

DESCRIPTION OF MAP UNITS

QUATERNARY

HUDSON EPISODE*

Op Peat—Partly-decayed organic debris accumulated in wetlands. Usually underlain by the same material that surrounds it.

Qa Alluvium—Sediment of modern streams. Channel sediment is mostly gravel, with a lesser amount of sand, over a lag of larger rocks. Little overbank sediment was observed, mostly sand and silt.

Qt Older alluvium—Stream sediment in low terraces along the Lester River; chiefly gravel.

WISCONSIN EPISODE: MICHIGAN SUBEPISODE

Fine-grained glacial sediment—Deposited by the Superior lobe within the Superior basin. These tills incorporate silt and clay deposited in the basin during recessions between advances.

Qtc Clay till—Reddish-brown (2.5YR5/3 to 4/4) clay (Fig. 1); massive, calcareous. The upper meter is commonly leached; secondary carbonate nodules are common in the meter or two below the leached zone. Commonly contains more than 1 percent coarse-grained fragments (greater than 2 millimeters in diameter). In places, contains inclusions of brown (7.5YR4/3) to reddish-brown (5YR4/4) calcareous clay with few coarse-grained fragments. These inclusions are interpreted to reflect incorporation of gray Lake Agassiz clay, which was deposited in Lake Superior prior to the Marquette advance that deposited this till (Clayton, 1983). The average thickness is 3 to 4 meters, but is absent in a large area near Lake Superior, where the underlying clayey till (Qit) forms the surface.

Qti Clay till—Reddish-brown (5-2.5YR5/3 to 4/4) silty clay (Fig. 1); massive, slightly calcareous in places. Variable content of coarse-grained fragments, but generally more than 2 percent. The average thickness is about 3 meters, but a thickness of 15 meters was observed in a stream cut along the Lester River.

Qts Silty till—Reddish-brown (mostly 5YR4/3 to 3/4) silt loam (Fig. 1); massive, noncalcareous. Variable content of coarse-grained fragments, averaging 4 to 5 percent. The average thickness is unlikely to be more than 2 meters.

Cromwell Formation (Wright and others, 1970)—Glacial and glacial meltwater sediment of the Superior lobe. Further defined as reddish-brown sandy to silty till containing fragments of red sandstone from the Superior basin, and associated sand and gravel. All the glacial sediments mapped at the surface in this area contain clasts chiefly of rocks of the Superior basin, including some red sandstone (although red felsite is more common). The fine-grained tills above are not included in the Cromwell Formation because they contain little sand. The formation is divided into two unsorted glacial facies and one stratified facies.

Qct Till, subglacial facies—Reddish-brown (5YR5/4 to 4/4) rocky loam to sandy loam; compact, jointed, noncalcareous. Coarse-grained fragments average 12 percent. Topography is controlled chiefly by bedrock. The average thickness is about 3 meters.

Qch Till, supraglacial facies—Reddish-brown (5YR5/4 to 4/4) rocky loam to sandy loam; noncalcareous. Less compact and jointed, and probably coarser on average than the subglacial till. Large-scale topography is controlled by bedrock, but small hummocks and hollows of about 3 meters relief were caused when ice melted from under supraglacial debris. Full thickness was not observed in the map area, and is probably variable; the average thickness is likely greater than 3 meters. Interpreted to be underlain by till of the subglacial facies (Qct), but this was not observed. Geomorphically, it forms part of the Highland moraine (Wright, 1972).

Qcd Ice-contact delta—Sand and gravel mantled by till. Most particles are dark-gray and red; noncalcareous. Overall texture ranges from fine-grained sand to coarse-grained gravel, but individual beds have a narrower range, such as fine- to coarse-grained gravel. Sand and gravel beds are about 10-meters-thick. Most of the unit was likely derived from the glacier, which deposited it in small ice-marginal lakes. Overlain in most places by 1 to 3 meters of till of the Cromwell Formation (units Qct and Qch), which in turn is overlain in places by thin silty till (Qts).

