George H. Ryan, Governor

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ILLINOIS STATE GEOLOGICAL SURVEY
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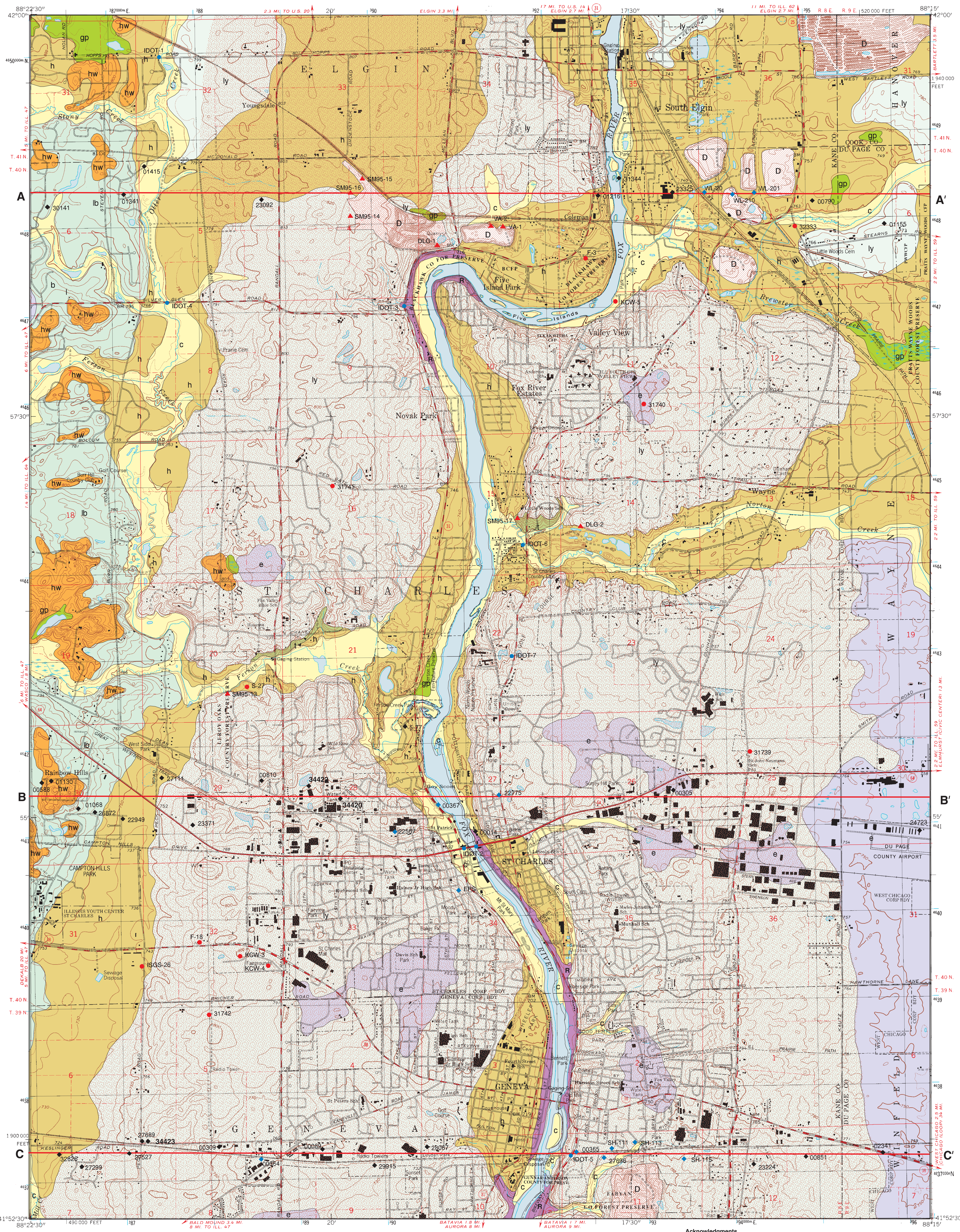
Illinois Geological Quadrangle Map: IGQ Geneva-SG
2002

SURFICIAL GEOLOGY MAP

Geneva 7.5-minute Quadrangle, Kane County, Illinois

David A. Grimley and B. Brandon Curry



Topographic Map Base Produced by the United States Geological Survey in cooperation with State of Illinois Agencies
Control by USGS and NOS/NOAA
Planimetry by photogrammetric methods from aerial photographs taken 1963. Topography by planetable surveys 1947-48. Revised from aerial photographs taken 1988. Field checked 1991
Map edited 1993
Projection and 10,000-foot grid ticks: Illinois coordinate system, east zone (transverse Mercator)
1000-meter Universal Transverse Mercator grid ticks, zone 16, shown in blue
1927 North American Datum (NAD 27)
North American Datum of 1983 (NAD 83) is shown by dashed corner ticks
Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs. This information is unchecked

Scale 1:24,000

0 — 2 miles
0 — 2 kilometers
0 — 2000 feet

Base map contour interval 10 feet

Base map compiled at the Illinois State Geological Survey (ISGS) from digital data provided by the U.S. Geological Survey and the ISGS

