

# MAR 19680112: NORTHERN ALBERTA

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SCHEDULE  
to Sulphur Prospecting Permit No. 143 19680112

IN TOWNSHIP ONE HUNDRED AND THIRTEEN (113), RANGE THREE (3),  
WEST OF THE FIFTH (5) MERIDIAN:

Sections Nineteen (19) and Twenty (20) and  
Sections Twenty-nine (29) to Thirty-two (32)  
inclusive;

AND

IN TOWNSHIP ONE HUNDRED AND FOURTEEN (114), RANGE THREE (3),  
WEST OF THE FIFTH (5) MERIDIAN:

Sections Five (5) to Eight (8) inclusive;

AND

IN TOWNSHIP ONE HUNDRED AND THIRTEEN (113), RANGE FOUR (4),  
WEST OF THE FIFTH (5) MERIDIAN:

Section One (1), Sections Nine (9) to Six-  
teen (16) inclusive, Sections Twenty-one  
(21) to Twenty-eight (28) inclusive and Sec-  
tions Thirty-three (33) to Thirty-six (36)  
inclusive;

containing an area of Nineteen Thousand, Eight Hundred and  
Forty (19,840) acres, more or less.

845/15+16  
NE

THIS REPORT HAS BEEN PREPARED  
FOR THE EXCLUSIVE USE OF:

Harold P. Killoran

COPY NO:.....2.....

19680112

ECONOMIC MINERALS  
FILE REPORT No.  
S-AF-131(1)  
S-AF-143(1)

PHOTOGEOLOGICAL STUDY  
SULPHUR PROSPECTING PERMITS NOS. 131 AND 143  
NORTHERN ALBERTA

Prepared For  
Harold P. Killoran  
September, 1968

J. C. SPROULE AND ASSOCIATES LTD.  
OIL AND GAS ENGINEERING AND GEOLOGICAL CONSULTANTS

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PHOTOGEOLOGICAL STUDY

SULPHUR PROSPECTING PERMITS NOS. 131 AND 143

NORTHERN ALBERTA

INTRODUCTION

This report has been prepared at the request of Mr. Harold P. Killoran, hereinafter referred to as the "Company." The request made was for a photo-geological analysis of the Company's Sulphur Prospecting Permits Nos. 131 and 143, integrated with other available geological information. A map of north-central Alberta, Figure 1, shows the general geological setting of the Company Permits and their relationship to other sulphur permits in the area. Figure 2 represents the results of this preliminary study on a photogeological mosaic.

The immediate objective of this photogeological study was to identify from the study of aerial photographs those areas that, from our present knowledge, would be the most favourable for the occurrence of sulphur. Such areas could then be examined in the field to determine the presence or absence of sulphur.

Sulphur Prospecting Permits Nos. 131 and 143 total approximately 39,680 acres; 19,840 acres per Permit.

BEDROCK GEOLOGY AND TOPOGRAPHY

Sulphur Prospecting Permits Nos. 131 and 143 are located approximately 60 miles northeast of Fort Vermilion, about 20 miles north of the Peace River. In these Permit areas, the bedrock consists of Cretaceous shales and sandstones. The Cretaceous-Devonian boundary runs in a southwest-northeast direction between the Caribou Mountains and the Peace River, approximately through Sulphur Prospecting Permit No. 8, the discovery Permit (see Figure 1). The subject Permits are four or five miles northwest of this geological boundary.

The Company Permits include a portion of the Caribou Mountains. Topography in the area is quite varied and ranges from gently rolling to hilly. The minimum elevation is around 1,200 feet in the southern portion of Sulphur Prospecting Permit No. 131. The ground surface rises to the northwest until elevations in excess of 3,000 feet are reached in the western portion of Permit No. 131.

MODE OF OCCURRENCE AND RELATIONSHIP OF SULPHUR TO GENERAL GEOLOGY

Within the general area of interest in which sulphur prospecting permits have been issued (Figure 1), the principal bedrock formations are of Cretaceous age, but, to the north and northeast, erosion has stripped off the Cretaceous beds exposing older Devonian rocks. The Devonian, as well as overlying Cretaceous rocks, are generally inclined gently westward into the Alberta Syncline so that progressively younger rocks of both Paleozoic and Mesozoic ages are present in that direction.

