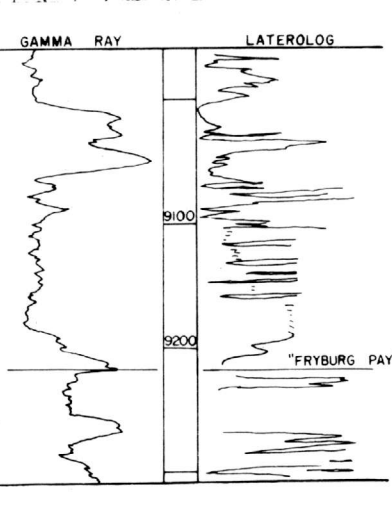
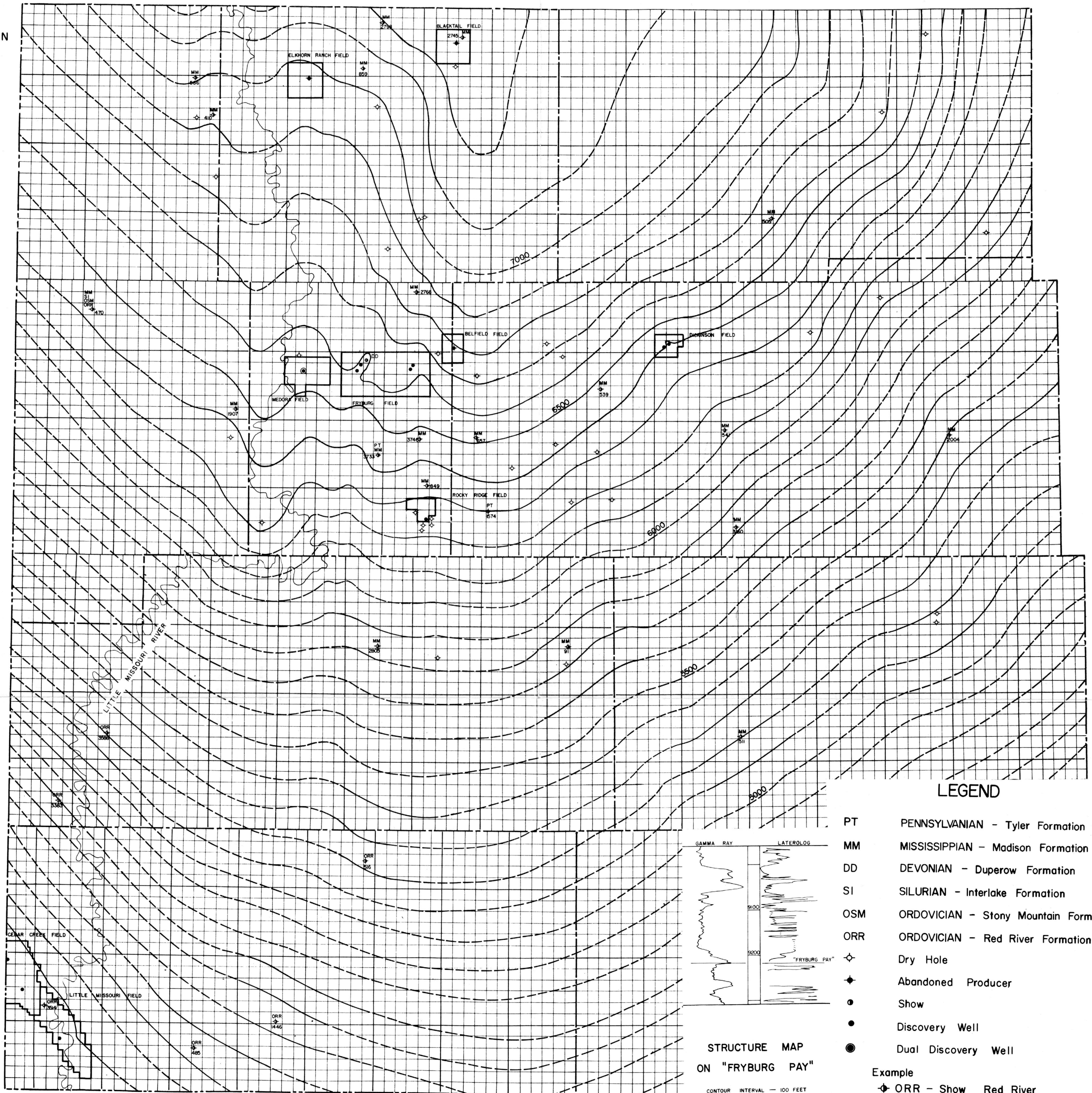


