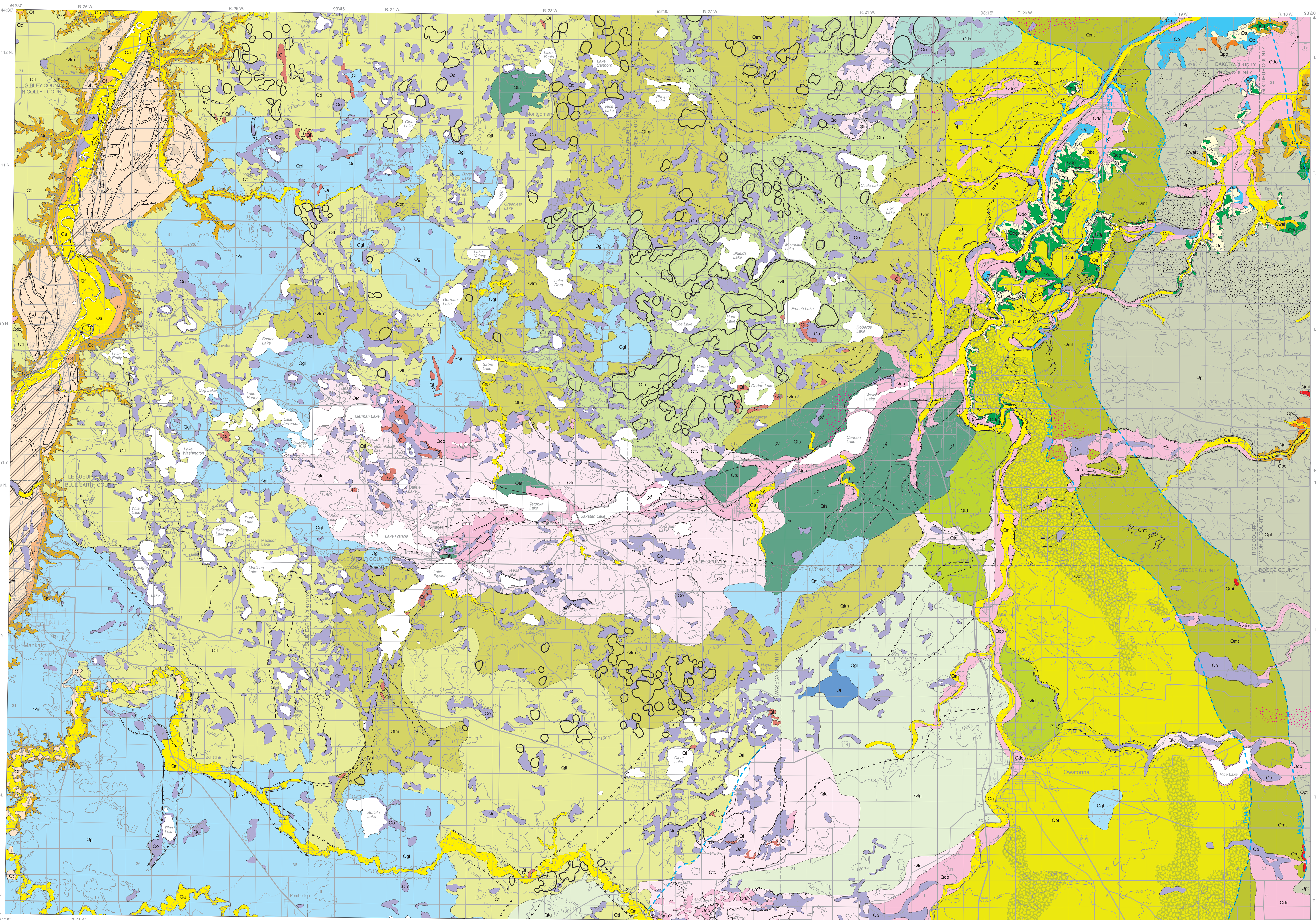


Digital base modified from Minnesota Department of Transportation BaseMap data; digital base annotation by Minnesota Geological Survey

