UNIVERSITY OF MINNESOTA
MINNESOTA GEOLOGICAL SURVEY
David L. Southwick, Interim Director

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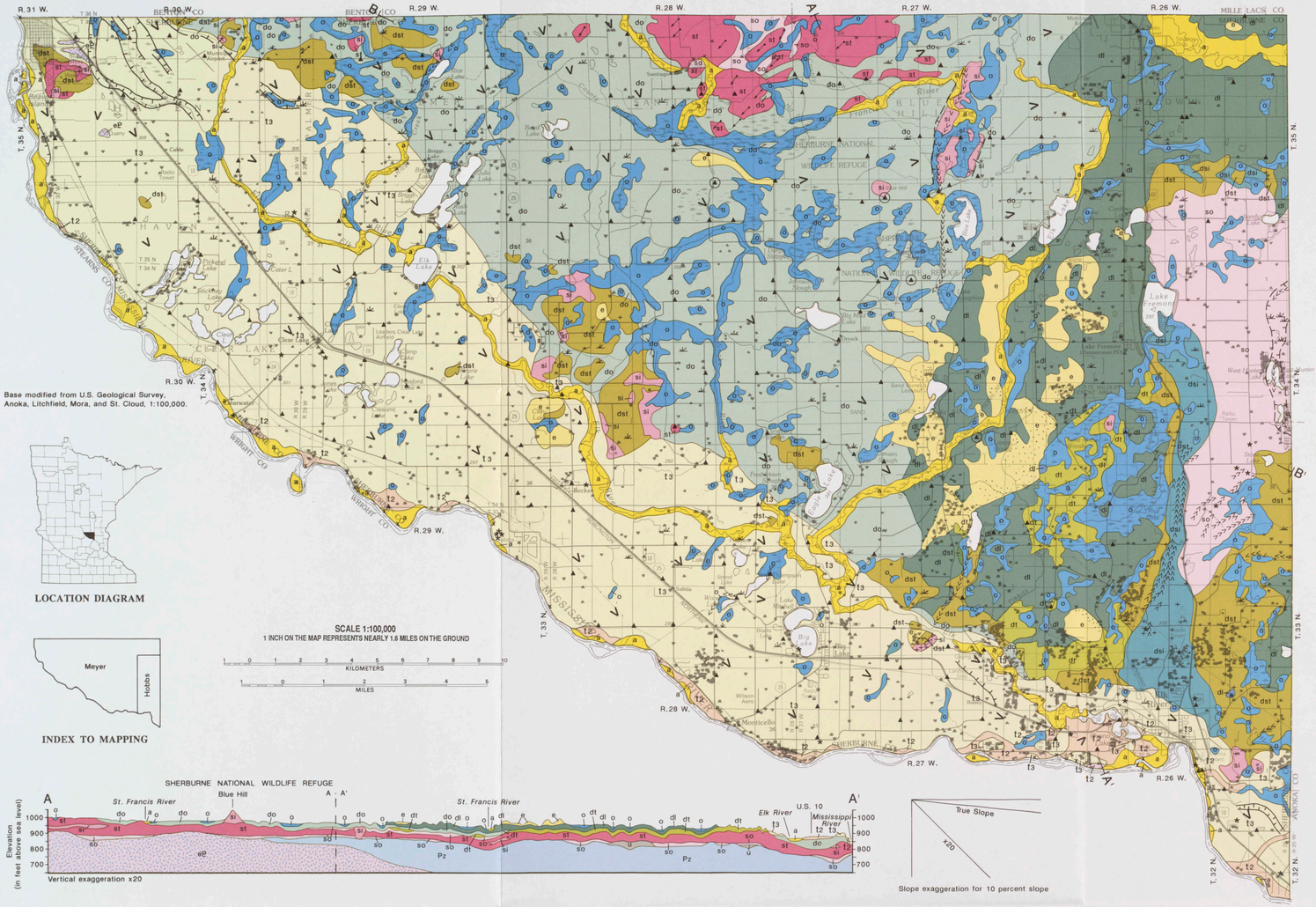
MINNESOTA DEPARTMENT OF NATURAL RESOURCES, DIVISION OF WATERS

MISCELLANEOUS MAP SERIES
MAP M-77
Quaternary map, Sherburne County

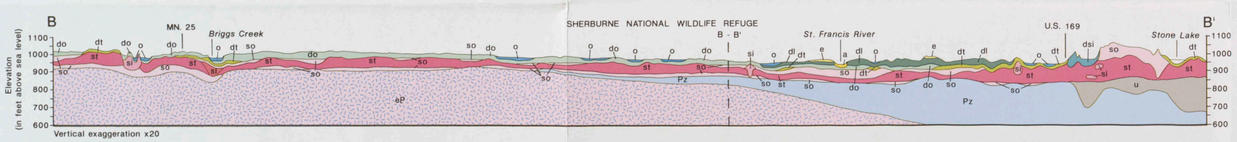


LOCATION DIAGRAM

INDEX TO MAPPING

SCALE 1:100,000
1 INCH ON THE MAP REPRESENTS NEARLY 1.6 MILES ON THE GROUND

Slope exaggeration for 10 percent slope



Cartography by Richard B. Darling

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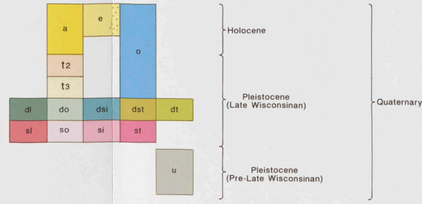
CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