Qhd Delta sediment—Chiefly sand. Deposited by the French River and its tributaries as they entered successively lower stages of glacial Lake Superior as the lake declined toward postglacial water levels. One- or 2-meters-thick over fine-grained glacial sediment.

Qls Laminated glacial lake sediment—Reddish-brown (chiefly 2.5YR4/4) calcareous clay and silt. Finely laminated; contains little sand and few coarse-grained fragments. Deposited in a small glacial lake dammed between the Superior lobe and higher ground in the Lester River area. Associated either with the clay till (Qtc) or the clayey till (Qti).

Qil Glacial lake sediment—Reddish-brown to reddish-gray (typically 5YR4/3 to 4/4) calcareous silt and clay. Sand amounts to generally less than 10 percent (Fig. 1), and coarse-grained fragments are usually less than 1 percent. Typically unbedded, but horizontal beds and obscure color bands are present in places. Associated with the silty till (Qts).

MESOPROTEROZOIC

Eb Bedrock at or near the surface—Dominated by mafic volcanic flows and diabase. The larger areas of this unit are diabase sills that form prominent ridges now tilted toward Lake Superior. The surface of the rock has been smoothed by glacial erosion and is relatively unweathered. Narrow areas of this unit along streams and the Lake Superior shoreline are shown as bedrock outcrop (see Map Symbols).

*Time-event classification follows Hansel and Johnson (1996).

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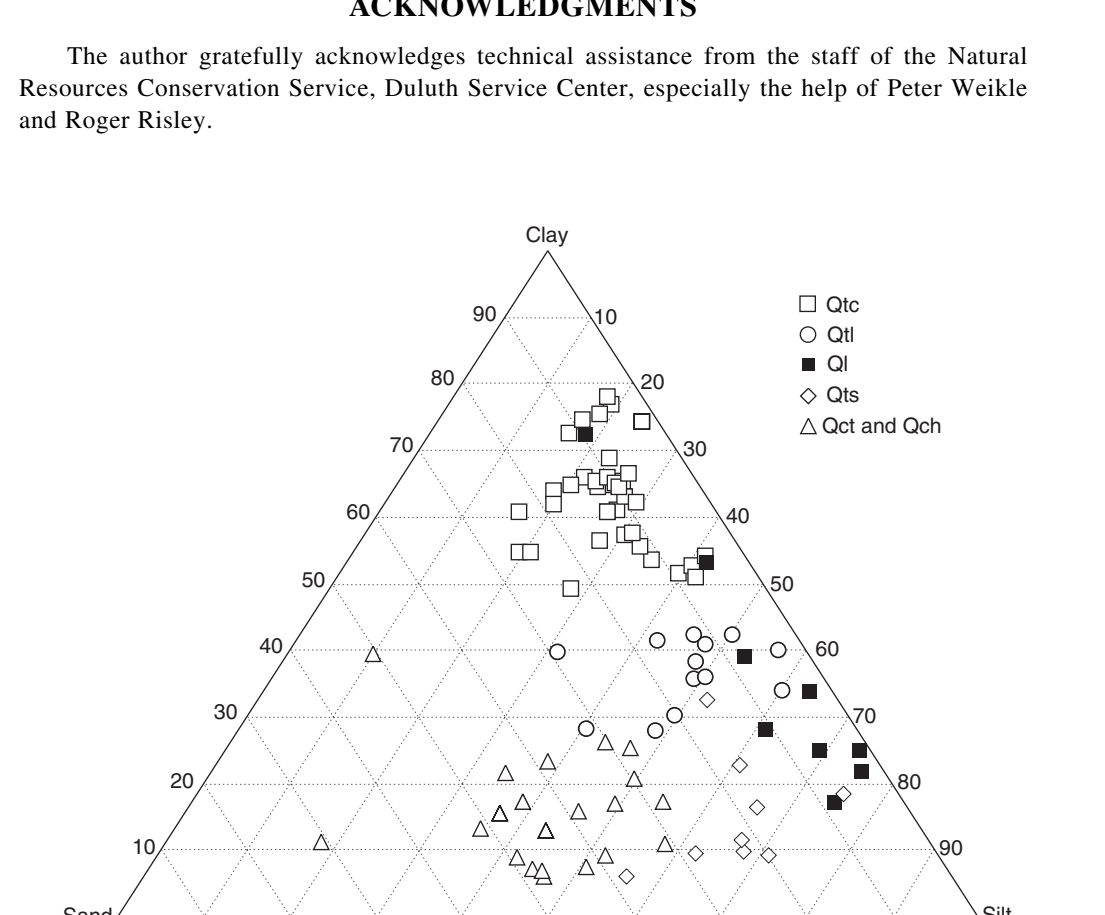


