DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

PREPARED IN COOPERATION WITH
THE STATE OF MINNESOTA
DEPARTMENT OF IRON RANGE RESOURCES AND REHABILITATION

MISCELLANEOUS GEOLOGIC INVESTIGATIONS
MAP I-403

PRELIMINARY SURFICIAL GEOLOGIC MAP OF THE MESABI-VERMILION IRON RANGE AREA NORTHEASTERN MINNESOTA

Ground-water studies in northeastern Minnesota are being conducted by the U.S. Geological Survey, in cooperation with the Minnesota Department of Iron Range Resources and Rehabilitation. The principal sources of ground water in this area are deposits of glacial sand and gravel.

To determine the occurrence and extent of these deposits a reconnaissance of the surficial geology within a 4400 square mile area was made. The area mapped is a parallelogram and includes the economically important parts of the Mesabi and Vermilion Iron Ranges. The west edge of the parallelogram extends from the junction of Aitkin, Cass, and Itasca Counties northward to the northwest corner of T. 59 N., R. 27 W. The area then extends northeastward to the St. Louis-Lake County line between the southeast corner of T. 57 N., R. 12 W., and the northeast corner of T. 63 N., R. 12 W.

In addition to the surficial reconnaissance, test-drilling data were utilized, as were field notes of Survey geologists who had previously worked in parts of the area.

U.S. Geological Survey topographic quadrangle maps, which cover about two-thirds of the area, were used as field maps. County highway maps were used in the northwest and southwest parts of the area. The surficial geologic map was compiled on high-altitude aerial photographs (scale 1:62,000) and transferred to a 1:125,000 scale base (enlarged from 1:250,000 Army Map Service series) by means of a vertical sketch projector. The colored patterns show areas where a particular surficial material is predominant. The areas outlined with a heavy line and identified by black patterns are geomorphic features. These were determined by study of aerial photographs, topographic maps where available, and field examination. No attempt has been made to assign ages to the deposits or to work out a sequence of events.

The geomorphic features shown on the map are as follows:

Area of surface or near-surface bedrock.—Individual bedrock outcrops are not shown on this map, but areas of shallow bedrock, as determined from topographic forms and observed outcrops, have been outlined.

The entire northeastern part of the area is one of surface or near surface bedrock and individual knobs are not outlined. A linear ridge of bedrock hills called the Giants Range extends along the north edge of the Mesabi Iron Range.

Flood plain of present stream.—This feature is restricted to the larger streams where the flood plain is a well-defined meander belt.

Drumlinoid ridge.—Elongate linear ridges believed to represent deposition along the course of an advancing glacier are identified by an arrow along their crest in the inferred direction of ice movement. Most of these lie in the southeast part of the area (Toimi drumlin field of Wright, 1956, p. 15, 17), but to the west others extend southwest from the Giants Range. Unlike the short tear-drop shape of typical drumlins, these features are long ridges exhibiting a smooth rounded topography in transverse cross section.

Terminal or recessional moraine.—East of Hibbing the moraines trend east-west or northwest-southeast, and their surficial lithology is predominantly either gray bouldery till or sand and gravel. Physiographically, these moraines are narrow ridges with irregular pitted crests. Along their extent they contain sections which could be more properly grouped under ice-contact topography, but which have been included in the outline of the moraine to preserve its continuity.

West of Hibbing the moraines show less linearity and continuity. They are distinguished by a surface of abundant knobs and ice-shove ridges. They are mantled by sand or thin silty till.

Pitted outwash plain.—These features are continuous gently sloping plains containing kettles.

Esker or crevasse filling.—Eskers and narrow crevasse fillings are indicated by a dotted line along their crest. Broad features interpreted as crevasse fillings are included under ice-contact areas.

Ice-contact area.—Ice-contact features typically exhibit steep-sided faces which were formed in direct contact with glacial ice. Areas of concentrated eskers, crevasse fillings, and (or) kame complexes are included in this category.