Recommended Citation

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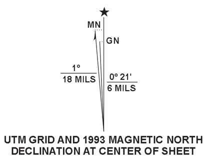
For more information contact:
ILLINOIS STATE GEOLOGICAL SURVEY
615 East Peabody Drive
Champaign, Illinois 61820-6964
(217) 333-4747
http://www.isgs.uiuc.edu

Released by the authority of the State of Illinois: 2002

1	2	3
4		5
6	7	8

1 Pingree Grove
2 Elgin
3 Streamwood
4 Elburn
5 West Chicago
6 Sugar Grove
7 Aurora North
8 Naperville

ADJOINING 7.5-MINUTE QUADRANGLES



UTM GRID AND 1993 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

Acknowledgments

Ardith Hansel and Barb Stiff assisted with field work and with interpretations of the geology. This map benefited from discussions with David Gross and Herb Glass and also from review comments of Michael Barnhardt, Leon Follmer, Ardith Hansel, and Donald Luman. Engineering boring logs were provided by the Illinois Department of Transportation and by Bud Inslee and Ken Blood, Fox Mill Ltd. Partnership. The authors thank the Glennwood School personnel and the Strube, Biddle, and Kupar families for allowing access to their property for drilling. Herb Glass and Randy Hughes analyzed many samples for clay minerals, which were useful for stratigraphic correlations. Digital cartography by S.L Beaverson and B.J Stiff. Pam Carrillo and Melony Barrett greatly helped with map preparation.

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Quaternary Geology

The Geneva Quadrangle in northeastern Illinois, about 40 miles west of downtown Chicago (fig. 1), is a glaciated area on the edge of rapid urbanization in Kane County. The present-day landscape and most surficial deposits in the Geneva Quadrangle resulted primarily from the action of continental glaciers during the last glaciation (Wisconsin Episode). Deposits of the next-to-last glaciation (Illinois Episode) are preserved in buried bedrock valleys and lowlands (see cross sections) where they were not eroded by subsequent glacial advances. Pre-Illinois episode glacial advances probably occurred in the region (Willman and Frye 1970); however, their deposits have not been recognized in Kane County, either because they were eroded or are not distinguishable from Illinois Episode deposits. As a result of the many glacial pulses during the Wisconsin and Illinois Episodes, bedrock is buried by up to 180 feet of unsorted glacial debris (till), sorted sand and gravel (glaciofluvial deposits), sorted silt and clay (glacial and postglacial lake sediment), and peat (marsh deposits). Minor thicknesses of windblown silt (loess), peat, and modern river sediment thinly cover the glacial deposits with 2 to 20 feet of loose sediment. In a few areas of high bedrock along the Fox River, Silurian dolomite and Ordovician shale and limestone crop out or are near the surface, such as shown along cross section C–C′.

During early glaciations, ice advanced generally toward the southwest from Canada via the Lake Michigan basin (fig. 1; Willman and Frye 1970). During the most recent glaciation (the Wisconsin Episode), two sublobes of the Lake Michigan glacial lobe (the Harvard and Princeton Sublobes) merged and overlapped in Kane County (fig. 1; Hansel and Johnson 1996, Curry et al. 1999). The flow of these sublobes, generally to the west, was constricted by bedrock highs (fig. 2) or preexisting moraines in northwestern and central Kane County. As a consequence, several moraines, well separated to the south, become less separated or overlap in Kane County (fig. 1). Thus, significant stacking of various types of glacial deposits, of contrasting age and lithology, occurs in the Geneva Quadrangle (see cross sections).

Deposits of the Illinois Episode glaciation include yellow-brown to pinkish brown loam to sandy loam till (Glasford Formation) as much as 50 feet thick, and outwash sand and gravel (Pearl Formation) as much as 80 feet thick. Some sand bodies occur within the Glasford Formation, and some unsorted mudflow or till deposits (diamicton) occur within the Pearl Formation. Both the Glasford and Pearl Formations are preserved below Wisconsin Episode deposits, primarily in bedrock lowlands or in buried valley segments below an elevation of 700 feet (see cross sections). None of the Illinois Episode deposits were found exposed in outcrops in this quadrangle. Based on water wells and municipal water supply borings, Pearl Formation sand and gravel is up to 100 feet thick in the St. Charles Bedrock Valley, which extends from northeast to southwest across this quadrangle (fig. 2 and cross sections). The upper 5 to 10 feet of Glasford Formation till was weathered during the Sangamon interglacial episode (from about 130,000 to 55,000 years before present). This weathered zone is commonly described as a green clay in water well drillers' logs. In some former depressions, the till deposits are overlain by as much as 10 feet of peat and organic silt (Robein Member of Roxana Silt) deposited in cool to cold climate bogs, between about 50,000 and 24,000 years before present in northern Illinois (Meyers and King 1985, Curry 1989).

