Department of Natural Resources
ILLINOIS STATE GEOLOGICAL SURVEY
William W. Shilts, Chief

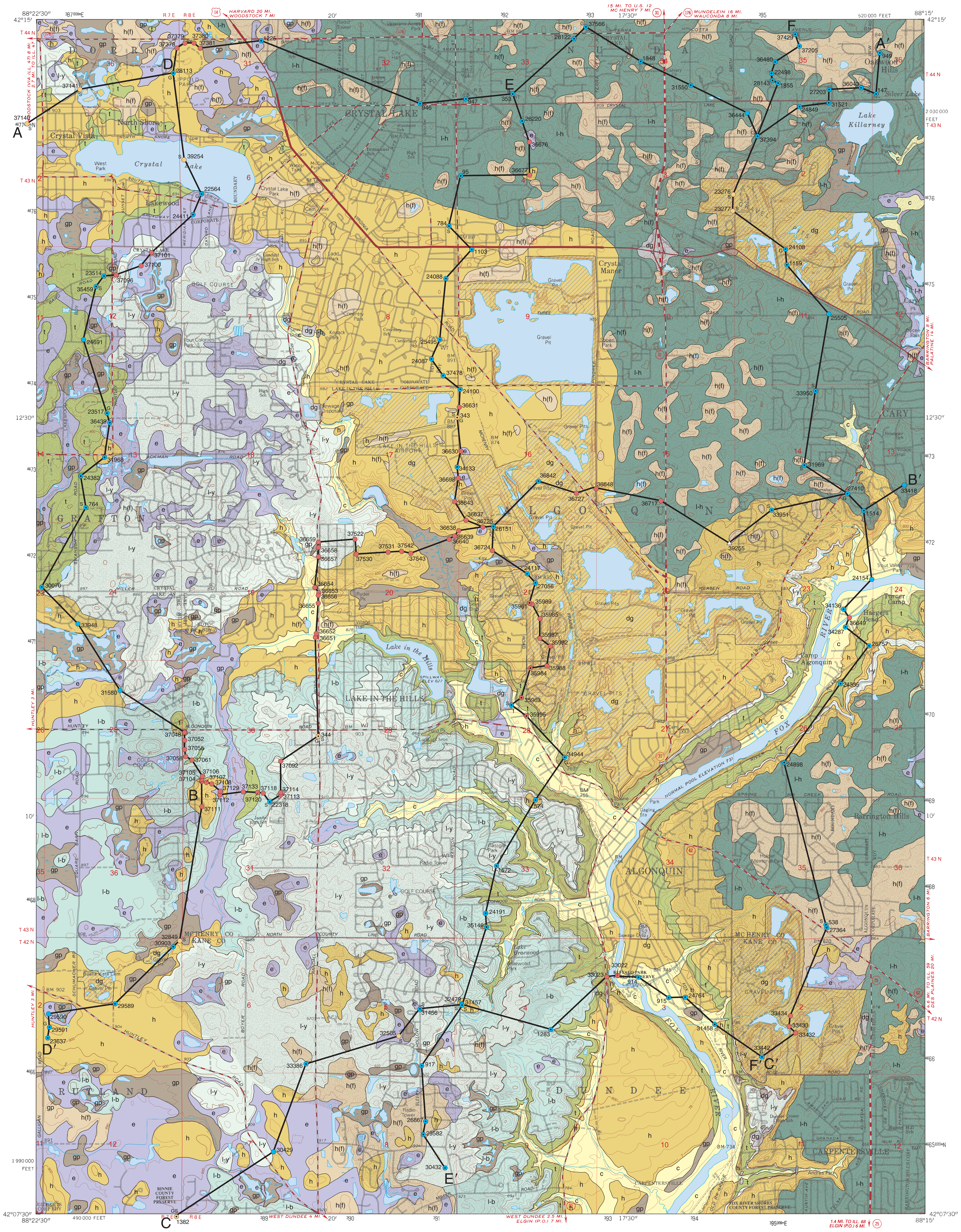
SURFICIAL GEOLOGY OF CRYSTAL LAKE QUADRANGLE

McHENRY AND KANE COUNTIES, ILLINOIS

B. Brandon Curry

2005

Illinois Geologic Quadrangle Map
IGQ Crystal Lake-SG



QUATERNARY DEPOSITS

Description	Unit	Interpretation
HUDSON EPISODE (~12,500 years before present (B.P.) to present)		
Fill or disturbed earth material	Disturbed ground, dg	**Disturbed land;** embankments and mounds (gray); pits and quarries (diagonal lines)
Peat and muck (black and brown); interbedded sand, silty clay (gray) and marl (white to light gray); less than 10 feet thick in most places	Grayslake Peat, gp	**Decomposed wetland vegetation and sediment** in depressions and on slopes associated with discharge of groundwater
Sand and gravel; well-sorted sand and lenses of peat, grading laterally to organic-rich fossiliferous silt and clay; as much as 40 feet thick in the Fox River valley; generally less than 3 feet thick in smaller upland valleys	Cahokia Formation, c	**Floodplain alluvium** along rivers and streams
HUDSON AND WISCONSIN EPISODES (25,000 years B.P. to present)		
Silt, clay, and fine sand; layered to massive; gray to brown, fossiliferous in many places. Surficial deposits are generally less than 20 feet thick and are at least 33 feet thick below Crystal Lake	Equality Formation, e	**Lake deposits** in kettles and some valleys tributary to the Fox River
Fine facies; sand, fine to medium, uniform to stratified; lenses of fossiliferous silt, loam, gravelly sand, and diamicton at base; yellowish brown to gray; as much as 38 feet thick	Henry Formation (fine facies), h(f)	**Lake sediment and slope deposits** in most depressions on moraines
WISCONSIN EPISODE (~12,500–25,000 years B.P.)		
Sand and gravel, or sand; lenses of silt and clay or diamicton; yellowish brown to brown; about 30 feet thick as channelized deposits along Fox River, from less than 10 to more than 180 feet thick as proglacial outwash in fan deposits in front of and below the Woodstock Moraine (fig. 4, sheet 3)	Henry Formation, h	**Channelized proglacial outwash** along Fox River valley; **proglacial outwash deposited in deltas and alluvial fans as outwash plains** downslope of glacial margins
Diamicton; sandy loam to loam; dolomite-rich; usually oxidized yellowish brown; includes lenses and layers of sand and gravel; in most places, less than 15 feet thick; in some areas, Haeger Member diamicton is buried by as much as 20 feet of sand and gravel (Henry Formation)	Haeger Member, Lemont Formation, l-h	**Till and debris flow deposits** associated with the Woodstock Moraine (fig. 4, sheet 3)
Sand and gravel below the Haeger Member; less than 15 feet thick west of the Fox River and as much as 140 feet thick in the subsurface east of the Fox River	Beverly Tongue, Henry Formation (cross sections only), h-b	**Proglacial outwash deposited primarily in alluvial fans** covered by diamicton of the Haeger Member
Diamicton; silty clay, silty clay loam, and clay; gray, oxidizing to yellowish brown; includes layers of sand and gravel, silt, and silty clay; as much as 80 feet thick	Yorkville Member, Lemont Formation, l-y	**Till and debris flow deposits** associated with the Barlina Moraine (fig. 4, Sheet 3); till and proglacial lake deposits in subsurface east of Fox River
Sand and gravel below the Yorkville Member; as much as 60 feet thick	Unnamed Tongue, Henry Formation (cross sections only), h(l-y)	**Proglacial outwash** covered by diamicton of the Yorkville Member
Diamicton; sandy loam to loam with abundant cobbles; gray to grayish brown, oxidizing to yellowish brown to brown; includes layers of sand and gravel or silt and sorted sediment; as much as 50 feet thick	Batestown Member, Lemont Formation, l-b	**Till and debris flow deposits** associated with the Barlina Moraine where it is buried by a thin mantle of Yorkville diamicton
Sand and gravel below the Batestown Member; as much as 35 feet thick	Unnamed Tongue, Henry Formation (cross sections only), h(l-b)	**Proglacial outwash** covered by diamicton of the Batestown Member
Diamicton; clay loam to loam (roughly equal amounts of sand, silt, and clay) with lenses of sand and gravel or sand; reddish brown, brown where oxidized; from less than 10 to more than 200 feet thick; thickens to the west	Tiskilwa Formation, t	**Till and debris flow deposits**
Sand and gravel below the Tiskilwa Formation; as much as 55 feet thick	Ashmore Tongue, Henry Formation (cross sections only), h-a	**Proglacial outwash** deposited in alluvial fans and in deltas covered by diamicton of the Tiskilwa Formation and, in places, silt and clay of the Peddicord Tongue
Silt and clay above the Robein Member or Glasford Formation and below the Tiskilwa Formation; less than 35 feet thick	Peddicord Tongue, Equality Formation (cross sections only), e-p	**Proglacial lake deposits**
WISCONSIN EPISODE (~55,000–25,000 years B.P.)		
Silt and clay; organic-rich, black to brown; leached of carbonate minerals; contains wood fragments; less than 10 feet thick; patchy distribution	Robein Member, Roxana Silt (cross sections only), r-r	**Deposits accreted in low-lying areas**
ILLINOIS EPISODE (~200,000–130,000 years B.P.)		
Diamicton; sandy loam to loam, reddish brown, pinkish brown, and brown; bouldery in places; abundant lenses of sand and gravel; as much as 70 feet thick; generally thicker to the north	Glasford Formation (cross sections only), g	**Till, debris flow deposits, and outwash**

