Section 29 by one mile. (See Structural Map and Cross-section.)

3) COSTS

Total cost for a Manville sand gas well with dehydrating equipment would be approximately \$52,500. Cost for an oil well in the same horizon would be approximately \$58,500. If production is obtained from the Elk Point, the completion cost would be higher because of the longer string of casing and tubing required.

4) RESERVES

From the Manville sand, the recoverable gas reserve would be 2,560,000 Mcf assuming a pay zone twenty feet by 640 acres. At seven cents per Mcf the net value of the gas would be \$179,200. A Manville sand oil producer would offer reserves of 320,000 barrels assuming recovery at 400 barrels per acre foot from a ten foot pay zone and a spacing of 80

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acres. This would give a net value of \$342,800. at \$1.04 per barrel.

5) WELL PROGNOSIS

Location: 6-32-48-5 W4M

Objective horizons: Elk Point Potash and Reef
Manville Group

Deepest formation to be penetrated: 50 feet into the
Elk Point Reef

Drilling depth: 4133 feet

Elevations: K.B. : 2150 (est.)

Ground: 2138 (est.)

Assuming a K.B. elevation of 2150 feet the following formations are predicted to occur as follows:

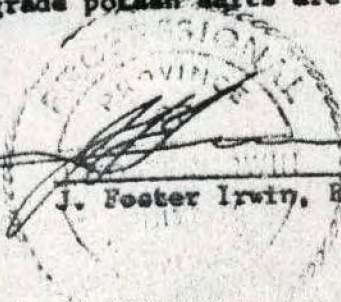
<u>Formations</u>	<u>Sub-Sea Depth</u>	<u>Drilling Depth</u>
2nd White Specks	+646	1504
Viking	+500	1650
Manville-Colony	+350	1800
Sparky	+210	1940
Lower Sand	+70	2080
Woodbend	-62	2212
Cooking Lake	-510	2660
Beaverhill Lake	-724	2874
Elk Point Evaporites	-1511	3661
Elk Point Carbonate(Reef)	-1933	4083
T.D.	-1983	4133

RECOMMENDATIONS

It is recommended that an initial test well, as shown on the attached Location Plan (6-32-48-5 W4M) be drilled to investigate the probable economic horizons for both potash and petroleum, as well as natural gas possibilities.

A careful and reliable assessment of results from the initial hole will be required before recommendations for further exploration or development can be advanced.

The proposed well is considered to represent a reasonable "prospect" with above average potential. The possibility of intersecting ore grade potash salts are believed to be attractive.



 J. Foster Irwin, B.Sc., P.Eng.


/mo

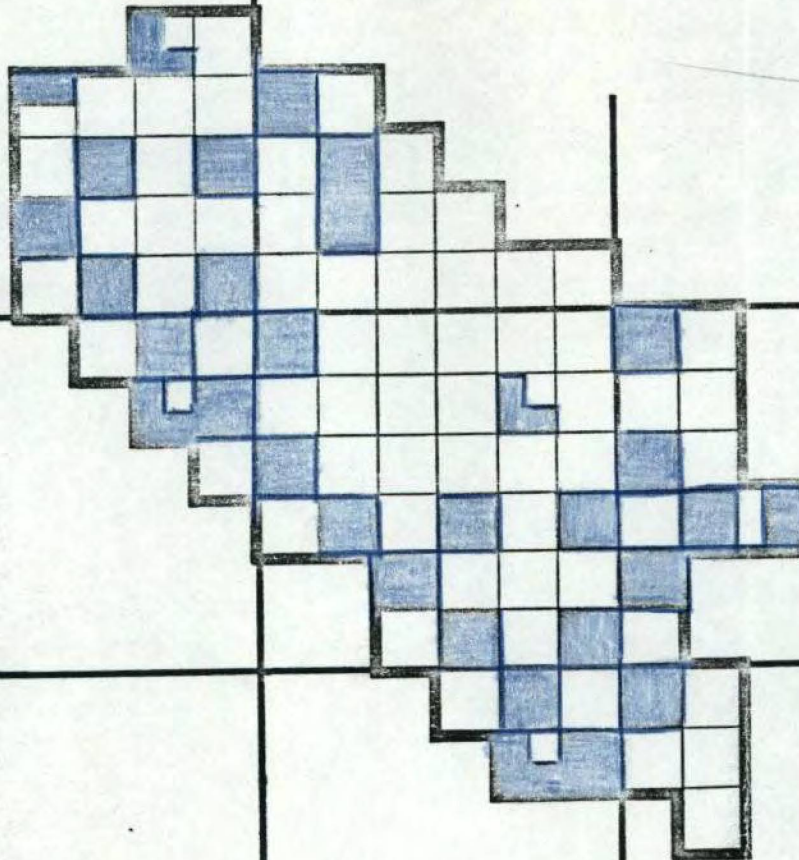
SCALE
0 1 2 3
MILES

POTASH PROSPECTING PERMIT No. 2 73E/247

BAYFIELD OIL & GAS LTD.,
% JOHNSON and SADDY, BARRISTERS
and SOLICITORS,
606, TORONTO - DOMINION BANK BLDG.,
EDMONTON, ALBERTA