The first major deposit of the last glaciation (Wisconsin Episode) is a pinkish brown to gray loam to clay loam diamicton with minor sand and gravel bodies (Tiskilwa Formation). This unit overlies Illinois Episode deposits or bedrock in the Geneva Quadrangle. The typically dense and uniform Tiskilwa Formation is interpreted to be primarily subglacial till but also includes debris flows. This unit is up to 100 feet thick (cross section B–B′), but thins to the southeast beneath the younger units. The Tiskilwa till has a distinctive pinkish hue and also has diagnostic physical properties in northeastern Illinois, averaging 35 ± 10% sand (0.063 mm), 39 ± 5% silt (0.004 to 0.063 mm), and 26 ± 6% clay (<0.004 mm) and 66 ± 3% illite in the clay mineral fraction based on hundreds of samples (Wickham et al. 1988).

The Tiskilwa till in the Geneva Quadrangle was deposited by two sublobes of the Lake Michigan Lobe. Initially, the Harvard Sublobe advanced and formed the Marengo Moraine in western Kane County (fig. 1) between about 25,500 and 22,500 years before present. A change in the configuration of the ice margin occurred afterward when ice of the Princeton Sublobe advanced and formed the Bloomington Morainic System (fig. 1) between about 22,500 and 19,000 years before present. The Princeton Sublobe is thought to have overtopped the Marengo Moraine in much of Kane County (Wickham et al. 1988). Fabric analyses (A.K. Hansel) from the Fox River Stone Quarry (Sec. 4, T40N, R8E) indicate a westerly direction of ice advance (from the Harvard Sublobe) during the deposition of the lower part of Tiskilwa Formation, changing to a northwesterly advance (from the Princeton Sublobe) during the deposition of the upper Tiskilwa Formation (Curry et al. 1999).

Throughout most of the Geneva Quadrangle, but especially west of the Fox River, a yellow-brown to gray, silt loam to loam diamicton (Batestown Member, Lemont Formation) overlies the Tiskilwa Formation. Batestown diamicton, 5 to 30 feet thick, is generally softer, less uniform, and less pink than the Tiskilwa diamicton. The Batestown diamicton in some places has a pale-pinkish hue because of incorporation of Tiskilwa till. When uniform, Batestown tills (previously called Malden Till Member; Willman and Frye 1970) are fairly silty, averaging 32 ± 6% sand, 46 ± 5% silt, and 22 ± 5% clay in northeastern Illinois (Wickham et al. 1988). A higher percentage of illite in the clay mineral fraction for Batestown till (76 ± 2%) than for Tiskilwa till reflects more influence from Lake Michigan basin shales (Wickham et al. 1988).

Batestown diamicton is also commonly associated with sand and gravel (Henry Formation), a result of widespread glacial meltwater deposition during stagnant ice conditions. The Elburn Complex (Willman and Frye 1970), in extreme western portions of the quadrangle, contains numerous hills, many of which are kames, with sand and gravel in their cores. Therefore, this geomorphic region is interpreted to be a stagnation (kamic) moraine. The kames formed where sand and gravel was deposited by meltwater flowing into holes or low areas in the ice or along the margin of stagnant ice. Sand and gravel intermixed with diamicton bodies (Wasco facies of the Henry Formation) can be up to 60 feet thick in the largest kames (cross section B–B′). The flanks of these kames are overlain by 5 to 20 feet of Batestown diamicton, deposited as debris-rich stagnant ice melted out on top of the sand and gravel. Sand and gravel (Henry Formation), deposited between glacial advances, is also found underneath some landscapes mapped as Batestown Member diamicton (see cross section A–A′).

The extensive kamic landscape in central Kane County is probably a result of the convergence of the Harvard and Princeton Sublobes in this area and their inability to advance upgradient over the prominent Marengo Moraine (fig. 1). These conditions, and the obstruction of drainage to the northwest, are consistent with ice stagnation in the deteriorating Harvard Sublobe and in the interlobate area, as the Princeton Sublobe regionally advanced to the southwest and cut off the Harvard Sublobe after Tiskilwa till deposition. Deposition of Batestown diamicton and Wasco sand and gravel occurred between about 19,000 and 18,000 years before present.

Trending north-south in the middle of the Geneva Quadrangle are the broad and gently undulating Minooka and St. Charles Moraines (fig. 1), which contain as much as 80 feet of gray to yellow-brown silty clay diamicton (Yorkville Member, Lemont Formation). Yorkville tills are notable in northeastern Illinois for their high percentages of shale clasts, illite (averaging 77 ± 2%; Wickham et al. 1988), and clay (averaging 43 ± 12%; Wickham et al. 1988).