POSTGLACIAL DEPOSITS

e — EOLIAN SAND—Windblown, fine sand more than 5 feet thick, forming low-lying dunes. Pattern indicates dune relief exceeding 30 feet.

o — ORGANIC DEPOSITS—Peat and organic-rich sediment; shown where generally more than 3 feet thick. Includes small bodies of open water. Many bogs too small to show in color indicated by symbol.

a — FLOODPLAIN ALLUVIUM—Mississippi River alluvium consists of less than 5 feet of silt loam to loamy sand overlying sand, gravelly sand, and cobbly gravel. Alluvium of smaller rivers is less gravelly with depth and is typically topped and interbedded with thin organic-rich layers. Contacts with other map units are commonly scarps.

MISSISSIPPI RIVER TERRACE DEPOSITS—Most contacts with other map units are scarps. Lower terrace is absent in Sherburne County; present only below St. Anthony Falls in Minneapolis.

t2 — MIDDLE TERRACE—Sand, gravelly sand, and cobbly gravel; mixed clasts of Superior lobe and Des Moines lobe provenance.

t3 — UPPER TERRACE—Sand, gravelly sand, and cobbly gravel; mixed clasts of Des Moines lobe and Superior lobe provenance. Covered by thin peat in the channel bottoms on the upper terrace in the northwestern corner of the map area.

DEPOSITS ASSOCIATED WITH THE DES MOINES LOBE—Keewatin provenance (Fig. 1; Table 1).

dl — LACUSTRINE SAND—Very fine to medium sand, loamy in places; chiefly laid down in an early stage of Glacial Lake Anoka, but includes sediment deposited in small ice-walled lakes in the area between Lake Fremont and Elk River. The fine sand of Glacial Lake Anoka is underlain by coarser outwash sand in many places. The boundary with unit do is gradational because it consisted of deltas at the mouths of outwash streams when deposition of outwash ceased. Thin clay and silt beds at depth in the Princeton area may have been deposited in Glacial Lake Grantsburg. The upper few feet of sand has commonly been reworked by wind action.

do — OUTWASH—Sand, gravelly sand, and gravel. Commonly includes Superior lobe rock types. The upper few feet has in many places been reworked by wind action. Commonly overlain by thin peat in low-lying areas.

dsi — ICE-CONTACT STRATIFIED DEPOSITS—Sand, gravelly sand, and cobbly gravel; locally covered and interbedded with sandy glacial till and both eolian and lacustrine fine sand and silt. Shale clasts rare to abundant.

dt — GLACIAL TILL—Chiefly loam-textured, unsorted sediment, with some scattered pebbles, cobbles, and boulders; few lenses of stratified sediment. Commonly overlain by a few feet of lacustrine or eolian sand.

dst — TILL OVER SUPERIOR LOBE DEPOSITS—Loam, sandy clay loam, and sandy loam ranging from less than 1 to 20 feet in thickness, over a zone of interbedded Des Moines lobe till and Superior lobe till, sand, and gravel. Where topography is steeply rolling or gullied, Superior lobe deposits are locally at or very near the surface. Capped in places by thin deposits of fine sand, primarily eolian in origin. Shown as unit dt over Superior lobe materials on cross sections.

DEPOSITS ASSOCIATED WITH THE SUPERIOR LOBE—Labradoran provenance (Table 1)

sl — LAKE SEDIMENT—Chiefly laminated silt and clay. Partly fills a large channel cut into till. Shown only on cross section B—B'.

so — OUTWASH—Sand, gravelly sand, and gravel. The large area north of Elk River is capped in places by thin Des Moines lobe deposits.

si — ICE-CONTACT STRATIFIED DEPOSITS—Sand, gravelly sand, and cobbly gravel; locally includes thick beds of silt, very fine sand, or till. In some places mapped as unit si, it is overlain by patchy Superior till or thin Des Moines lobe deposits.

st — GLACIAL TILL—Chiefly sandy loam-textured, unsorted sediment, with pebbles, cobbles, and boulders. In the northern part of the county, mostly very dense, subglacial till, overlain in places by thin deposits ranging from sand to cobbly gravel. In the subsurface in southern Sherburne County, lenses of sand and gravel are more common and the supraglacial till is generally thicker.

