UNIVERSITY OF MINNESOTA
MINNESOTA GEOLOGICAL SURVEY
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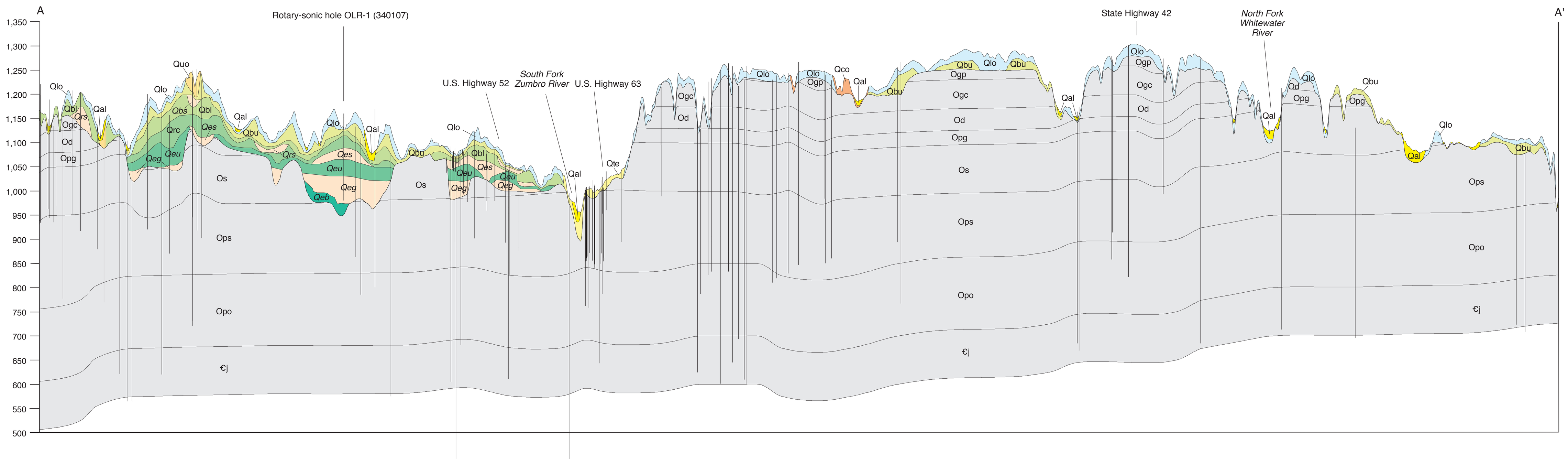
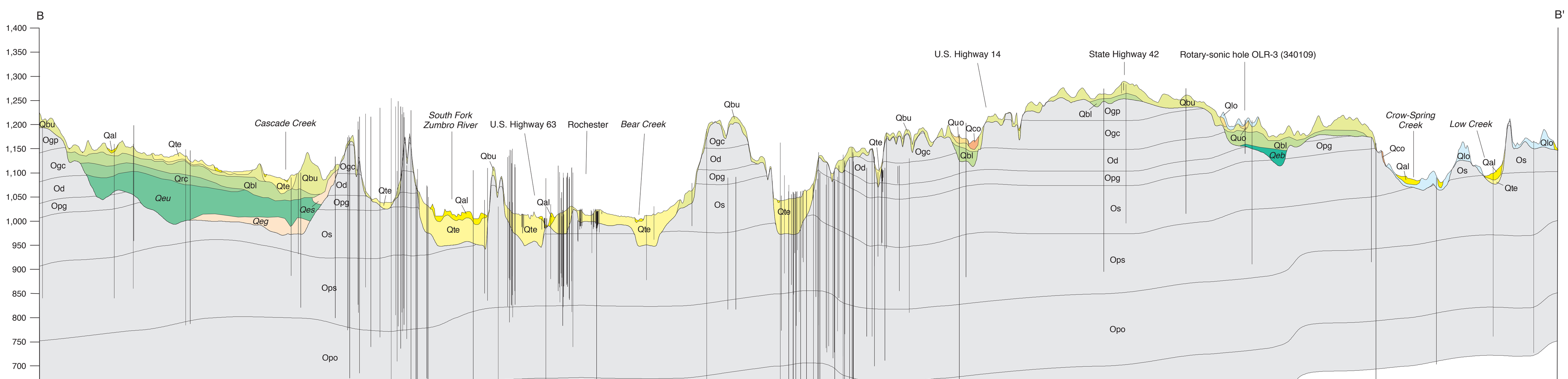
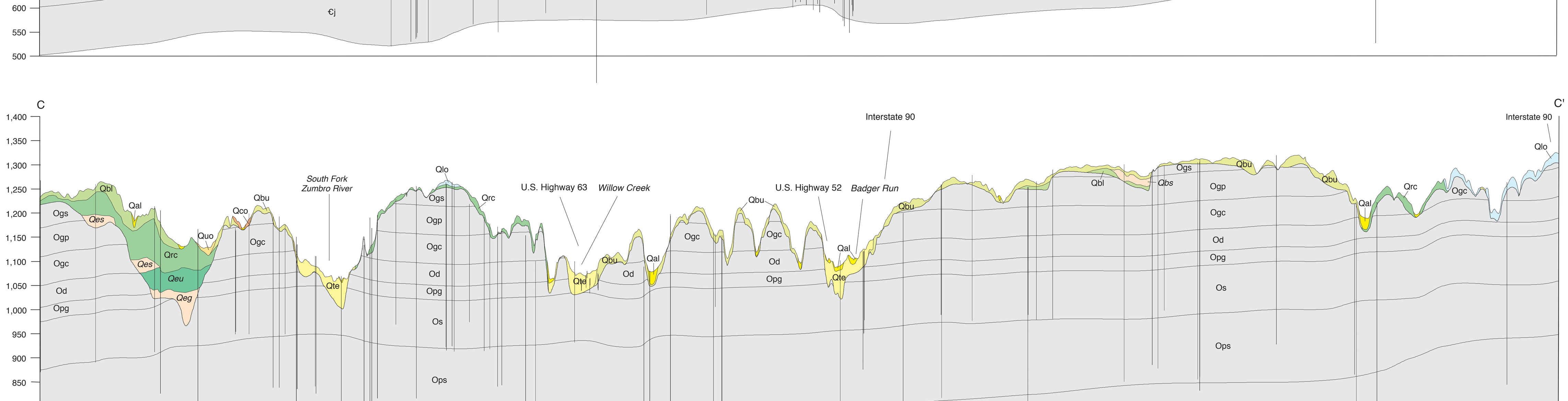
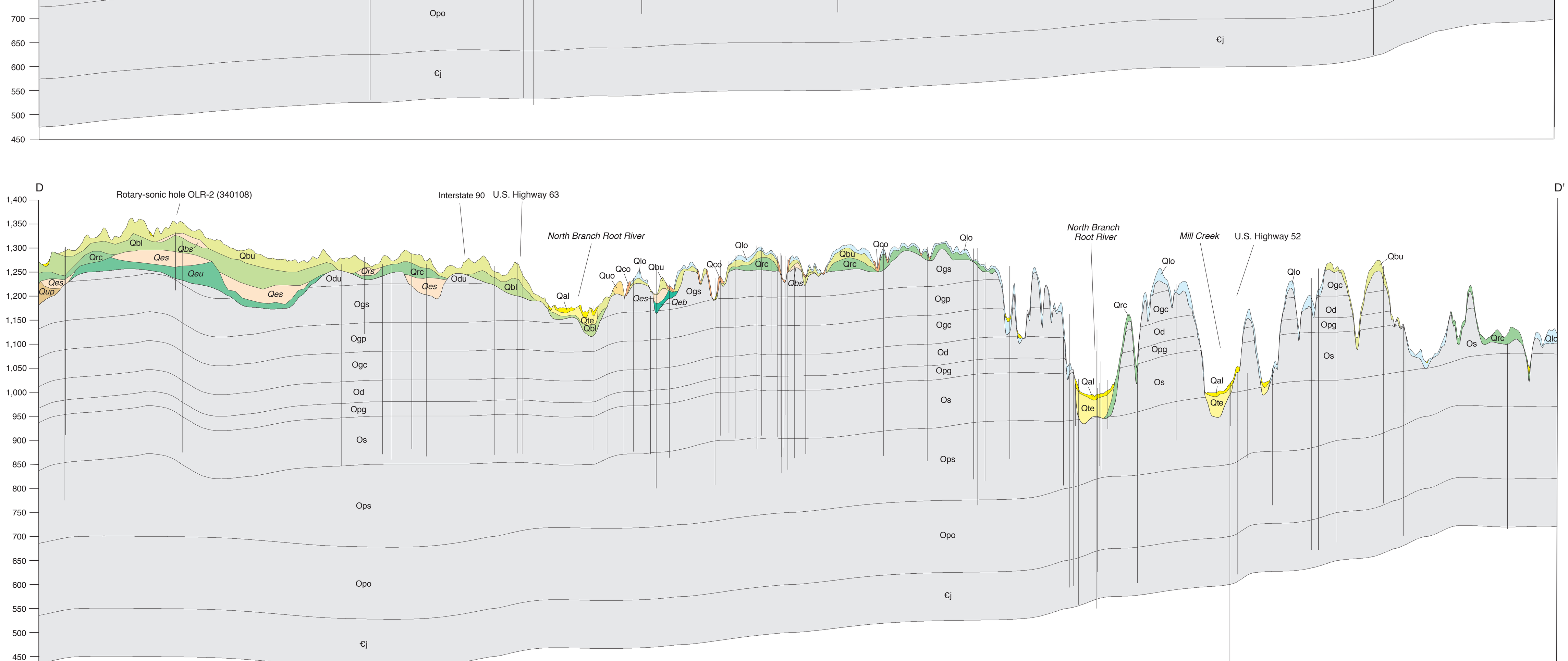
COUNTY ATLAS SERIES
ATLAS C-49, PART A
Olmsted County
Plate 4—Quaternary Stratigraphy









