MANITOBA
DEPARTMENT OF MINES AND NATURAL RESOURCES
MINES BRANCH

55° 101° 100° 99° 98°

GRASS RIVER PROVINCIAL PARK
Cranberry Portage
Reed Lake
CORMORANT FOREST
Cormorant Lake
CLEARWATER PROVINCIAL PARK
Atikameg L.
RESERVE
Moose Lake
The Pas
Saskatchewan River
Cedar Lake
Red Deer Lake
Dawson Bay
PORCUPINE FOREST RESERVE
Swan Lake
DUCK MOUNTAIN FOREST RESERVE
Winnipegosis
Dauphin Lake
Dauphin
RIDING MOUNTAIN NATIONAL PARK
Assiniboine
HEMISPHERE HELIUM CORP RES. # 2 (1961)
BRALORNE RES. "B" (1966)
2178 BRALORNE 8-20-32-8
Lake St. Martin
2165 BRALORNE 8-30-27-8
2174 BRALORNE 7-6-25-5
2171 BRALORNE 7-24-24-8
2160 BRALORNE 16-20-23-5
BRALORNE RES. "A" (1966)
BRALORNE RES. "C" (1966)
1846 H.H. 16-15-20-7
HEMISPHERE HELIUM CORP. RES. # 1 B (1961)
1845 H.H. 14-17-20-5
Reindeer Island
Berens I.
Berens River
Hecla I.
Black I.
Winnipeg River
Portage La Prairie
WINNIPEG
STBONIFACE
Red River
BRANDON
SPRUCE WOODS FOREST RESERVE
Cross Lake
Playgreen Lake
Nelson River
WHITESHELL FOREST RESERVE
AGASSIZ FOREST RESERVE
SANDILANDS FOREST RESERVE
NORTHWEST ANGLE FOREST RESERVE
TURTLE MT. FOREST RESERVE

