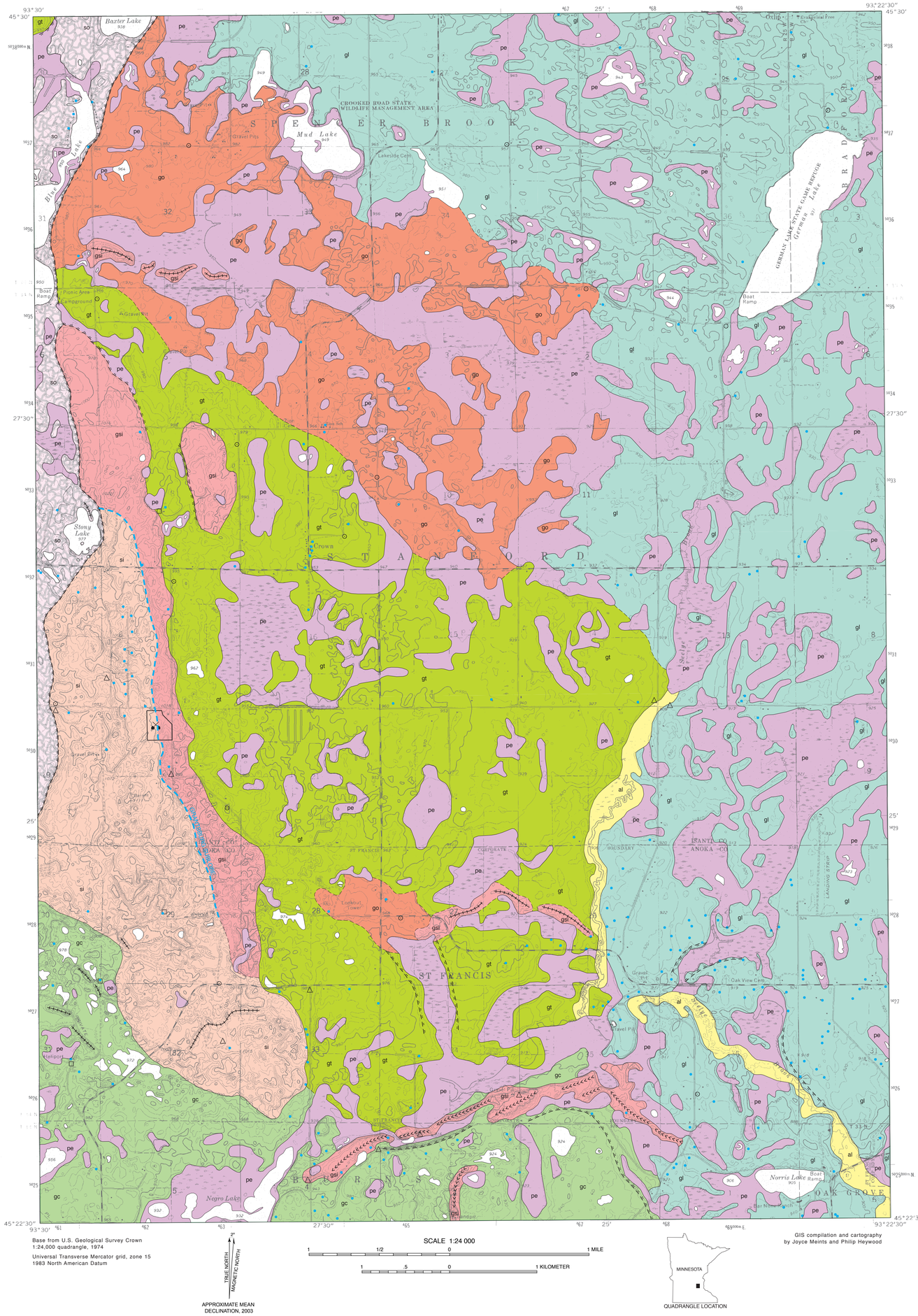
UNIVERSITY OF MINNESOTA

MINNESOTA GEOLOGICAL SURVEY
V.W. Chandler, *Interim Director*

Prepared and Published with the Support of
THE U.S. GEOLOGICAL SURVEY AS PART OF THE 2002 STATE GEOLOGIC MAPPING PROGRAM ELEMENT (STATEMAP)
OF THE NATIONAL GEOLOGIC MAPPING PROGRAM