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129



STRUCTURE MAP
ON "FRYBURG PAY"
CONTOUR INTERVAL - 100 FEET

- LEGEND**
- PT PENNSYLVANIAN - Tyler Formation
 - MM MISSISSIPPIAN - Madison Formation
 - DD DEVONIAN - Duperow Formation
 - SI SILURIAN - Interlake Formation
 - OSM ORDOVICIAN - Stony Mountain Formation
 - ORR ORDOVICIAN - Red River Formation
 - ◇ Dry Hole
 - ◆ Abandoned Producer
 - Show
 - Discovery Well
 - Dual Discovery Well
 - Example
◆ ORR - Show Red River

MAP 1

A Look at the Petroleum Potential of Southwestern North Dakota

by
S. B. ANDERSON

INTRODUCTION

The purpose of this report is to draw attention to factors favorable for petroleum exploration in southwestern North Dakota. Four maps and two tables are included:

- Map 1—Structure map on the Mississippian Madison "Fryburg Pay."
- Map 2—Structure map on the Permian Minnekahta Formation.
- Map 3—Structure map on the Cretaceous Mowry Formation.
- Map 4—Map indicating the extent of the salts above the Mississippian.
- Table 1—Compilation of fields showing producing formation.
- Table 2—Table of wells yielding oil on drill stem tests.

Accompanying the maps and tables are a brief description of the geographic and geologic settings, brief explanations of the maps and a review of the age and nomenclature of the salts.

GEOGRAPHIC SETTING

The area is located in the semi-arid and sparsely populated southwestern portion of North Dakota. It is bounded by Townships 129 N. and 144 N., and by Ranges

91 W. and 107 W.; it includes all of Golden Valley, Billings, Stark, Slope and Hettinger Counties, and the southern half of Dunn County. Roughly the western half of the area lies in the rugged, well dissected portion of the State that is referred to as the "Badlands," and is devoted primarily to cattle grazing. The eastern half is characterized by a less dissected, rolling topography and is devoted primarily to grain farming and cattle grazing.