Vertical exaggeration = 50X

GIS compilation by J.D. Hamilton
Edited by Lori Robinson

LOCATION DIAGRAM

QUATERNARY STRATIGRAPHY

By

Jennifer M. McDonald and Katherine J. Marshall

2020

CROSS-SECTION SYMBOLS

Geologic contact—Approximately located.

Drill hole—Well records from the County Well Index within 0.3 mile (0.5 kilometer) of the cross-section line. Rotary-sonic core holes are labeled. The top of the drill hole may not coincide with the cross-section surface elevation line because the point is located near, but not on, the cross-section line and therefore may have a different surface elevation. In areas of less data, subsurface records (not shown) within 0.6 mile (1 kilometer) of the cross-section line were used to depict the units.

INTRODUCTION

The Quaternary Stratigraphy plate depicts the unconsolidated sediments encountered between the land and bedrock surfaces in Olmsted County. Cross sections A–A' through D–D' are representative of 40 cross sections (Fig. 1) for the Olmsted County Geologic Atlas. Because the thickness of unconsolidated sediments in Olmsted County is relatively shallow, a generalized depiction of the bedrock, to roughly 1,000 feet (305 meters) below the surface, is also show in cross sections A–A' through D–D'. For a more detailed description of the bedrock, see Plate 2, *Bedrock Geology*. Cross sections of the unconsolidated material allow the creation of a three-dimensional model of the Quaternary sediments of Olmsted County. Plate 5, *Sand-Distribution Model*, shows the major sand bodies from this model. All the cross sections used to develop the model can be accessed through the digital files available on the Minnesota Geological Survey's website.

