

MAR 19680037: NORTHERN ALBERTA

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PHOTOGEOLOGICAL STUDY
SULPHUR PROSPECTING PERMITS NOS. 21, 22 AND 23
NORTHERN ALBERTA

Prepared For
Spooner Mines and Oils Limited
June, 1968

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PHOTOGEOLOGICAL STUDY

SULPHUR PROSPECTING PERMITS NOS. 21, 22 AND 23

NORTHERN ALBERTA

INTRODUCTION

This report has been prepared at the request of Mr. Noble Harbinson, acting for Spooner Mines and Oils Limited, hereinafter referred to as the "Company." The request made was for a photogeological analysis of the Company's Sulphur Prospecting Permits Nos. 21, 22 and 23, integrated with other available geological information. The results of the study are presented visually on a photogeological mosaic (Figure 1) and a photogeological map (Figure 2) which shows the general geological setting of the Company permits and their relationship to known sulphur occurrences in the area.

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 from the standpoint of the occurrence of sulphur. Such areas could then be examined in the field to determine the presence or absence of sulphur.

The Company's holdings discussed in this report consist of three Sulphur Prospecting Permits, Nos. 21, 22 and 23, totalling 59,520 acres.

General background information pertaining to the development of the sulphur play in northern Alberta, regional geological setting and mode of occurrence has been presented earlier in our preliminary geological report

entitled, "Geological Report, Alberta Sulphur Prospecting Permits Nos. 11, 21, 22, 23 and 35, North-Central Alberta" dated February 23, 1968, and will not, therefore, be repeated here. This report will rather present more detailed information on the Company's individual permits.

BEDROCK GEOLOGY AND TOPOGRAPHY

Most of the area of the three Permits concerned are located within the area underlain by Paleozoic (Devonian) rocks, although the northeast edge of Permit No. 21 is underlain by Cretaceous and the southeast corner of Permit No. 23 by Cretaceous. From the standpoint of the regional occurrence of Sulphur, therefore, these Permits are relatively well located (See Figure 2).

The Cretaceous rocks consist of shales, sandy shales and sandstones. The Devonian rocks consist of limestones, dolomites, shales and evaporites. Outcrops of bedrock are sparse. Cretaceous rocks are poorly consolidated and bentonitic in character. Slumping is common in these sediments along the steeper slopes and stream cuts. The Devonian limestones and dolomites, being more resistant to erosion, create chutes and rapids on the Peace River between Vermilion Rapids and Vermilion Falls (Figure 2). Other Devonian outcrops are present down-river from Vermilion Falls, as well as along Harper Creek in the extreme southeastern part of the map.

The bedrock, whether of Devonian or Cretaceous age, is overlain by a variable thickness of glacial till, glacio-lacustrine and recent deposits.

The general topography of the area has not been altered significantly by glaciation. Large topographic features, such as the Caribou Mountains in the northwestern corner of the general map-area and the Birch Mountains, located just to the southeast of the general area, represent pre-glacial erosional remnants rising abruptly from 1,000 feet to 2,000 feet above the surrounding lowlands.

The central and southern portions of the general map-area, including the subject Permits, are situated in broad lowlands with very little topographic relief.

SUPERFICIAL GEOLOGY

The superficial 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 superficial 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 indicates 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 (Bayrock, 1960)⁽¹⁾ and the average direction of flow in the subject area was to the west-southwest.

The 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 area.

As the glacier retreated, the lowland to the northwest 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 which vary in thickness from a few inches to 50 feet.

(1) Names and dates in brackets are referred to in the Bibliography at the end of this report.

Several periods of still-stand of one of these Pleistocene lakes is suggested by R. S. Taylor (1960) from mapped deposits in the Peace River Valley. Three large areas of sandy aeolian and alluvial material, adjacent to the modern Peace River at elevations of approximately 1,400 feet, 1,100 feet and 900 feet above sea-level, are interpreted as deltas that have been partly reworked into dunes by wind action. The lowest occurring, and by far the largest, of these sandy deposits is in the subject area. It commences on the west side of the mapped area, near Vermilion Chutes, and extends to the northeast adjacent to the Peace River. It also covers most of the area south of the Peace River with the exception of some of the areas of higher ground. The eastern limits extend beyond the mapped area.