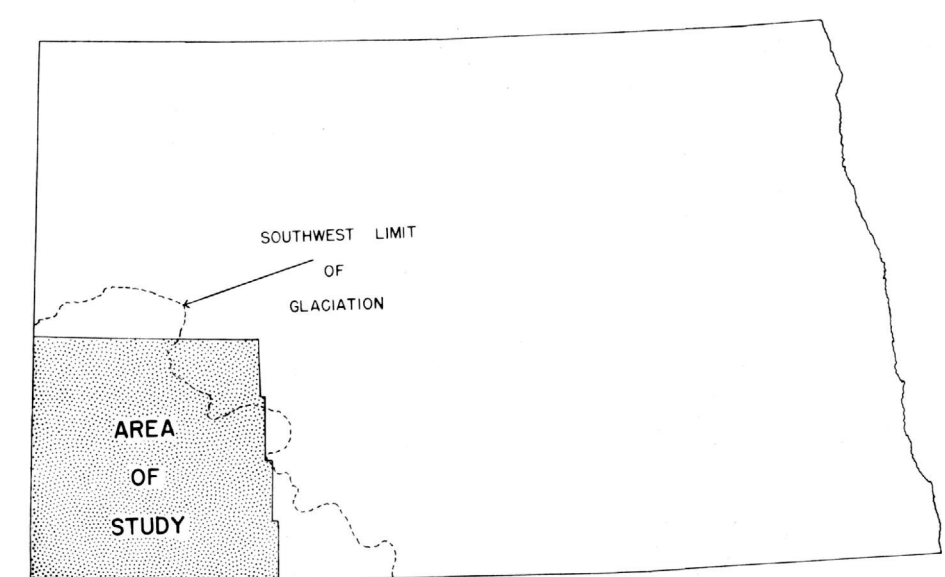
GEOLOGIC SETTING

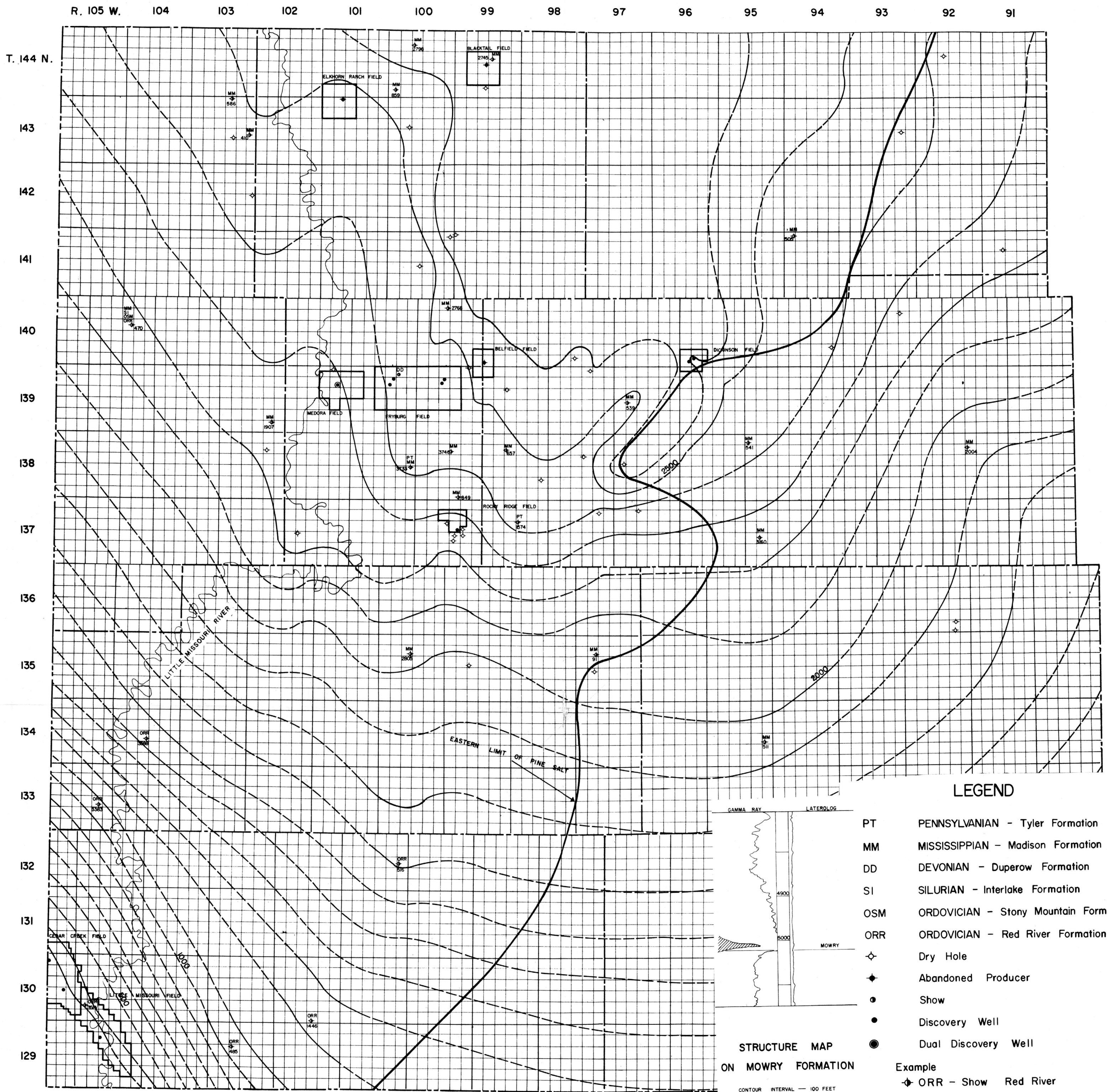
The area lies wholly within the Williston Basin. The stratigraphic section is one of the most complete in the State; beds dip gently northward, and range in age from Cambrian to Tertiary. The only section of consequence regionally that is absent is the salt of the Devonian Prairie Formation. Rocks exposed range in age from the Cretaceous Pierre Formation to the Oligocene White River Formation, but the Paleocene Tongue River Formation is at the surface throughout most of the area. All but the northeastern part of the area lies outside the limits of Pleistocene glaciation. The glacial deposits that are present locally are, for the most part, only glacial erratics that do not interfere with surface mapping techniques applied in petroleum prospecting.

