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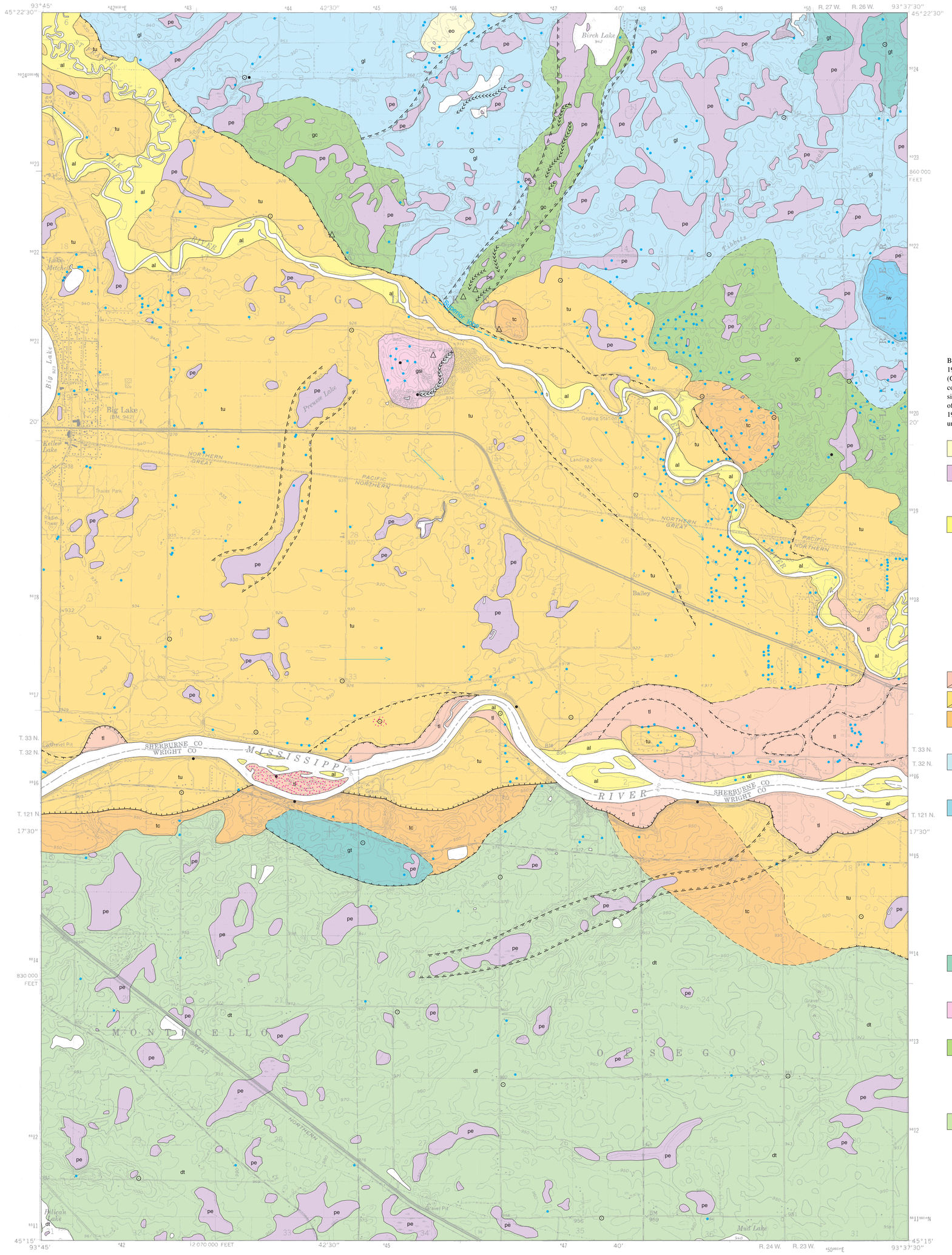
MISCELLANEOUS MAP SERIES
MAP M-123
Surficial Geology, Big Lake Quadrangle

SURFICIAL GEOLOGY OF THE BIG LAKE QUADRANGLE, SHERBURNE AND WRIGHT COUNTIES, MINNESOTA

by

Barbara A. Lusardi
2002



Base from U.S. Geological Survey Big Lake 1:24,000 quadrangle, 1991.

Universal Transverse Mercator grid, zone 15
1983 North American Datum

2°9'
TRUE NORTH
MAGNETIC NORTH
APPROXIMATE MEAN DECLINATION, 2002

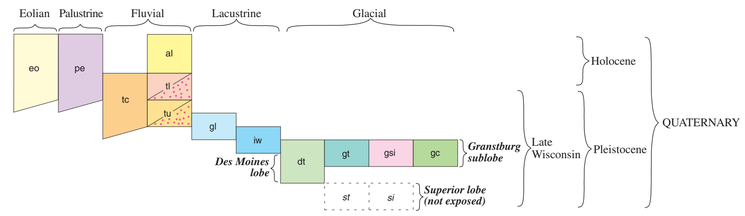
SCALE 1:24 000
1 0 1/2 1 MILE
1 0 .5 1 KILOMETER

CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

QUADRANGLE LOCATION

GIS compilation and cartography by
Joyce Meints and Philip Heywood
Edited by Lori Robinson

CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

This map emphasizes the distribution and origin of surficial materials in the area of the Big Lake 7.5-minute quadrangle. It was constructed in part using aerial photographs taken in 1977 (1:80,000-scale) and U.S. Soil Conservation Service soil-survey maps for Sherburne (Grimes, 1968) and Wright (Edwards, 1968) Counties. This was augmented by fieldwork conducted during 2001. Most exposures consisted of excavations, including construction sites and road cuts. Surface samples were supplemented with soil borings drilled to a depth of about 14.5 feet (4.4 meters). Additional data from previous mapping (Meyer and Hobbs, 1993; Meyer and Lusardi, 2000) were also included in the analyses and interpretation of map units.

EOLIAN DEPOSITS

eo **Eolian sand**—Very fine- to medium-grained sand; forms low-lying dunes.

PALUSTRINE DEPOSITS

pe **Organic deposits (Holocene to Pleistocene)**—Ponded and shallow-water sediments consisting of dark-brown to black, drained and undrained peat and muck. Typically found in depressions and surrounding lakes; may include sandy beach sediments.

FLUVIAL DEPOSITS

al **Alluvium—floodplain deposits (Holocene)**—River-channel, overbank, and slackwater sediments consisting of predominantly medium- to coarse-grained sand; interbedded with sandy loam to silt loam; layers of gravel. Organic debris is disseminated in the sediments and forms discrete peat beds. Grades into sediment of the lower terrace.

Alluvium—terrace deposits (Holocene and Pleistocene)—Fluvial sediments laid down during early, high stages of the Mississippi River and preserved as terraces above the modern floodplain. Predominantly medium- to coarse-grained sand with up to 40 percent gravel; variable thickness from 25 to 75 feet (7.5 to 23 meters) according to water well records. Thins closer to the present river channel. In places, scoured till (unit *st*) is within 10 feet (3 meters) of the surface (indicated by pattern). Sediment on lower terrace surfaces grades into floodplain alluvium. Terraces are separated into upper and lower surfaces based on general differences in elevation. In some places, there is a distinct scarp marking the edge of one terrace surface to another. In other places, the slope between surfaces is gradational and the contact line distinguishing the upper and lower surfaces is drawn to the elevation contour.

tl ***Lower terrace***—Surface ranges in elevation from approximately 870 to 910 feet (265 to 277 meters).

tu ***Upper terrace***—Surface ranges in elevation from approximately 910 to over 930 feet (277 to 283 meters).

tc ***Collapsed terrace***—Fluvial sediments as above; deposited on stagnant ice. As the ice melted, the sediments collapsed leaving an irregular terrace surface above the modern floodplain and the lower and upper terraces.

LACUSTRINE DEPOSITS

gl **Glacial lake deposits (Pleistocene)**—Lacustrine sediment consisting of very fine- to fine-grained sand; no gravel; variable thickness (4 to 15 feet [1.2 to 4.5 meters]) over Grantsburg till (unit gt); grades westward into coarser grained outwash sediments. In places the fine-grained sand has been sculpted by wind to form dunes (unit eo).

iw **Ice-walled lake deposits (Pleistocene)**—Lacustrine sediment consisting of predominantly very fine- to medium-grained sand; variable thickness from 40 to 70 feet (12 to 21 meters). Interpreted to have been deposited in a lake within stagnant ice. As the ice melted, the lake sediment remained as a high plateau on the landscape; collapsed in places where the lake formed on top of ice. In places the fine-grained sand has been sculpted by wind to form dunes (unit eo).

GLACIAL DEPOSITS

Sediment deposited by ice of the Grantsburg sublobe—a northeastward-trending offshoot of the Des Moines lobe—Deposits contain abundant crystalline rocks (basalt and granite), many red rocks (sandstone and rhyolite), and some gray, siliceous shale fragments. The till color is variable but typically is yellow-brown where oxidized. As it crossed this area, the Grantsburg sublobe incorporated much of the debris left by the Superior lobe (Fig. 1). In places, the till is a blend of the northwest and northeast source material; in other places, the till is stratified with distinct brown and "red" layers.

gt ***Till (Pleistocene)***—Unsorted sediment consisting of pebbles (abundant), cobbles (common), and boulders (rare) in a loamy to sandy loam matrix; pockets of silt, sand, and gravel in places. Average composition of the very coarse-grained sand fraction includes crystalline rocks (70 ± 6 percent), carbonate rocks (18 ± 4 percent), and shale fragments (12 ± 5 percent).

gsi ***Till over ice contact deposits (Pleistocene)***—Till, as above, over Superior lobe ice contact deposits (unit *si* in correlation of map units). Topographic relief is derived from Superior lobe deposits that consist of poorly sorted sand and gravel; layers of silty sand to cobble gravel; little to no shale.

gc ***Till/sand complex (Pleistocene)***—A mixture of sediments including till, ice-contact sand and gravel, and minor lacustrine deposits; modified by subglacial processes. Superior lobe deposits are mixed with, or thinly overlain by, sediments of the Grantsburg sublobe. Topography is collapsed and irregular; abundant elongate ridges.