PRE-QUATERNARY

Description	Unit	Interpretation
Dolomite; microcrystalline; cherty in places (Kankakee and Joliet Formations), shaly, fossiliferous dolomite, shale, and thin beds of vuggy dolomite (Maquoketa Group)	Kankakee and Joliet Formations; Maquoketa Group (cross sections only), Pz	**Bedrock**

Base map compiled by Illinois State Geological Survey from digital data provided by the United States Geological Survey. PLSS compiled in 1991. Hypsography compiled 1992. Transportation and hydrography updated from imagery dated 1999.

North American Datum of 1983 (NAD 83)
Projection: Transverse Mercator
10,000-foot ticks: Illinois State Plane Coordinate system, east zone (Transverse Mercator)
1,000-meter grid: Universal Transverse Mercator grid, zone 16

Recommended citation:
Curry, B.B., 2005, Surficial Geology of Crystal Lake Quadrangle, McHenry and Kane Counties, Illinois: Illinois State Geological Survey, Illinois Geologic Quadrangle Map, IGQ Crystal Lake-SG, 1:24,000.

SCALE 1:24 000

1 — 1/2 — 0 — 1 MILE
1000 — 0 — 1000 — 2000 — 3000 — 4000 — 5000 — 6000 — 7000 FEET
1 — .5 — 0 — 1 KILOMETER

BASE MAP CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

Released by the authority of the State of Illinois: 2005

Geology based on field work by B. Curry, 1998–2001.

Digital cartography by M. Barrett and J. Domier, Illinois State Geological Survey.

Data Type

- Field outcrop
- Stratigraphic boring
- Water well
- Engineering boring
- SG Boring with samples (S) or geophysical log (G); dot indicates to bedrock

Contact

A—A′ Line of cross section

Moraine

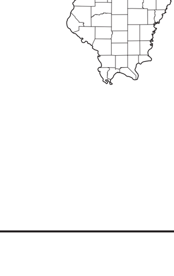
Water

Note: Numeric labels indicate the county number, a portion of the 12-digit API number on file at the ISGS Geological Records Unit. Outcrop labels indicate field number.

ILLINOIS
DEPARTMENT OF NATURAL RESOURCES

1905-2005 ISGS Illinois State Geological Survey

For more information contact:
Illinois State Geological Survey
615 East Peabody Drive
Champaign, Illinois 61820-6964
(217) 244-2414
http://www.isgs.uiuc.edu