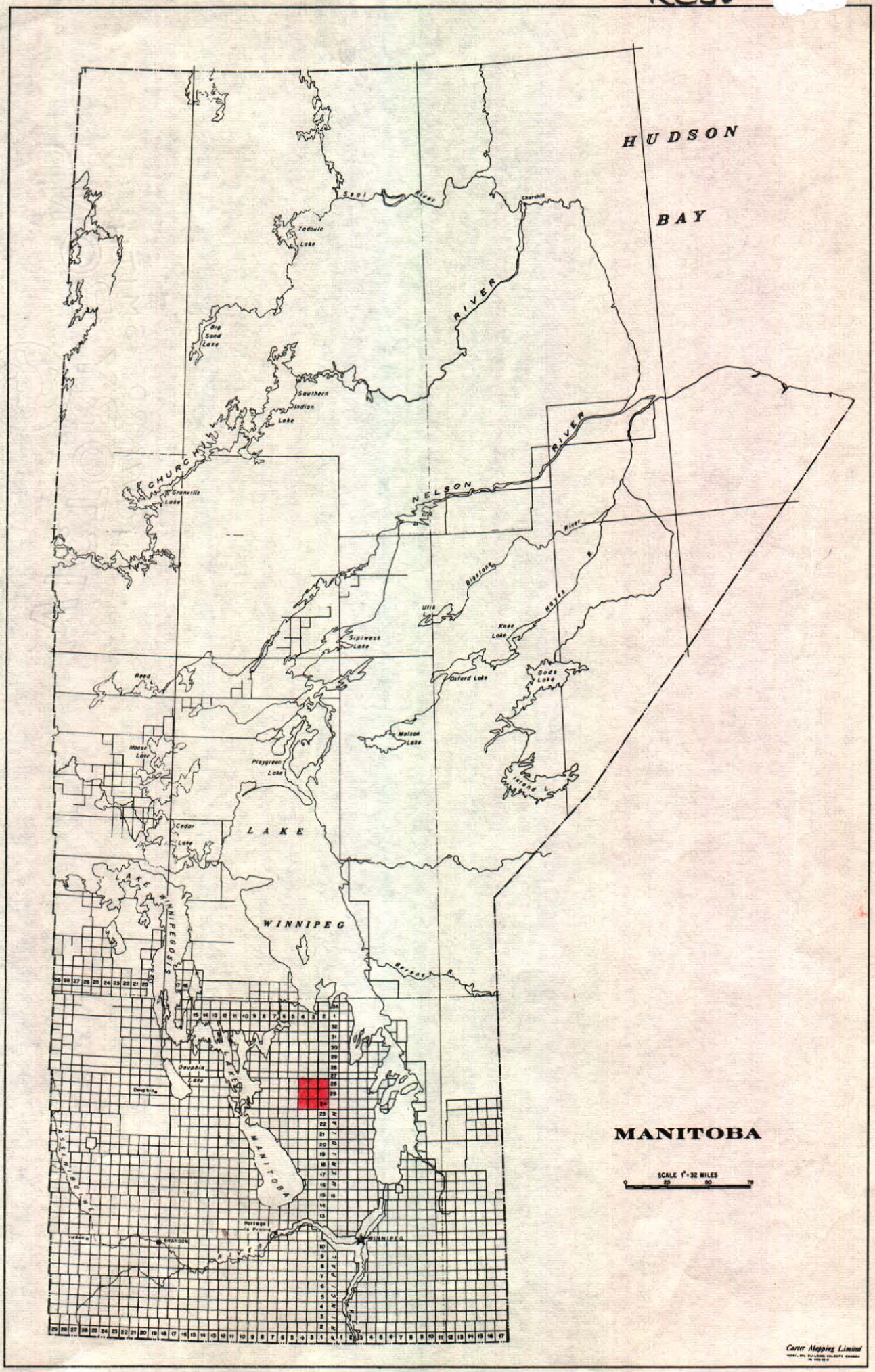
0 8 16 32 48 64
MILES

LAKE WINNIPEGOSIS
LAKE MANITOBA
LAKE WINNIPEG
SASKATCHEWAN
ONTARIO
PRINCIPAL MERIDIAN

47 46 45 44 43 42 41 40 39 38 37 36 35 34 33 32 31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1

53° 52° 51° 50° 49°
95° 96° 97° 98° 99° 100° 101°
U. S. A.

Res.



Carter Mapping Limited

MACROFRACTURE PATTERN ANALYSIS SURVEY

of

FISHERTON AREA-INTERLAKE REGION,

MANITOBA

for

BRALORNE PIONEER PETROLEUMS LTD.

by

M. Berisoff

July 1966.

Respectfully submitted by:

M. Berisoff, P. Geol.

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Enclosures.

INTRODUCTION.

The Fisherton area is located in the Interlake region of south-central Manitoba. The specific area considered in this report consists of the central four-township area within Townships 24, 25 and 26, Ranges 2, 3 and 4 West of the Prime Meridian. The area of investigation extended beyond the central four-township area; partly to provide control for the central portion, but primarily to extend the area of study into those areas where anomalies extend from the central area, or where new anomalies were noted, as in the eastern half of Township 25, Range 2 W. P.M.

The photogeology discussed in this report consists primarily of an analysis of the macrofracture patterns. Auxiliary surveys consist of geomorphology in which structural and glacial trends are considered, and glacial melt pattern variations where these are applicable. The purpose of this study is to indicate possible buried structural features which could be significant in the accumulation of hydrocarbons or helium-bearing gases.

SUMMARY AND CONCLUSIONS.

A photogeological study was done in the Fisherton area utilizing the geomorphology, macrofracture patterns and glacial melt patterns where it was feasible to use the latter method.

Two prime areas were mapped where all three types of investigation revealed anomalies. One of these is located primarily in the northeastern part of Township 25, Range 2 W. P.M. The other major anomalous area is located at the boundaries of Township 24, Ranges 2 and 3 W. P.M. and Township 25, Range 3 W. P.M. These anomalies are quite well defined and appear to warrant further investigation.

Lesser anomalies are shown on the map in Township 25, Ranges 3 and 4 W. P.M. These areas could be considered for further investigation in the future.

GEOMORPHOLOGY.