Present-day drainage was established soon after the lakes were drained and conforms generally to preglacial lowlands.

PHOTOGEOLOGICAL STUDY

WITH RECOMMENDATIONS FOR FIELD EVALUATIONS

Strong photo-alignments, some of which indicate bedrock faulting or fracturing, are the dominant structural features in the general area of study (Figure 2). The dominant alignments trend northwest-southeast and are present on Company Sulphur Prospecting Permits Nos. 21, 22 and 23, as well as Sulphur Prospecting Permit No. 8, the discovery permit located immediately south of Sulphur Prospecting Permit No. 21, and west of Sulphur Prospecting Permit No. 22. Stream channels and muskeg patterns, as is frequently the case, appear to be influenced by this structural trend. For example, the Wentzel River, flowing in a southwesterly direction, abruptly changes its course to the southeast as it enters Company Sulphur Prospecting Permit No. 21. The pattern of muskeg

development in the area is in a general west-southwest direction, conforming with the direction of glacial flow. This pattern also changes to the northwest-southeast in the vicinity of the Company permits and is especially noticeable in the northeastern part of Sulphur Prospecting Permit No. 23 and the southwestern part of Sulphur Prospecting Permit No. 8.

Sulphur springs are known to be present in the vicinity of the sulphur occurrence on Sulphur Prospecting Permit No. 8 and along Harper Creek in the extreme southeastern part of the map-area. It would not seem illogical, therefore, to expect springs to occur along the general fault trend joining these two areas. Company Sulphur Prospecting Permit No. 23 is especially favourably located with respect to this fault trend.

The most prominent surface geological feature of the area is a broad glacio-lacustrine embayment opening to the east and occupying much of the Paleozoic embayment along the Peace River Valley, as illustrated on Figure 2. Within this embayment it has been noted that in areas where lacustrine sediments are thick, their surface is quite smooth and uniform and underlying glacial deposits have been concealed. These areas, interpreted as bedrock lows, within the glacio-lacustrine outline are inhabited today by very extensive muskegs and dried up lake beds. This evidence would imply that these areas are historically old topographic lows and could have served as catchment basins during the post-glacial period. The sulphur occurrence on Sulphur Prospecting Permit No. 8, one of the Discovery Permits for the area, is located in one of these inferred bedrock depressions (see Figure 2).

In areas interpreted as bedrock highs, the surface is irregular and glacial groovings and deposits can be seen through a veneer of lacustrine sediments. These features are generally somewhat topographically higher than adjacent low areas and being better drained, they also support most of the tree growth in the area.

The following areas of special interest are recommended for field examination:

Sulphur Prospecting Permit No. 23

A prominent northwest-southeast-trending fracture pattern in the north-eastern portion of this permit is of particular interest because of its alignment with similar trending fracture systems to the northwest and southeast where sulphur springs and deposits are known to occur.

Area '1' is a large, poorly(?) drained area that covers approximately one-third of the subject permit. Numerous faults and/or fractures make this large southeast-trending area a prime prospect for possible sulphur deposition. Quite aside from the matter of a sulphur source, much depends upon the effectiveness of the drainage.

Company sulphur test hole No. 2, located within Area '1' and in an old vegetation-filled lake, penetrated 60 feet of mostly lacustrine clay without reaching bedrock. Minor shows of sulphur were encountered.

Area '2' has a few closed patches of muskeg that should receive special attention in the field. This area drains into Area '1'.

Area '3' is interpreted as a bedrock high that is covered with a veneer of lacustrine sediments and glacial till. Company sulphur test holes Nos. 1, 3 and 4 encountered bedrock at a relatively shallow depth and found little or no evidence of sulphur. This area is not considered prospective for sulphur.