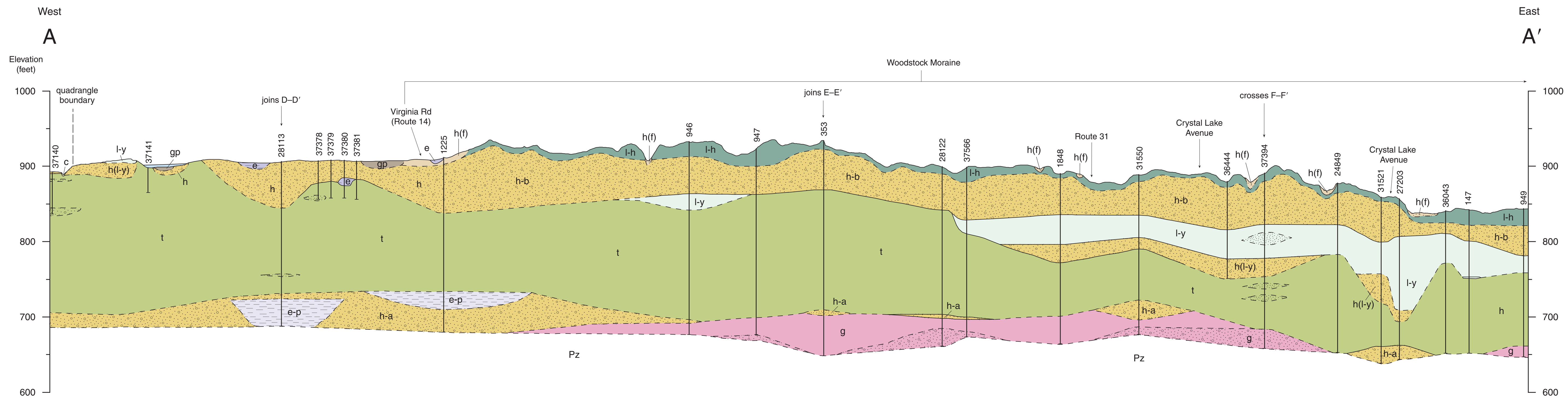
1	2	3
4		5
6	7	8

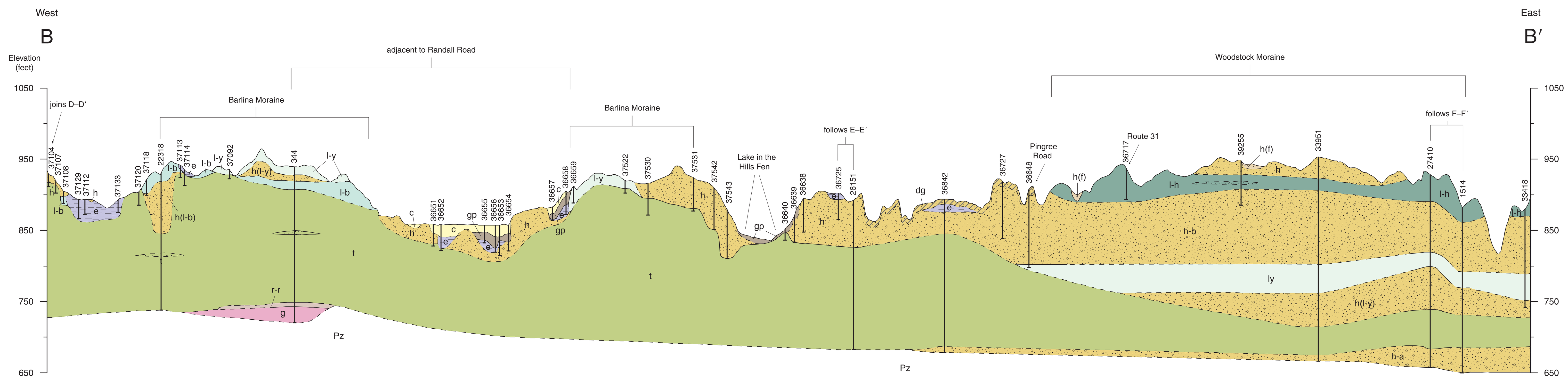
ADJOINING QUADRANGLES
1 Woodstock
2 McHenry
3 Wauconda
4 Huntley
5 Barrington
6 Pingree Grove
7 Elgin
8 Streamwood

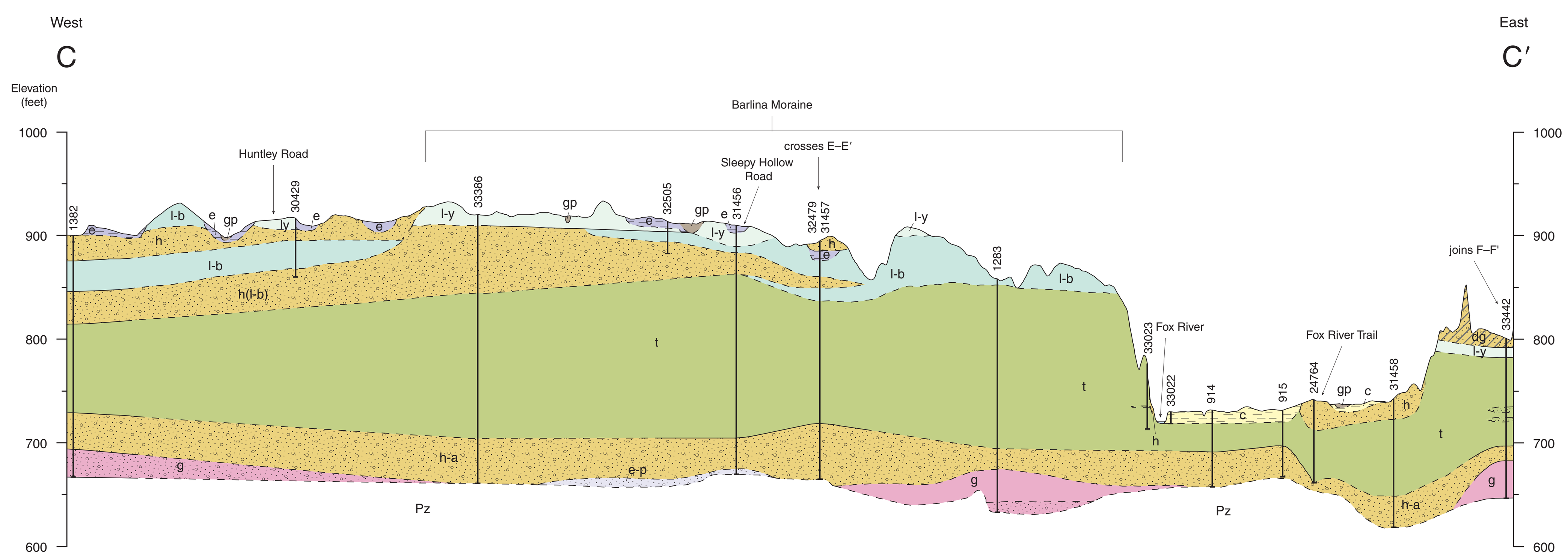
$2\frac{1}{2}°$
TRUE NORTH
MAGNETIC NORTH
APPROXIMATE MEAN DECLINATION, 2005

ROAD CLASSIFICATION

Primary highway, hard surface
Secondary highway, hard surface
Light-duty road, hard or improved surface
Unimproved road
Interstate Route
U.S. Route
State Route



