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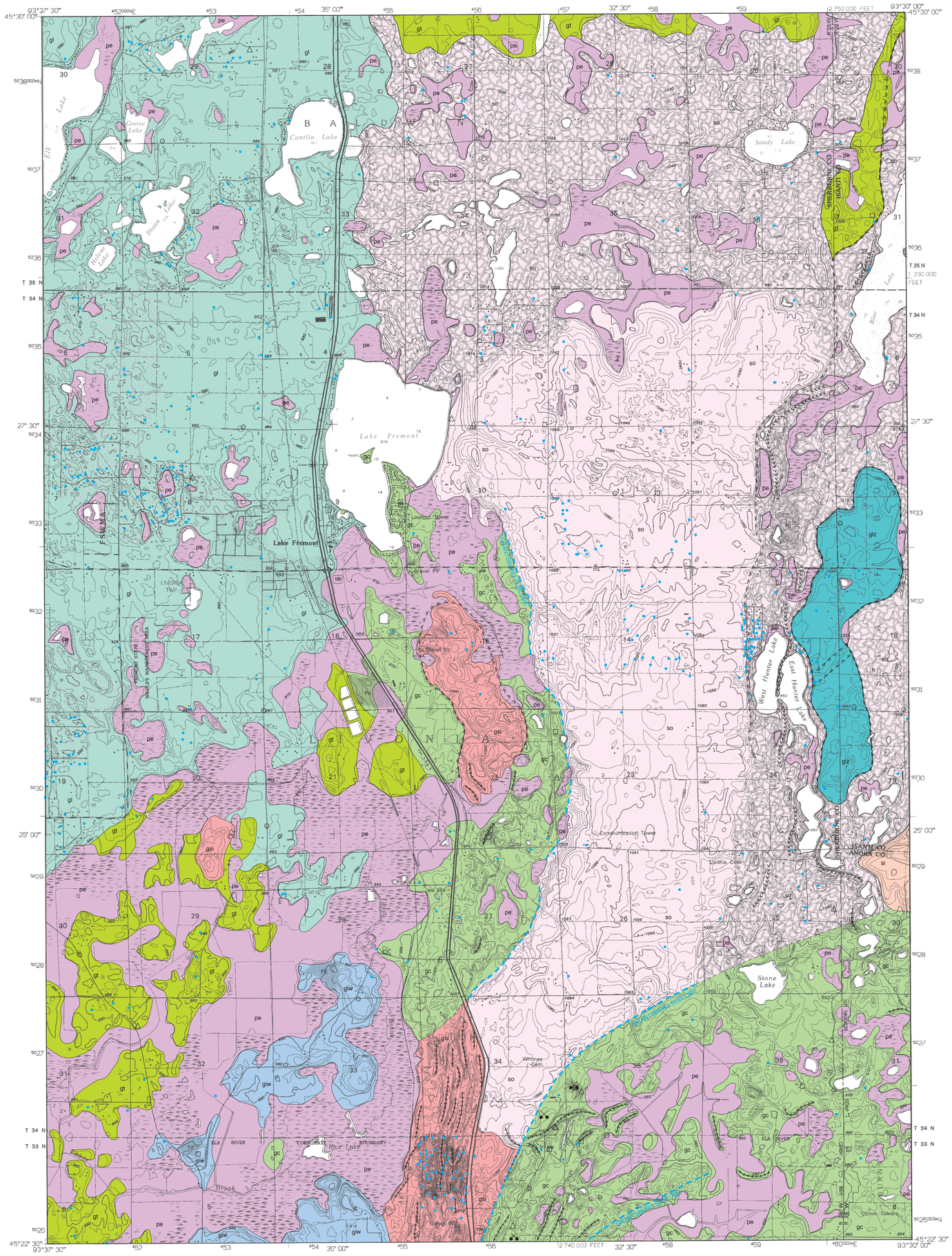
MINNESOTA GEOLOGICAL SURVEY
MISCELLANEOUS MAP SERIES, MAP M-134
Surficial Geology, Lake Fremont Quadrangle