DATE OF ISSUE - OCTOBER 13, 1965
AREA - 41,231 ACRES

 - NOT IN PERMIT



TP. 49

TP. 48

TP. 47

R. 6

R. 5

R. 4 W. 4 M.

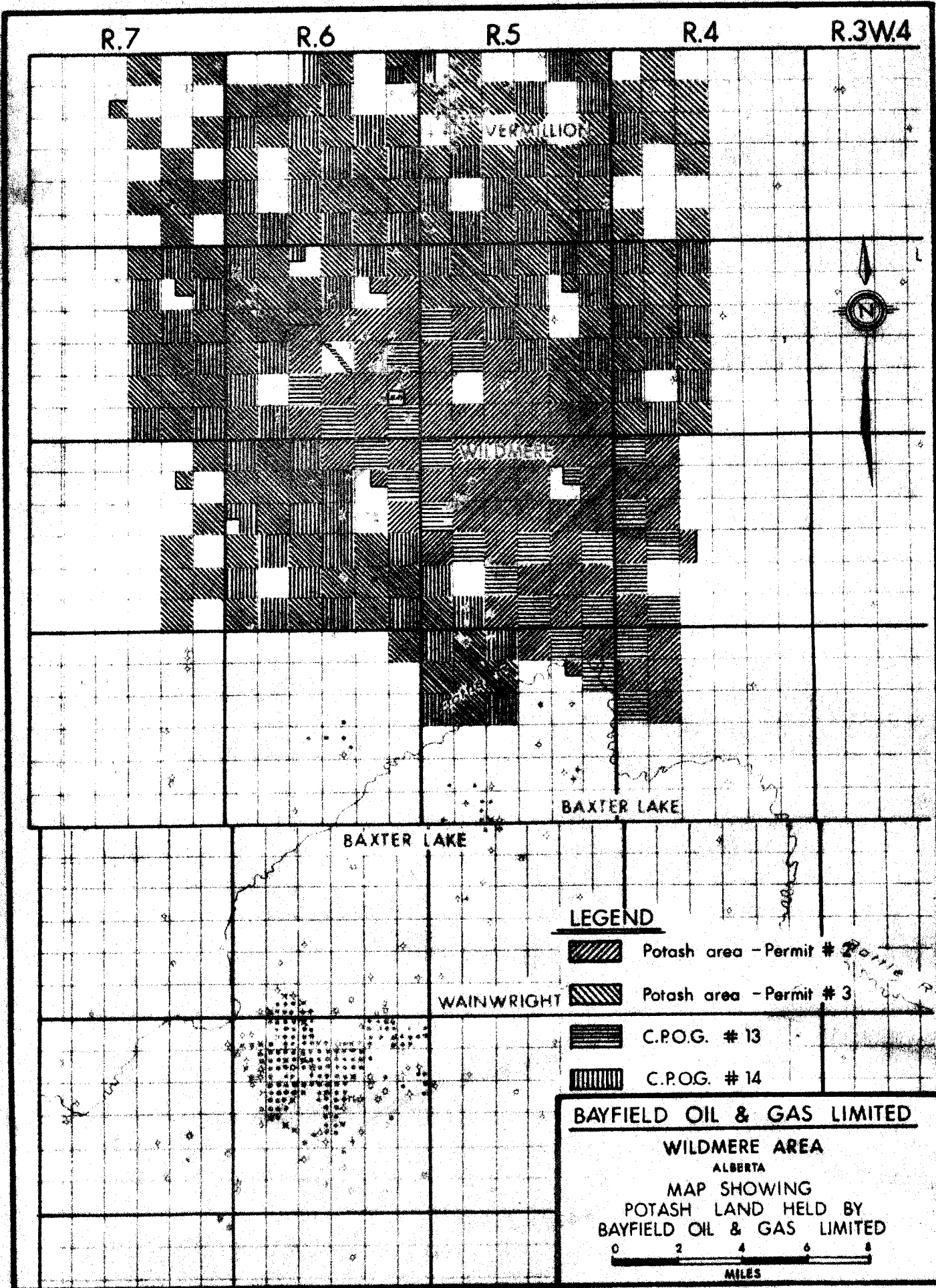


Figure 1 19660007

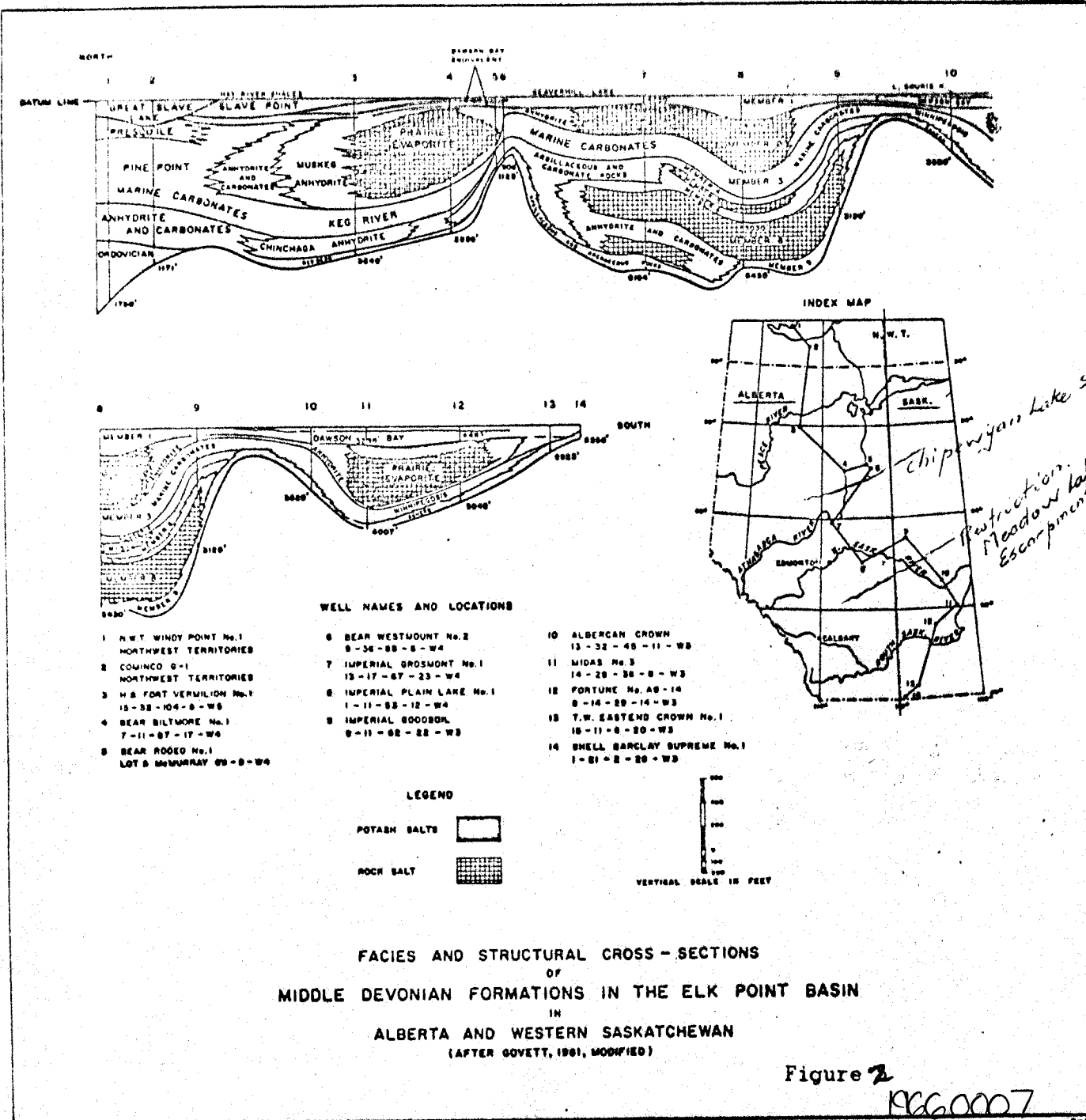