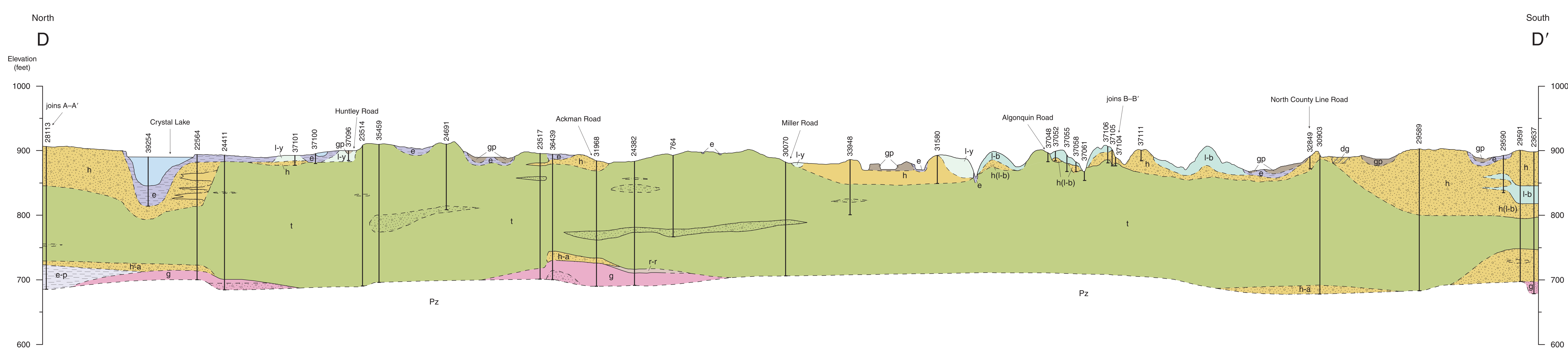


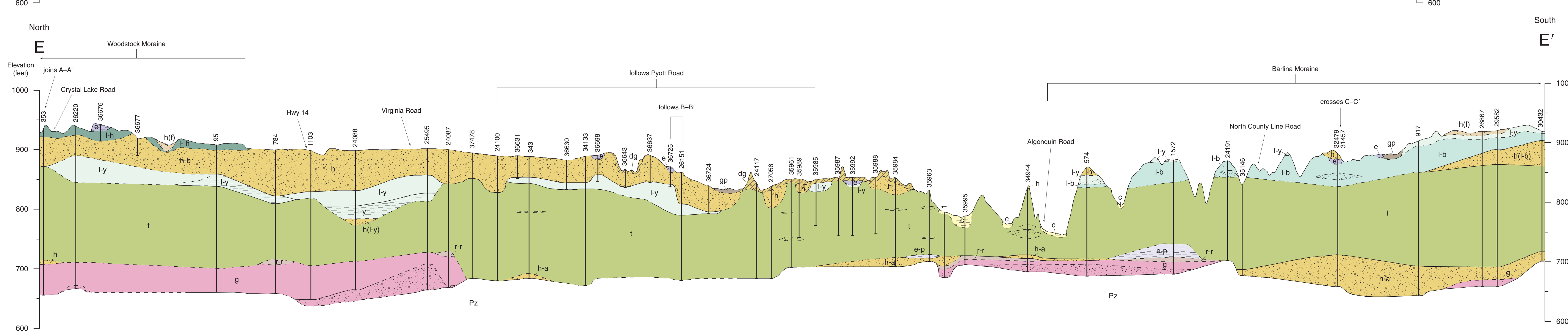


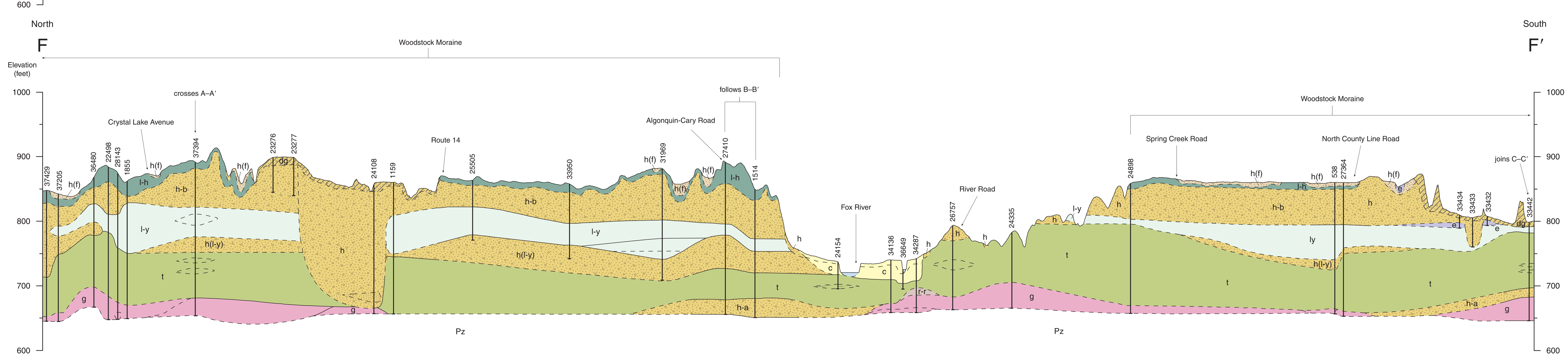
Cross Sections

- Sand and gravel
- Fine and very fine sand
- Silt and clay
- Diamicton
- Contact
- Inferred contact

Horizontal scale: 1 inch = 2000 feet
Vertical scale: 1 inch = 100 feet
Vertical exaggeration: 20×







Purpose

This surficial geology map identifies, describes, and locates near-surface geologic materials relevant to the many environmental and economic issues in this growing metropolitan area. The Crystal Lake Quadrangle is home to approximately 100,000 residents, including the municipalities of Crystal Lake (38,000; Illinois Census 2000), Carpentersville (30,586), Algonquin (23,276), Lake in the Hills (23,152), Cary (15,531), Huntley (5,730), and Lakewood (2,337).

There are several noteworthy geologic and hydrogeologic concerns of the Crystal Lake area, including these:

- Potential reserves of sand and gravel aggregate; the Crystal Lake area has been a center for sand and gravel mining in northeastern Illinois for more than half a century (Masters 1978, Cobb and Fraser 1981).
- The quality and quantity of groundwater used in municipal and private drinking water supplies and location of aquifers in the glacial drift; about three fourths of the quadrangle's groundwater is pumped from layers of sand and gravel in the glacial drift (Curry et al. 1997).
- Polluted groundwater, such as at the Precision Twist site in Sec. 33, T43N, R8E, and the old McHenry County Landfill Superfund Site in Sec. 3, T42N, R8E, in Crystal Lake (Patrick McNulty, McHenry County Department of Health, personal communication; Illinois Environmental Protection Agency, personal communication).
- Eight additional Superfund Sites (Illinois Environmental Protection Agency, personal communication).
- Proposed landfill sites, such as the Pyott Road Landfill of the 1980s (Jennings 1985).
- Local flooding in closed depressions and along streams tributary to the Fox River (Illinois Representative Cal Skinner 2000, personal communication).
- Landslides along U.S. Route 31 at Buffalo Park Forest Preserve in south Algonquin (Illinois Department of Transportation, unpublished report).

The surficial geology map depicts materials encountered below a mantle of weathered, silty soil (loess) within 2 to 4 feet of ground surface. The accompanying cross sections show the vertical dimension of the deposits, including several units that do not appear on the map and are completely buried by younger glacial drift. Other geologic maps that depict features related to the surficial geology map and cross sections include those of the bedrock topography, glacial drift thickness, and thickness of surficial sand and gravel deposits (Curry 2005a, 2005b).

Methods

The sources of data used to prepare the surficial geology map and cross sections are described on the data point locations map (Curry 2005c). These include 8 key stratigraphic borings sampled by Illinois State Geological Survey geologists or by a consulting geologist. Data for these borings in McHenry County are summarized elsewhere (Curry 1995; see also, Lund 1965, Jennings 1985). Other data sources include 11 gamma-ray logs of existing water wells; 184 shallow borings (not to bedrock and, on average, about 50 feet deep) for aggregate exploration, road and other construction, and geological investigation; 104 property evaluation borings (on average, about 15 feet deep); 375 logs from water-well drillers; and 60 outcrops described by the author and other ISGS geologists. Data for many of these borings are available from the ISGS Geological Records Unit.

Different levels of data interpretation were needed to complete the cross sections and map. The highest-quality data (the key stratigraphic borings, borings with gamma-ray logs, and outcrops) were used to prepare preliminary cross sections. Supplemental data were added, where available, along the lines of section; the preliminary cross sections served as guides for interpreting the geometry of sediment layers. After preliminary cross sections were made, surficial geology map unit boundaries were drawn based in part on previous investigations (Curry et al. 1997, Wickham et al. 1988) and interpretations of the Kane County and McHenry County soil survey maps (Goddard 1979, Ray and Wascher 1965, respectively), primarily to delineate areas of peat and alluvium. In some areas, the altitude of unit contacts on the cross sections was adjusted to reflect the mapped distribution of the lithologic units. The smallest map units cover about 1 acre; areas this small generally show small patches of peat or lake sediment in shallow depressions.

