DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
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THE MINNESOTA GEOLOGICAL SURVEY
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GEOPHYSICAL INVESTIGATIONS
MAP GP-144

AEROMAGNETIC MAP OF CENTRAL MARSHALL AND WESTERN PENNINGTON COUNTIES, MINNESOTA

By

K. G. Books, G. M. Schwartz, J. L. Meuschke, and W. J. Dempsey

TOTAL INTENSITY CONTOURS RELATIVE TO ARBITRARY DATUM

SHEET 1 OF 2

EXPLANATION

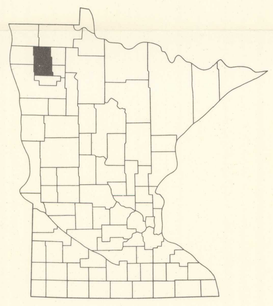
146

Magnetic contours with flight traverse; dashed contours indicate incomplete or doubtful data. Contour intervals 50 and 250 gammas

Magnetic contour enclosing area of lower magnetic intensity

X 4170
Measured maximum or minimum intensity within closed high or closed low

Drill hole



Index map of Minnesota showing area covered by this map

This aeromagnetic contour map and accompanying profiles are a part of a series showing the results of aeromagnetic surveys over approximately 49,000 square miles in Minnesota. The survey was conducted by the U. S. Geological Survey in cooperation with the Minnesota Geological Survey. The purpose of the investigation was to delineate the major magnetic trends associated with known iron ore deposits and to indicate areas that may be favorable for additional exploration.

Total-intensity aeromagnetic data were obtained by flying north-south lines spaced a mile apart at altitudes close to 500 feet above the ground. Magnetic detecting equipment consisted of the continuous recording AN/ASQ-3A airborne magnetometer modified for geophysical use with the detecting element towed about 75 feet below the aircraft. A continuous record of the altitude above ground was obtained by a recording radio altimeter. Flight lines plotted on aerial photos were used for pilot guidance. The actual flight path was recorded by a gyrostabilized continuous-strip camera, establishing ground location control. A system of simultaneous identification points marked the camera, altimeter, and magnetometer records. East-west base lines were flown to correct for diurnal variation and drift and to adjust the flight lines to a common arbitrary datum.

The magnetic anomalies shown on this map result from differences in the magnetic properties of the buried Precambrian rocks and not of the overlying rocks described in this text. The available data on both the depth of drift and the nature of rocks underlying the glacial drift—although meager—are as complete as possible.

The area mapped lies below the highest beach level of former glacial Lake Agassiz. The beaches of the principal stages, however, traverse the area from north to south. These are mainly on the west side of a north-trending belt of water-laid moraine lying west of Thief River Falls. Except for lake beaches, which furnish some low ridges, relief is low as a result of the leveling effect of lake erosion and deposition. The glacial drift and overlying lake sediments are very thick so that wells less than 200 feet deep do not reach bedrock. The greatest known thickness of drift is 350 feet.

Sedimentary rocks of Cretaceous age are not known, but local outliers may be present. The Precambrian rocks are covered at most places by residual clays and the Precambrian surface slopes gently to the southwest. In the northern part of the area a few rather poor well records indicate that the area is underlain largely by granite. Except for the east-west magnetic anomaly in the central part of the map the pattern of the magnetic contours is in accord with this interpretation. At Thief River Falls, Precambrian granite was reported in a water well at 400 to 480 feet. Granite is also reported at 400 feet in a well located in sec. 8, T. 153 N., R. 44 W. Decomposed granite is also reported at 400 feet in sec. 14, T. 154 N., R. 45 W.

Note

Aeromagnetic data are obtained and compiled along a continuous line, whereas ground magnetic surveys are made at separate points. Errors within the normal limits of any magnetic measurement may cause slight discrepancies between flight lines in an aeromagnetic map, which would be more obvious than similar discrepancies between points in a ground magnetic map. For this reason as much care should be exercised in evaluating magnetic features that appear as elongations along a single aeromagnetic traverse as in interpreting an anomaly indicated by a single ground station.

Aeromagnetic survey flown 500 feet above surface in 1952 by W. J. Dempsey and L. A. Anderson. Compilation directed by J. L. Meuschke and K. G. Books. Geology by G. M. Schwartz

Base map from Minnesota Department of Highway maps
Planimetry does not meet national standard map accuracy

APPROXIMATE MEAN DECLINATION, 1958

1 ½ 0 1 2 3 4 Miles

Approximate scale
Contour interval 50 and 250 gammas
1958

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