Sulphur Prospecting Permits Nos. 21 and 22

The above two Company permits adjoin each other and will be considered here as a unit. These permits are immediately adjacent to Sulphur Prospecting Permit No. 8 and have certain features that are similar and others that are dissimilar.

The setting for the sulphur occurrences on Sulphur Prospecting Permit No. 8 is a large muskeg area developed in an area of relatively thick glacio-lacustrine and/or recent deposits. Geomorphic evidence also suggests a local bedrock depression as outlined on the accompanying photogeological map (Figure 2). This outline includes both Company Sulphur Prospecting Permits Nos. 21 and 22. The northeast half of this feature differs, however, from the southeast half in that there are fewer indications of fracturing and smaller areas of muskeg.

Area '4' includes those large southwest-trending areas of muskeg immediately northwest of the Peace River. These have been developed within the old channel of the Peace River and are probably too well drained to be considered very prospective. A brief examination of these areas should be made in the field, however, with special attention directed to the extreme southwestern part of Sulphur Prospecting Permit No. 22, where the edge of the old river channel is not well defined.

Area '5' comprises a line of closed muskegs trending in a southwesterly direction across Sulphur Prospecting Permit No. 22. Each of these should be examined closely for evidence of sulphur.

Area '6' includes numerous small patches of muskeg in the eastern part of Sulphur Prospecting Permit No. 21 that are recommended for field evaluation.

Area '7', a small muskeg in the western part of Sulphur Prospecting Permit No. 21, occurs along a well-defined fracture and should be field checked.

In addition to the above special areas of interest, any evidence of sulphur springs should be noted and sampled as well as those sulphurous waters found in muskeg areas.

CONCLUSIONS AND RECOMMENDATIONS

From our overall sulphur studies in the general area we concluded that the most likely sources of commercial sulphur are superficial deposits. It is of interest in this connection to note that the nearby reservoir of McMurray oil, reputed to amount to about 600 billion barrels of oil-in-place, contains four to five percent sulphur by weight. The sulphur in this oil reservoir would, therefore, amount to about eight to ten billion long tons. Since that sulphur is also of secondary origin, probably common to the present occurrences, it is not impossible to postulate the occurrence of commercial deposits in the area, other than in the oil sands.

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

We have determined that a number of such features show well on the photomosaics and these areas have been outlined on the accompanying Figure 1, a photogeological mosaic and Figure 2, a regional geological map.

In view of the above, it is recommended that a field check of representative localities within the three subject permits be made by a helicopter-borne geological crew. This crew should be prepared to conduct spot-sampling trenching and/or auger testing as the occasion demands. We are, however, not yet prepared to recommend that the Company conduct the full detailed field geological survey described in our letter of February 6th. It is proposed rather that the Company authorize the preliminary field check referred to above at a total cost of \$750 per permit. The results of that

preliminary field work will then inform the Company as to whether or not the full-scale field work referred to in our letter of February 6th should be proceeded with. If the preliminary results do not indicate that further work should be done, it would then be recommended that the Company apply immediately for return of their \$2,500 deposit in each of the permits for which abandonment is indicated.


V. A. Farley


J. C. Sproule, P. Geol.

1009 Fourth Avenue S.W.,
Calgary, Alberta.
June 21, 1968.

VAF/JCS/ab

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Taylor, R. S. (1960); Some Pleistocene Lakes of Northern Alberta and Adjacent Areas (Revised), Journal of the Alberta Society of Petroleum Geologists, Vol. 8, No. 6, pp. 167-177.

Sproule, J. C. (1951); The McMurray Formation in its Relation to Oil Occurrence. Proceedings Athabasca Oil Sands Conference. Oil Sands Project, Government of Alberta.

THIS REPORT HAS BEEN PREPARED
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SPOONER MINES AND OILS LIMITED

COPY NO: 5.....