Geologic Setting

Glacial deposits mantle most of Illinois. In the Crystal Lake Quadrangle, drift is as much as 290 feet thick (Curry 2005b). In northeastern Illinois, near-surface glacial sediment was deposited during the last glaciation (Wisconsin Episode) from about 24,500 to 15,000 radiocarbon years ago. During this time, the Lake Michigan Lobe, a south-flowing tongue of the Laurentide Ice Sheet, formed numerous subdued ridges with hummocky topography known as moraines. Movement of the Lake Michigan Lobe

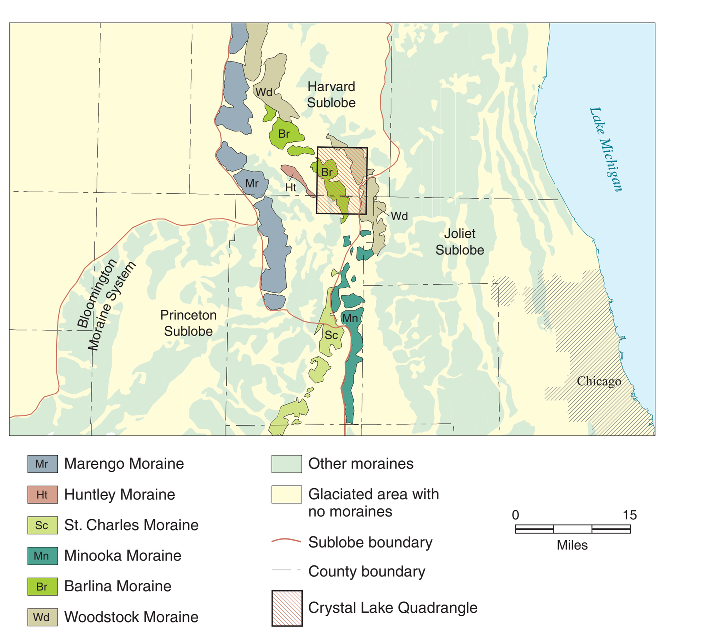


Figure 1 Wisconsin Episode moraines in northeastern Illinois. Moraines were formed near the terminus of glacial ice at various positions of the Lake Michigan Lobe. Glacial ice advanced in a westerly and southwesterly direction into Illinois from the Lake Michigan basin. The older moraines of this figure generally occur to the west and the younger moraines to the east. In the area of the last glaciation, the yellow areas are typically drainageways or plains of outwash, lake sediment, or till. Adapted from Willman and Frye (1970) and Hansel and Johnson (1996).

was complex and, at times, sublobes with unique flow patterns formed distinctive tracts of moraines (fig. 1). The sublobes melted back and readvanced several times during the Wisconsin Episode glaciation; each moraine represents the sediment deposited at the glacial margin during separate readvances. Meltwater carried and deposited sand and gravel atop, below, and through the glacier, as well as along drainageways beyond the moraines (fig. 2). In some low areas, meltwater deposited fine-grained lake sediment.

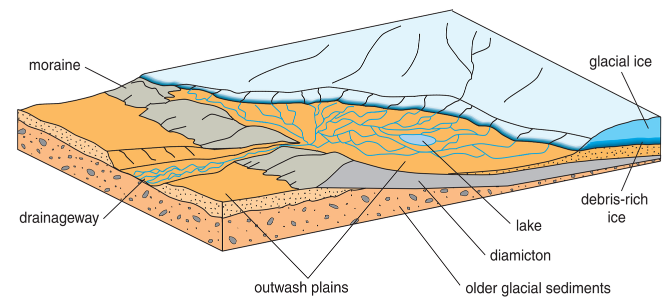


Figure 2 Conceptual model of landform and sediment assemblages associated with the margins of continental glaciers (Curry et al. 1997).

Glacial History

The succession of Quaternary glacial sediments in northeastern Illinois was deposited on an unconformity formed on Paleozoic bedrock. In the northern two thirds of the Crystal Lake Quadrangle, the bedrock underlying the drift is composed of primarily Silurian age dolomite of the Wilhelmi, Elwood, and Kankakee Formations (Graese et al. 1988). As much as about 70 feet thick in the northern part of the quadrangle, Silurian dolomites pinch out to the south. In the southern third of the quadrangle, the bedrock underlying the glacial drift is composed of shaly dolomite of the Ordovician Maquoketa Group (Graese 1991, Graese et al. 1988, Curry 2005a). Prior to and during the Quaternary Period (from about 1.8 million years ago to the present), the bedrock was eroded to form a landscape with river valleys and intervening uplands. Glacial sand and gravel deposits commonly filled in low areas and valleys on the landscape. Significant drift aquifers occupy deep bedrock valleys in the region, but significant buried bedrock valleys do not occur in the Crystal Lake Quadrangle (Curry 2005a).

The oldest glacial sediment present in the area is deeply buried and occurs below 730 feet above mean sea level. This sediment was deposited during the Illinois Episode about 180,000 to 130,000 years ago (Curry and Pavich 1996) and includes less than 50 feet of till, lake sediment, and outwash of the Glasford Formation (unit g on the cross sections). In places, the old drift is overlain by patchy deposits less than 10 feet thick of buried peat known as the Robein Member of the Roxana Silt (unit r-r; Curry 1989, Curry and Pavich 1996).

At the base of Wisconsin Episode sediments are layers of outwash sand and gravel and lake sediment. These materials were deposited in streams and lakes ahead of the advancing glacier (fig. 2). With time, the glacial ice covered these proglacial sediments and buried them with deposits of till and debris flows of the Tiskilwa Formation. Buried outwash is mapped as the Ashmore Tongue of the Henry Formation (unit h-a) and the lake sediment as the Peddicord Tongue of the Equality Formation (unit e-p). Both units are buried deeply and are shown only on the cross sections. Deposits of the Peddicord Tongue are thin and patchy, but the Ashmore Tongue is more than 70 feet thick in places. The Ashmore Tongue is an important aquifer in many areas in the quadrangle, especially to the south (see cross section C–C′).

The Lake Michigan Lobe reached its terminal position about 24,500 radiocarbon years ago when it began to form the Marengo Moraine about 6 miles west of Crystal Lake (fig. 1). The Marengo Moraine is composed of the Tiskilwa Formation, the thickest and most lithologically uniform glacial drift unit in the region (Wickham et al. 1988). The uniform matrix texture, great thickness, paucity of significantly thick and continuous sand and gravel lenses (Wickham et al. 1988, Curry et al. 1997), and sedimentology (Curry et al. 1999) collectively imply that most Tiskilwa diamicton is till that was deposited in a subglacial environment. The unit tends to contain more lenses and layers of sand and gravel in the northern and eastern parts of the quadrangle than to the south and west.

The direction of ice flow was from east to west during the formation of the Marengo Moraine. After the moraine formed, the direction of ice flow changed dramatically as looping moraines of the Bloomington Morainic System were formed (fig. 1). At the Wedgewood Subdivision in western Crystal Lake (Sec. 3, T42N, R8E), a lake deposit above a layer of Tiskilwa Formation diamicton yielded organic matter dated at 23,230 ± 500 yr before present (BP) (ISGS-2345; Curry et al. 1997). This finding indicates that the ice melted back rapidly from the position of the Marengo Moraine and that a proglacial lake formed between the Marengo Moraine and the Lake Michigan Lobe when the Bloomington Morainic System was formed to the south and west (Curry et al. 1997).