To define the geologic units shown on the cross sections, interpretations of new data collected for this study are combined with data from previous studies completed in the area (Plate 3, *Surficial Geology*). Most of the geologic units match the units mapped on Plate 3, but some new units appear only in the subsurface. Other units are the result of dividing units from the surficial map into multiple subsurface units. Figure 2 illustrates the relationships between age, provenance, stratigraphic position, and location of the glacial sediments in Olmsted County. Exposures, auger samples, drill core, and drill cuttings, combined with water-well and soil-boring drillers' logs (Plate 1, *Database Map*), were used to interpret the stratigraphy. Samples and descriptions from four rotary-sonic core sites (Figs. 3 through 6) were examined for this study. Figure 7 contains images from the rotary-sonic cores that represent the major glacial till units in the subsurface. Table 1 summarizes the texture and composition of the most prevalent glacial till units.

Several factors should be kept in mind when viewing the cross sections. First, the vertical dimension in the cross sections was exaggerated 50 times the horizontal dimension in order to show the commonly thin, complex units of the Quaternary section. As a result, the relief of surfaces is greater and dip of units appear much steeper than true. Second, the complexity of the subsurface units shown on the cross section is partly a function of the amount of data available. Where data are scarce, the geologic units are generally portrayed or modeled as thick continuous layers, with minimal elevation changes. Where there are more data, units tend to be portrayed as discontinuous and variable in both thickness and elevation over relatively short distances. This more accurately reflects the complexity of Quaternary deposits, especially those deposits that are older and have undergone more episodes of erosion. Lastly, in Olmsted County, Quaternary units are commonly very thin and patchy, and in areas where the depth to bedrock is 10 feet (3 meters) or less, it is difficult to portray more than one Quaternary unit, and therefore the cross sections only display the underlying Quaternary unit. For this reason, the geology represented on the surficial geology map (Plate 3) does not always match what is depicted in the cross-section view. For example, where the Quaternary sediments are a thin veneer over steeply sloping bedrock valleys, the overlying Quaternary units were commonly drawn as continuous units extending down the valley walls, although in reality these units are commonly topped by colluvium (see Plate 3 for unit description). For this reason, the colluvium unit (Qco) is not depicted as extensively in the cross sections and sand-body models as it is shown on the surficial geology map. It should also be noted that, due to the nature of projecting surface elevations and depth to bedrock in a cross-sectional view, the cross sections do not accurately represent areas where the surficial unit is O€u (see Plate 3 for unit description). Because the surficial geology map represents the geology below the soil horizon, the O€u unit depicts where bedrock is covered by less than 3 feet (1 meter) of Quaternary sediment or loess. This is difficult to depict in the cross-sectional view and the closest (in proximity) Quaternary unit represents the O€u unit.

Most diamicton (unsorted sediment) in Olmsted County is interpreted to be till, sediment more or less directly deposited by glacial ice. Till is composed of clay to boulder-sized fragments (Table 1). The Quaternary deposits present in the subsurface of the county are divided in the cross sections into finer- and coarser-grained sediment. The till and fine-grained lake sediment are depicted in green shades, which can be considered potential aquitards, and the glacial outwash and fluvial sediments are depicted in yellow and orange hues, which are potential aquifers. By convention, the name designations of subsurface sand and gravel bodies depicted are associated with their underlying till (except for the sand and gravel unit Quo, which is a surficial unit) even though meltwater from the ice that deposited the overlying till may in fact be responsible for depositing some or all of the sand and gravel. The sand and gravel units, therefore, commonly include sediment derived from more than one formation.

Sand bodies were assumed to divide the deposits of the various glacial episodes that affected the county (Fig. 2), acknowledging that sand lenses occur within, as well as above and below, individual till and fine-grained lake deposits. The characteristics of the various tills of Olmsted County are generally similar to one another (Table 1). They were distinguished in the subsurface primarily on the basis of intervening sand beds, except for within the vicinity of core holes. In the absence of intervening sand beds, individual till units were distinguished by changes in described texture, oxidation, color (Fig. 7), hardness, or where core, auger, or cuttings samples were available, in clast content (Table 1). An organic layer, part of the Bennington Member of the Rose Creek Formation, commonly separates the Browerville and Rose Creek Formations. However, it has been documented in rotary-sonic cores drilled in neighboring Dodge County (Meyer and others, 2019) that organic debris is also found within the Browerville Formation, as incorporated sediment within till or in a peat layer separating two tills of the formation. This peat layer within the Browerville Formation indicates the formation was laid down during more than one ice advance, with sufficient time between advances for an organic layer to accumulate.

Although lithologic differences are present where more than one Browerville Formation till is depicted, the differences are not consistent from site to site. Therefore the division of the Browerville Formation into two units on the cross sections (Qbu, Qbl) is only approximate, and was done primarily as a means to depict sand beds within the formation for the sand models (Plate 5). The younger Browerville Formation was mapped as part of the Qbu unit because it was more recently deposited, where the Browerville Formation is relatively thin, such as in eastern Olmsted County. The Elmdale Formation was also divided into two units on the cross sections (*Qeu*, *Qeb*) as a means to depict sand beds within the formation for the sand models (Plate 5). The Elmdale Formation was also likely laid down by more than one ice advance (Meyer, 2000), but data were insufficient to characterize the individual deposits or estimate an intervening time interval. In a few places, surficial units were too small or thin to show on the cross sections. Underlying bedrock units are indicated on the cross sections by unit boundaries and labels corresponding to those described on Plate 2, *Bedrock Geology*. Detailed descriptions for each of the named Quaternary lithostratigraphic units can be found in Johnson and others (2016).

TILL GEOCHEMICAL ANALYSES

Geochemical analyses were conducted on 17 till samples from the rotary-sonic core ORL-1 (Fig. 3; Table 2). Combined with the core description, documentation of intervening sand and lacustrine units, textural and lithological changes, till geochemistry aided in the separation of units within this core. This analysis was conducted as part of a broader program of analyses (Thorleifson and others, 2019). In a manner consistent with methods used by Thorleifson and others (2007), the <63-micron fraction of till samples was analyzed by ICP-mass spectrometry following a four-acid, near-total dissolution utilizing hydrochloric, perchloric, nitric, and hydrofluoric acids.