Base from U.S. Geological Survey Lake Fremont 1:24,000 quadrangle, 1974

Universal Transverse Mercator grid, zone 15
1983 North American Datum

APPROXIMATE MEAN DECLINATION, 2003

SCALE 1:24 000

1 1/2 0 1 MILE

1 .5 0 1 KILOMETER

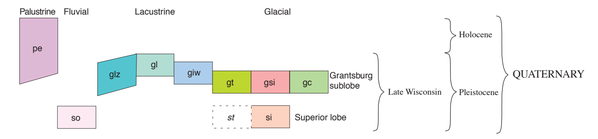
MINNESOTA
QUADRANGLE LOCATION

GIS compilation and cartography by Joyce Meints and Philip Heywood

SURFICIAL GEOLOGY OF THE LAKE FREMONT QUADRANGLE, SHERBURNE, ISANTI, AND ANOKA COUNTIES, MINNESOTA

By
Barbara A. Lusardi
2003

CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

INTRODUCTION

This map emphasizes the distribution and origin of surficial materials in the area of the Lake Fremont 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 of Sherburne (Grimes, 1968), Isanti (Farnham, and others, 1958), and Anoka (Chamberlin, 1977) Counties. This was augmented by fieldwork conducted during 2002. Most exposures consisted of excavations, including construction sites and road cuts. Surface samples were supplemented with soil borings drilled to a depth of about 17 feet (5.2 meters). Data from previous mapping (Meyer and Hobbs, 1993; Meyer and others, 1993; Meyer and Patterson, 1999) were also included in the analyses and interpretation of map units.

HOLOCENE

pe — **Clay, silt, and organic debris**—Dark brown to black peat and muck. *Peat and bog sediment*

PLEISTOCENE

Sediment associated with the northwest-source Grantsburg sublobe of the Des Moines lobe—Deposits contain abundant crystalline rocks (basalt, granite, and rhyolite), many red sandstone fragments, and some gray, siliceous shale fragments. The till color is variable but is typically 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.

gl — ***Sand***—Very fine to coarse-grained; little to no gravel; massive to stratified in places. Variable thickness, generally 5–70 ft (1.5–21 m); distributed over a wide, relatively level area. Interpreted to have been deposited in a flooded outwash plain, (sandur) environment, or in a shallow lake. *Lake sediment*.

glw — ***Sand***—Very fine to medium-grained. Forms isolated or coalescing knobs within an otherwise low-relief landscape. Over 16 ft (5 m) thick. 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. *Lake sediment*.

Sand and silt—Very fine grained sand to clayey silt; no gravel; obscurely bedded; 16–26 ft (5–8 m) thick where drilled. *Lake sediment*.

glz — ***Loam to sandy loam***—Pebbly, unsorted; pockets of silt, sand, and gravel in places. Average composition of the very coarse grained sand fraction includes crystalline rocks (70 ± 10 percent), carbonate rocks (16 ± 7 percent), and shale fragments (13 ± 4 percent). About 30 ft (9 m) thick. *Glacial till*.

gt — ***Loam to sandy loam over sand and gravel***—Sediments as above, over poorly sorted, shale-free sand and gravel and layers of silty sand to cobble gravel. Elongate ridges are common. Generally less than 20 ft (6 m) thick; some areas may have little to no till cover. *Thin glacial till over Superior lobe sand and gravel*.

gsi — ***Loam to sandy loam and sand and gravel***—Mixture of sediments described above, including loam to sandy loam (till); poorly sorted, shale free sand and gravel; layers of silty sand to cobble gravel (outwash sediments), and very fine sand to clayey silt (lake sediments). Topography is low in elevation, irregular and hummocky; abundant elongate ridges. Glacial deposits associated with the Superior lobe (outwash) are mixed with, or thinly overlain by, glacial till and lake sediments associated with the Grantsburg sublobe. *Collapsed glacial sediment*.

gc — **Sediment associated with the northeast-source Superior lobe**—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 a 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, granite, and rhyolite) and many red sandstone fragments. Till color is variable but is typically strong brown with a red tint (7.5 YR).

