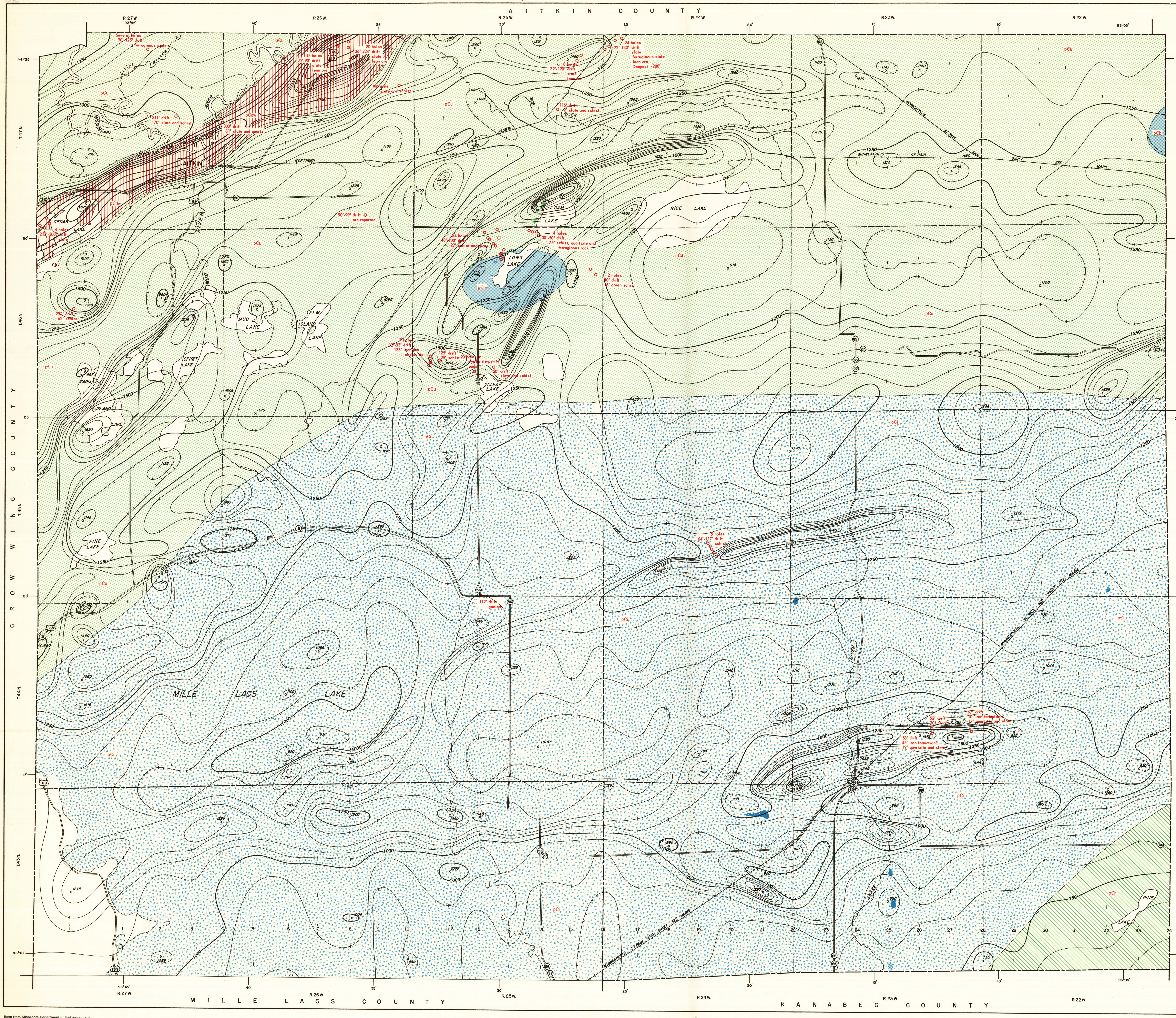
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

PREPARED IN COOPERATION WITH
THE MINNESOTA GEOLOGICAL SURVEY

GEOPHYSICAL INVESTIGATIONS
MAP GP 101



Base from Minnesota Department of Highways maps

TOTAL INTENSITY AEROMAGNETIC AND GEOLOGIC MAP OF SOUTHERN AITKIN COUNTY AND NORTHERN MILLE LACS COUNTY, MINNESOTA

RELATIVE TO ARBITRARY DATUM

1 ½ 0 1 2 3 4 MILES

Contour interval 50 & 250 gammas

Flown 1000 feet above surface

1953

EXPLANATION

FORMATIONS

PRE-CAMBRIAN

Keweenawan

p€h — Hinkley sandstone (Upper Keweenawan)

p€bi — Basic intrusives--diabase or gabbro (Middle Keweenawan and older)

Huronian

p€dw — Deerwood iron-formation--the relation of the Deerwood iron-formation and other formations is uncertain and its correlation is not fully understood.