MINNESOTA GEOLOGICAL SURVEY
MISCELLANEOUS MAP SERIES, MAP M-133
Surficial Geology, Crown Quadrangle



Base from U.S. Geological Survey Crown 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

QUADRANGLE LOCATION

GIS compilation and cartography by Joyce Meints and Philip Heywood

The University of Minnesota is an equal opportunity educator and employer

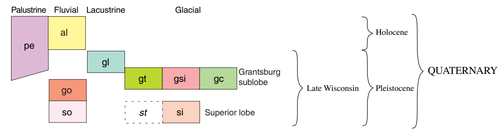
SURFICIAL GEOLOGY OF THE CROWN QUADRANGLE, ANOKA AND ISANTI COUNTIES, MINNESOTA

By

Barbara A. Lusardi

2003

CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

This map emphasizes the distribution and origin of surficial materials in the area of the Crown 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 Isanti (Farnham, and others, 1958) and Anoka (Chamberlin, 1977) Counties, which were augmented by fieldwork conducted during 2002. Most exposures consisted of excavations and included construction sites and road cuts. Surface samples were supplemented with soil borings drilled to a depth of about 17 feet (5.2 meters). Additional data from previous mapping (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.*

al — **Sand**—Medium- to coarse-grained; interbedded with sandy loam to silt loam; layers of sand and gravel. Organic debris may be disseminated in the sediments and (or) form discrete peat beds. *Alluvium.*

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 materials; 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 5–50 ft (1.5–15 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.*

go — ***Sand, gravelly sand, and cobble gravel***—Moderately to poorly sorted; crossbedded to flatbedded; interbedded in places with unsorted sediments (till, cobbles, boulders). Variable thickness, generally 10–45 ft (3–14 m). Unit contains sediment from both northeast and northwest sources that include abundant crystalline rocks (basalt, granite, and rhyolite), many red sandstones, and some gray, siliceous shale fragments. *Outwash.*

gt — ***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 (76 ± 11 percent), carbonate rocks (13 ± 8 percent), and shale fragments (11 ± 5 percent). Variable thickness: over 100 ft (30 m) in places to the south and about 30 ft (9 m) to the north. *Glacial till.*

gsi — ***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.*

gc — ***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.*

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 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 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; rare shale fragments. The landscape is locally hummocky and characterized by irregular troughs where shown by the map symbol below. 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 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. Over 100 ft (30 m) thick in places. Mantled in places by younger deposits of the Grantsburg sublobe. Interbedded with layers of sandy loam to loam at depth. 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.

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. Arrow heads indicate inferred flow direction. Eskers indicating south and west flow are interpreted to be of Superior-lobe origin and may be buried by a thin layer of Des Moines–lobe deposits (mapped as unit gsi).

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—Label on up-ice side. Temporary position of the edge of the Grantsburg sublobe as indicated by topographic evidence, such as elongate tract of irregular hills or break in slope.

Gravel pit (sand and gravel)—Indicates areal extent of a large gravel pit; outline drawn from aerial photographs, site-specific observations, and location as shown on the topographic map. Superior lobe ice-contact deposits (unit si) are exposed in this pit.

⊙ **Soil boring**—Auger depths average 17 feet (5.2 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; 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 230 well records for the Crown 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].

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 Lake Fremont quadrangle, Sherburne, Isanti, and Anoka Counties, East-Central Minnesota: Minnesota Geological Survey Miscellaneous Map Series, Map M-134, scale 1:24,000 [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, Assessment RHA-1, scale 1:200,000, 94°09'00"–92°38'45"/N45°44'07"–45°02'08" [single printed sheet].

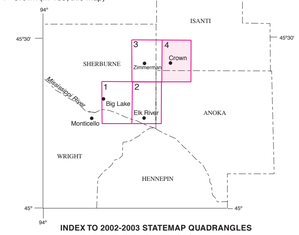
Patterson, C.J., 1994, Tunnel-valley fans of the St. Croix moraine, east-central Minnesota, USA, *in* Warren, W.P., and Croot, D.G., eds., Formation and deformation of glacial deposits—Proceedings of the meeting of the commission on the formation and deformation of glacial deposits: Rotterdam, Balkema,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

ACKNOWLEDGMENTS

Howard C. 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

Supported by the U.S. Geological Survey, National Cooperative Geologic Mapping Program, under assistance Award No. 02HQAG0036.

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



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 quadrangle location.