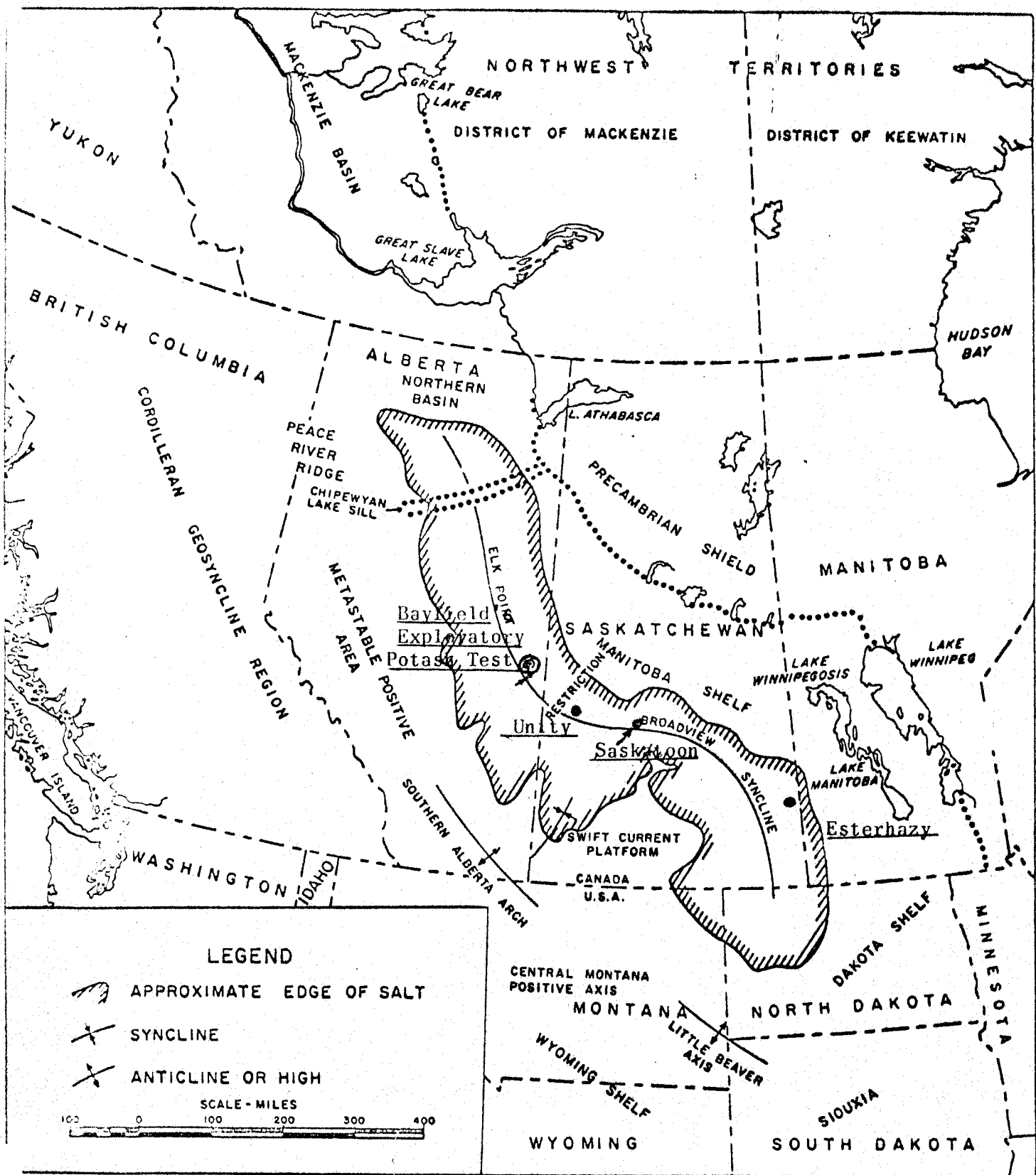
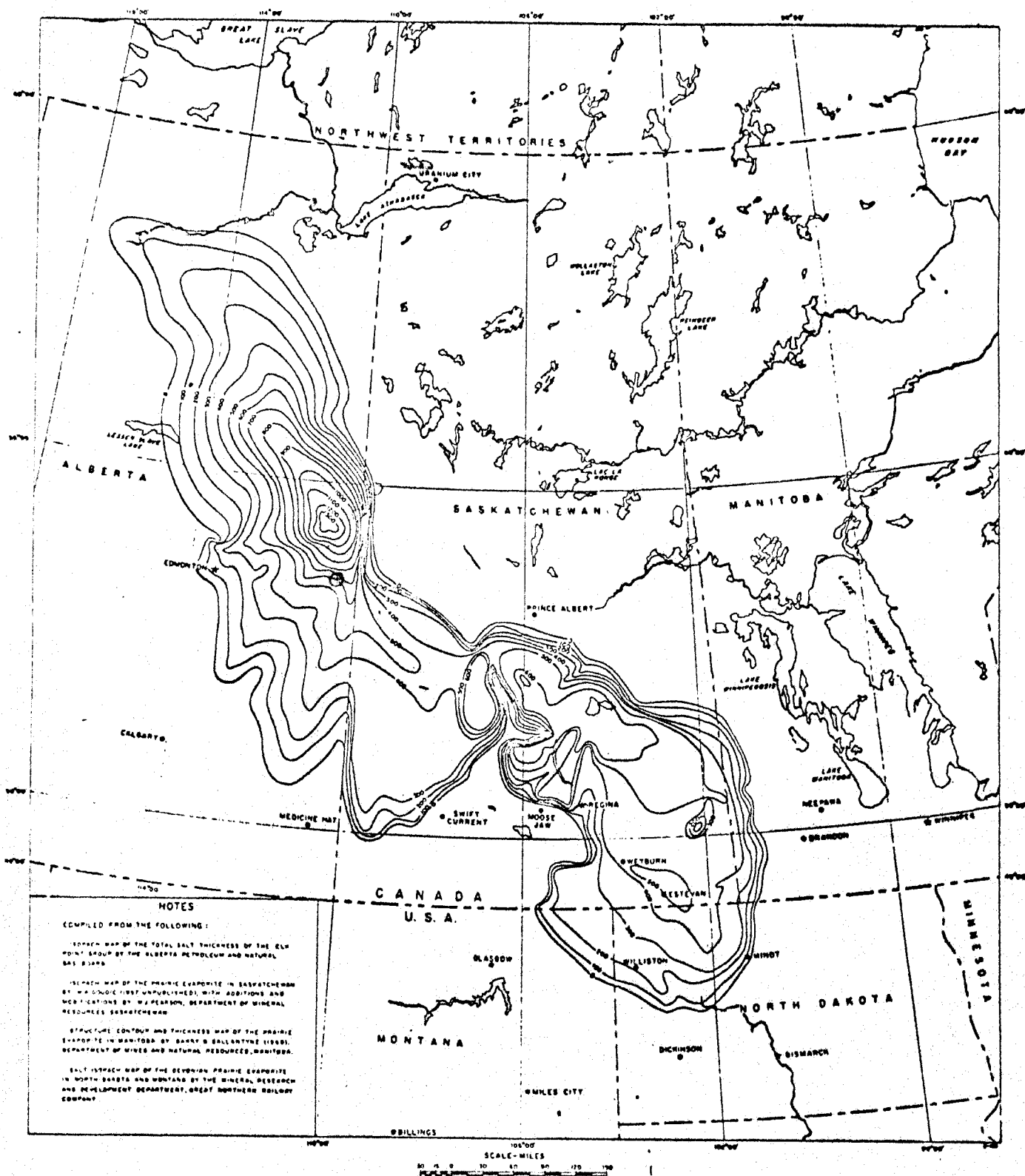