Huronian(?)

p€i — Intrusives--McGrath gneiss, quartz monzonite (Algoman)

p€u — Undifferentiated slate and schist--probably Thompson slate in this area. (Knife Lake)

OUTCROPS
(Lithologic symbols)

Diabase

Gneiss

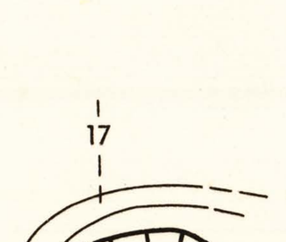
Quartz monzonite

Quartzite

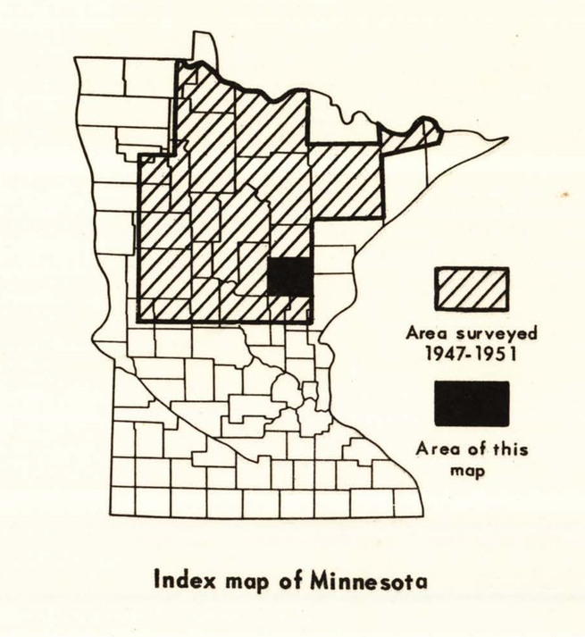
Indefinite contact

Drill hole

The stratigraphic classification and nomenclature of this report follow the usage of the Minnesota Geological Survey.



Magnetic contours with flight traverse; dashed contours indicate incomplete or doubtful data; hachured contour encloses area of lower magnetic intensity; 'x' and number denote location and value of measured maximum or minimum intensity within closed contour.



Index map of Minnesota

An aeromagnetic survey covering an area of approximately 30,000 square miles in north-central Minnesota was made during May and August 1947, May 1948, and September and October 1949 by the U. S. Geological Survey in cooperation with the Minnesota Geological Survey. The purpose of the survey was to delineate the major magnetic trends associated with known iron ore deposits and to indicate areas that may be favorable for additional exploration.

North-south traverses were flown at 1-mile intervals. This spacing was selected to cover as large an area as possible with a minimum of flying. The aeromagnetic information is presented in two forms: as an aeromagnetic map, contoured to a common arbitrary datum, and as magnetic profiles that accompany the map.

The measurements were made with an AN/ASQ-3A airborne magnetometer installed in a Beechcraft AT-11 airplane for the 1947 and 1948 flights and in a Douglas DC-3 for the 1949 flights; the detecting element of the magnetometer was towed about 75 feet below the plane. The elevation of the plane, ranging between 900 and 1,100 feet above the ground, was recorded with a continuous-recording radio altimeter. Aerial photographs were used for pilot guidance during the flights, and the flight path was recorded by a gyrostabilized continuous-strip camera. Positional accuracy of all the surveys after 1947 was increased by use of a gyrostabilized vertical sight.

G. M. Schwartz, Director of the Minnesota Geological Survey, furnished the geologic and drill-hole information for this map.

The drift (Pleistocene) is not as thick in this area as in many parts of the State; a few scattered outcrops are known. The south beach line of glacial Lake Upham extends across the northern fifth of the area.

The three southern tiers of townships-- T. 43 N. to T. 45 N.-- are underlain by Woyski's McGrath gneiss,[1] probably with some local remnants of Leith's Cuyuna series. During the early exploration of the Cuyuna district two holes were drilled to investigate the elongated anomaly in T. 44 N., R. 23 W. Iron-bearing rocks were reported to have been found in the holes, but this report cannot be verified. Near the western end of a similar-shaped anomaly in T. 45 N., Rs. 23 and 24 W., five holes were drilled and schist was found.

From the relationship of the rocks as now understood it seems probable that granite intruded the other rocks and that conditions were unfavorable for iron ore formation in the southern part of the area.

The two northern tiers of townships are underlain by metamorphosed sedimentary rocks intruded locally by basic igneous rocks. The correlation of the sedimentary rocks is uncertain. Some of the slates and schists are believed to be related to the Thomson slate, which is exposed to the east in Carlton County. To the west Leith's Cuyuna series is probably present, but the relation of the Thomson slate and Cuyuna series is uncertain. Some geologists believe that the Cuyuna series corresponds to the Animikie group. This correlation is doubtful, however, because of the amount of metamorphism of the Cuyuna series and the relationship of the formations as they are traced eastward.

Numerous holes were drilled in the area of a magnetic anomaly in T. 46 N., R. 25 W. A large replacement body of pyrrhotite and pyrite was found in the slate and schist. There is evidence that the original rock was highly ferruginous and that the pyrrhotite and pyrite have developed by addition of sulfur. It is generally assumed that the sulfide mineralization was related to a basic intrusive body that now crops out about 2 miles to the north. The replacement body varies in composition from that of a diabase to that of a diorite.

The anomaly in T. 47 N., Rs. 26 and 27 W., is associated with the continuation of the so-called South Range of the Cuyuna district. The drilling records in this area are incomplete, and the records available are from holes that are not suitably located to give adequate information on the cause of the anomaly.

Quartzite crops out in secs. 34 and 35, T. 47 N., R. 25 W. It has been suggested that this may be correlated with the Pokegama quartzite of the Mesabi range, but there is little evidence to support this interpretation.

The geologic map of the State of Minnesota, published in 1932, shows a belt of Deerwood iron-bearing formation extending across the northwest corner of T. 47 N., R. 24 W. The aeromagnetic map indicates that if iron-bearing rocks exist in that area they probably trend nearly due east across the township.

[1]Woyski, Margaret Skillman, Intrusives of Central Minnesota: Geol. Soc. America Bull., vol. 69, pp. 999-1016, 1949.

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.

INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D. C.

SHEET 1 OF 2

Aeromagnetic survey 1948 by J. R. Henderson and J. L. Meuschke
Compilation directed by J. L. Meuschke

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Per Set