The subject area is characterized mainly by fairly flat topography ranging to low hills or ridges, generally oriented in north-northwest to northwest directions and usually covered with deciduous trees. Locally, as in the northwestern part of the area studied, conifers are also present.

The intervening low areas between the ridges commonly contain muskeg or swamps and occasionally open water in the form of small lakes.

The pattern of ridges and intervening flats is developed primarily as a result of glacial movement. The trends of these topographical features are apparently more or less in line with the strike of the sub-glacial bedrock which probably had influenced to a degree the direction of glacial movement. As a result, those fractures which are parallel to this direction are difficult to isolate. The glacial drift cover is generally fairly thin, and is absent locally in areas to the west and northwest of the subject area. Soil conditions sufficient to allow farming are present in the central to southeastern parts of the subject area. The drainage is generally poor throughout the area, with the minor exception of the Fisher River which originates near the southern part of the subject area and flows northeasterly into Fisher Bay.

An area of anomalous glacial deposits is present in the southeastern part of Township 25, Range 2 W. P. M. and in the southwestern part of Township 25, Range 1 W. P. M. The irregular moraine pattern is probably recessional in origin and is characterized by strongly undulating topography, the hills of which appear to consist mainly of sand and gravel. Some evidence is present of post-glacial movement of the sand by wind. Fractures tend to be poorly expressed at the surface in such areas, however, those that are present suggest that this area is disturbed or faulted at depth.

Except for the latter area discussed, the fracture evidence is generally good to excellent. This is the case primarily because the drift cover is thin. The fracture and fault traces immediately northwest of the subject area locally control and coincide with muskeg areas. Exposure of the fracture and fault lines themselves is direct where the drift cover is sparce to non-existent as in the Sleeve Lake area immediately west of the southwest corner of the subject area.

A number of the fractures are probably the surface traces of faults. This is substantiated in some cases by the variation on either side of the trace of the vegetation, topographic elevation, or soil type or nature caused by the differential movement along the fault line. Fracture traces which show such evidence have been identified as possible fault traces on the macro-fracture pattern map.

FRACTURES.

The fracture traces observed on the aerial photographs and mosaics of either continuous lines or discontinuous, but aligned surface features. The lines or alignments could be either darker or lighter in tone than the surrounding land surface. In some instances, the alignments separate light-toned areas from darker toned areas. Such linear features are formed by variations in vegetation, soils or moisture content. Occasionally, one type of glacial deposit is separated from another kind along a fracture alignment.

The topographic elevation within the fracture line is commonly slightly lower than that of the surrounding terrain. Portions of stream courses are often controlled by fracture lines.

The fracture traces used in this survey range in length from about 3/4 of a mile to over 3 miles. They are usually relatively straight. Most of these fracture traces would be in the category of those called "macro-fractures" by some fracture analysts.

Some of the lineations up to 1 1/2 miles long represent so-called "micro-fractures". Although numerous, these lineations shown represent only a small percentage of the total of micro-fractures that could be found in the area. Those shown on the fracture pattern map are the longest and best developed. They are mapped because they are within the macro-fracture range of length and development.

ORIGINS OF FRACTURE TRACES.

The lineations at the present day surface are apparently reflections or extensions of underlying vertical or near-vertical fractures in the bedrock that have been transmitted through the glacial drift. The majority of the micro-fractures are considered to have been formed as a result of flexures within the earth's crust, due perhaps to tidal forces and possibly other cyclical and non-cyclical stresses.

Faulting and failure zones are probably responsible for the development of many of the fractures. This applies particularly to the macro-fractures, some of which are considered by the writer to represent the surface traces of fault planes at depth. Numerous fractures considered to be fault-induced and indicated as such on the macro-fracture pattern map, show variations between the topographic features on either side of the fracture trace. In some cases, apparent offset of surface features along the fracture or fault traces are evident, indicating transcurrent movement.