19680037

SULPHUR PROSPECTING PERMIT No. 21

ALASKA - CANADIAN CORPORATION,
SUITE 220 - 630 - 8th AVENUE S.W.,
CALGARY, ALBERTA

DATE OF ISSUE - NOVEMBER 30, 1967
AREA - 19,840 ACRES

TP. 111

CORRECTION LINE

84J/10

TP. 110

TP. 109

R. 5

R. 4

R. 3 W. 5 M.

19680037

SULPHUR PROSPECTING PERMIT No. 22

ALASKA - CANADIAN CORPORATION,
SUITE 220, 630 - 8th AVENUE S.W.,
CALGARY, ALBERTA

DATE OF ISSUE - NOVEMBER 30, 1967
AREA - 19,840 ACRES

CORRECTION LINE

TP. 110

84J/10

TP. 109

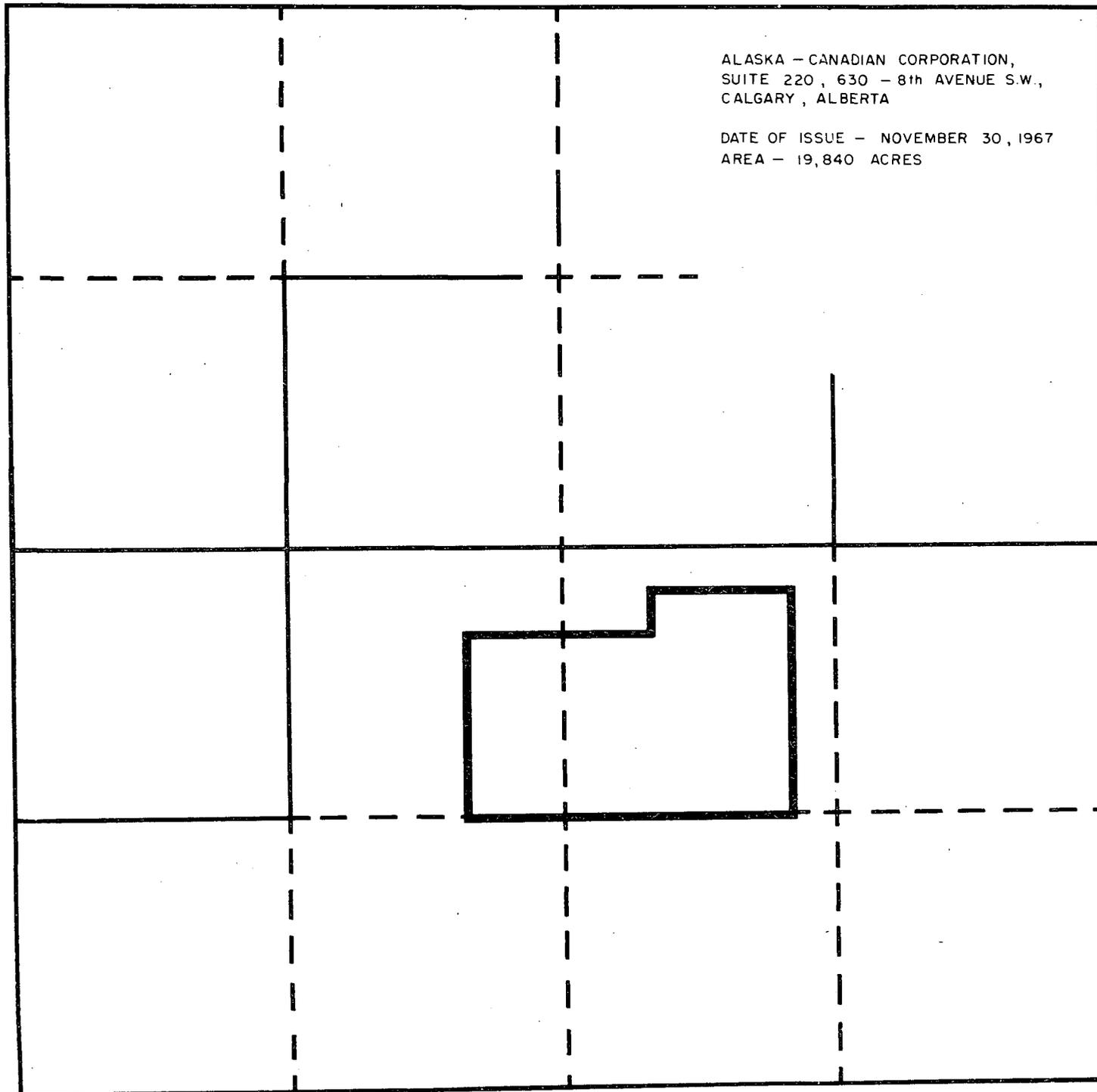
R. 4

R. 3 W. 5 M.

SULPHUR PROSPECTING PERMIT No. 23