Figure 2
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THE ELK POINT SALT BASIN AND RELATED TECTONIC ELEMENTS

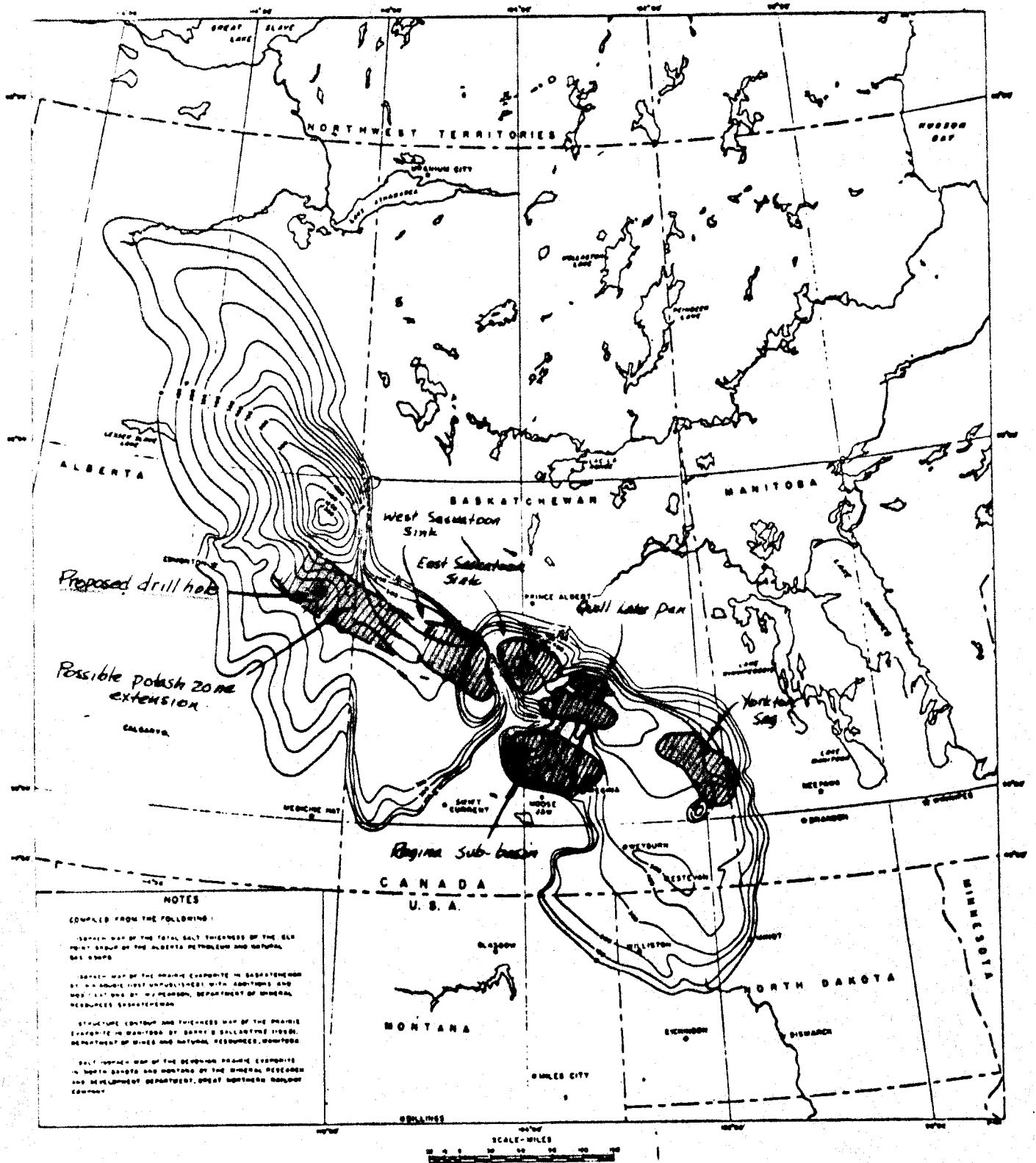
Figure 3 19660007



ISOPACH MAP SHOWING THE TOTAL THICKNESS OF THE SALT IN THE ELK POINT GROUP.