In most instances, however, the macrofractures probably represent either the extension to the surface of fractures or fault planes at depth, in some cases from the basement, or have their origin as zones of failure adjacent to buried structures (e.g. anticlines, domes, etc.) or from those areas where competent rock masses are present adjacent to less competent rocks (e.g.: buried reefs adjacent to shales, basement hills adjacent to sand and shale-filled valleys, etc.). Such zones of failure might be considered as "incipient faults" as many later fault-producing stresses would tend to be relieved along these fracture planes.

THE MACROFRACTURE PATTERN ANALYSIS MAP.

The macrofracture pattern analysis map shows numerous linear features mapped as continuous, generally straight lines. Such lineations are considered to be well-defined macrofracture traces. Those linear features mapped as broken lines are probable macro-fracture traces, although in some instances some of them which are oriented in north-northwest to northwest directions could be "pseudo-fractures" caused by glacial movement or sub-mask bedding plane directions, or both. In general, the fractures mapped as broken lines, particularly those which are oriented in directions other than north-northwest to northwest have weaker surface expression than those marked with solid lines, although their effect upon the strata at depth may be equally great.

THE MAJOR LINEAR TRENDS MAP.

The major linear trends map shows the strong linear features developed primarily as a result of glacial movement. Some of these linear features could have originated by the subcropping of sub-glacial bedrock. A number of these lines could also represent fracture traces. In many cases a combination of any two or all three of the above factors might be responsible for the development of the linear features. The apparently disturbed area in Township 25, Ranges 1 and 2 W.P.M. is relatively devoid of linear trends in the general north-northwest to northwest directions.

PROSPECT AREAS.

A number of anomalies are shown on the macrofracture pattern analysis map. The best of these are located in the northeastern part of Township 25, Range 2 W.P.M. and in the northwestern and northeastern areas of Township 24, Ranges 2 and 3 W.P.M., respectively. Firstly, in these areas the macrofractures suggest structural or paleotopographical highs at depth. Secondly, the major linear trends at these anomalies suggest possible structures (southwest plunging anticlines) of the sub-glacial strata, or a rotation of glacial movement around such structures. Thirdly, the glacial melt patterns in these areas are similar, although not identical to those found in the proximity of many oil and gas fields in Saskatchewan, Alberta and Ontario.

Other possible, but less well-defined prospect areas are present centred in the general northeastern part of Township 25, Range 3 W.P.M. and in a north-south line across the central part of Township 25, Range 4

W. P. M. The macrofractures and major trend lines provide evidence of these features, but the glacial melt patterns characteristic of these prime areas are not apparent.

RECOMMENDATIONS.

It is suggested that further exploratory work be done in the anomalous areas, particularly in the "Prime Areas". This could consist of other surveys to more closely define the areas of interest. Alternatively, a direct test by drilling may prove to be feasible. In Township 25, Range 2 W. P. M. a test in section 35 or 36 should be near the crest of the interpreted structure; a test in section 34 or 35 would probably be most effective for a stratigraphic trap. In Township 24, Range 3 W. P. M., a stratigraphic trap reservoir might be present in parts of sections 25 and 26 and most of section 35, with the axis of the structure possibly extending across sections 36 and 25.

R. 4 R. 3 R 2 W P M

T. 26

T. 25

T. 24

Prime Area

Prime Area

Prime Area

Prime Area

LEGEND

MACROFRACTURE TRACES

MACROFRACTURE TRACES—POSSIBLE FAULT LINES

LINEAR FEATURE — INFERRED MACROFRACTURE TRACE
INTERPRETATION BASED ON MACROFRACTURES
SUPPLEMENTED BY GLACIAL MELT PATTERNS AND
OTHER GEOMORPHOLOGICAL FEATURES

INTERPRETED SUBSURFACE "HIGHS"