After the Princeton Sublobe melted, the Harvard Sublobe of the Lake Michigan Lobe was active from about 19,000 to 15,000 yr BP (Hansel and Johnson, 1992). The Harvard Sublobe waxed and waned three times across parts of the Crystal Lake Quadrangle (fig. 1). The first readvance reached the position of the Huntley Moraine just to the west of the Crystal Lake Quadrangle, and sediment associated with the Batestown Member was deposited. The second readvance reached the position of the Barlina Moraine, and sediment associated with the Yorkville Member was deposited. The third and final ice margin advanced to the position of the Woodstock Moraine and deposited thick proglacial sand and gravel outwash of the Beverly Tongue (Henry Formation) and sandy loam diamicton of the Haeger Member (Lemont Formation).

As the ice melted from the Crystal Lake Quadrangle, numerous kettle depressions formed on the Woodstock and Barlina Moraines. As melting occurred, the sides of the kettles became unstable, and deposits of sand and diamicton were redeposited in the basins. In Sec. 3, T43N, R8E, cores from two kettles in borings 37144 and 22742 (Curry 2005c) reveal a succession of more than 40 feet of such postglacial sediment classified with a fine-grained facies of the Henry Formation. The lower part is composed of about 20 feet of fossiliferous silt, sand and gravel, and thin beds of loam diamicton; the upper part was 20 feet of oxidized, well-sorted, medium- to fine-grained sand. Fossil stems and leaves yielded radiocarbon ages of 14,610 ± 110 yr BP (ISGS-A-0143) and 14,860 ± 110 yr BP (ISGS-A-0165), suggesting that the Harvard Sublobe had retreated from the area by about 15,000 yr BP. Deposits of fine, sorted sediment of the Equality Formation (map unit e) and peat and marl of the Grayslake Peat (map unit gp) also fill many kettle depressions and other low-lying areas. The thickest known deposit of surficial lake silt and clay (33 feet) was cored in boring 39254 under 42 feet of water in Crystal Lake (see cross section D–D′); spruce wood sampled near the bottom of the core yielded a radiocarbon age of 13,560 ± 90 yr BP (ISGS-4367). The thickness of peat deposits has been measured in only a few places in the map area. The maximum thickness of peat measured at the Lake in the Hills fen is only about 7 feet (center of cross section B–B′).

Also during deglaciation, large meltwater floods along the present-day Fox River carved a channel across the Woodstock Moraine. Downstream of the moraine, the floods eroded more than 100 feet of glacial sediment from the Fox River valley, leaving behind large point bars (~1 mi^2) and terraces (fig. 3). The sand and gravel constituting the large point bar on the Crystal Lake Quadrangle was likely deposited contemporaneously with another large point bar deposit in the core of the large, abandoned meander of the Fox River 3 miles south in the Elgin Quadrangle (Curry 1998, Curry et al. 1999; fig. 3). Subtle ridges (scroll bars) on the point bars and scarps on the terraces suggest that flooding was episodic. Postglacial erosion has incised these terraces and, in places, exposed diamicton of the Tiskilwa Formation along several reaches of the Fox River.

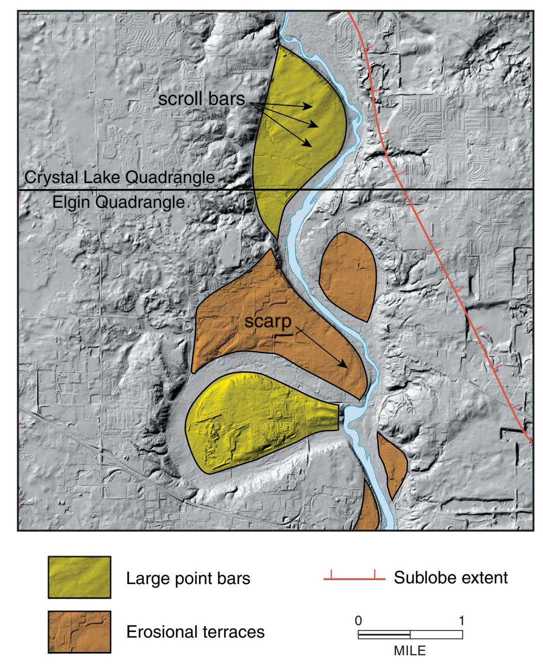


Figure 3 Location of large point bars and erosional terraces along the Fox River in Kane County in the southern part of the Crystal Lake Quadrangle and northern part of the Elgin Quadrangle. The scroll bars evident on the large point bar may be related to the scarps on the erosional terrace immediately to the south. The Fox River has eroded at least 50 feet into the highest parts of these landforms. The maximum extent of the Harvard Sublobe during the Woodstock Phase is shown in brown. Modified from Curry et al. (1999).

The Wedron Group glacial diamicton units, most surficial lake sediment, and coarse outwash are capped by about 3 feet of weathered silty clay and silty clay loam loess known as Peoria Silt (Hansel and Johnson 1996). The loess is generally organic-rich in the upper foot because it contains the modern soil, but, because it is ubiquitous and thin, the Peoria Silt was not mapped.

Most evidence indicates that after the effects of glaciation and its associated flooding abated about 10,000 years ago there has been little modification of the landscape. The most significant change is the infilling of basins such as Crystal Lake, where postglacial lake sediment dating from about 10,000 years old to the present has filled about 30% of the available basin space. Sediment stored as alluvium along the Fox River and its tributaries rarely attains thicknesses of more than 20 feet. These floodplain deposits, classified with the Cahokia Formation, include deposits of gravelly sand, sand, peat, and silty clay.

Landscape-Sediment (Lithofacies) Assemblages

Landscape-sediment assemblages relate the origin and composition of landforms. The glaciated landscape of northeastern Illinois is subdivided into five generalized landscape-sediment assemblages, including (1) lakes and lake plains, (2) outwash plains, (3) drainageways, (4) stream valleys, and (5) moraines. Examples of each are found on the Crystal Lake Quadrangle (fig. 4). Lake plains and lakes are underlain by fine-grained sediment, marl, or peat. Outwash plains are underlain by deposits of sand and gravel deposited in front of glacial margins (fig. 2), such as the one that formed the Woodstock Moraine (fig. 4). Originally eroded by meltwater, drainageways are generally underlain by two kinds of river sediment (alluvium): (1) outwash sand and gravel and (2) finer alluvium of postglacial streams.