After deposition of Batestown Member diamicton, glacial ice receded toward Lake Michigan before readvancing to the St. Charles Moraine and then melting back a few miles to the Minooka Moraine. The moraines are separated by the Fox River, except west of South Elgin, where Minooka ice apparently crossed the Fox River Valley, depositing an upland outwash fan delta (2.5 km wide) on the St. Charles Moraine (Sec. 33, T41N, R8E). Fossil tundra plants found in lacustrine deposits underlying the fan delta at Fox River Stone Quarry yielded radiocarbon ages of 17,539 ± 128 years (ISGS A-0021) and 17,176 ± 127 years before present (ISGS A-0103), approximately the time between the formation of the two moraines. Fossil plant fragments, seeds, small freshwater clams, and ostracodes (sand-sized aquatic crustaceans) suggest climatic conditions similar to modern-day tundra conditions in northern Canada (Curry et al. 1999).

A relatively thin covering (<20 feet) of stratified fine sand, silt, and clay (Equality Formation) occurs in many low-lying areas, where deposition occurred in former glacial lakes during the last glacial episode. Some lakes formed on top of glacial ice (as in Sec. 11, T40N, R8E); others formed proglacially between the edge of glacial ice and older end moraines (southeastern edge of map); and yet others formed in slackwater areas of larger creeks and rivers. Outwash sand and gravel (Henry Formation) is generally less than 40 feet thick but may be up to 70 feet thick along some portions of terraces along Otter Creek and the Fox River (cross sections A–A′ and C–C′). These coarse-grained river deposits (outwash) were periodically laid down by glacial meltwater during deglaciation. Outwash along an abandoned valley in the southwest portion of the Geneva Quadrangle was probably deposited when the St. Charles Moraine was formed. Outwash in the Fox River Valley is attributed to westward glacial advances to the Woodstock and West Chicago Moraines north and east of this area (fig. 1; Leighton et al. 1928–1930). Similarly, outwash in Brewster and Norton Creek valleys, which dissect the Minooka Moraine, is related to the Woodstock and West Chicago Moraines, immediately east of the mapped area (fig. 1).

After ice of the Wisconsin Episode receded, 2 to 4 feet of loess (Peoria Silt) was deposited by episodic dust storms, which deflated silt from outwash in the Rock River and Mississippi River valleys. During postglacial times, the Grayslake Peat was deposited in current and former marshy depressions where high water tables and lack of oxygen prevented organic materials from decomposing. Modern stream sediment (primarily sand and silt deposits) is inset into outwash, lake deposits, and till along the many creeks and rivers in the area. Thin colluvial deposits, occurring on some steep hillsides, were not mapped.

Material Resources and Environmental Hazards

Sand and Gravel

Significant sand and gravel deposits include the Henry Formation, the Pearl Formation, and sorted sediment within till units. Sources of economically minable sand and gravel are mostly limited to the Henry Formation (including the Wasco facies) because sand and gravel bodies within till units are more limited and unpredictable in dimensions and because Pearl Formation sand and gravel is buried too deeply in bedrock valleys (see cross sections and fig. 2).

Sand and gravel deposits in central Kane County have been a source of construction materials for many years (Leighton et al. 1928–1930, Block 1960, Masters 1978). Small pits once operated in outwash deposits in terraces and deltas (undifferentiated Henry Formation) and in ice-contact deposits in kamic hills (Wasco facies, Henry Formation). Large sand and gravel operations once existed on terraces near the great bend of the Fox River south of South Elgin (Gross 1969). Few pits remain in the Geneva 7.5-minute Quadrangle because of the rapid suburban growth of the area and because of the trend toward fewer but larger sand and gravel operations in the county. As of 1997, only one moderate-size operation existed in the outwash fan north of the Fox River Stone Quarry, west of South Elgin. Today, sand and gravel is commonly used by the construction industry for concrete, asphalt, fill, and roadbase (Goldman 1994).

Groundwater and Its Potential for Contamination

Groundwater, pumped from sand and gravel aquifers, is extensively used by households, municipalities, and industries in Kane County (Curry and Seaber 1990). In valleys and lowlands, bodies or tongues of Henry Formation sand and gravel compose the most significant Quaternary aquifer (see stippled areas of cross sections). Sand and gravel deposits, in former valleys that were buried by as much as 80 feet of gray to yellow-brown silty clay diamicton (Yorkville Member, Lemont Formation), provide a high-quality water supply that is fairly well protected from surface contamination by overlying silty or clayey till deposits. For instance, an excellent water supply for the towns of Geneva and St. Charles is found in the Pearl Formation sand and gravel in the St. Charles Bedrock Valley west of these towns (cross sections B–B′ and C–C′). In upland areas, the most common Quaternary aquifers are the Wasco facies of the Henry Formation and sand and gravel bodies within till units (stippled areas of cross sections). Many wells in the area obtain water from sand and gravel layers within and below the Glasford Formation, from fractured dolomite bedrock, or deep sandstone aquifers. Curry and Seaber (1990) provide an overview of the bedrock and Quaternary sediment aquifers and groundwater resources in Kane County.