ALASKA - CANADIAN CORPORATION,
SUITE 220, 630 - 8th AVENUE S.W.,
CALGARY, ALBERTA

DATE OF ISSUE - NOVEMBER 30, 1967
AREA - 19,840 ACRES



TP. 108

84J/749

TP. 107

R. 4

R. 3

R. 2 W. 5 M.

PHOTOGEOLOGICAL MAP SULPHUR PROSPECTING PERMIT Nos. 21, 22 and 23 FORT VERMILION AREA ALBERTA

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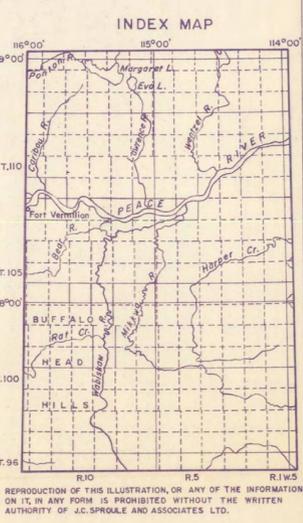
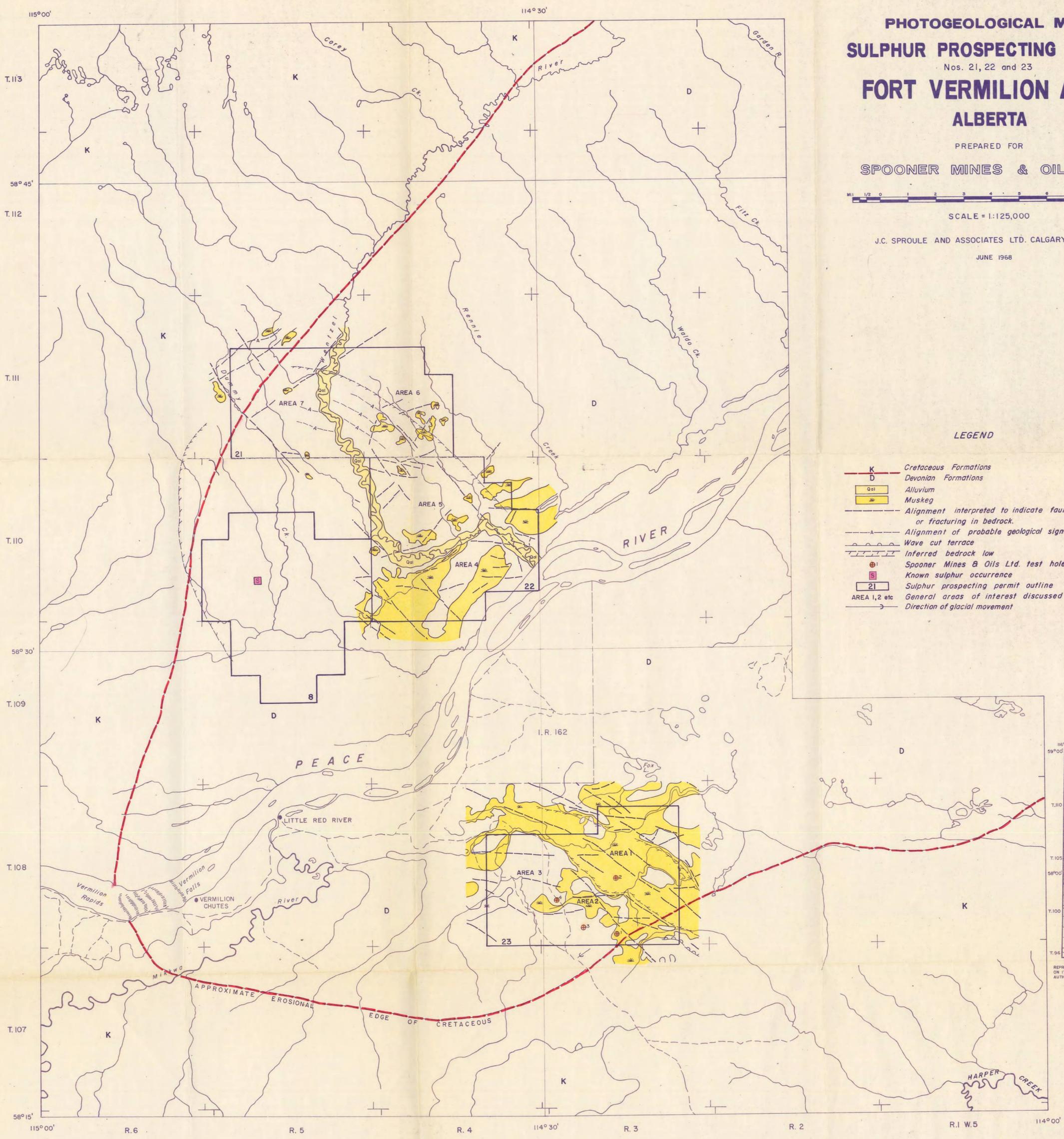
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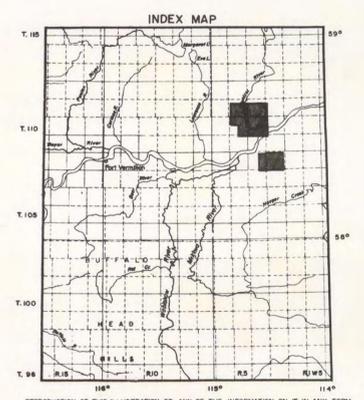
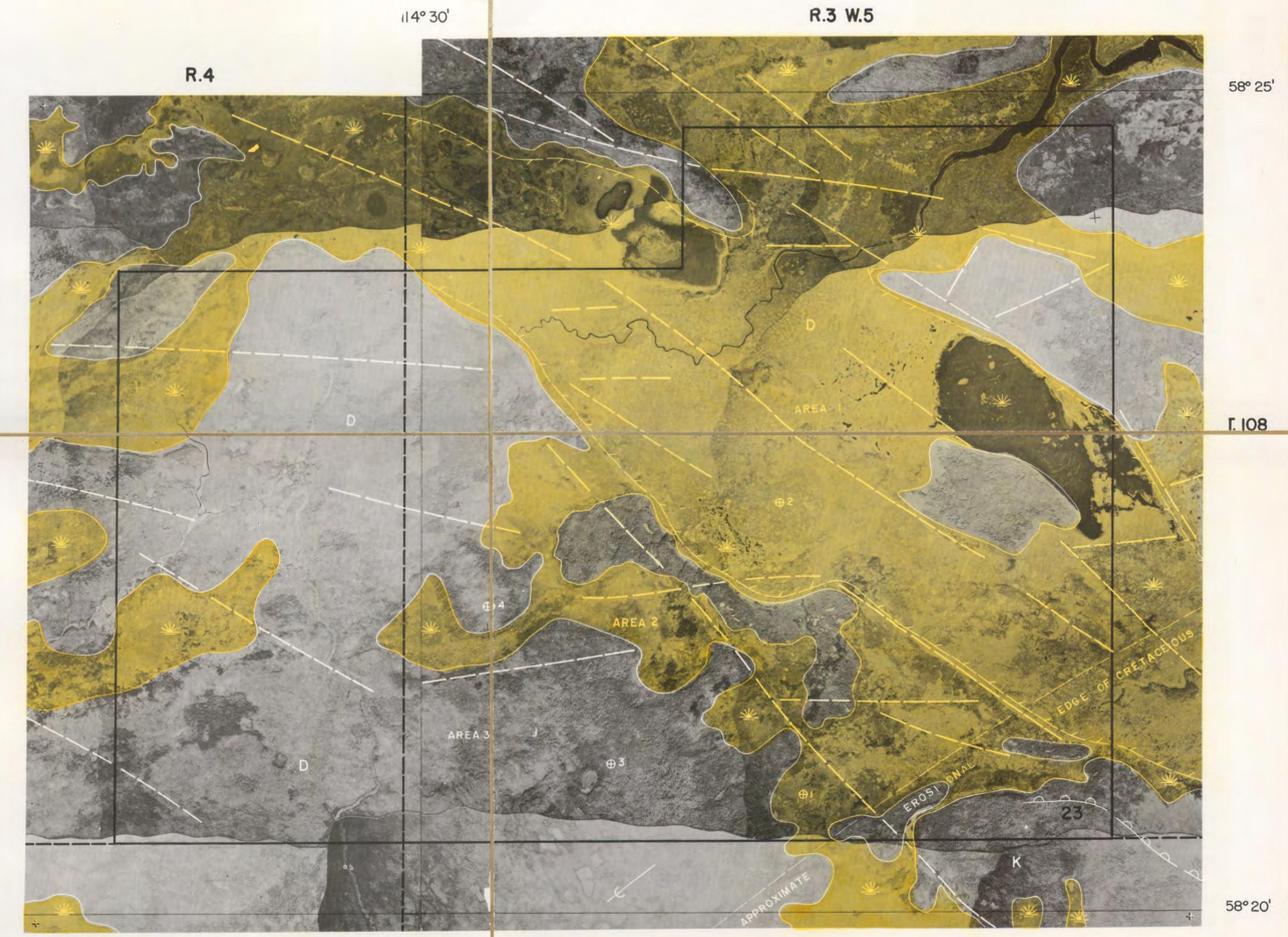
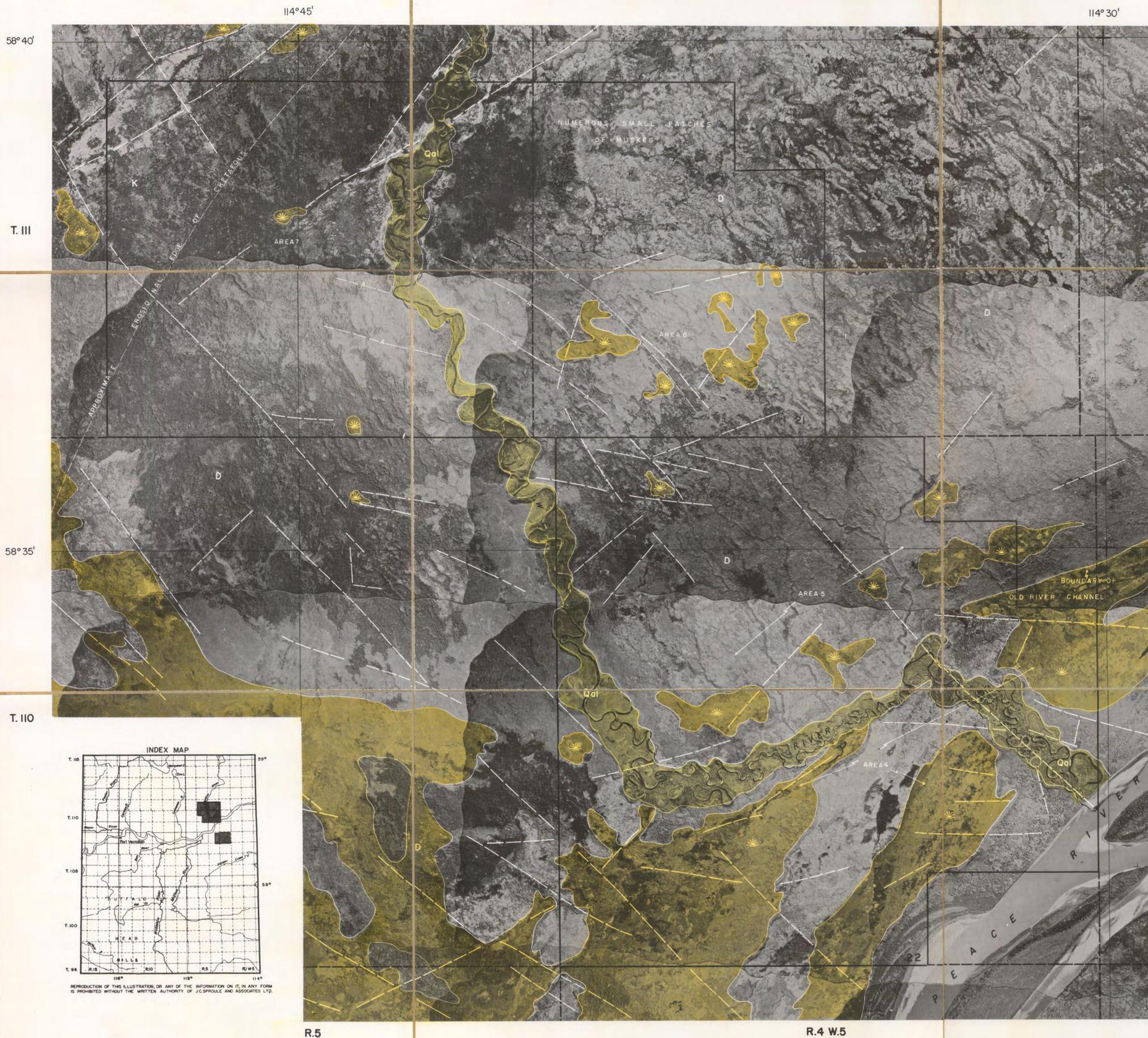
JUNE 1968