The bedrock, whether of Devonian or Cretaceous age, is overlain by a variable thickness of glacial and related sediments. The thickness of these overlying sediments is generally at a minimum in those areas where river valleys are deeply incised and greatest in the hilly portions of the area.

The surficial geology of the area is of particular interest to the subject of possible economic occurrences of sulphur because of the probability that any economic deposits in this area are in surficial deposits.

The last glacier to cover the subject area was of Wisconsin age. Dating by 'carbon 14' method indicates that this advancement over the region occurred over 31,000 years ago. Ice flow features on the Glacial Map of Canada indicate that this glacier came from an area west of Hudson Bay. The thickness of the glacier is estimated to have been approximately 5,000 feet and the average direction of flow in the subject area was to the west-southwest.

The general absence of terminal moraines and other ice marginal features indicates that the retreat of the glacier was mainly by rapid stagnation. Dead-ice moraine forms the surface or underlies lacustrine deposits over much of the regional area.



As the glacier retreated, the lowland to the north was blocked by ice and meltwaters and could not drain freely. Extensive proglacial and superglacial lakes were formed, resulting in the deposition of glacio-lacustrine deposits that vary in thickness from a few inches to fifty feet or more.

It is, at this time, not clear as to what extent the sulphur is developed in surficial deposits and to what extent it may be present within the stratified deposits of the Cretaceous and/or Devonian, but both modes of occurrence may exist. The most likely commercial deposits are, however, probably surficial.

Sulphur occurrences in the general region may be broken into three groups, as follows:

- (1) In muskeg or other poorly drained lacustrine or "dried lacustrine" areas. The most important known apparent example of this type is the Sulphur Prospecting Permit No. 8 discovery occurrence.
- (2) Deposits of elemental sulphur in connection with active springs with or without associated gas. One such known occurrence involved gas, which was, at least in part, combustible.
- (3) Cretaceous shales in the area frequently contain finely disseminated sulphur. Although we know of no reported concentrations of significant size from the Cretaceous, the possibility of such economic occurrences cannot be entirely eliminated.

In many parts of the general area, burnt shales have also been reported. These usually appear to be associated with recent slumps, possibly because the slumping brings the combustible material, which may include sulphur, in contact

with the surface. The origin of the combustion is, at this time, purely conjectural, but lightning produced forest fires are the most likely cause.

We are not prepared at this time to enter into detailed discussions of theories of origin because of the large number of presently uncertain factors in this new area. Studies in the area are, however, likely to yield substantial information over the coming field season. Meanwhile, theories of origin from Paleozoic connate waters or from bedded Devonian and other gypsum and anhydrite deposits are of principal interest.

The manner of occurrence of sulphur deposits will determine whether they can be mined at the surface by stripping or from deeper strata by the Frasch process.

Solution of many of the questions of origin and occurrence is of prime economic importance and should be given very detailed attention as the present permit areas are evaluated.

Meanwhile, it is of general interest to the overall sulphur problem in this region that continuous flowing sulphur springs have been known in the area for nearly 200 years and that such springs are still known along a broad area along the Mesozoic-Paleozoic surface geological contact that extends from Western Saskatchewan, through the McMurray oil sands area, and across the present region of sulphur permits into the southern part of the Northwest Territories near Pine Point and westward along the Liard River. It is of further possible significance that there appears to be a genetic relationship between these sulphur occurrences and the McMurray oil, which has a four to five percent sulphur content. In addition to this, there is considerable free sulphur associated with the McMurray oil sands, both within and outside of the oil saturated area. As a measure of the amount of sulphur already known to have been deposited, probably

from the same type of connate waters that can be expected to have deposited the sulphur under study, we might refer to the "reserve" of the sulphur in the McMurray oil sands. Most recent estimates indicate that there is over 600 billion barrels of oil-in-place in the McMurray oil sands. This oil contains four to five percent of sulphur weighing approximately eight to ten billion long tons.