Agricultural or industrial contaminants are a potential threat to groundwater quality in near-surface aquifers that are not overlain by a clayey, unfractured confining unit (such as clayey till or lake sediment). Shallow sand and gravel aquifers, such as the Henry Formation, exposed at the surface or buried by a thin loess cap (<4 feet) are most vulnerable to contamination. The Yorkville Member, Lemont Formation (containing 30% to 50% clay), is an excellent aquitard, which protects the groundwater in underlying sand and gravel deposits. The groundwater in deposits of the St. Charles Bedrock Valley is well protected where the valley is overlain by clayey deposits of the St. Charles Moraine. Tiskilwa Formation till, containing an average of 25% to 30% clay, is a good aquitard where it is uniform in texture and does not contain sand bodies. Batestown Member till (typically 15% to 20% clay in the quadrangle) is a fair to poor aquitard because it is less clayey than Tiskilwa Formation till and is more heterogeneous, containing numerous sand bodies and lenses, particularly where it is associated with or near areas of kamic topography (see cross sections). Berg et al. (1984) summarized the factors that determine the potential for contamination of shallow aquifers in Illinois.

Mapping Techniques and Data Sources

This surficial geologic map is based in part on soil parent materials compiled from the *Soil Survey of Kane County, Illinois* (Goddard 1979, scale 1:15,840) and early unpublished data and geologic maps at 1:62,500 scale (Leighton et al. 1928–1930). The map was considerably modified based on field observations and new drill cores taken in 1995. Additional data sources for the surficial geology map include Leverett (1899), Gross (1969), Curry et al. (1988), and unpublished field notes on file at the Illinois State Geological Survey (ISGS). Well log descriptions, Illinois Department of Transportation records, and other logs of engineering data, on file at the ISGS Geologic Records Unit, were also used to aid in mapping, especially in drafting the three cross sections.

The locations of the most important data points used for constructing this surficial geology map are shown on the map and are described in detail (Grimley 2002). Some of the key stratigraphic sites include the Fox River Stone Quarry outcrops, Woodland Landfill borings, Settler's Hill Landfill borings, Geneva and St. Charles municipal water test borings, test borings for the proposed Superconducting Super Collider (Kempton et al. 1987, Curry et al. 1988), and new STATEMAP borings.

Cross Sections

Sand and gravel bodies are stippled on cross sections. Their extents are estimated from available data. Additional sand and gravel lenses undoubtedly occur within tills of the Glasford Formation, Tiskilwa Formation, and the Batestown and Yorkville Members of Lemont Formation, but these lenses are not shown except where water wells, test holes, or outcrops indicate their presence. Sand and gravel lenses, deposited by former glacial meltwater channels, are difficult to predict in the absence of detailed data. A cover of loess, 2- to 4-feet thick, at the ground surface is not shown, nor are most other geologic units that are less than 5 feet thick.

All water wells and test holes used for the three cross sections are transposed from no more than 2,000 feet to the north or south of the cross section lines (see map). Data points were transposed to positions on the cross section with similar geomorphology and with surface elevations similar to those of the original borings. Many water wells extend deep into bedrock, and so their full extent is not shown. For details of the stratigraphic information yielded from these wells and test holes, a report of key outcrop and boring descriptions (Grimley 2002) is available from the ISGS. Well log descriptions are also available from ISGS at the Geologic Record Unit.

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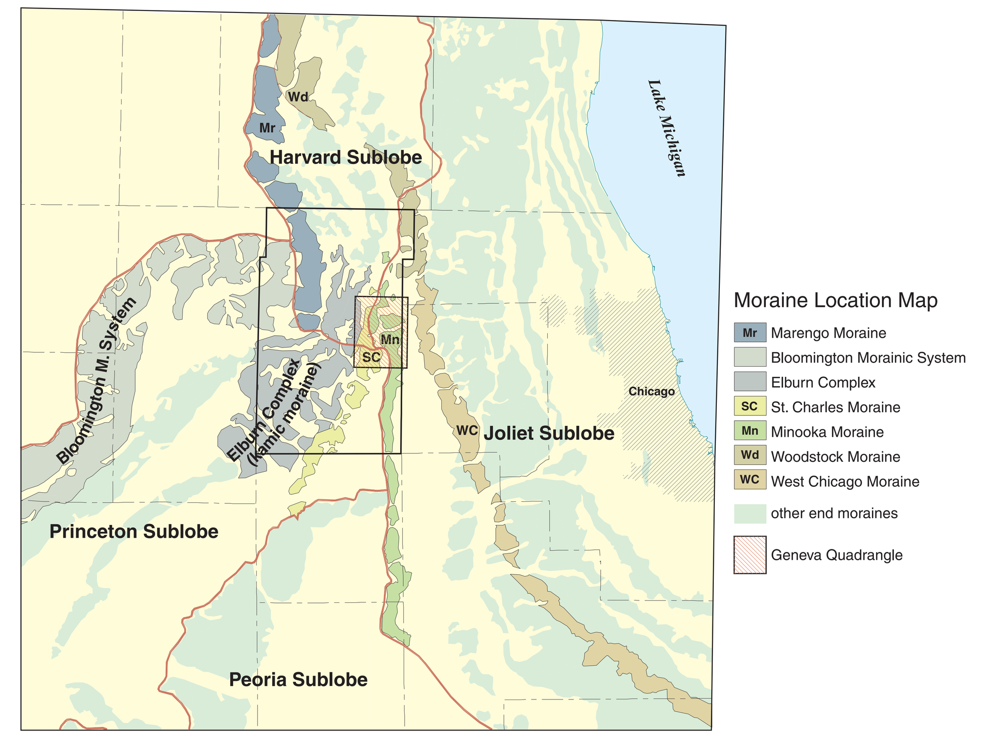