UNDIFFERENTIATED PLEISTOCENE SEDIMENT

u — PLEISTOCENE DEPOSITS—Primarily pre-late Wisconsinan Keewatin-source till, interbedded in places with stratified deposits and an older Superior lobe till. Shown only on cross sections where the data are insufficient to distinguish stratigraphic units.

PALEOZOIC SEDIMENTARY ROCKS

Pz — CAMBRIAN ROCKS, UNDIVIDED—Quartzose sandstone, feldspathic to glauconitic sandstone and siltstone, and dolomitic siltstone. Shown only on cross sections.

PRECAMBRIAN ROCKS, UNDIVIDED

eP — EARLY PROTEROZOIC IGNEOUS ROCKS—Includes the Reformatory Granite at the surface in the northwestern corner of the county.

MAP SYMBOLS

- Geologic contact—Approximately located; inferred on cross sections. Subsurface units in the cross sections are greatly simplified, and in general are less continuous than shown.
- Bogs—Selected organic deposits too small to show in color.
- General flow direction of braided streams that deposited surficial sand and gravel—Arrows point downstream.
- Scarp or channel on the upper terrace. Shown only where prominent.
- >>>>>> Esker—Sinuous ridge of sand and gravel deposited in an ice-walled channel of a glacial meltwater stream. Arrows show inferred flow direction. South-flowing eskers interpreted to be of Superior lobe origin are buried by Des Moines lobe deposits. North-flowing eskers mapped over unit so at the east edge of the county are too narrow to show except as symbol.
- Drumlin—Streamlined hill or ridge, typically of glacial till, with long axis in inferred direction of Superior lobe ice movement across northern Sherburne County.
- Sides of a buried tunnel valley—Drainage channel interpreted to have formed below Superior lobe ice.
- Located water well; driller's log used to compile this map. Data available in CWI computer file at MGS. Symbols omitted for monitoring wells at the Elk River landfill beneath symbols for eskers.
- ▲ Soil boring records—Generally more accurate and detailed than well logs, but not as deep; in paper files at MGS.
- ★ Cuttings samples—Stored at MGS.
- Split-spoon and cuttings samples–Logs, sample data, and samples stored at MGS, which supervised drilling of these four test holes.
- × Natural exposures of Quaternary sediment—Large or otherwise significant exposures noted in 1990 and likely to remain for some years into the future.
- \+ Artificial exposures of Quaternary sediment—Large or otherwise significant excavations noted in 1990, longevity uncertain.

ACKNOWLEDGMENTS

Carrie J. Patterson compiled information from soil maps and interpreted air photos. Thanks are due to the many landowners, government officials, and gravel pit operators who allowed access to sites across the county.

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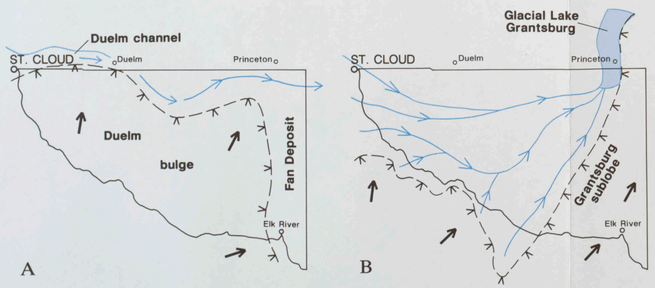

Figure 1. Des Moines lobe offshoots into Sherburne County

A. Maximum position of a short-lived northward extension of the Des Moines lobe named for the town of Duelm on Highway 6 in Benton County just north of Sherburne County. The associated Duelm channel carried meltwater eastward along the edge of the ice. Eastward advance of the ice was blocked by a large Superior lobe fan deposit north of Elk River, and by other large constructional features left by the Superior lobe to the southeast across Hennepin County (Meyer and Hobbs, 1989).

B. The Grantsburg sublobe formed when Des Moines lobe ice was able to override the Superior lobe constructional features, and surge across the lowland to the northeast as far as Grantsburg, Wisconsin. The Duelm bulge receded off the topographically higher terrain of western Sherburne County, and was replaced by an extensive outwash plain laid down by meltwater flowing northeastward into Glacial Lake Grantsburg (Cooper, 1935). Following stagnation of the Grantsburg sublobe, meltwater flow across the county was east and southeast into Glacial Lake Anoka (Meyer, 1993).

Table 1. Comparison of glacial deposits in Sherburne County

	Keewatin	Labradoran
Till texture	loam to clay loam	sandy loam
Color (oxidized)	yellow brown to olive brown	brown to reddish brown
Color (unoxidized)	gray to dark gray	reddish gray
Paleozoic carbonate	common	rare to uncommon
Dark gray to gray-green rocks	uncommon to common	common to abundant
Red felsite and sandstone	rare to common	common
Cretaceous shale	absent to abundant	absent

QUATERNARY GEOLOGIC MAP OF SHERBURNE COUNTY, MINNESOTA

By

Gary N. Meyer and Howard C. Hobbs

1993