The above and other evidence available would indicate that what is needed to produce an economic sulphur deposit in this area is a favourable combination of faults and fractures for sulphate spring exits, sulphur supply in the connate waters and poorly drained lacustrine or other flat basin areas immediately adjacent to the spring exits. All these individual circumstances are known to exist. Under the proper combination of circumstances, there is no definite limit to the amount of sulphur that could be formed. Whether or not, or where, commercial deposits are present remains to be seen.

PHOTOGEOLOGICAL STUDY

WITH RECOMMENDATIONS FOR FIELD EVALUATION

Bedrock is believed to be in close proximity to the surface here as evidenced by the large number of faults or fractures interpreted from the aerial photographs. The bedrock underlying the study area is believed to consist of Cretaceous sediments that thin to the southeast toward the Cretaceous-Devonian contact (Figure 1). The decreasing thickness of Cretaceous in this direction results mainly from truncation of beds by the erosional topographic slope of the Caribou Mountains.

The Permits are drained by Clements Creek and a number of other small tributary streams that flow southeastward into the Wentzel River. The course of the Wentzel River is to the southwestward.

Several local areas of depression or flattening occur within the Company Permits which serve to restrict drainage and currently contain alluvium and/or muskeg. These features are outlined on the accompanying mosaic as areas of interest and should be investigated in the field. Of particular interest are those areas in the southeastern portions of the Permits where Cretaceous deposits overlying Devonian are the thinnest. These are designated as 'Area 1' to 'Area 8' inclusive, and are recommended for initial field examination. The remaining areas, 'Area 9' to 'Area 12' inclusive, are listed in order of importance and should be checked on the ground.

CONCLUSIONS AND RECOMMENDATIONS


From our overall sulphur studies in the general area, we conclude that the most likely sources of commercial sulphur are surficial deposits.

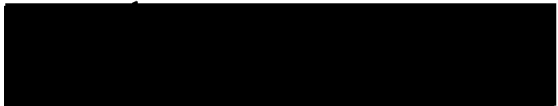
We also conclude, from our regional studies of the sulphur prospects of the subject area, that surficial deposits of sulphur are likely to occur in muskegs, lakes, or abandoned lacustrine depressions, with particular reference to such areas that are along or adjacent to fractures and/or faults responsible for sulphate water springs.

We have determined that a number of such features show well on the air photographs and these areas have been outlined on the accompanying photogeological mosaic, Figure 2.