The character of the drainageway sediment assemblage changes along the course of the river system depending on variables such as the distance from the meltwater source or the depth to bedrock. The Fox River valley is an outstanding example of a glacial drainageway. Steep slopes often connect the floodplains of glacial drainageways with glaciated uplands (fig. 4). Stream valleys are also floored by alluvium of modern streams, the character of which changes rapidly as the stream approaches its confluence with the master trunk stream. In the Crystal Lake Quadrangle, the master trunk stream is the Fox River. Thick deposits of coarse- to fine-grained alluvium and peat are near the mouths of valleys that are tributary to the Fox River. These deposits are thinner toward the stream's headwaters, where many streams have formed wide floodplains by lateral migration and beveling of the underlying glacial sediment (fig. 4) but with little, if any, alluvium. Moraines formed when glacier margins were relatively

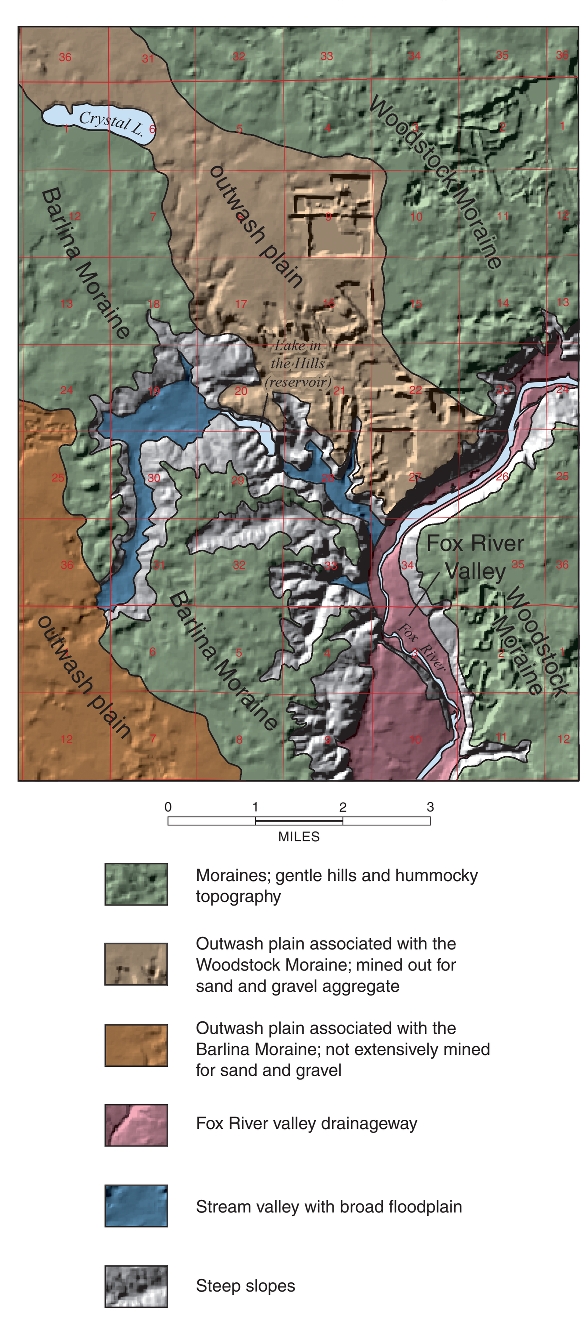


Figure 4 Landform map of the Crystal Lake Quadrangle using the 10-meter USGS digital elevation model of the topographic map. Scale is 1:100,000.

Table 1 Selected physical properties of the most significant stratigraphic units. Mean values are given for most parameters. Hydraulic conductivity values are estimated.

	Stratigraphic Unit							
Material	Tiskilwa diamicton (regional)	Tiskilwa diamicton (local)	Batestown diamicton	Yorkville diamicton	Haeger diamicton	Equality silt and clay	Grayslake peat	Henry sand and gravel
Gravel (%)	7	4	16	10	11	1	2	29
Sand (%)	37	34	43	20	45	8	8	53
Silt (%)	37	33	41	47	37	60	52	32
Clay (%)	26	34	16	33	18	32	40	15
Moisture content (%)	11	12.2	10	14	12	29	112	17
Vertical hydraulic conductivity (cm/sec)	-	10^{-8} to 10^{-9}	10^{-4} to 10^{-5}	10^{-5} to 10^{-6}	10^{-4} to 10^{-5}	10^{-5} to 10^{-6}	-	10^{-2} to 10^{-4}
Liquid limit[1]	-	24	15	25	-	-	-	-
Plastic limit[1]	-	11	12	14	-	-	-	-
Plasticity index[1]	-	13	3	11	-	-	-	-
Reference[2]	1	5	2	2, 4	1	3	3	3
Color (fresh)	red-brown	red-brown	brown	gray	gray	gray	dark brown	brown
Unif. Soil Class.[3]	CL	CL	CL	CL	CL	CL, ML	OH	SC, GW
Samples (no.)	283	25	63	428	25	198	10	113

[1] See Holtz and Kovacs 1981.
[2] Reference: 1 = Curry 1995, 2 = Curry 1991, 3 = Graese et al. 1988, 4 = Kesich 1999, 5 = Jennings 1985.
[3] Unified Soil Classification: CL = lean clay; ML = lean silt; OH = compressible soil; SC = sand, poorly graded; GW = gravel, well graded.

stationary; moraines comprise diamicton and interbedded lenses and sheets of sand and gravel (fig. 2). If moraines formed during a single interval of ice stabilization, such as the Marengo Moraine (fig. 1), the internal sediment architecture may be simple (i.e., composed of one kind of diamicton). Moraines in the Crystal Lake Quadrangle are complex. The Barlina Moraine, for example, was formed when the ice margin readvanced to about the same location at different times. The Barlina Moraine is composed of three lithologically distinctive diamicton units interbedded with sand and gravel.

Materials (Lithostratigraphic Units)

Classification and Terminology

Geologists map geologic materials as lithostratigraphic units, which have unique physical properties (e.g., color and grain-size distribution) and occur in a specific level in the succession of sediment layers (see map and fig. 5). For deposits of the last glaciation, a special distinction is made based on grain size and sorting. Deposits composed of similar-sized grains (i.e., well-sorted sediment or poorly graded sediment) are classified with the Mason Group, whereas deposits composed of a poorly sorted mixture of grain sizes (i.e., diamicton) are classified with the Wedron Group (Hansel and Johnson 1996). Regionally important layers of sand and gravel or fine-grained sediment that occur between named lithostratigraphic units of the Wedron Group are called stratigraphic tongues. Sand and gravel layers that are mappable at a scale of 1:24,000, but do not occur regionally, are unnamed tongues.

"Diamicton" describes a deposit of particles with a wide range of grain sizes, usually from clay to boulders. Most diamicton of glacial origin in Illinois is matrix-supported, meaning that the larger particles (gravel to boulders) are encased in a mixture of finer particles (clay, silt, and sand).

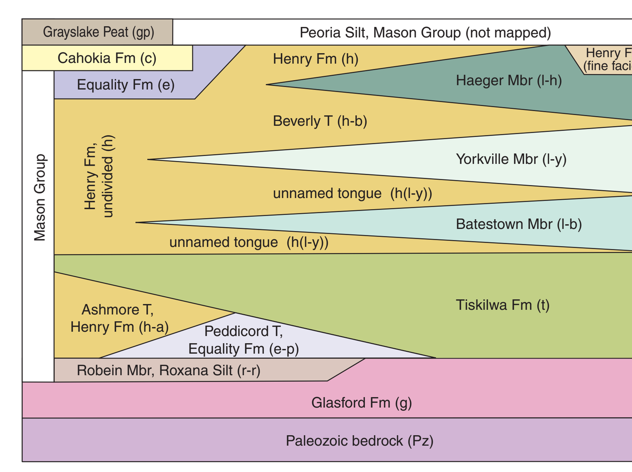


Figure 5 Schematic representation of the spatial relationships among the lithostratigraphic units and associated tongues.

In Illinois, the lithology of a diamicton in a moraine commonly contrasts with that of adjacent moraines. The most commonly used lithological criteria to differentiate among diamicton units include color, particle-size distribution of the <2-mm matrix, and clay mineral composition (Wickham et al. 1988). Quaternary geologists use textural terms such as "loam" and "clay loam" to describe the particle-size distribution of the matrix; the terms are based on the soil texture classification of the U.S. Department of Agriculture (Buol et al. 1980).