Universal Transverse Mercator Projection, grid zone 15
1983 North American Datum

Contours derived using USGS 90-meter grid cell digital elevation data

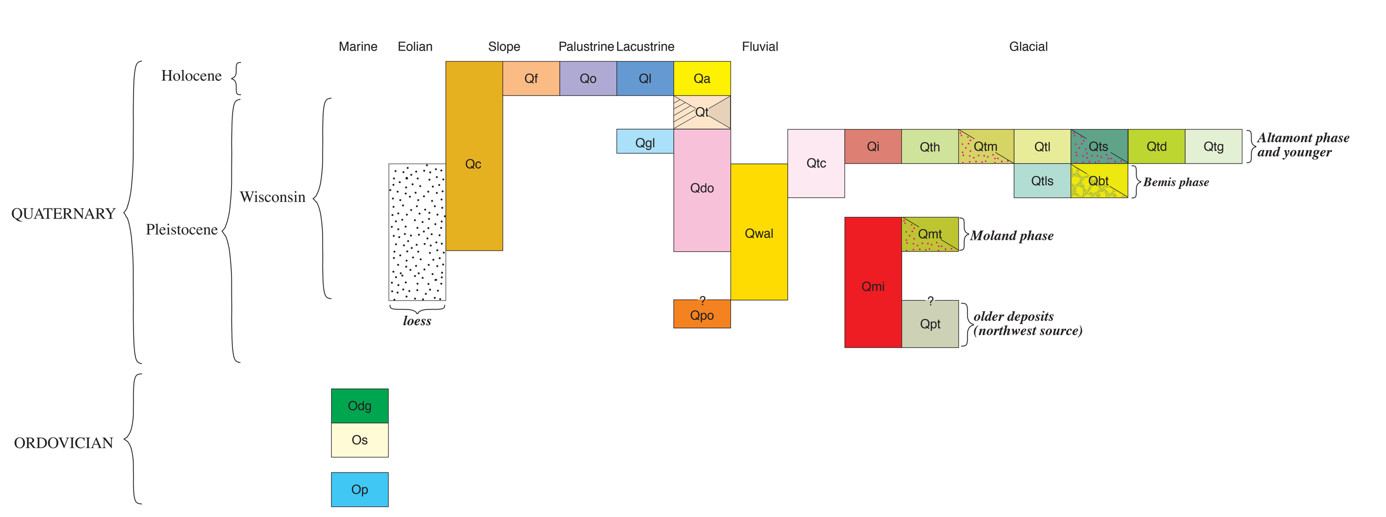
SCALE 1:100 000

CONTOUR INTERVAL 50 FEET

APPROXIMATE MEAN DECLINATION, 2002

GIS compilation and cartography by Joyce Meints and Philip Heywood

CORRELATION OF MAP UNITS



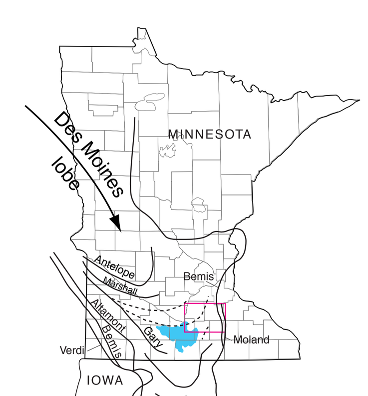
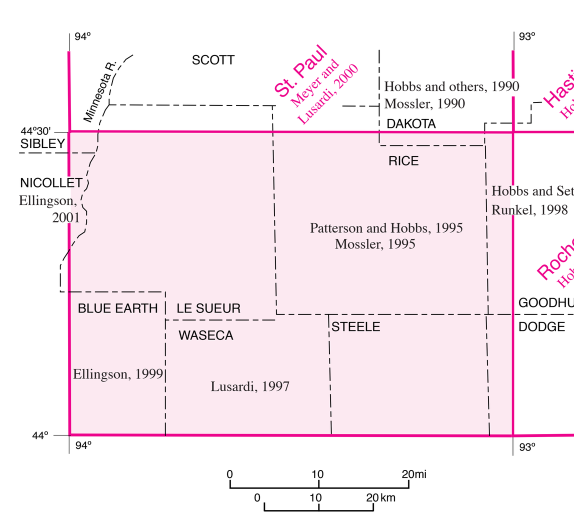


Figure 1. Location of the Faribault 1:100,000-scale quadrangle (magenta outline) and Glacial Lake Minnesota (blue tint) in relation to Late Wisconsin phases of the Des Moines lobe. Modified from Patterson (1997), and Patterson and others (1999).



INDEX TO MAPPING

The above index map shows the location of the Faribault 1:100,000 quadrangle (shaded in pink) relative to surrounding counties and to the recently completed St. Paul, Hastings, and Rochester 1:100,000 STATEMAP quadrangles. Cited sources were used to compile the geology of the Faribault quadrangle. Areas in Le Sueur, Sibley, Steele, and Dodge Counties were mapped by C.J. Patterson, H.C. Hobbs, and B.A. Lusardi of the Minnesota Geological Survey.