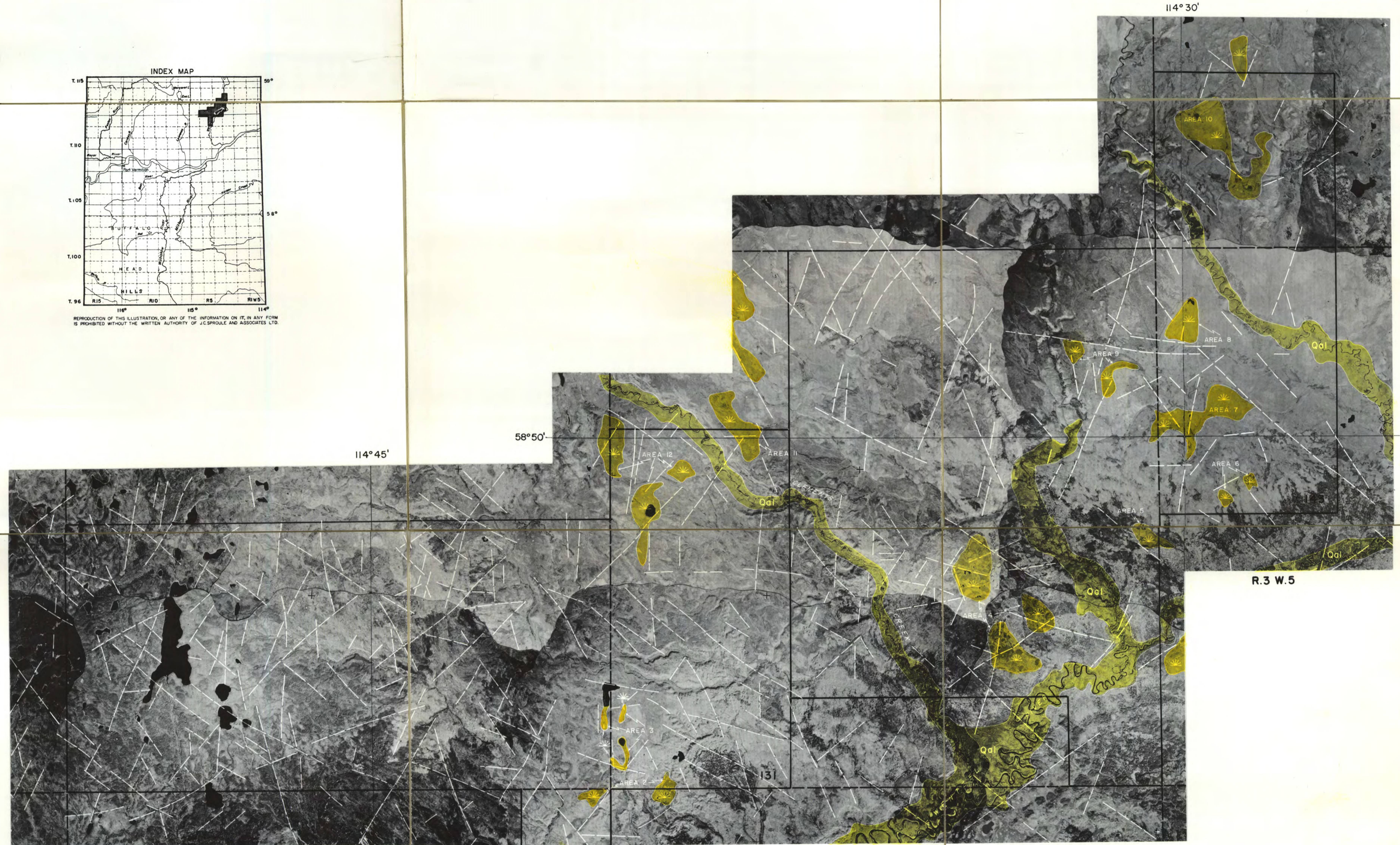
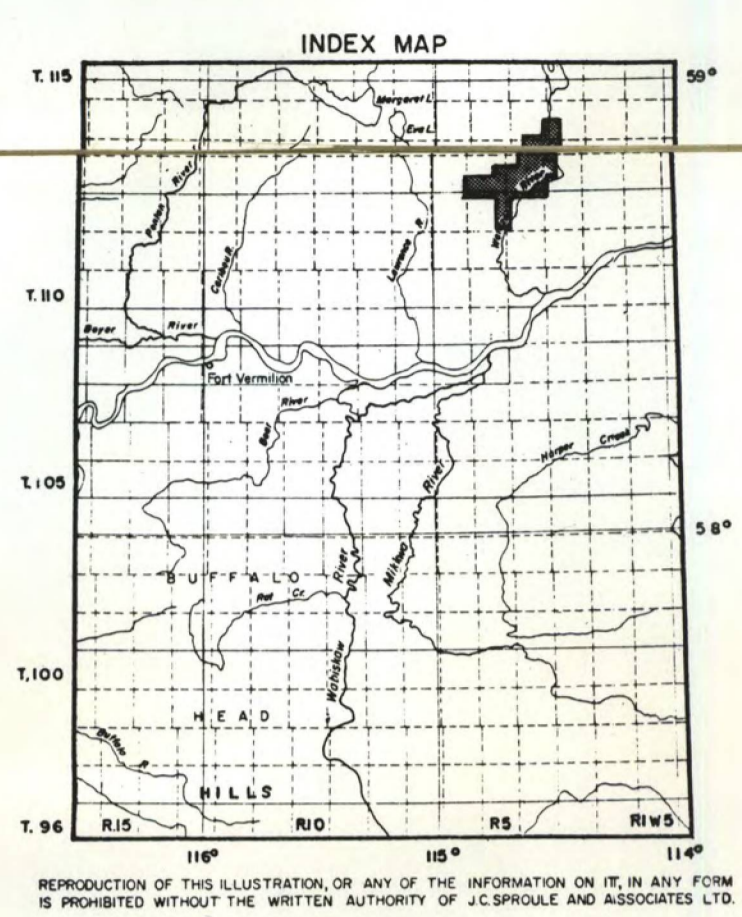
In view of the above, it is recommended that a field check be made of the localities that have been indicated by the photogeological study to be prospective. This field check would be that indicated as Step 1 of Phase II in our letter of June 15, 1968.