Figure 4

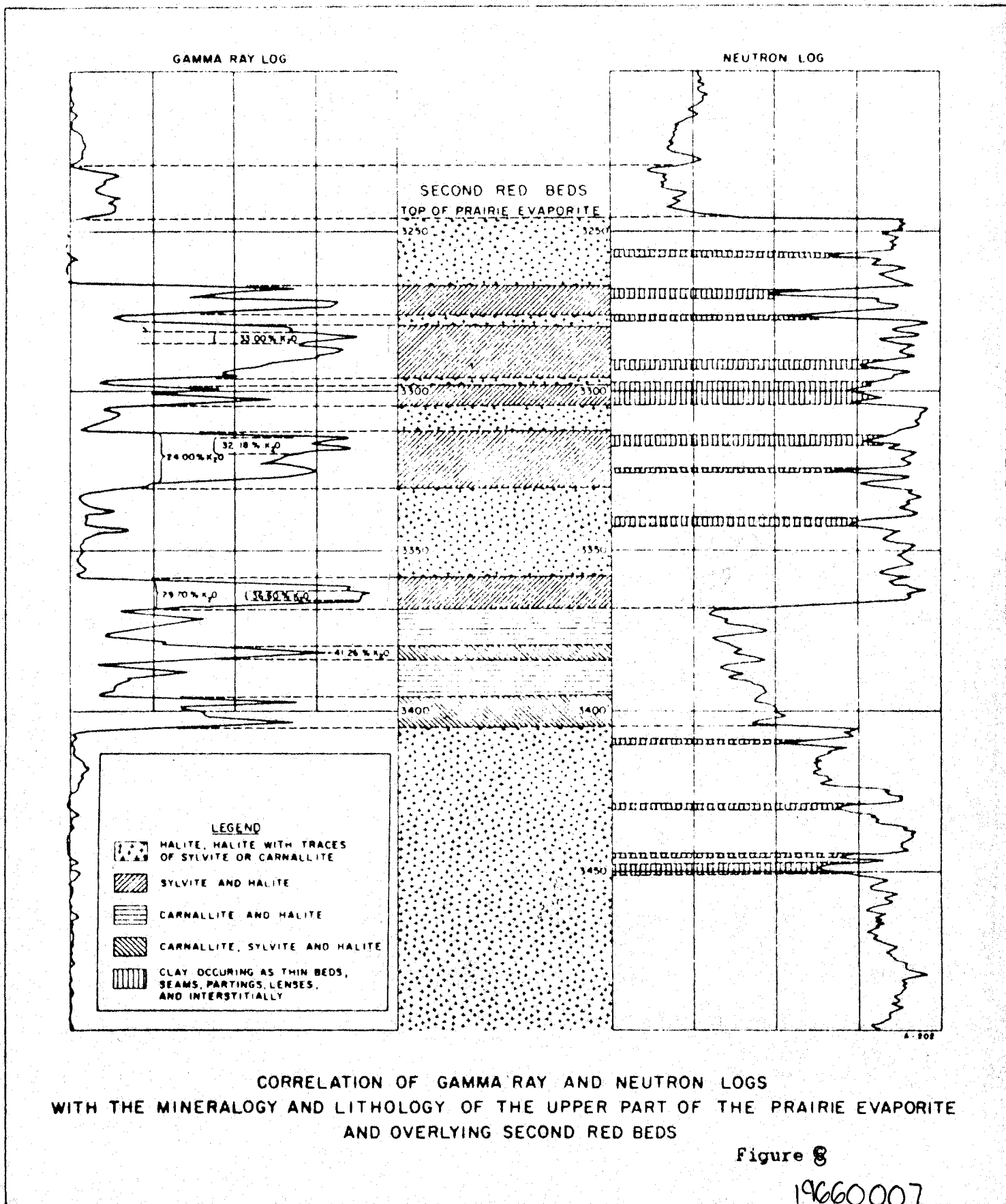
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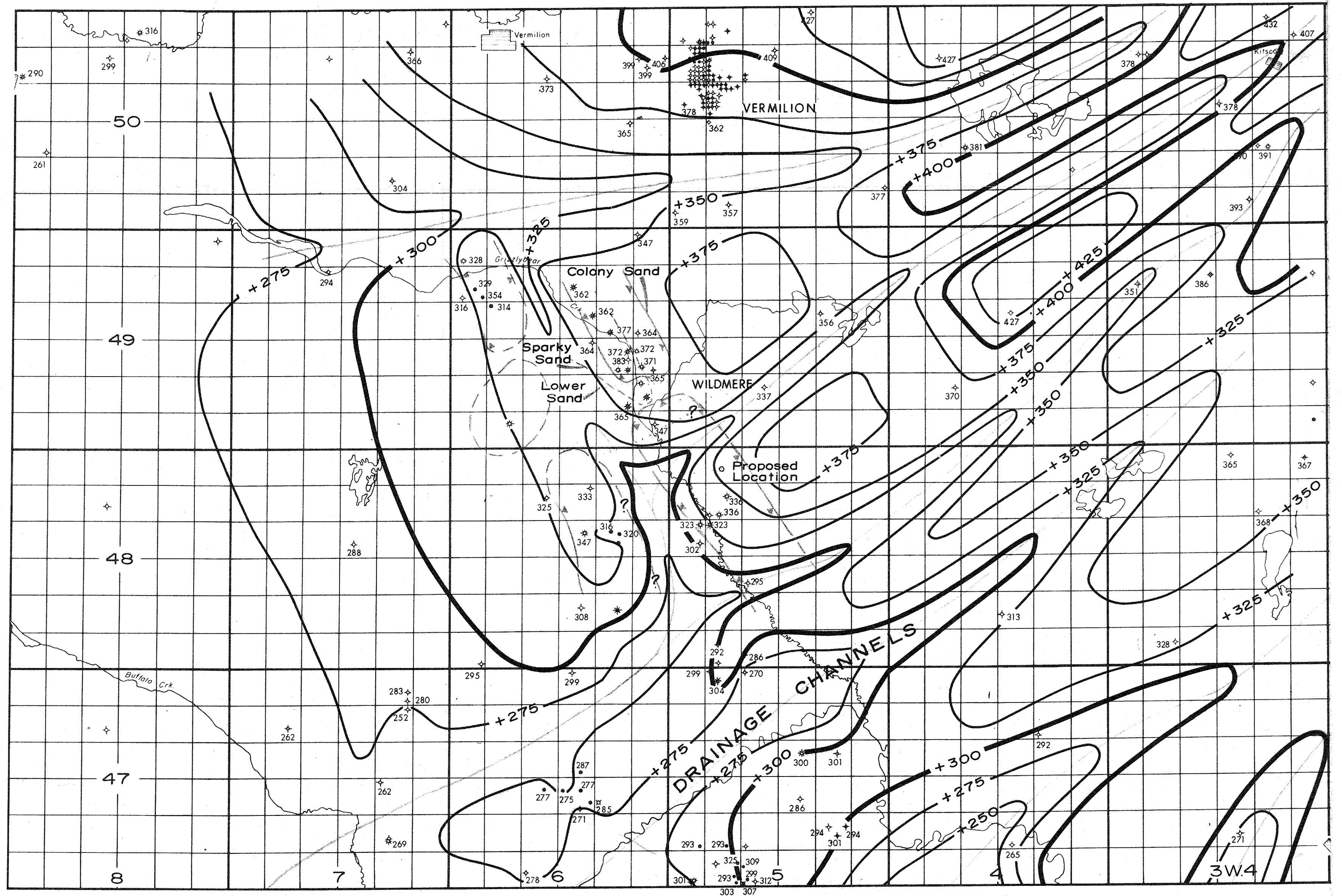