Elements appearing to correlate with the Winnipeg-provenance Browerville and Elmdale Formation tills sampled from core OLR-1 include magnesium, calcium, zinc, and nickel. This geochemical signal is similar to the Browerville and Elmdale Formation till samples processed from rotary-sonic cores collected in Dodge County to the east (Meyer and others, 2019), where the samples also correlated with sulfur, cobalt, and arsenic. For this study, cobalt was only found in the Browerville Formation till samples and not the Elmdale Formation till samples, and the amount of sulfur in core OLR-1 was relatively consistent throughout the entire sample (Table 2). Also unlike Meyer and others (2019), the suite of samples from core OLR-1 displayed a higher arsenic content in the Rose Creek Formation till samples than the Browerville and Elmdale Formation till samples (Fig. 3). These discrepancies express that a broader geochemical analysis of pre-Wisconsinan tills in Minnesota is needed to understand how these chemical signals vary within units over larger spatial distances.

Elements appearing to correlate with the Rainy-provenance Rose Creek Formation till included arsenic, molybdenum, and phosphorus (Fig. 3; Table 2). With the exception of the arsenic value, these findings agree with the samples from Dodge County. Only one sample of the Superior-provenance St. Francis Formation till was processed, and elements appearing to correlate with it include copper, potassium, and zirconium (Fig. 3), as well as titanium, yttrium and hafnium (Table 2). While more analysis on the geochemical values of pre-Wisconsinan tills in Minnesota is needed, this initial research supports our interpretation of four separate till units in Olmsted County. In addition, some elements appear to be responding to multiple controlling factors, such as aeration during deposition and the interaction of groundwater at unit boundaries.

ACKNOWLEDGEMENTS

In addition to the current and former employees of the Minnesota Geological Survey acknowledged on Plate 3, Daniel Conrad helped analyze the geochemical data and created some of the illustrations for this plate. Numerous water-well companies contributed subsurface information used in this atlas, and special thanks are given to those who have donated drill cuttings over the years to the Minnesota Geological Survey. Thanks are extended to the landowners who allowed rotary-sonic drilling on their property, and to Martin Larsen of the Olmsted County Soil and Water Conservation District.

DESCRIPTION OF CROSS-SECTION UNITS

Each unit description on the cross sections is placed in one of three categories, as indicated in parentheses after the description: 1. *Surficial Geology* unit—Unit having an identical description, label, and color as on Plate 3, *Surficial Geology*; see Plate 3 for detailed descriptions; 2. New unit—Unit that is depicted only in the subsurface that has a unique label and color (the subsurface sand and gravel units have the same color to emphasize their status as potential aquifers); and 3. Modified unit—One unit from Plate 3 divided into two (or more) units on the cross sections.

HOLOCENE

Qal — **Sand and gravel, sandy loam to silt loam** (*Surficial Geology* unit).

PLEISTOCENE

Wisconsinan

Qco — **Loam, locally includes silt to boulders** (*Surficial Geology* unit).

Qte — **Gravelly sand to sandy loam** (*Surficial Geology* unit).

Peoria Formation

Qlo — ***Silty loam*** (*Surficial Geology* unit)—Shown as a stippled pattern on Plate 3.

Pre-Wisconsinan (Illinoian and Pre-Illinoian Episodes, undivided)

Quo — **Sand to gravelly sand with minor beds of silt and clay** (*Surficial Geology* unit).

Browerville Formation

Qbu — ***Loam diamicton*** (modified unit)—Included in map unit Qbv from Plate 3. In places can range from clay loam to silt loam to sandy loam in texture, and include beds and lenses of silt and clay to sand and gravel.

Qbs — ***Sand to gravel*** (new unit)—Primarily glaciofluvial sediment laid down by meltwater from glacial ice that deposited till of the Browerville Formation. Primarily topped by unit Qbu (see cross section C–C').

Qbl — ***Loam diamicton*** (modified unit)—Included in map unit Qbv from Plate 3. In places can range from clay loam to silt loam to sandy loam in texture, and include beds and lenses of silt and clay to sand and gravel.

Browerville and Rose Creek Formations

Qrs — ***Sand to gravel*** (new unit)—Primarily glaciofluvial sediment of the Browerville and/or Rose Creek Formations.

Rose Creek Formation

Qrc — ***Loam diamicton*** (*Surficial Geology* unit)—In places can range from silt loam to sandy loam in texture, and include beds and lenses of silt and clay to sand and gravel (Fig. 3). In Olmsted County, the Rose Creek Formation may also include St. Francis Formation diamicton. The St. Francis Formation was not mapped as a separate unit because of its very patchy distribution. The St. Francis Formation is a reddish-brown (7.5YR 4/3 to 5YR 4/4) till of the Superior provenance. During this project, it was only found in rotary-sonic core OLR-1 (Figs. 3, 7). This Superior-provenance till was also observed by Hobbs (1988) and most likely correlates to the St. Francis Formation mapped in Dodge County by Meyer and others (2019; unit *Qsf*), but has been included as part of the Rose Creek Formation because it has been interpreted to be a thin inclusion within Rose Creek Formation diamicton.

Rose Creek and Elmdale Formations

Qes — ***Sand to gravel*** (new unit)—Included in map unit Quo from Plate 3. Primarily glaciofluvial sediment of the Rose Creek and/or Elmdale Formations. May also include sediment of the St. Francis Formation.

Elmdale Formation

Qeu — ***Loam diamicton*** (modified unit)—Included in map unit Qel from Plate 3. In places can range from clay loam to silt loam to sandy loam in texture, and include beds and lenses of silt and clay to sand and gravel.

Qeg — ***Sand to gravel*** (new unit)—Primarily fluvial sediment, but likely includes some coarse-grained lacustrine sediment in places.