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V.A. Farley.

  
S.R.L. Harding, P. Geol.

1009 Fourth Avenue S.W.,  
Calgary 2, Alberta.  
September 5, 1968.  
VAF:SRLH:ldl



T. 113

T. 114

T. 113

R. 5

R. 4

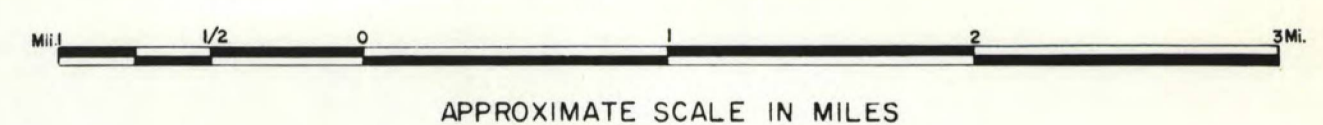
R. 3 W. 5

T. 112

- LEGEND**
- SURFICIAL DEPOSITS**
- Alluvium
  - Muskeg
- PHOTOGEOLOGICAL SYMBOLS**
- AREA 1, 2 etc. Areas of interest discussed in report
  - 131, 143 Sulphur prospecting permit outline
  - Alignment interpreted to indicate faulting or fracturing in bedrock
  - Alignment of probable geological significance