MAPS

The maps indicate that the structure reflected on the Madison "Fryburg Pay" can also be seen on the Permian Minnekahta, and to a lesser degree on the Cretaceous Mowry. The major feature indicated on these maps is a northward plunging anticlinal trend extending from T. 135 N. through T. 144 N. in Ranges 101, 102 and 103 W. Four fields and seven pools have been found on this trend; of these, three fields and six pools are presently producing.

Each map includes locations of all wells drilled outside the field areas, and all discovery wells. Also indicated is a well with a Devonian show in the Fryburg field and a non-producing well with a Madison show in the Blacktail field. For all wells reporting shows on drill stem tests, the formation that yielded the show is designated.





MAP 3

TABLE 1 - Fields, Pools, and Producing Formations, Southwestern North Dakota

Field	Age	Producing Formation or Pool	Production	Remarks
Belknap	Pennsylvanian	Tyler	Oil	Plugged and Abandoned
Blacktail	Mississippian	Madison	Oil	Plugged and Abandoned
Cedar Creek	Ordovician	Red River	Oil	Producing
Cedar Creek	Mississippian	Madison	Oil	Plugged and Abandoned
Cedar Creek	Cretaceous	Eagle	Gas	Produced since July 1929
Dickinson	Mississippian	Madison	Oil	Plugged and Abandoned
Dickinson	Pennsylvanian	Tyler	Oil	Producing
Elkhorn Ranch	Devonian-Mississippian	Three Forks-Bakken	Oil	Plugged and Abandoned
Fryburg	Ordovician	Red River	Oil	Producing
Fryburg	Mississippian	Madison	Oil	Producing
Fryburg	Pennsylvanian	Tyler	Oil	Producing
Little Missouri	Ordovician	Red River	Oil	Producing
Little Missouri	Cretaceous	Eagle	Gas	Produced since May 1945
Medora	Mississippian	Madison	Oil	Producing
Medora	Pennsylvanian	Tyler	Oil	Producing
Rocky Ridge	Pennsylvanian	Tyler	Oil	Contains well with State's largest cumulative production.*

*The largest producing well in the State, Pan American Petroleum Corporation's Lucy Fritz No. 1, is located in the Rocky Ridge Field, near the center of the report area. This well has produced 780,130 barrels of oil from January 7, 1957 to January 1, 1966. Production is from Pennsylvanian Tyler Sandstone.

nomics conditions. Drilling depths are relatively great, targets are probably small, well control is sparse, and details have not been worked out concerning the time or times of oil migration relative to the formation of traps.

Drilling has been the most extensive on the two structural trends. Other trends probably are present, but sparse well control permits the drawing of only generalized contours. Further drilling should yield additional details of the Fryburg trend and should show the presence of a number of additional, though possibly small, structures. One aspect of the structure contour maps that cannot be effectively analyzed from available data is the apparent reflection or repetition of older structure in younger rocks.

Although the presence of traps not directly of tectonic origin is speculative, there are some possibilities believed worth considering. For example, the Devonian Winnipegosis, Dawson Bay, and Souris River Formations appear to wedge out updip on the east flank of the Cedar Creek anticline (Anderson, 1963). Sandstones of the Pennsylvanian Minnelusa Formation, in contact with shales and salts of the Permian Opeche Formation, are an attractive possibility. Jurassic and Cretaceous rocks contain reservoir rocks which might conceivably contain traps created by solution of salts lower in the section. Solution margins of these salts in themselves may be favorable. The Pennsylvanian Tyler Formation has additional potential, though targets are probably linear and difficult to predict.

Thus at present, southwestern North Dakota offers more possibilities than answers. Extensive, well-directed exploration will be required before critical aspects of the geologic history of the area can be understood and used effectively.