MACROFRACTURE PATTERN ANALYSIS MAP

FISHERTON AREA—INTERLAKE REGION

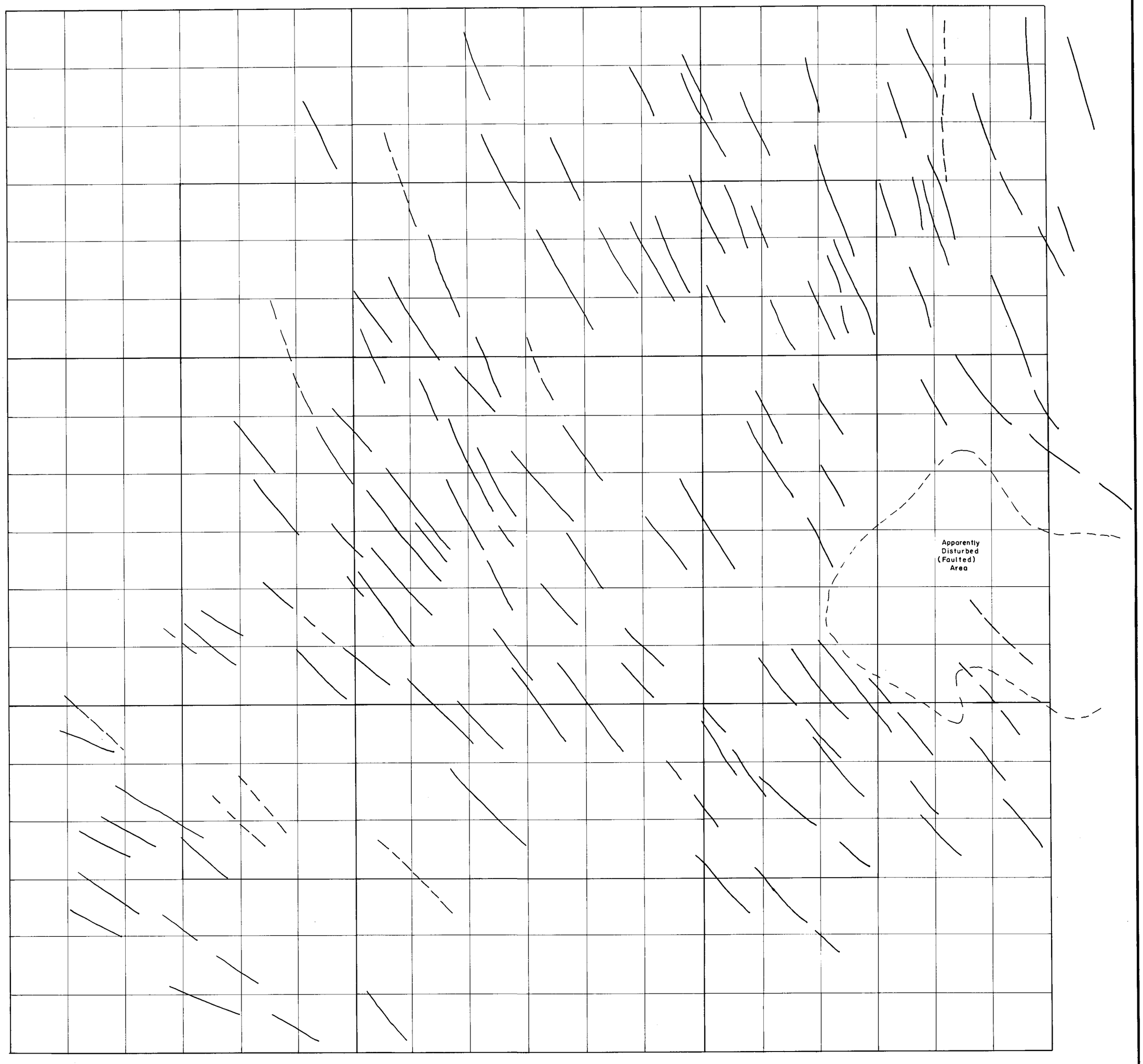
MANITOBA

FOR

BRALORNE PIONEER PETROLEUMS LTD.

Scale: 1 in.= 1.06 mi.

by M. Berisoff, P. Geol. July 1966



MAJOR LINEAR TRENDS (PRIMARILY GLACIAL, INCLUDES SOME STRUCTURAL)

FISHERTON AREA—INTERLAKE REGION
MANITOBA
FOR
BRALORNE PIONEER PETROLEUMS LTD.

Scale: 1 in = 1.06 mi

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July 1966