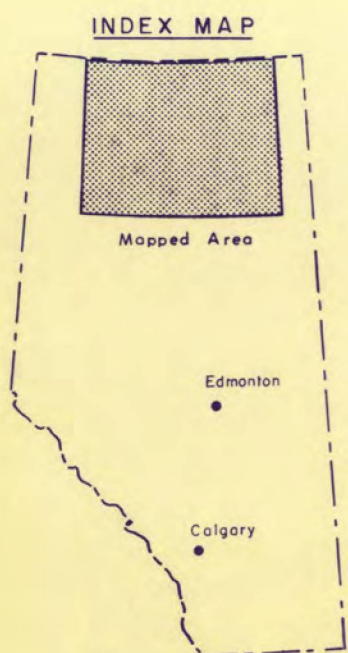
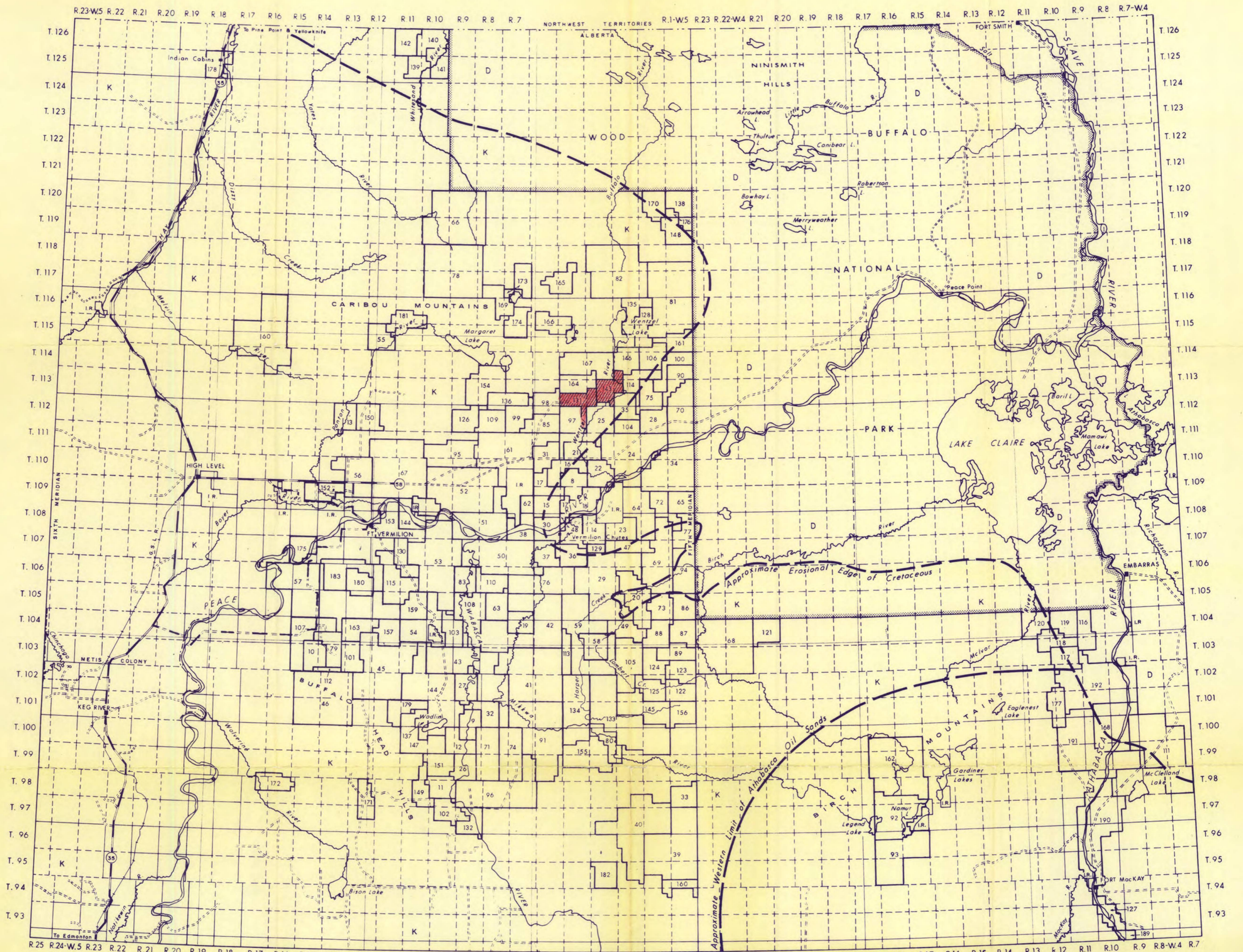
**PHOTOGEOLOGICAL MOSAIC**  
**SULPHUR PROSPECTING PERMIT**  
 Nos. 131, 143  
**FORT VERMILION AREA**  
**ALBERTA**

PREPARED FOR  
**HAROLD P. KILLORAN**



THIS IS A SEMICONTROLLED MAP-MOSAIC AND SHOULD NOT BE MISTAKEN FOR AN ACCURATE GEOGRAPHIC BASE

J.C. SPROULE AND ASSOCIATES LTD. CALGARY, ALBERTA  
 AUGUST 1968

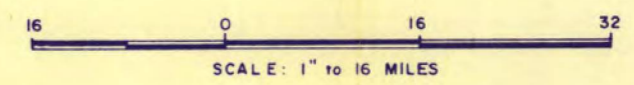


LEGEND

- K Cretaceous Formations
- D Devonian Formations
- 94 Sulphur Prospecting Permits
- Subject Permits (Nos. 131 & 143)
- Highway - Gravelled
- All Weather Road - Gravelled
- Dry Weather Road - Dirt - Truck Trail

