



**Geomagnetic Survey of the Tioga Area,  
North Dakota**



by  
**MILLER HANSEN**

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**ABSTRACT**

This magnetic map of the Tioga, North Dakota vicinity includes the areas of two major and five minor oil fields. Contours of vertical magnetic intensity are shown on the map with Mission Canyon structure contours superimposed. The magnetic information will be used as a guide in the interpretation of planned magnetic surveys in adjacent areas.

**Introduction**

This map is the result of observations made with an Askania vertical component magnetometer during three field seasons from 1953 through 1955. The base map was drawn from county road maps prepared by the North Dakota Department of State Highways. The area of the survey includes approximately ten townships in Williams, Mountrail, and Burke Counties, North Dakota. The McGregor, East Tioga, White Earth, Capa and Hofflund oil fields in addition to the Beaver Lodge and Tioga fields, are located within the limits of this survey.

This investigation was undertaken in order to provide magnetic information on known producing structures. Magnetic investigations planned by the North Dakota Geological Survey in seasons to come will be interpreted in the light of information obtained from surveys such as this one over oil producing areas.

**Previous Work**

In 1954 a line of observations was run south across the Missouri River in order that a magnetic survey of the Keene Dome could be tied to the same magnetic base that was used in surveying the Tioga area. The results of the Keene Dome survey by Opp (1) have been published in the North Dakota Geological Survey's Report of Investigation No. 19.

**Instrument Data**

An Askania vertical magnetometer was used in making all observations. The instrument was calibrated by means of a Helmholtz coil about every two weeks while the field work was in progress.

**Field Procedure**

Observations were made at nearly all accessible mile corners. Procedures outlined by Jakosky (2) were followed exclusively in doing the field work. Corrections for latitude and longitude were computed from the chart "Lines of Equal Vertical Intensity for 1945, United States", which appears in the U. S. Department of Commerce publication, "United States Magnetic Tables and Magnetic Charts for 1945," Serial 667.

The question of how much interference might be expected due to cased drill holes caused some concern until a report by Barret (3) was located. Barret's work shows that effect of casing on the vertical component is negligible at a distance of about 200 feet from the casing head. All observations for this investigation were read at distances exceeding 600 feet from any well location, so the writer feels that no anomalous readings have resulted in the survey from this possible source of error.

**Discussion**

Station values in gammas were plotted on the map and magnetic contours were drawn on a 10 gamma interval. Structure contours are shown in red, superimposed on the magnetic contours. The structure contours were drawn by the staff of the North Dakota Geological Survey on top of the Mission canyon pay horizon with a contour interval of 100 feet.

The only close comparison between magnetic and structure contours is in the north-central portion of the map, where the 5300 gamma contour encloses about two-thirds of the area of a nose outlined by the -5800 foot structure contour.

The 5100 gamma contour in the southern portion of the map apparently bears no relation to Mission Canyon structure since it cuts across three structure contours. However, most of the wells in the Capa field and those in the northwestern part of the Hofflund field lie within that 5100 gamma contour.

Most of the Beaver Lodge field wells are located within the area outlined by the -6100 structure contour. The magnetic contours in this area range from 5080 to 5180 gammas, and again there is no apparent relationship between structure and magnetic contours.

The sole purpose of this map is to provide magnetic information over known production. Extended magnetic surveys will be required to determine whether more magnetic highs exist in adjacent areas.

**REFERENCES**

- Opp, A. G. "A magnetometer survey of the Keene Dome, McKenzie County, North Dakota", North Dakota Geol. Survey Report of Investigation No. 19, 1955.
- Jakosky, J. J. "Exploration geophysics", 2nd Edition, pp. 118-158, 1950.
- Barret, W. M., "Magnetic disturbance caused by buried casing", Am. Assoc. Petroleum Geologists Bull., Vol. 15, pp. 1371-89, 1931.

MAGNETIC CONTOURS ——— INTERVAL 10 GAMMAS  
 STRUCTURE CONTOURS - - - - - INTERVAL 100 FEET  
 OBSERVED VERTICAL MAGNETIC INTENSITY  
 TIOGA AREA, NORTH DAKOTA

SCALE 1 INCH = 1 MILE  
 OIL FIELDS [Stippled Box]