Figure 1. Texture of the less than 2 millimeter grain-size fraction of glacial and lacustrine sediment.

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MAP SYMBOLS

Geologic contact—Approximately located.

Esker—Slightly sinuous ridge of sand and gravel; noncalcareous; crudely flat-bedded. Deposited by streams at the base of the glacier that deposited the Cromwell Formation. Flow direction was to the northwest, up the regional slope, but down the hydraulic gradient of the ice, which was controlled by the surface slope of the ice.

Meltwater channel—Channel segments aligned parallel to presumed retreat ice margins of the glacier that deposited the Cromwell Formation. The general pattern of meltwater flow at this time was to the southwest, where the water followed the lowest course out of the Superior basin.

Lake Superior strandline—Faint lineation visible on aerial photographs; interpreted as one of the highest stands of glacial Lake Superior. Rises to the northeast as a result of postglacial rebound, from just below the 1100-foot contour line to just above it.

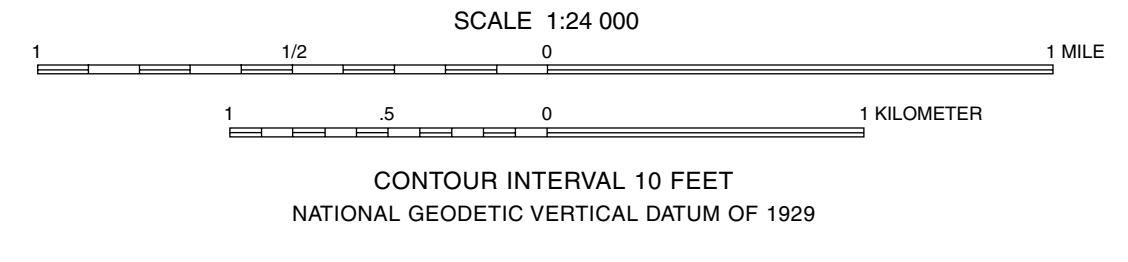
Meander scar—Curved scarp eroded by a meander of the Lester River at an earlier level of its incision. An inner hill is not always shown.

Bedrock outcrop—From Boerboom and others (2002).

Glacial striation—Arrow shows the direction of flow.

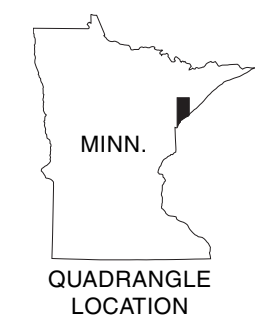
Soil boring—Most borings are less than 20 feet (6 meters) in depth.

Material sample—Outcrop, roadcut, and construction-site exposures examined, described, and sampled during the course of field work.



SURFICIAL GEOLOGY OF THE FRENCH RIVER AND LAKEWOOD QUADRANGLES, ST. LOUIS COUNTY, MINNESOTA

by
Howard C. Hobbs
2002



Base from U.S. Geological Survey French River and Lakewood 1:24,000 quadrangles, 1992. Universal Transverse Mercator grid, zone 15 1983 North American Datum