Qeb — ***Loam diamicton*** (modified unit)—Included in map unit Qel from Plate 3. In places can include beds and lenses of silt and clay to sand and gravel. In western Olmsted County, a carbonate-rich, silty lacustrine sediment below the Elmdale Formation till in a core hole (OLR-1; Fig. 3), and a silty till exposed in an outcrop (Q0039293; Fig. 1) both resemble the "VW" till of central Minnesota (Meyer and Knaeble, 1996; Lusardi, 2014; Meyer, 2015). This implies older units are likely included in unit *Qeb* in Olmsted County. Silty, carbonate-rich samples towards the base of some sections of Elmdale Formation till could indicate incorporation of the "VW" till or a "VW" lacustrine unit, such as is observed in the silty clay lacustrine sediments found at the bottom of rotary-sonic core OLR-2 (Fig. 4).

Undifferentiated Pleistocene deposits

Qus — **Sand to gravel** (new unit)—Sediment of unknown provenance. Unit *Qus* is not shown in any cross sections featured on the hard copy of the plate, but was mapped in Olmsted County and can be found in the digital files of the cross sections.

Qup — **Undifferentiated sediment** (new unit)—Includes diamicton and bedded clay, silt, sand, and gravel. Shown in areas where control data were absent.

PALEOZOIC

Bedrock units—Shown in gray; see Plate 2, *Bedrock Geology*, for detailed description of the bedrock geology.

Ops — **Shakopee Formation of the Prairie du Chien Group**

Opo — **Oneota Dolomite of the Prairie du Chein Group**

€j — **Jordan Sandstone**

€st — **St. Lawrence Formation**

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Table 1. Average values for the matrix texture and composition of the most prevalent tills recognized in Olmsted County. Matrix texture (the less than 2-millimeter grain-size fraction of the sample) is expressed as relative proportions of sand, silt, and clay in percent. The lithologic composition of the very coarse-grained sand fraction (1-2 millimeters) is expressed in percent as relative proportions of crystalline, carbonate, shale, Precambrian rocks, Paleozoic rocks (mostly carbonate), and Cretaceous rocks (mostly limestone for the Qbu and *Qeb* units) using the classification system of Hobbs (1998). The Precambrian 1-2 millimeter fraction is further differentiated by rock type—light (granite, gneiss, monomineralic quartz), dark (mafic-rich igneous and metamorphic rocks), and red (rhyolite, sandstone, and iron formation).

	MATRIX TEXTURE						CLAST TYPE								
				Percentage of the less than 2 millimeter fraction			Percentage of total grains counted of the 1-2 millimeter fraction			Percentage of total crystalline grains counted			Percentage of total grains counted of the 1-2 millimeter fraction		
Deposit description	Average depth (feet)	Total number of samples	Gravel (percentage of total sample weight)	Sand	Silt	Clay	Crystalline	Carbonate	Shale	Light	Dark	Red	Precambrian	Paleozoic	Cretaceous
Browerville Formation till (unit Qbv)	14	336	3.6	39	38	23	80.2	19.4	0.4	86 .0	12.0	2	78.3	18.1	3.6
Rose Creek Formation till (unit Qrc)	13	91	3.4	41	37	22	83.17	16.7	0.13	83.6	14.1	2.3	81.1	18.5	0.4
Elmdale Formation till (unit *Qeb*)	62.4	52	3.8	35	43	22	82	17.2	0.8	84.0	15.2	0.8	81	17	2

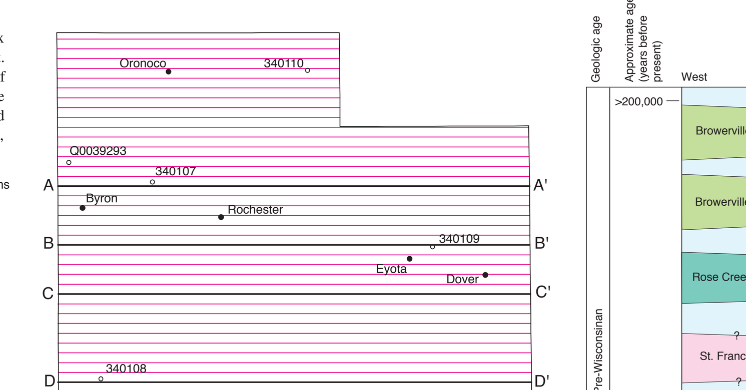


Figure 1. Location of the 42 west–east cross sections, constructed at 0.6-mile (1-kilometer) intervals, used to create a three-dimensional model of the Quaternary deposits of Olmsted County. The locations of cross sections A–A' through D–D' are shown here, and are also shown on Plate 3, *Surficial Geology*. Labeled circles depict the locations of the four Minnesota Geological Survey rotary-sonic core sites.

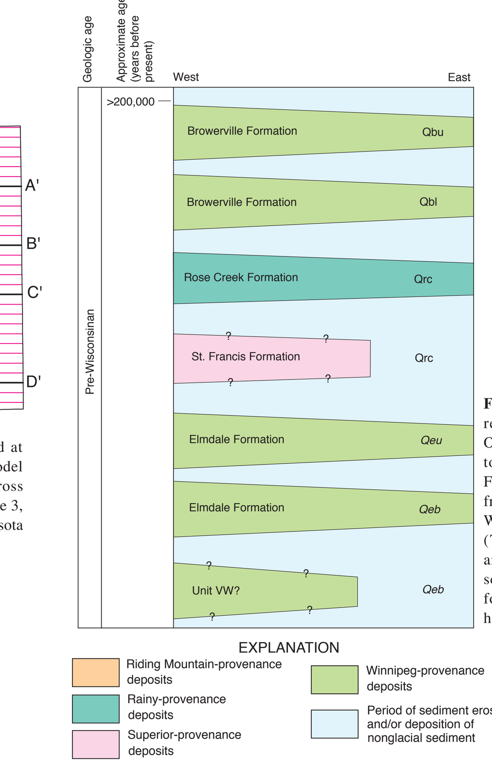
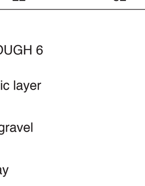


Figure 2. Diagram showing relative age, location (across Olmsted County from west to east), provenance (Plate 3, Fig. 1), and related unit labels from the cross sections for pre-Wisconsinan glacial sediments (Table 1). The age column and deposit drawing are not to scale. See the text on Plate 3 for discussion of the geologic history.