OCCURRENCES OF POTASH IN THE PRAIRIE EVAPORITE BASIN

Figure 5

19660007





- LEGEND**
- COLONY SAND
 - - - SPARKY SAND
 - LOWER SAND (REX ?)

BAYFIELD OIL & GAS LTD.
 WILDMERE AREA
 STRUCTURE TOP OF MANVILLE
 CONTOUR INTERVAL: 25' SCALE: 1" = 2 MILES

Figure G 19260007

A

WILDMERE	
Location of Well	COMPANY, FRANCO PUBLIC SERVICE
38 130 2	SERVICE
314 149 36 W4	WELL, V.C.C. #20
	FIELD, VERMILION, W.C.
	LOCATION, 10-29-48-SW4
	COUNTY, ALBERTA
	STATE, ALBERTA
	FILE NO.

Halliburton	
WELL LOG	
Location of Well	COMPANY, MARWAYNE OIL LTD.
Lsd 10	WELL, MARWAYNE V.C.C. #5
SEC 1	FIELD, VERMILION
TWP 49	LOCATION, 10-1-49-SW4
RGE 6 W4	COUNTY, ALBERTA
	STATE, CANADA
	FILE NO.

SCHEDULE	
Location of Well	COMPANY, AMALTA OIL LTD.
Lsd 10	WELL, AMALTA V.C.C. # 6
SEC 29	FIELD, WILDMERE
TWP 48	LOCATION, 10-29-48-SW4
RGE 5 W4	COUNTY, ALBERTA
	STATE, CANADA
	FILE NO.

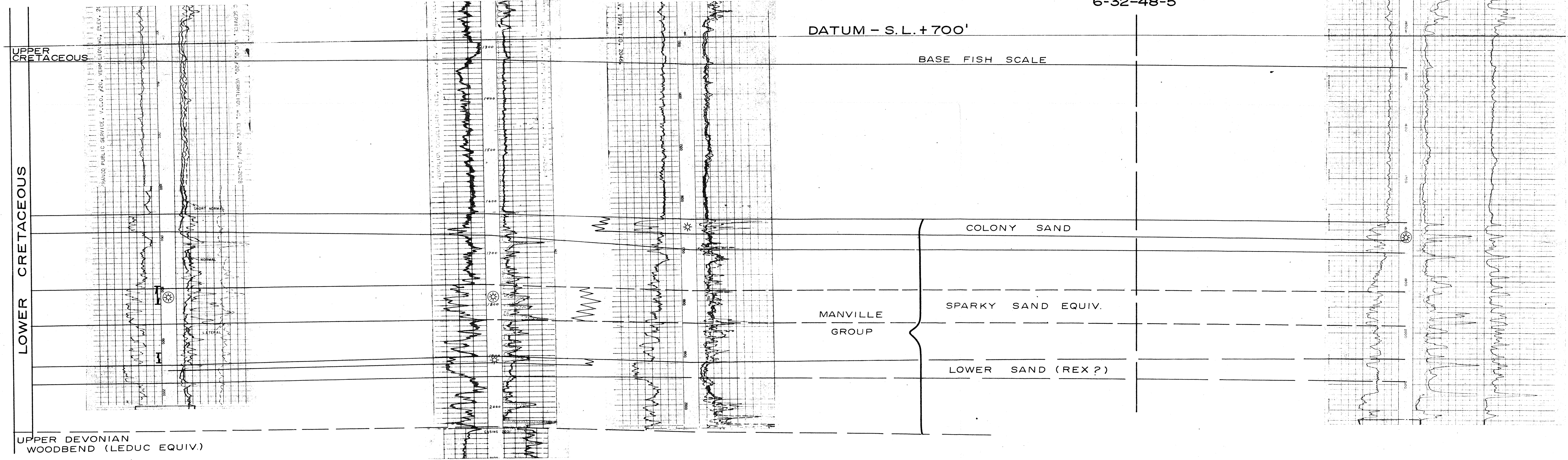
SCHEDULE	
Location of Well	COMPANY, AMALTA OIL LTD.
Lsd 10	WELL, AMALTA V.C.C. # 6
SEC 29	FIELD, WILDMERE
TWP 48	LOCATION, 10-29-48-SW4
RGE 5 W4	COUNTY, ALBERTA
	STATE, CANADA
	FILE NO.