INTRODUCTION

This map is a compilation of previous mapping from 1990 to the present and includes new mapping in areas where no previous geologic maps of an appropriate scale exist. Unlike other maps in this 1:100,000-scale STATEMAP series, the sediments on this map are not classified into lithostratigraphic units. Instead, a descriptive lithogenic model is used, whereby the materials are classified by the environment of deposition (fluvial, glacial, etc.) and the character of the sediments (sand, silt, clay, etc.) (Clayton, 1977). To distinguish between sediments attributed to different glacial events, the lithogenic units are subdivided using an informal phase system similar to that introduced by Wright and Ruhe (1965). To facilitate the use of this map with adjacent maps, the correlative lithostratigraphic unit name (formal or informal) and cited reference have also been included.

DESCRIPTION OF MAP UNITS

Qo **Organic deposits *(Holocene)***—Organic-rich silt and clay deposited in ponded water. Includes peat (partially decomposed plants), minor alluvial deposits along streams, as well as beach deposits around larger lakes.

Ql **Modern lake deposits *(Holocene)***—Clayey silt, sand, loamy sand, and loam that locally includes organic-rich layers and locally overlies peat or muck.

Qf **Alluvial fan deposits *(Holocene)***—Loam to loamy fine sand; beds of silt loam to silty clay loam, fine sand and gravel; disseminated organic debris. Deposited in floodplains and on terraces at the base of steep slopes and at the mouths of tributary streams.

Qa **Alluvium *(Holocene)***—Silt loam to loamy sand that overlies sand, gravelly sand, or cobbly gravel; deposited in river-channel, overbank, and slackwater environments. Coarser sediment may be present within the river channel. Organic debris is both disseminated in the sediments and forms discrete peat beds in places.

Qt **Terrace deposits *(Holocene and Pleistocene)***—Silt loam to sandy loam (finer grained in shallow channels) grading into loamy sand and gravel. Predominantly braided-stream sediments deposited when water levels were higher than present. Diagonal pattern indicates where bedrock is within 10 feet (3 m) of the surface. The two shaded areas southeast of Le Sueur are closed depressions that originated after the terrace was abandoned. They are most likely a result of bedrock collapse (karst or exhumed paleokarst). Terrace sands may be windblown in places to form dunes. Equivalent to undivided West Campus formation of Meyer and Patterson (1999).

Qc **Colluvium *(Holocene and Pleistocene)***—Reworked sediment derived from the mechanical weathering of upland deposits. Where uplands consist of glacial or fluvial sediments, colluvium consists of a friable mixture of sand, silt, clay, and pebbles; it may also contain disseminated organic debris. In the northeastern part of the map area, where bedrock is exposed, colluvium is Wisconsin in age and consists of angular fragments of local bedrock that are typically overlain by massive to poorly bedded silt. The silt includes mudflow and slopewash deposits derived from upland loess. The unit includes till and bedrock outcrops along steep slopes, sediment and talus that accumulates at the base of steep slopes, and sediment that is deposited along small streams in deep gullies.

Qgl **Glacial lake deposits *(Pleistocene)***—Silty clay loam to clay loam with minor interbeds of silt and medium-grained sand. The majority of the lake sediment at the surface across the southwestern portion of the map area was deposited in Glacial Lake Minnesota (Fig. 1). Lake sediment is relatively thin near the eastern margin, and it is generally less than 5 feet (1.5 m) thick in Waseca County. Patches of till may be exposed on topographic highs, in eroded lows, and along valley walls. Discontinuous and isolated patches of lacustrine sediment are interpreted to have been deposited in lakes on or within stagnant ice. As the ice melted, the lakes drained, but the lake sediment remained as high plateaus on the landscape.

Qdo **Outwash *(Pleistocene)***—Stratified fine to coarse sand and gravel with occasional layers of silt, fine sand, cobbles, and small boulders. The sediment was deposited by large braided meltwater streams that flowed from the Des Moines lobe glacier. Typical assemblage of rock types includes limestone, dolostone, granite, and gray shale. This unit is not subdivided by associated phase.

Des Moines–lobe sediment associated with northwest-source ice advances of the Altamont and younger phases *(Pleistocene)*.

Qi **Ice-contact deposits**—Stratified sand, gravelly sand, and cobbly gravel. Deposited in contact with melting ice. Typically faulted and folded, and commonly interbedded with, or capped by, sandy to loamy diamicton (mudflow sediment) and silt (lake sediment). Boulders may be present.