KEY FOR FIGURES 3 THROUGH 6



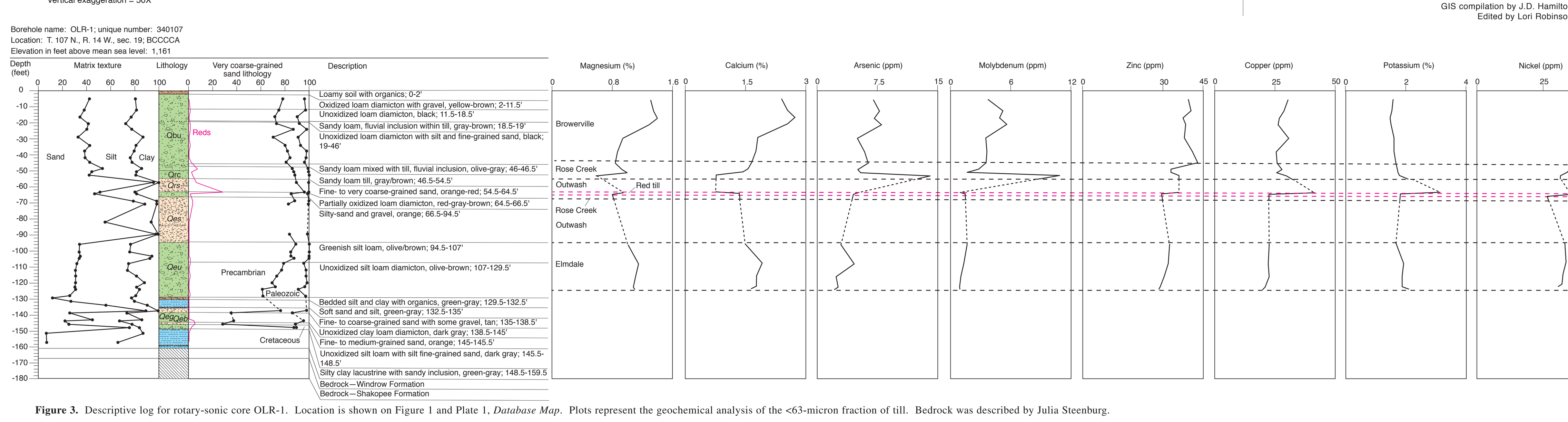


Figure 3. Descriptive log for rotary-sonic core OLR-1. Location is shown on Figure 1 and Plate 1, *Database Map*. Plots represent the geochemical analysis of the <63-micron fraction of till. Bedrock was described by Julia Steenberg.

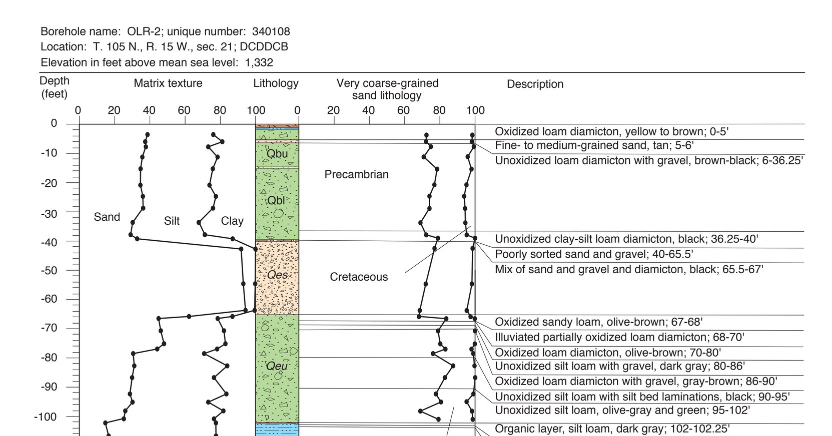


Figure 4. Descriptive log for rotary-sonic core OLR-2. Location is shown on Figure 1 and Plate 1. Bedrock was described by Julia Steenburg.

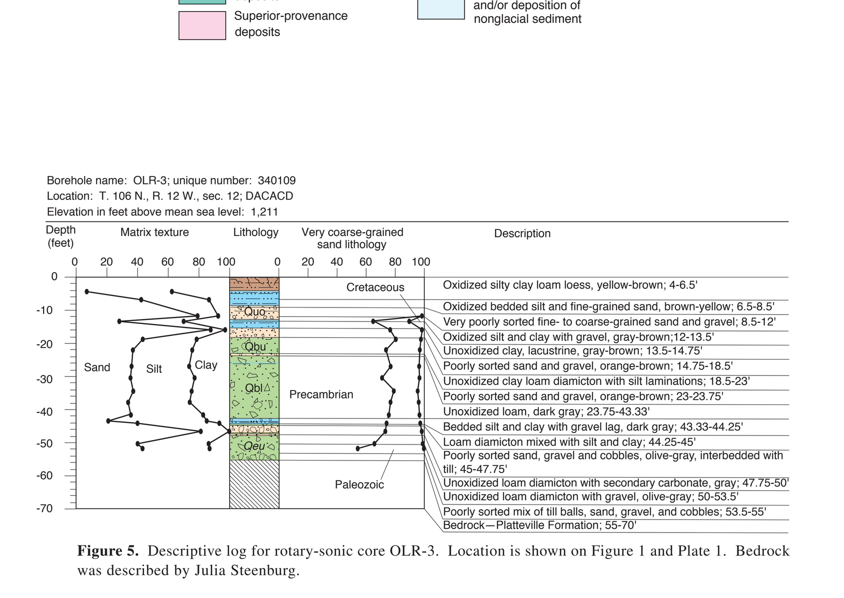


Figure 5. Descriptive log for rotary-sonic core OLR-3. Location is shown on Figure 1 and Plate 1. Bedrock was described by Julia Steenburg.