B

NORTHWEST

SOUTHEAST

PROPOSED LOCATION
6-32-48-5

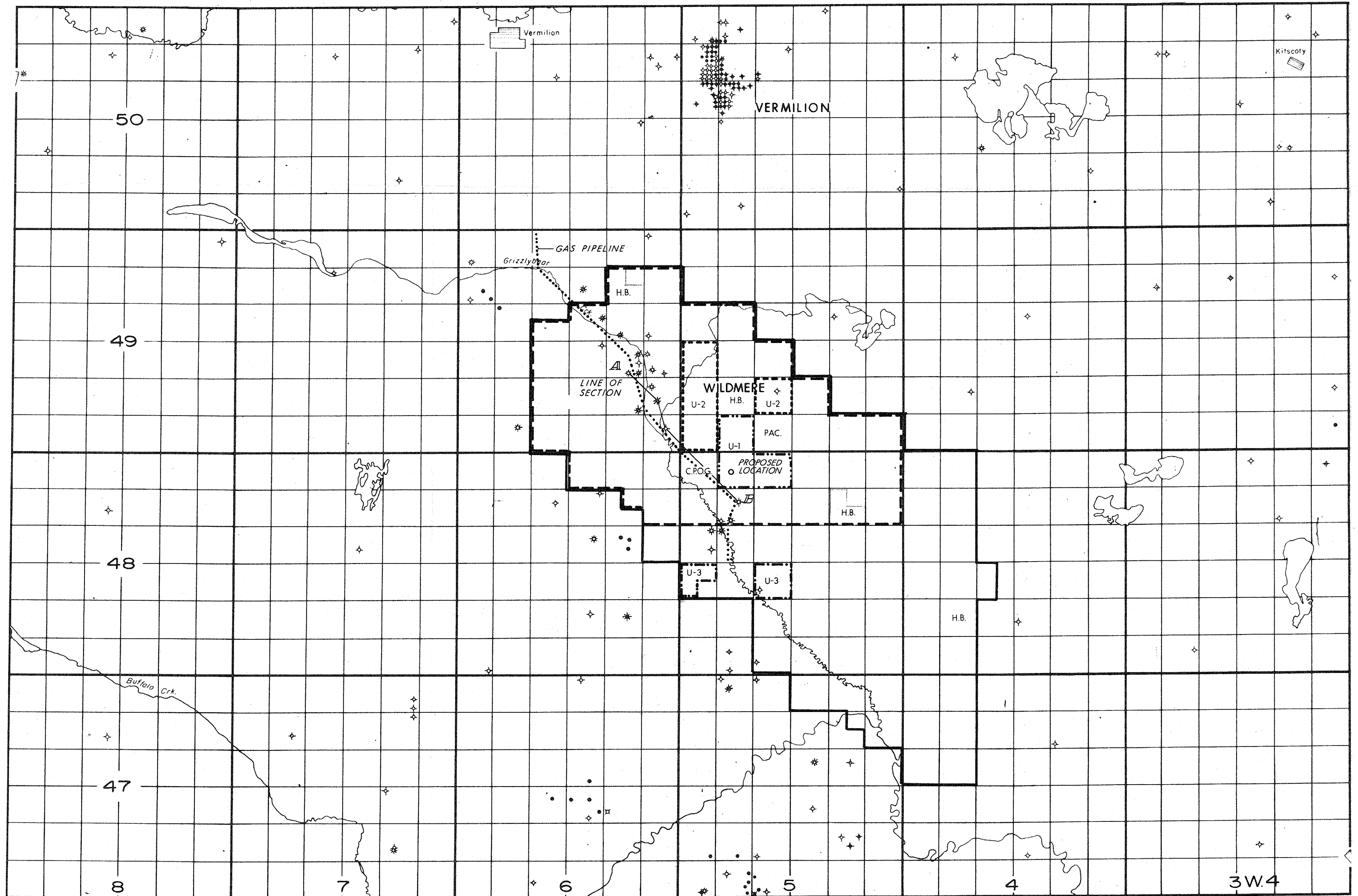


- ⊛ PRODUCING GAS ZONE
- * POSSIBLE GAS ZONE



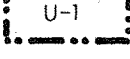
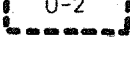
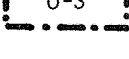
BAYFIELD OIL & GAS LTD.
 WILDMERE AREA
 STRUCTURAL CROSS SECTION A-B

HORIZONTAL SCALE: 5" = 1 MILE.
 VERTICAL SCALE: 1" = 100 FEET.

Figure 7 PG00007



LEGEND

-  POTASH AREA - PERMIT 2
-  EARNED POTASH AREA
-  U-1 P.&N.G. LEASE
-  U-2 P.&N.G. LEASE
-  U-3 P.&N.G. LEASE

BAYFIELD OIL & GAS LTD.
 WILDMERE AREA
 LAND MAP

SCALE: 1" = 2 MILES