Also included are areas of probable outwash deposits, but whose basic topography is ice contact. These areas have isolated flat-topped hills, the tops of which, if connected, would form a gently sloping surface. The lows between the hills contain swamps, lakes, or smaller ice contact features.

Limit of glacial lake.—The contact line represents the approximate upper limit of glacial lakes within the area. The line is drawn on the break in slope from the flat-lying lake plain to higher ground. In areas of little relief, the line is approximate. Beaches were not discernible on the high altitude photographs and were not identified during the brief field reconnaissance. Within the lake basin the sediment types include swamps, sand, silt, and lake-washed till.

Glacial Lake Upham, the northern part of which lies in the south-central part of the area, was identified by Winchell (1901, p. 124, 125) as having a level of 1300 feet above sea level. The authors have mapped a high level of 1400 feet extending through the Giants Range at Biwabik, and a lower level receding southward from 1370 to 1350 feet above sea level. Still lower levels are reported south of the mapped area.

Glacial Lake Aitkin,the northern part of which lies in the southwest part of the area, was identified by Upham (1899, p. 46–47) as having a level of about 1200 feet above sea level. It has been extended northward with a lake level of approximately 1310 feet to include areas north of Grand Rapids.

Glacial Lake Norwood (Winchell, 1901, p. 125) has been outlined with a lake level of 1450 feet. It lies north of the Giants Range on the eastern Mesabi Iron Range.

The existence of other glacial lakes has been noted. One is outlined southeast of Babbitt at an altitude of about 1540 feet. A large lake at an altitude of 1400 feet above sea level exists in the northcentral part of the area, but its limits have not been defined.

REFERENCES

Upham, Warren, 1899, The geology of Aitkin County, *in* Winchell, N. H., The Geology of Minnesota: Minnesota Geol. Survey Final Report, v. 4, p. 25–54.

Winchell, N. H., 1901, Glacial lakes of Minnesota: Geol. Soc. America Bull., v. 12, p. 109–128.

Wright, H. E., Jr., 1956, Sequence of glaciation in eastern Minnesota: Geol. Soc. America Guidebook, Minneapolis meeting, pt. 3, p. 1–24.

EXPLANATION

SEDIMENT TYPES

QUATERNARY	Qct — Till, *Clayey, reddish-brown*	
	Qtst — Till, *Silty, brown*	
	Qs — Till, *Intermixed* Qct *and* Qtst	
	Qrst — Till, *Sandy, reddish-brown*	
	Qgbt — Till, *Bouldery, gray to brown*	
	Qsal — Swamp and alluvial deposits, *Peat, clay, silt, and sand*	
QUATERNARY	Qsi — Silt to silty clay	
	Qs — Sand, *May contain some gravel*	
	Qsg — Sand and gravel	
	Tgcf — Sandy and stony glacial debris, *Thin and discontinuous over bedrock*	
	Contact, *Dashed where approximate*	

GEOMORPHIC FEATURES

- Terminal or recessional moraine
- Ice-contact area
- Pitted outwash plain
- Area of surface or near-surface bedrock
- Flood plain of present stream
- Drumlinoid ridge, *Arrow along axis, in direction of ice movement*
- Esker or crevasse filling
- 1330 — 1340 — Limit of glacial lake, *Approximate lake level indicated in feet above mean sea level; queried where extent unknown beyond this point; × indicates change in altitude of glacial lake limit*
- Contact of geomorphic feature, *Dashed where approximate; dotted where concealed*

INDEX MAP OF MINNESOTA SHOWING LOCATION OF MAP AREA

Base from U.S. Geological Survey maps of Hibbing and Two Harbors, Minnesota 1:250 000

Geology by R. D. Cotter, H. L. Young, and T. C. Winter, 1962

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SCALE 1:125 000

2 0 2 4 6 8 10 MILES

2 0 2 4 6 8 10 KILOMETERS

CONTOUR INTERVAL 50 FEET
DATUM IS MEAN SEA LEVEL

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