Till—Unsorted sediment (diamicton) deposited directly by an active glacier; loam-textured, pebbly, with scattered cobbles and rare boulders. Shale clasts generally compose 25–40 percent in the very coarse (1-2 mm) sand fraction. Oxidized yellowish to olive brown above unoxidized gray. Calcareous except for a leached zone extending a few feet below the surface. Equivalent to New Ulm formation of Meyer and Patterson (1999).

Qtg *Ground moraine*—Level to undulating topography.

Qtd *Dissected till*—Modified by slope processes. This unit differs from stagnation deposits in that its geomorphology reflects pre-advance topography characterized by shallow bedrock knobs incised around the edges by surface drainage.

Stagnation deposits—Till as above deposited directly by a stagnating glacier. Topography is characterized by circular flat-topped hills, or plateaus, which are predominantly till; capped in places by lake sediment or till-like debris flows interbedded with lake sediment. The plateaus are interpreted to represent saturated debris that was deposited in lows on stagnant ice; the deposits now stand as topographic highs on the landscape. Distinctions are made, in part, on the basis of the degree of collapse or changes in topographic relief.

Qtl *Low-relief*—Low, undulating topography; widely spaced, circular, flat-topped hills; overall relief of about 10–30 feet (3–9 m).

Qtm *Medium-relief*—Round or elliptical hills with an overall relief of about 40–70 feet (12–21 m). Pattern indicates where till is generally less than 10 feet (3 m) thick over sand and gravel.

Qth *High-relief*—Hummocky, irregular topography that includes circular flat-topped hills and many collapsed channels; overall relief about 60–100 feet (18–30 m).

Qtc **Till and sand and gravel complex**—Sand and gravel overlain by till; includes small areas of sand and gravel at the surface. The large area shown in the center of the map was deposited by large amounts of meltwater draining from the ice in the area later occupied by Glacial Lake Minnesota. The topography is hummocky and irregular due to the melting of buried ice.

Qts **Till over scoured surface**—Till, as above, that is draped over a surface scoured by the same meltwater event described above. The till is thin enough that the landscape reflects the topography of the surface underneath. Clearly visible on aerial photographs and topographic maps as a network of anastomosing channels and longitudinal bars eroded by meltwater that flowed in braided streams. The northernmost occurrence of this unit may be related to the drainage of an ice-supported lake that extended further north (represented by the unit Qgl). Pattern indicates where till is generally less than 10 feet (3 m) thick over sand and gravel.

Des Moines–lobe sediment associated with northwest-source ice advances of the Bemis phase *(Pleistocene)*.

Loess—Silt to very fine sand mixed with some clay. Eroded and transported by wind from outwash plains and older till surfaces (Peoria formation of Hobbs, 1999). Shown only where thicker than 5 feet (1.5 m), although thin windblown sediment extends across much of the eastern portion of the map area, especially on units Qmt and Qpt.

Qtls **Low-shale till**—Loam textured diamicton, pebbly; scattered cobbles and rare boulders; pockets of silt, sand, and gravel in places; generally less than 20 percent shale fragments in very coarse (1–2 mm) sand fraction. Inclusions of reddish-brown sediment indicate mixing with underlying Superior provenance (northeast source) deposits.

Qbt **Till**—Loam-textured diamicton, pebbly; scattered cobbles and rare boulders; pockets of silt, sand, and gravel in places. Shale clasts generally compose 20–30 percent in the very coarse (1–2 mm) sand fraction. Pattern indicates where topography is collapsed due to the melting of ice incorporated with the sediment. This unit marks the eastern terminus of the Des Moines lobe during the Bemis advance. Unlike the distinct morainic ridge that marks the extent of the ice in southwestern Minnesota, the eastern moraine consists of a zone of collapsed and hummocky topography. In many places, the till of the Bemis moraine is relatively thin and is locally draped over the pre-advance dissected landscape. Elsewhere, the underlying topography is subdued. The Bemis moraine looks like an impressive feature largely because it coincides with a drainage divide along much of its extent on this map.

Qwal **Older alluvium**—Sand and gravelly or loamy sand. Deposited in valleys above the level of outwash plains outside the area covered by ice during the last glaciation. Sediment was derived from adjacent uplands, which were eroded in response to reduced vegetation during the last glaciation. The pebble assemblage includes fragments of local bedrock as well as erratics derived from older glacial sediments. Commonly forms terraces above the present floodplains, but it also underlies modern alluvium in the same valleys.

Des Moines–lobe sediment associated with northwest-source ice advances of the of the Moland and older phases *(Pleistocene)*.