LEGEND

- K** Cretaceous Formations
- D** Devonian Formations
- Qal** Alluvium
- Ms** Muskeg
- - -** Alignment interpreted to indicate faulting or fracturing in bedrock.
- - -** Alignment of probable geological significance
- - -** Wave cut terrace
- - -** Inferred bedrock low
- ⊙** Spooner Mines & Oils Ltd. test hole
- S** Known sulphur occurrence
- 21** Sulphur prospecting permit outline
- AREA 1, 2 etc** General areas of interest discussed in text
- Direction of glacial movement



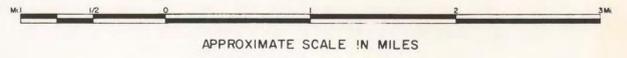
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- LEGEND**
- K Cretaceous Formations
 - D Devonian Formations
 - Qal Alluvium
 - Muskeg
 - Alignment interpreted to indicate faulting or fracturing in bedrock.
 - Alignment of probable geological significance
 - Wave cut terrace
 - Inferred bedrock low
 - ⊕1 Spooner Mines & Oils Ltd. test hole
 - 21 Sulphur prospecting permit outline
 - AREA 1,2 etc General areas of interest discussed in text
 - Direction of glacial movement

PHOTOGEOLOGICAL MOSAIC
SULPHUR PROSPECTING PERMIT
 Nos. 21 & 22. No. 23.
FORT VERMILION AREA
ALBERTA
 PREPARED FOR
SPOONER MINES & OILS LTD.



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

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 APRIL 1968