**NORTH - CENTRAL ALBERTA**

SHOWING  
SULPHUR PROSPECTING PERMITS



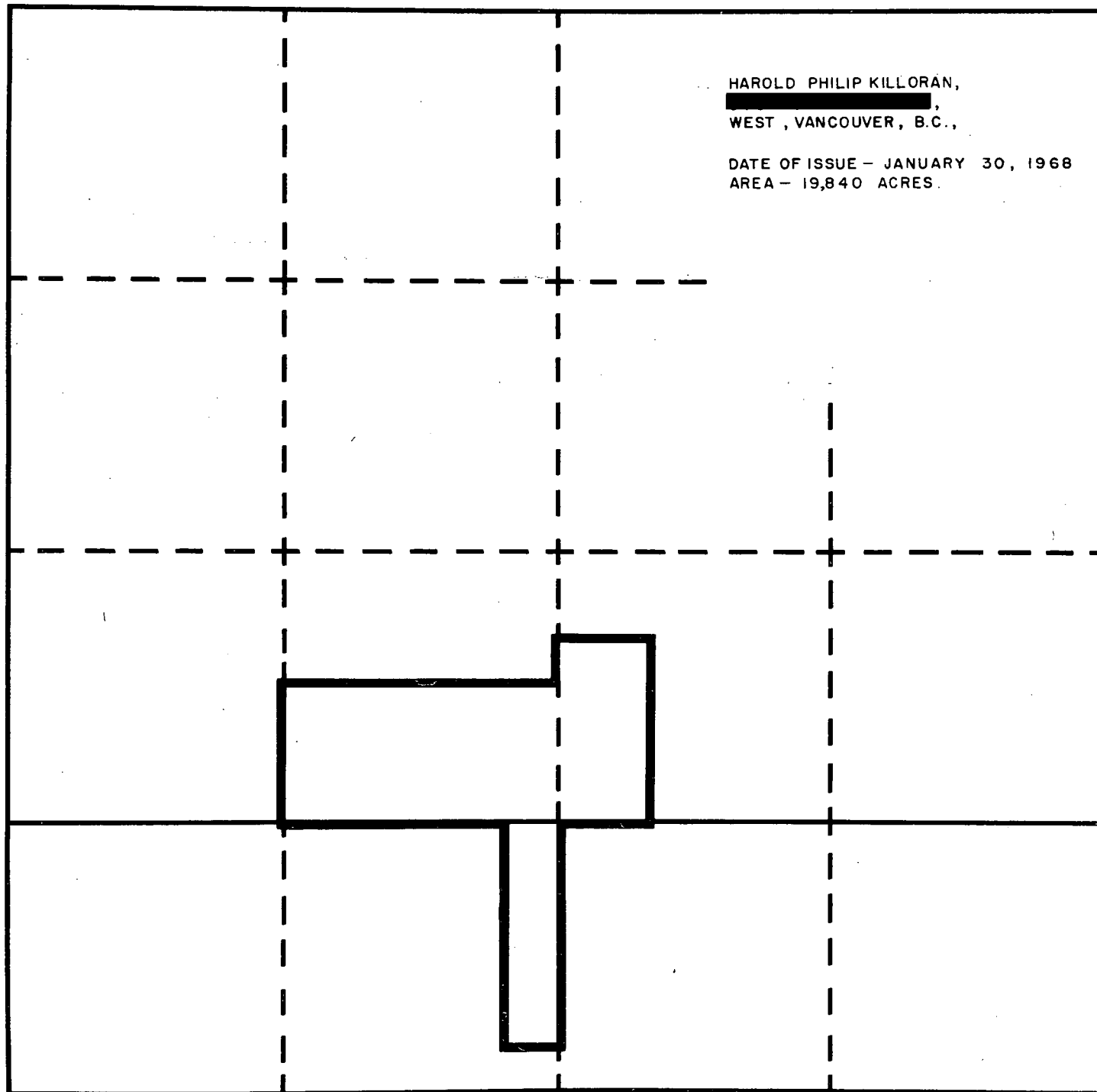
Prepared for  
HAROLD P. KILLORAN

NOTE: Permits as Published to: March 29, 1968 (Data on later permits not yet available)

# SULPHUR PROSPECTING PERMIT No. 131

HAROLD PHILIP KILLORAN,  
[REDACTED],  
WEST, VANCOUVER, B.C.,

DATE OF ISSUE - JANUARY 30, 1968  
AREA - 19,840 ACRES.



TP.

TP. 113

845/15410  
NE

TP. 112

R. 5

R. 4

R. 3 W. 5 M.