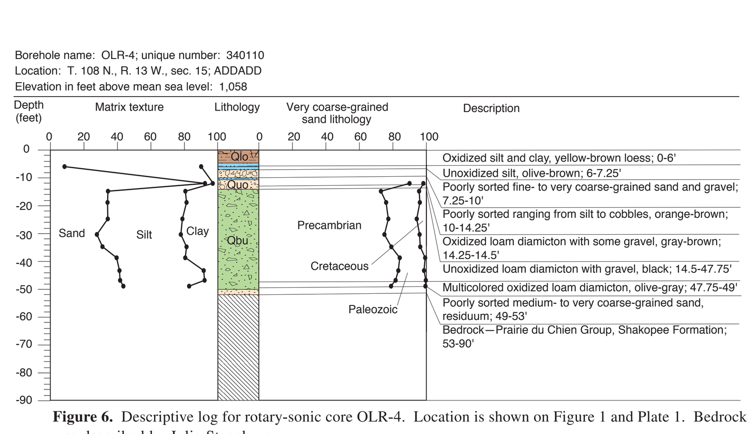


Figure 6. Descriptive log for rotary-sonic core OLR-4. Location is shown on Figure 1 and Plate 1. Bedrock was described by Julia Steenburg.

Figure 7. Examples of rotary-sonic core of Quaternary sediment drilled for this project. Up is to the left. Photos by Katherine Marshall.
A. Calcareous unoxidized till of the Browerville Formation. The segment is from core OLR-2 and is 31.7 to 33.3 feet (9.7 to 10.1 meters) in depth. The entire core is depicted in Figure 4.
B. Contact between oxidized reddish-brown till of Superior provenance over gray-brown till of the Rose Creek Formation. The segment is from core OLR-1 and is 63.5 to 65 feet (19.4 to 19.8 meters) in depth. The entire core is depicted in Figure 3.
C. Contact between till of oxidized gray-brown till of the Elmdale Formation and unoxidized black till of the Elmdale Formation. The segment is from core OLR-1 and is 94 to 96 feet (28.7 to 29.3 meters) in depth. The entire core is depicted in Figure 3.

Table 2. Geochemistry of the <63-micron fraction of Olmsted County till, analyzed by ICP-mass spectrometry. Elements mentioned in the text are highlighted. Till of the Browerville Formation includes samples from cross-section units Qbu and Qbl and till of the Elmdale Formation includes samples from cross-section units *Qeu* and *Qeb*.

Sample name	Formation	Weight kg	Ag ppm	Al %	As ppm	Ba ppm	Be ppm	Bi ppm	Ca %	Cd ppm	Ce ppm	Co ppm	Cr ppm	Cs ppm	Cu ppm	Fe %	Ga ppm	Ge ppm	Hf ppm
OLR-1-5.5	Browerville	0.28	0.11	6.42	14	410	1.83	0.31	4.8	0.32	87.5	10.6	61	3.98	30.4	3.83	17.8	0.18	4.9
OLR-1-12.5	Browerville	0.32	0.12	6.39	15.5	390	1.62	0.31	5.09	0.6	87	13.4	67	4.14	28.7	3.22	17.05	0.18	4.6
OLR-1-17	Browerville	0.28	0.12	6.18	14.2	390	1.71	0.29	5.46	0.52	80.7	11.8	66	3.77	26.8	3.52	16.05	0.16	4.6
OLR-1-21	Browerville	0.28	0.13	6.06	16	390	1.35	0.29	5.09	0.5	80.5	11.5	64	3.82	26.3	3.09	15.35	0.18	4.2
OLR-1-29.5	Browerville	0.32	0.1	6.96	10	370	1.5	0.29	3.61	0.43	84.4	12.6	75	4.16	30.7	4.13	17.65	0.16	4.2
OLR-1-38	Browerville	0.36	0.1	6.31	11.8	390	1.46	0.28	3.52	0.49	89.9	11.2	67	4.27	25.5	3.58	16	0.18	4.6
OLR-1-45	Browerville	0.28	0.11	6.49	12.7	370	1.92	0.31	3.31	0.48	93.5	11.9	67	4.69	25.9	3.65	17.5	0.18	5
OLR-1-49	Rose Creek	0.36	0.1	6.08	10.1	380	1.78	0.26	3.13	0.38	90.5	11.5	65	4	27.9	3.6	15.85	0.16	5.2
OLR-1-51	Rose Creek	0.32	0.1	5.64	10.8	530	1.41	0.22	2.88	0.36	88.8	10.7	59	3.3	25.7	2.82	14.6	0.16	5.1
OLR-1-53	Rose Creek	0.28	0.11	5.79	28.1	540	1.46	0.24	1.54	0.15	89.3	9.6	64	3.45	29.8	5.95	15.6	0.15	5.4
OLR-1-63.5	St. Francis	0.36	0.07	6.81	10.1	560	2.02	0.18	1.51	0.1	78.2	14.8	56	3.78	41.5	4.47	18.8	0.17	6.8
OLR-1-64.5	Rose Creek	0.28	0.09	6.56	9	450	1.7	0.27	2.69	0.12	92.1	13.4	64	4.43	22.5	3.14	17.3	0.14	4.7
OLR-1-96	Elmdale	0.32	0.07	6.81	5.9	480	1.72	0.23	2.98	0.19	82.9	11.8	64	3.85	22.6	2.53	17.5	0.18	4.8
OLR-1-108	Elmdale	0.28	0.07	6.7	9.2	480	1.91	0.22	3.83	0.15	80.5	12.4	66	4.23	22.2	3.13	17.15	0.16	4.3
OLR-1-116	Elmdale	0.28	0.09	6.47	4.7	570	1.65	0.22	3.55	0.16	79.8	11.6	61	4.01	22.6	3.07	16.65	0.17	4.2
OLR-1-122.5	Elmdale	0.28	0.1	6.29	5.2	470	1.76	0.21	3.54	0.15	83.2	11.7	60	4.13	20.9	3.07	16.8	0.18	4.6
OLR-1-124	Elmdale	0.28	0.08	6.31	4.3	510	1.75	0.22	3.29	0.13	80.9	10.9	59	4.31	20.1	2.93	16.45	0.17	4.3