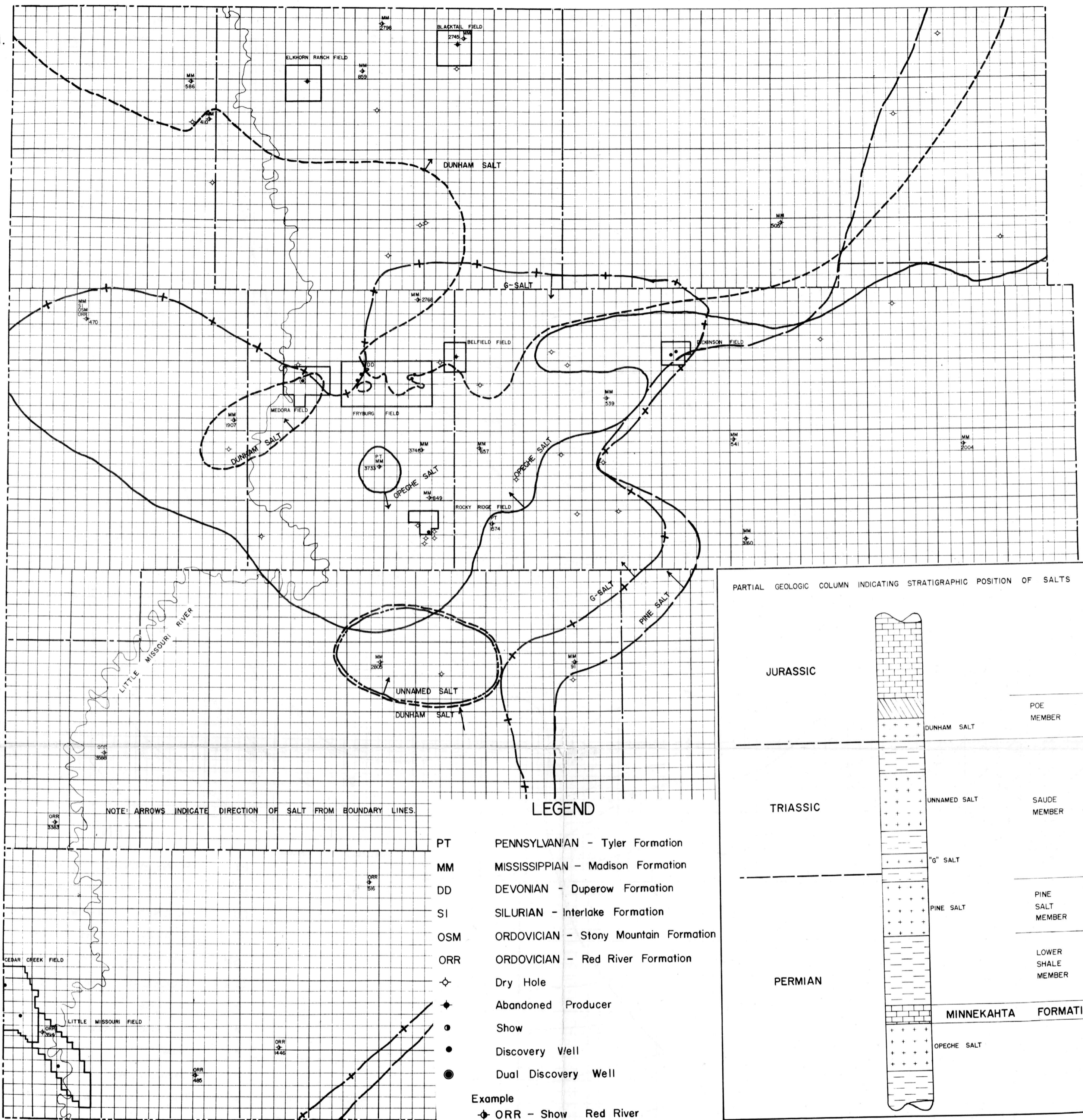
Selected References

Anderson, S. B., 1963, Selected Devonian possibilities in North Dakota: N. Dak. Geol. Survey, Miscellaneous Series 17.
Dow, W. G., 1964, The Spearfish Formation of western North Dakota: 3d Williston Basin Symposium vol. p. 127-132.