Figure 1 Wisconsin Episode moraines in northeastern Illinois.
Moraines, shown in blue and green, were formed near the terminus of glacial ice during various positions of the Lake Michigan Lobe. Glacial ice advanced in a westerly and southwesterly direction into Illinois from the Lake Michigan basin. Thus, the older moraines of this figure occur generally to the west and the younger moraines to the east. On this map, adapted from Willman and Frye (1970) and Hansel and Johnson (1996), Kane County is outlined in black, and the Geneva Quadrangle is hatchured in red. The thick red lines show the boundaries of glacial sublobes.

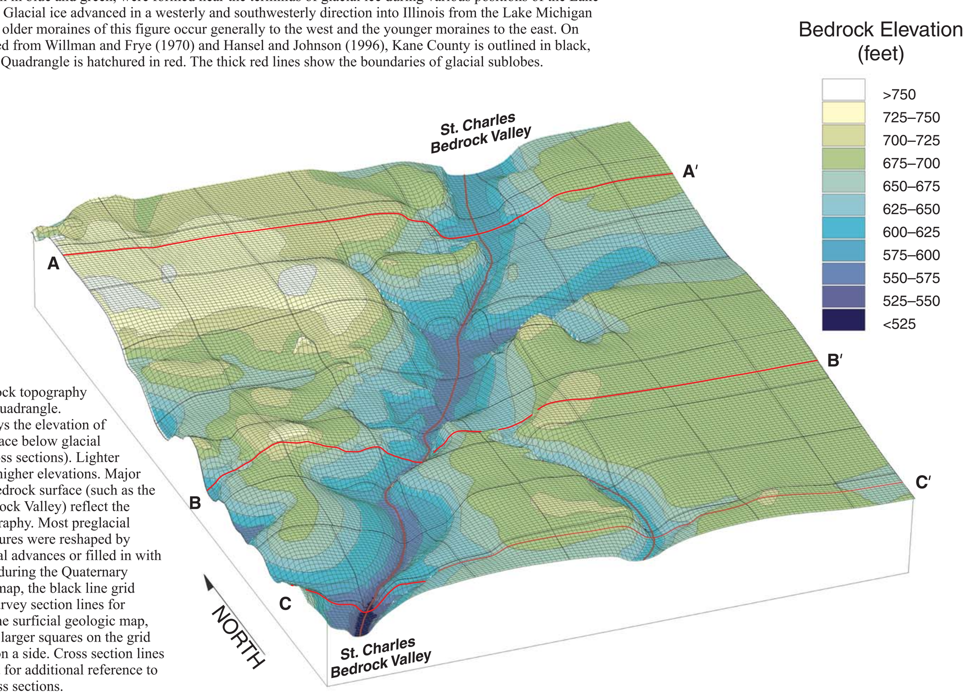
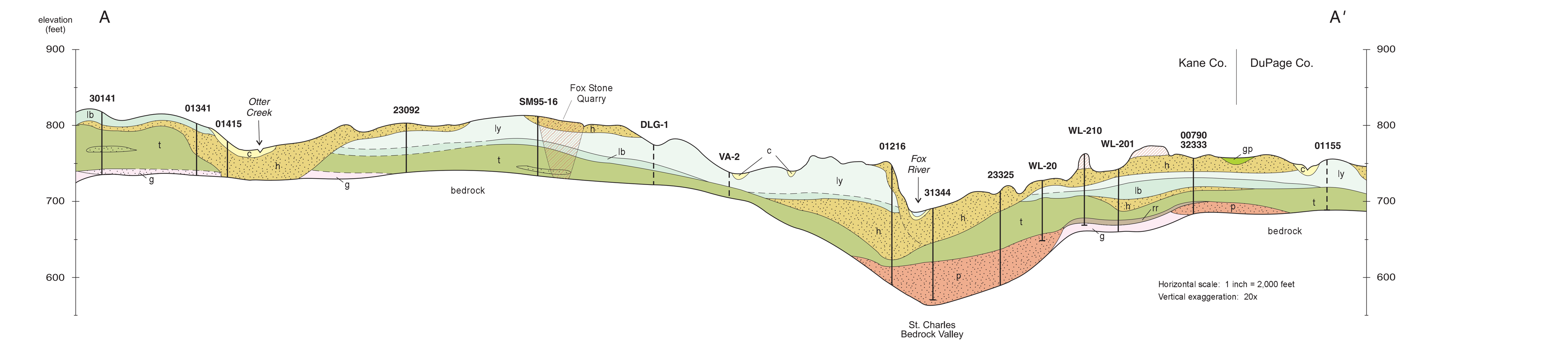
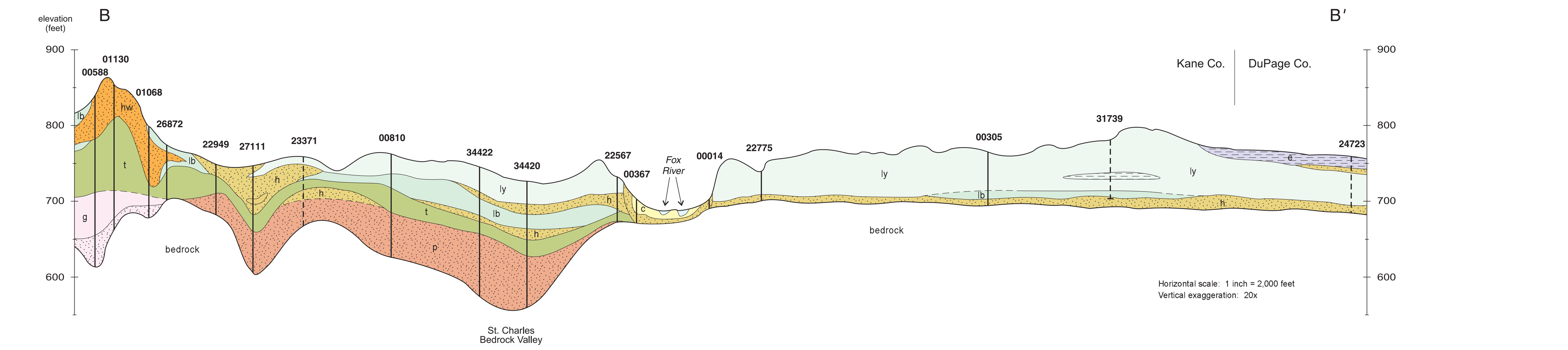
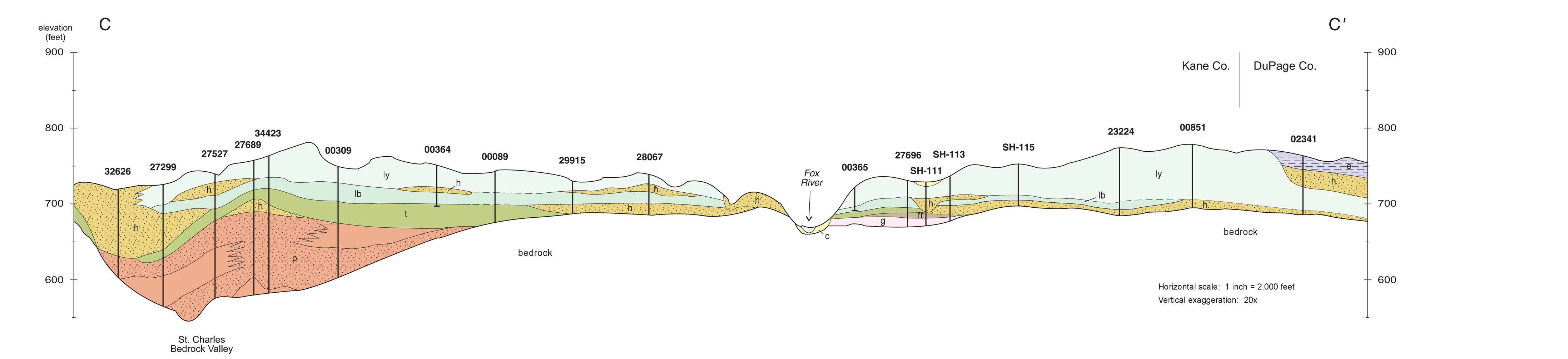