Qmi **Ice-contact deposits**—Stratified sand, gravelly sand, and cobbly gravel. Deposited in contact with melting ice. Typically faulted and folded, and commonly interbedded with, or capped by, sandy to loamy diamicton (mudflow sediment). Boulders may be present. Sediment is typically collapsed and discontinuous due to melting of buried ice blocks. Topography is subdued in these older deposits.

Qmt **Till**—Loam- to sandy loam textured diamicton; contains pebbles and scattered cobbles and boulders; generally less than 10 percent shale fragments in the very coarse (1-2 mm) sand fraction. Thickness ranges from less than 5 feet to about 15 feet. Stipple pattern shows where this unit is underlain by sand and gravel. Deposited by ice from the northwest that extended farther than the Bemis phase. Consists of thin glacial sediment draped over pre-existing topography, resulting in a subdued version of the previous landscape, including low relief hummocks and depressions. Overlies older till in most places, but in a few areas, directly overlies bedrock. Equivalent to Sheldon Creek member of the New Ulm formation of Meyer and Lusardi (2000).

Sediment associated with northwest-source ice advances older than the Moland phase *(Pleistocene)*.

Qpt **Tills**—Loam-textured calcareous diamicton; pebbly, with cobbles and rare boulders. Includes lenses of sorted sand and gravel in places. The surface is highly oxidized and the till is locally deeply leached. In contrast to other mapped tills, this unit does not contain shale. Consists of at least two tills, undivided. The upper till is friable loam to fine sandy loam; the lower one is firm loam to clay loam. Because of extensive erosion, the lower till is at the surface in much of the area mapped as unit Qpt. Equivalent to the Pierce Formation of Hobbs (2000).

Qpo **Outwash**—Deposited by meltwater streams from an ice lobe to the west. Chiefly sand and gravel; rich in carbonate clasts below the leached zone. Preserved only in patchy remnants. In contrast to outwash from the Des Moines lobe, this unit contains no shale.

Bedrock *(Ordovician)*.

Odg **Decorah, Platteville, and Glenwood Formations, undivided**—Shale, limestone, and dolostone. The Decorah Shale is gray-green, calcareous shale that contains thin limestone beds. It is underlain by fine-grained dolostone and limestone of the Platteville Formation, which is underlain by green, sandy shale of the Glenwood Formation.

Os **St. Peter Sandstone**—Fine- to medium-grained quartzose sandstone. Interbedded with siltstone and shale in its lower part.

Op **Prairie du Chien Group**—Oolitic sandy dolostone and sandstone of the Shakopee Formation overlies dolostone of the Oneota Dolomite.

DESCRIPTION OF MAP SYMBOLS

Geologic contact—Established from aerial photographs, geomorphic expression, soils maps, well logs, borings, and examination of surficial material.

General flow direction of braided streams—Arrows point in the direction glacial meltwater once flowed.

Stream-cut scarp—Ticks on downslope side; dashed where discontinuous or obscure. Marks flanks of former fluvial channel. Within a fluvial unit (outwash or terrace), symbol marks a downcutting event during the deposition of that unit. Boundaries of terrace units and alluvium are commonly at scarps and, therefore, they are not shown by a scarp symbol. Where paired, scarps bound stream-scoured areas. Till deposits downslope of scarps may be fluvially scoured and mantled in places by sand and gravel too thin and patchy to map separately.

Broad, indistinct, irregular trough—Ticks point downslope; identified by alignment of depressions and lakes. May mark collapsed and partially filled channel.

Esker—Sinuous ridge of sediment, chiefly sand and gravel, interpreted to have been deposited in an ice-walled channel of a glacial meltwater stream flowing at the base of the ice. The fluvial sediment is generally too narrow to map. Direction of flow indicated by arrow heads.

Plateau—Broad, relatively level area in a zone of hummocky topography. Plateaus range in size from 40 to greater than 640 acres (0.16–2.59 sq km). Predominantly till; capped in places by lake sediment. The plateaus are interpreted to represent saturated debris that was deposited in lows on stagnant ice; the deposits now stand as topographic highs on the landscape. Sorted sediment in the center of the plateau was deposited in standing water.

Bemis **Inferred ice margin**—Approximate maximum extent of ice advance; labels are on the up-ice side of margin.

Sand and gravel—Pattern indicates where till is generally less than 10 feet (3 m) thick over sand and gravel.

ACKNOWLEDGMENT

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SURFICIAL GEOLOGY OF THE FARIBAULT 30 x 60 MINUTE QUADRANGLE, SOUTH-CENTRAL MINNESOTA

Compiled by

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2002