MAP 4. LIMITS OF POST-MISSISSIPPIAN SALTS

R. 105 W. 104 103 102 101 100 99 98 97 96 95 94 93 92 91

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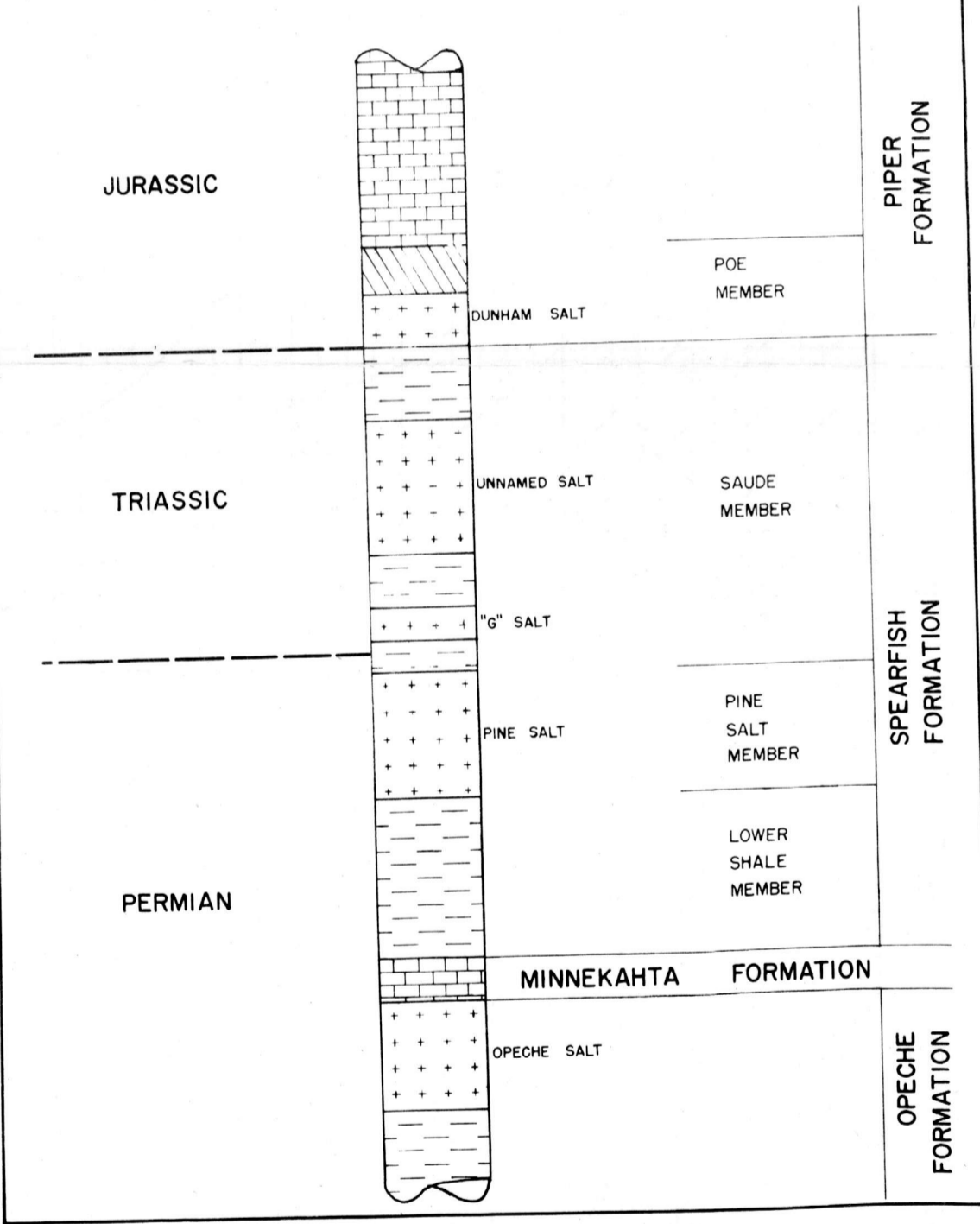
NOTE: ARROWS INDICATE DIRECTION OF SALT FROM BOUNDARY LINES.

LEGEND

- PT PENNSYLVANIAN - Tyler Formation
- MM MISSISSIPPIAN - Madison Formation
- DD DEVONIAN - Duperow Formation
- SI SILURIAN - Interlake Formation
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- Show
- Discovery Well
- Dual Discovery Well

Example
◆ ORR - Show Red River

PARTIAL GEOLOGIC COLUMN INDICATING STRATIGRAPHIC POSITION OF SALTS



**A LOOK AT THE PETROLEUM
POTENTIAL OF SOUTHWESTERN
NORTH DAKOTA**

NORTH DAKOTA
GEOLOGICAL SURVEY
WILSON M. LAIRD, State Geologist

by
S. B. ANDERSON

Report of Investigation No. 42



GRAND FORKS, NORTH DAKOTA
1966