Figure 2 Bedrock topography of the Geneva Quadrangle.
This map portrays the elevation of the bedrock surface below glacial deposits (see cross sections). Lighter shades indicate higher elevations. Major valleys on the bedrock surface (such as the St. Charles Bedrock Valley) reflect the preglacial topography. Most preglacial geomorphic features were reshaped by successive glacial advances or filled in with glacial deposits during the Quaternary Period. On this map, the black line grid indicates land survey section lines for reference with the surficial geologic map, with each of the larger squares on the grid being one mile on a side. Cross section lines are shown in red for additional reference to the map and cross sections.







Materials

Lithostratigraphy and Interpretations

QUATERNARY DEPOSITS

Hudson Episode (postglacial)
10,000–0 years B.P. (before present)

Materials	Unit	Lithostratigraphy and Interpretations
Peat, muck, organic silt, and clay; fibrous, sometimes interbedded with sand, silt, and clay; 5 to 10 feet thick.	gp	**Grayslake Peat** Swampy depressional deposits, lake filling, and slopewash; intertongues with Equality and Cahokia Formations.
Sand, silt, and clay, locally containing beds of sandy gravel; stratified 5 to 20 feet thick.	c	**Cahokia Formation** Alluvium; typically occurs in the floodplains and channels of the Fox River and streams such as Norton, Ferson, and Otter Creeks.