so — **Sand, gravelly sand, and cobble gravel**—Well to poorly sorted; crossbedded to flatbedded; interbedded in places with unsorted sediments (till, cobbles, boulders); contains abundant crystalline rocks (basalt, granite, and rhyolite) and red sandstone fragments. Unit is as thick as 100 ft (30 m) in places and forms a relatively level plain that is topographically higher than surrounding area. On the north and east sides of the mapped unit, the landscape becomes irregular and hummocky (see Map Symbols). Rare shale fragments may be found in this region, an indication that the Grantsburg sublobe was able to advance into the area. Sand and gravel is interpreted to have been deposited on top of ice that later melted. To the east, the landscape is characterized by irregular troughs and numerous eskers. This area is interpreted to have been part of a tunnel-valley complex that formed during the retreat of the Superior lobe. An eastward extension of fan deposits (see adjacent Crown quadrangle) suggests that the original tunnel may have filled with sediment, causing the meltwater to discharge through another outlet for a period of time. The high-relief sand and gravel deposits (unit si) on this and the adjacent quadrangle are the resulting fan deposits of that redirected tunnel-valley flow (Patterson, 1994). *Outwash*.

si — **Sand and gravel**—Poorly sorted sand and gravel; bedded; layers of silty sand to cobble gravel; little to no shale. Mantled in places by younger deposits of the Grantsburg sublobe. Topography is generally high relief, irregular, and hummocky. Fan-shaped feature interpreted to have been deposited by meltwater exiting a tunnel-valley to the north and flowing on or adjacent to stagnant ice. *Collapsed, high relief outwash*.

Sandy loam—Pebbly, unsorted; contains pockets of silt, sand, and gravel in places. Average composition of the very coarse grained sand fraction includes crystalline rocks (100 percent)—no carbonate rocks or shale fragments. This unit does not appear on the map, but is shown—as unit *st*—on the Correlation of Map Units. The description is included for comparison with overlying deposits. The unit was sampled only in gravel pits or drill holes, and not at the surface. *Glacial till*.

MAP SYMBOLS

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

Windblown sand—Dunes and blow-outs; relief locally exceeds 30 feet (9 meters).

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. Arrowheads indicate inferred flow direction. South- and west-flowing eskers are interpreted to be of Superior-lobe origin and may be buried by a thin layer of Des Moines–lobe deposits.

Elongate ridge—Interpreted to be an esker, although no flow direction is inferred.

Irregular trough—Collapsed and filled channel; may have been cut by meltwater flowing beneath the ice, or through stagnant ice; partially buried by subsequent glacial sediments.

Irregular, hummocky topography—Interpreted to have formed as sediments of unit (so) were deposited on stagnant ice. When the ice melted, the sediments collapsed.

Ice margin, obscure—Labels on up-ice side; Temporary position of the edge of the Grantsburg sublobe as indicated by topographic evidence: elongate tract of irregular hills, or break in slope.

Gravel pit (sand and gravel)—Superior-lobe ice-contact deposits (unit si) are exposed in many of these pits.

⊙ **Soil boring**—Auger depths average 17 feet (5.2 meters).

Sample locations.

△ Outcrops, road cuts, and construction sites.

□ Location of sample or observation by other geologists (Meyer and Hobbs, 1993; Meyer and others, 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 475 well records for the Lake Fremont quadrangle.

REFERENCES

Chamberlin, L.M., 1977, Soil survey of Anoka County, Minnesota: U.S. Soil Conservation Service, scale 1:15,840, W93°30'44"–93°01'06"/N45°24'47"–45°02'00" [printed diagrams, 68 numbered, fold-out diagrams bound with text].

Grimes, M.F., 1968, Soil survey of Sherburne County, Minnesota: U.S. Soil Conservation Service, scale 1:15,840, W94°09'–93°30'38"/N45°33'33"–45°14'44" [printed diagrams, 78 numbered, fold-out diagrams bound with text].

Farnham, R.S., Simonson, G.H., Johnson, W., and Hermanson, H.P., 1958, Soil survey of Isanti County, Minnesota: U.S. Soil Conservation Service, scale 1:20,000, W93°30'54"–93°01'12"/N45°44'00"–45°24'34" [printed diagrams, 40 numbered, fold-out diagrams bound with text].