Sediment deposited by ice of the northwest-source Des Moines lobe—Deposits contain abundant gray, siliceous shale fragments. The till color is variable but typically is yellow-brown where oxidized.

dt ***Till (Pleistocene)***—Unsorted sediment consisting of pebbles (abundant), cobbles (common), and boulders (rare) in a loamy matrix; pockets of silt, sand, and gravel in places. Average composition of the very coarse-grained sand fraction includes crystalline rocks (42 ± 6 percent), carbonate rocks (23 ± 4 percent), and shale fragments (35 ± 5 percent).

Sediment deposited by ice of the northeast-source Superior lobe (not shown on map)—The Superior lobe occupied this area prior to the Des Moines lobe and the Grantsburg sublobe. It is likely that ice from the Superior lobe advance was still melting when the Des Moines lobe moved into the region. Thus, the landscape records the most recent glacial events in the sediments described above and also the history of earlier glacial events, which is reflected in the landforms and sediments just beneath the surface. Collapsed irregular troughs, elongate ridges, and mounds of debris can be attributed to the Superior lobe. These deposits contain abundant crystalline rocks (basalt and granite) and many red rocks (sandstone and rhyolite). Till color is variable but is typically strong brown with a red tint (7.5 YR). Superior lobe deposits were sampled only in gravel pits or drill holes, not at the surface; therefore, these units do not appear on the map. They are mantled by younger deposits of the Des Moines lobe and Grantsburg sublobe. A description of Superior lobe deposits is included herein for comparison with those overlying deposits.

Till (st) (Pleistocene)—Unsorted sediment consisting of pebbles (abundant), cobbles (common), and boulders (rare) in a sandy loam matrix; pockets of silt, sand, and gravel in places. Average composition of the very coarse-grained sand fraction includes crystalline rocks (95 ± 4 percent), carbonate rocks (4 ± 4 percent), and shale fragments (1 ± 1 percent). This unit occurs near the surface in places along the Mississippi River (patterned units tu and tl).

Ice-contact deposits (si) (Pleistocene)—Stratified sediments consisting of poorly sorted sand and gravel; layers of silty sand to cobble gravel; little to no shale. Deposited at the mouth of a subglacial channel at the edge of the ice. Mined for construction aggregate.

MAP SYMBOLS

Contact—Dashed where gradational or inferred. Established from aerial photographs, geomorphic expression, soils maps, well logs, borings, and examination of surficial material.

Esker—Sinuous ridge of sand and gravel deposited in an ice-walled channel. The subglacial fluvial sediment may be covered by 10 feet (3 meters) or more of till. Arrows indicate inferred flow direction. South- and west-flowing eskers are interpreted to be of Superior lobe origin and are buried by a thin layer of Des Moines lobe deposits. The esker ridge may no longer exist due to mining of sand and gravel deposits. Esker position inferred from the presence of narrow, elongate lakes and from aerial photographs taken prior to excavation.

Ice margin—Label on up-ice side; temporary position of the edge of the Superior lobe as indicated by the presence of ice-contact deposits at the end of tunnel valleys.

Irregular trough—Locally contains long lakes or chains of lakes. Interpreted to reflect valleys cut by meltwater flowing beneath Superior lobe ice that were partially buried by subsequent glacial events. May have a fan of debris accumulated at the mouth of the trough.

Scarp—Hachures point down scarp; dashed where discontinuous or obscure. Marks former channel or ice contact position. Symbol appears at the base of the scarp at the boundary between upland and channel or ice contact sediments.

General flow direction—Arrows point downstream in the direction glacial meltwater once flowed.

Soil boring—Auger depths average 16 feet (5 meters).

Sample location—Includes outcrops, road cuts, and construction sites.

Sample location—Marks location of sample or observation by other geologists (Meyer and Hobbs, 1993).

Record of water-well construction—Location of a water well for which there is a log prepared by a well driller. The information on the log is interpreted by a geologist and the location of the well verified. There are 543 well records for the Big Lake quadrangle.

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Edwards, R.J., 1968, Soil survey of Wright County, Minnesota: U.S. Soil Conservation Service, scale 1:15,840, W94°15'22"–93°30'54"/N45°25'23"–44°58'40" [printed diagrams, 126 numbered, fold-out diagrams bound with text].

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ACKNOWLEDGMENTS

Brad Setter and Alan R. Knaeble drilled the Giddings holes and described many of the 71 samples collected in the Big Lake quadrangle.

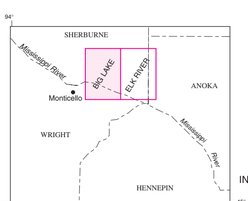

Figure 1. Simplified drawing of ice lobes at ~14 Ka showing location of quadrangle.

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