Wisconsin Episode–Mason Group (last glaciation)
55,000–10,000 years B.P.

Materials	Unit	Lithostratigraphy and Interpretations
Clay and silt, containing some beds of fine to medium sand; laminated to massive; 5 to 25 feet thick.	e	**Equality Formation** Lacustrine sediment; intertongues with other units in Mason and Wedron Groups; occurs in proglacial, supraglacial, slackwater, and some postglacial lake basins; overlain by 0 to 4 feet of Peoria Silt (loess).
Sand and gravel; stratified to massive; generally well sorted; can be cross-bedded or plane-bedded, containing beds of silt, clay, and diamicton; generally 5 to 75 feet thick.	h	**Henry Formation** (except Wasco facies) Outwash; intertongues with Equality Formation and diamicton units of the Wedron Group; occurs in glacial meltwater channels and outwash plains adjacent to end moraines; overlain by 0 to 4 feet of Peoria Silt.
Sand and gravel, containing lenses of silt, clay, and diamicton; irregularly bedded and moderately sorted; 5 to 60 feet thick.	hw	**Wasco facies, Henry Formation** Ice-contact sediment; interstratified and associated with the Batestown-Member, Lemont Formation; occurs in kames and kamic moraines; overlain by 0 to 4 feet of Peoria Silt.
Organic silt, peat, silt, and clay; brown, black, gray, and blue-gray; stratified; leached; up to 10 feet thick.	rr	**Robein Member, Roxana Silt** (in cross sections only) Depressional deposits; accumulated in poorly drained landscapes; underlies Henry Formation or Tiskilwa Formation.

Wisconsin Episode –Wedron Group (last glaciation)
55,000–10,000 years B.P.

Materials	Unit	Lithostratigraphy and Interpretations
Diamicton, silty clay to silty clay loam; gray to gray-brown; oxidizes to yellow-brown; generally massive but locally contains beds of sorted sediment, often fine-grained; contains shale and dolomite clasts; 5 to 80 feet thick.	ly	**Yorkville Member, Lemont Formation** Till and ice margin sediment; overlain by 0 to 4 feet of Peoria Silt.
Diamicton, silt loam to loam; gray to gray-brown, oxidizing to yellow-brown, orange-brown, or pale pinkish brown; lower portion is massive; upper portion is often stratified and inter-bedded with silt and sand; 5 to 30 feet thick.	lb	**Batestown Member, Lemont Formation** Till and ice marginal sediment; typically associated with Wasco facies, Henry Formation; present in kamic topography; overlain by 0 to 4 feet of Peoria Silt.
Diamicton, loam to clay loam; pinkish brown to gray; locally contains beds or small channels of sand and gravel; as much as 100 feet thick.	t	**Tiskilwa Formation** Till and ice marginal sediment; pinches out to the south and east; outcrops in areas along lower portions of Norton and Ferson Creeks; mainly not present south of Norton Creek on the east side of the Fox River; overlain by 0 to 4 feet of Peoria Silt.

Illinois Episode–(next to last glaciation)
about 200,000–130,000 years B.P.

Materials	Unit	Lithostratigraphy and Interpretations
Sand and gravel with some silt and clay; stratified and sorted; contains some lenses of diamicton; 0 to 110 feet thick.	p	**Pearl Formation** (in cross sections only) Outwash; contains some mud flow and ice marginal sediment; intertongues with Glasford Formation; occurs primarily in the St. Charles Bedrock Valley and its tributaries.
Diamicton, loam to sandy loam; pinkish brown to brown; contains some sand and gravel bodies; 0 to 80 feet thick.	g	**Glasford Formation** (in cross sections only) Till and ice-marginal sediment; intertongues with the Pearl Formation; occurrence is patchy; most commonly preserved in bedrock lows in northern and western areas of the quadrangle.

SILURIAN AND ORDOVICIAN BEDROCK

Materials	Unit	Lithostratigraphy and Interpretations
Limestone, shale, and dolomite within about 5 feet of ground surface; rock units dip gently to the east.	R	**bedrock exposures or near-surface bedrock** Silurian carbonate and Ordovician shale and dolomite (Maquoketa Group) outcrop in a few exposures along the Fox River; these rock units dip gently to the east; Silurian rock is preserved on bedrock highs but has been eroded through to the underlying Maquoketa Group in most bedrock valleys (fig. 2 and Curry et al. 1988).

Data Points

- Water wells
- IDOT borings
- Engineering borings
- Outcrops
- ISGS borings
- Water
- D Disturbed ground (significant spoil piles or removed earth in gravel pits, quarries, and landfills)
- Moraines (map only)

Cross Sections

- More reliable contact (based on higher-quality data)
- Less reliable data (based on lower quality data)
- Data point less than 1,000 feet from cross section line
- Data point more than 1,000 feet from cross section line
- Sand and gravel (cross sections only)
- Fine-grained lake sediments (cross sections only)
- Diamicton, silt, or clay (cross sections only)