Sample name	In ppm	K %	La ppm	Li ppm	Mg %	Mn ppm	Mo ppm	Na %	Nb ppm	Ni ppm	P ppm	Pb ppm	Rb ppm	Re ppm	S %	Sb ppm	Sc ppm	Se ppm	Sn ppm	Sr ppm	Ta ppm	Te ppm	Th ppm	Ti %	Tl ppm	U ppm	V ppm	W ppm	Y ppm	Zn ppm	Zr ppm
OLR-1-5.5	0.055	1.57	44.6	46.9	1.31	438	3.74	0.45	15.7	35.2	680	21.6	78.1	<0.002	0.03	0.91	11.7	1	1.9	131	0.98	0.1	12.85	0.395	0.65	4.2	104	1.3	23.8	79	177.5
OLR-1-12.5	0.048	1.53	44.6	52.1	1.35	437	5.21	0.43	15.7	45.4	650	23.4	78.5	0.03	1.22	1.12	11.1	2	1.9	134.5	0.96	0.1	12.75	0.394	1.08	7.6	104	1.3	23.4	81	171.5
OLR-1-17	0.049	1.47	41.4	47.1	1.4	485	4.88	0.42	14.8	39.2	650	22.3	74.5	0.016	1.29	0.97	10.2	2	1.9	134.5	0.91	0.08	11.85	0.397	0.9	4.8	100	1.2	22.4	75	168
OLR-1-21	0.053	1.5	40.8	44.3	1.29	397	5.6	0.45	14.7	37.6	660	22.1	73.1	0.014	1.3	0.96	9.8	2	1.8	136	0.9	0.11	11.65	0.392	0.88	5.1	99	1.2	22.9	77	161
OLR-1-29.5	0.058	1.6	43.4	41.2	0.94	407	3.51	0.49	15.7	41.7	700	22.4	82	0.013	1.39	0.75	11.6	2	1.8	138.5	1	0.07	11.95	0.404	0.77	3.8	103	1.2	22.2	76	164
OLR-1-38	0.053	1.6	44.1	44.3	0.87	327	3.62	0.44	18.1	35.9	710	21.4	82.2	0.009	1.37	0.96	10.8	3	1.9	132.5	1.11	0.1	12.35	0.404	0.86	4.1	108	1.3	22.8	82	169
OLR-1-45	0.058	1.66	45.7	52	0.84	347	3.54	0.39	20.2	37.1	710	23.3	89.7	0.011	1.21	0.93	11.7	3	2.1	130.5	1.28	0.07	12.85	0.426	0.84	3.9	116	1.3	24.2	86	181
OLR-1-49	0.052	1.71	44.4	42.4	0.93	396	2.8	0.47	18.7	34	730	21.2	81.3	0.011	0.82	0.85	11.5	2	1.9	126	1.24	0.06	12.25	0.429	0.81	3.4	106	1.2	23.6	66	187.5
OLR-1-51	0.046	1.73	43.2	35.3	1	372	1.65	0.57	16.2	30.9	720	21.6	75	0.01	0.57	0.74	10.4	1	1.6	135.5	0.99	0.08	12	0.427	0.7	3.8	94	1.1	24.3	66	188.5
OLR-1-53	0.049	1.78	42.2	31.2	0.58	763	10.85	0.59	16.7	30.8	930	20.5	78.6	<0.002	0.02	0.83	11.1	1	1.6	123	1.11	0.1	12.25	0.432	0.62	2.7	97	1.2	24.3	72	192.5
OLR-1-63.5	0.052	3.13	37.2	29.7	0.95	709	0.95	0.57	13.7	35.8	710	19.3	104.5	<0.002	0.01	1.15	12.3	1	2.3	92.5	0.92	<0.05	10.25	0.538	0.65	2.7	86	1.1	32	72	241
OLR-1-64.5	0.053	1.81	44.9	41.4	0.8	272	1.46	0.48	17.1	24.4	650	21.9	87.5	<0.002	0.01	0.6	12.2	1	1.9	122	1.04	0.07	12.75	0.437	0.61	2.7	101	1.3	22.5	59	176.5
OLR-1-96	0.047	1.68	42	39.5	1.01	245	1.65	0.69	14.7	32.9	510	21	81.1	0.009	0.45	0.53	11.5	1	1.7	142.5	0.93	0.05	11.95	0.407	0.62	4.1	90	1.2	20.4	65	171
OLR-1-108	0.042	1.92	41.4	37.4	1.15	514	1.32	0.68	13.7	33.4	580	22.5	83.6	<0.002	0.3	0.56	11.3	1	1.7	150.5	0.92	0.06	11.7	0.39	0.58	2.9	94	1.2	20.2	64	156
OLR-1-116	0.043	1.87	40.5	35.9	1.11	485	1.03	0.71	13.4	31.9	620	18.8	81.7	0.002	0.21	0.56	11	<1	1.6	153.5	0.88	0.06	11.25	0.375	0.58	2.7	90	1.1	20	61	153
OLR-1-122.5	0.043	1.87	42.5	35.5	1.08	458	0.9	0.66	14.1	31.4	620	19.8	86.3	<0.002	0.18	0.55	10.9	1	1.7	149.5	0.92	<0.05	11.65	0.369	0.57	2.7	87	1.2	20.6	58	157
OLR-1-124	0.04	2.09	40.9	34.8	1.1	435	0.93	0.62	13.4	29.6	560	22.4	87.3	<0.002	0.16	0.65	10.4	1	1.7	146	0.88	<0.05	11.8	0.373	0.54	2.6	87	1.2	19.5	57	152.5