Lusardi, B.A., 2002a, Surficial geology of the Big Lake quadrangle, Sherburne and Wright Counties, Minnesota: Minnesota Geological Survey Miscellaneous Map Series, Map M-123, scale 1:24,000 [single printed sheet].

Lusardi, B.A., 2002b, Surficial geology of the Elk River quadrangle, Sherburne, Wright, and Anoka Counties, Minnesota: Minnesota Geological Survey Miscellaneous Map Series, Map M-124, scale 1:24,000 [single printed sheet].

Lusardi, B.A., 2003, Surficial geology of the Crown quadrangle, Anoka and Isanti Counties, East-Central Minnesota: Minnesota Geological Survey Miscellaneous Map Series, Map M-133, scale 1:24,000 [single printed sheet].

Meyer, G.N., and Hobbs, H.C., 1993, Quaternary geologic map of Sherburne County, Minnesota: Minnesota Geological Survey Miscellaneous Map Series, Map M-77, 1 pl., scale 1:100,000, W94°09'–93°30'38"/N45°33'33"–45°14'44" [single printed sheet].

Meyer, G.N., and Patterson, C.J., 1999, Surficial geology of the Anoka 30 x 60 minute quadrangle, Minnesota: Minnesota Geological Survey Miscellaneous Map Series, Map M-97, scale 1:100,000, W93°00'–92°00'/N45°30'–45°00' [electronic file].

Meyer, G.N., Patterson, C.J., Hobbs, H.C., and Lehr, J.D., 1993, Surficial geology, Plate 1 *in* Meyer, G.N., and Falteisek, J., eds., Anoka Sand Plain regional hydrogeologic assessment: Minnesota Department of Natural Resources, Division of Waters Regional Hydrogeologic Assessment Series, RHA-1, scale 1:200,000, 94°09'00"–92°38'45"/N45°44'07"–45°02'08" [single printed sheet].

Patterson, C.J., 1994, Tunnel-valley fans of the St. Croix moraine, east-central Minnesota, USA, *in* Warren, W.P., and Croot, D.G., eds., Formation and deformation of glacial deposits: Proceedings of the meeting of the commission on the formation and deformation of glacial deposits: Rotterdam, Balkema, p. 69–87.

ACKNOWLEDGMENTS

Howard Hobbs and Alan R. Knaeble drilled the Giddings auger holes and described many of the 178 samples collected in the Lake Fremont and Crown quadrangles.

Every reasonable effort has been made to ensure the accuracy of the factual data on which this map interpretation is based; however, the Minnesota Geological Survey does not warrant or guarantee that there are no errors. Users may wish to verify critical information; sources include both the references listed here and information on file at the offices of the Minnesota Geological Survey in St. Paul. In addition, effort has been made to ensure that the interpretation conforms to sound geologic and cartographic principles. No claim is made that the interpretation shown is rigorously correct, however, and it should not be used to guide engineering-scale decisions without site-specific verification.

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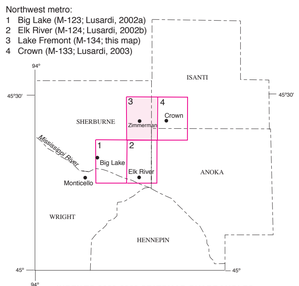
Northwest metro:
1 Big Lake (M-123; Lusardi, 2002a)
2 Elk River (M-124; Lusardi, 2002b)
3 Lake Fremont (M-134; this map)
4 Crown (M-133; Lusardi, 2003)



INDEX TO 2002-2003 STATEMAP QUADRANGLES IN THE TWIN CITIES METROPOLITAN AREA

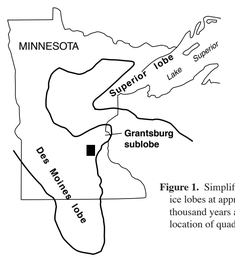


Figure 1. Simplified drawing of ice lobes at approximately 14 thousand years ago, showing location of quadrangle