Mason Group

Two kinds of materials composed of sorted sediment of the Mason Group are identified in this quadrangle (table 1). One is sand and gravel of the Henry Formation. The other is finer-grained deposits of fine sand, silt, and clay of the Equality Formation. The Henry sand and gravel deposits, especially as they occur at or just below ground surface, can be important sources of aggregate resources or aquifers (Curry and Seaber 1990). Several types of deposits are recognized as part of the Henry Formation. The distinction usually is stratigraphic; that is, the named facies or stratigraphic tongue is dependent on the diamicton unit under which the sand and gravel lies. The fine-grained deposits of the Equality Formation form important local aquitards that impede the movement of groundwater. The Grayslake Peat (peat and marl) and Cahokia Formation (interbeds of sand and gravel, sand, clayey silt, and peat) are special units of the Mason Group. Both units occur in areas prone to flooding. The Grayslake Peat occurs in depressions or at the foot of slopes that receive year-round moisture from groundwater. The Cahokia Formation is the alluvium of postglacial rivers and streams. Due to the very high moisture content and high compressibility, peat, marl, and clayey sediments are not suitable for foundation material, and they often are classified as fat clays or organic soils (Unified Soil Classification System; Holtz and Kovacs 1981). Desiccation of these units caused by drainage may lead to cracking and subsidence.

Wedron Group

Four lithologically distinct diamicton units of the Wedron Group are mapped on the Crystal Lake Quadrangle (table 1). All units classify as lean clays in the Unified Soil Classification System (Holtz and Kovacs 1981). The most diagnostic characteristics of each unit and assessments of the units as aquitards are listed. The stratigraphic nomenclature follows that of Willman and Frye (1970) with modifications to the lithologic units of the last glaciation by Hansel and Johnson (1996).

- Tiskilwa Formation diamicton is reddish-brown, hard, thick, and uniform and has a matrix texture of clay loam to loam. Thick Tiskilwa Formation diamicton is the most significant drift aquitard in the region.

- Batestown Member (Lemont Formation) diamicton is brown, friable when dry (crumbly), thin, sandy, and contains abundant interbeds of sand and gravel.

- Yorkville Member (Lemont Formation) diamicton is gray, very fine-grained, hard, thin, and contains little sand and gravel. In the Crystal Lake Quadrangle, the Yorkville Member contains abundant fractures formed by desiccation and weathering. The Batestown and Yorkville units are leaky aquitards because they are thin, weathered, and contain many interbeds of sand and gravel.

- Haeger Member (Lemont Formation) diamicton is very sandy, very friable, and associated with thick deposits of sand and gravel. The Haeger Member is a very leaky aquitard and is almost everywhere oxidized and weathered.

Acknowledgments

The author thanks the companies and corporations, private land owners, and municipalities who provided access to their properties or water wells for geophysical (gamma-ray) logging. Special thanks goes to the Crystal Lake and Algonquin Park Districts, Meyer Materials Company, Vulcan Materials Company, Layne-Western (Aurora, Illinois) of Layne Christensen Co., Patrick Technologies, Inc., and Testing Service Corporation. The text was improved through suggestions by Timothy Kemmis and Ardith Hansel.

References

Buol, S.W., F.D. Hole, and R.J. McCracken, 1980, Soil genesis and classfication, 2nd ed.: Ames, The Iowa State University Press, 404 p.

Cobb, J.C., and G.S. Fraser, 1981, Application of sedimentology to development of sand and gravel resources in McHenry and Kane Counties, northeastern Illinois: Illinois State Geological Survey, Illinois Mineral Notes 82, 17 p.

Curry, B.B., 1989, Absence of Altonian glaciation in Illinois: Quaternary Research, v. 31, p. 1–13.

Curry, B.B., 1991, Statistical evaluation of common geotechnical parameters of glacial drift units at Fermi National Accelerator Laboratory, Batavia, Illinois: Association of Engineering Geologists, 34th Annual Meeting Proceedings, Greensburg, PA, p. 258.

Curry, B.B., 1995, Groundwater protection mapping for McHenry County, Illinois: Drilling Report: Illinois State Geological Survey, Open File Report 1995-1, 123 p.

Curry, B.B., 1998, Quaternary geology map, Elgin Quadrangle: Illinois State Geological Survey (U.S. Geological Survey STATEMAP program), 1:24,000.

Curry, B.B., 2005a, Bedrock topography of Crystal Lake Quadrangle, McHenry and Kane Counties, Illinois: Illinois State Geological Survey, Illinois Geological Quadrangle Map, IGQ Crystal Lake-BT, 1:24,000.

Curry, B.B., 2005b, Drift thickness of Crystal Lake Quadrangle, McHenry and Kane Counties, Illinois: Illinois State Geological Survey, Illinois Geological Quadrangle Map, IGQ Crystal Lake-DT, 1:24,000.

Curry, B.B., 2005c, Data point locations of Crystal Lake Quadrangle, McHenry and Kane County, Illinois: Illinois State Geological Survey, Illinois Geological Quadrangle Map, IGQ Crystal Lake-DP, 1:24,000.

Curry, B.B., R.C. Berg, and R.C. Vaiden, 1997, Geologic mapping for environmental planning, McHenry County, Illinois: Illinois State Geological Survey, Circular 559, 79 p.

Curry, B.B., D.A. Grimley, and J.A. Stravers, 1999, Quaternary geology, geomorphology, and climatic history of Kane County, Illinois: Illinois State Geological Survey, Guidebook 28, 40 p.

Curry, B.B., and M.J. Pavich, 1996, Absence of glaciation in Illinois during marine isotope stages 3 through 5: Quaternary Research, v. 31, p. 19–26.

Curry, B.B., and P.R. Seaber, 1990, Hydrogeology of the shallow groundwater resources, Kane County, Illinois: Illinois State Geological Survey, Contract/Grant Report 1989-3, 34 p.

Goddard, T.M., 1979, Soil survey of Kane County, Illinois: Urbana-Champaign, Illinois: Illinois Agricultural Experimental Station, Soil Report No. 109, 179 p.

Graese, A.M., 1991, Facies analysis of the Ordovician Maquoketa Group and adjacent strata in Kane County, northeastern Illinois: Illinois State Geological Survey, Circular 547, 36 p.

Graese, A.M., R.A. Bauer, B.B. Curry, R.C. Vaiden, W.G. Dixon Jr., and J.P. Kempton, 1988, Geological/geotechnical studies for siting the Supercollider Superconducter in Illinois—Regional summary: Illinois State Geological Survey, Environmental Geology Notes 123, 100 p.

Hansel, A.K., and W.H. Johnson, 1992, Fluctuations of the Lake Michigan Lobe during the late Wisconsin subepisode. Sveriges Geologiska Undersökning, Series Ca 81, p. 122–144.

Hansel, A.K., and W.H. Johnson, 1996, Wedron and Mason Groups: Lithostratigraphic reclassification of deposits of the Wisconsin Episode, Lake Michigan Lobe area: Illinois State Geological Survey, Bulletin 104, 116 p.

Holtz, R.D., and W.D. Kovacs, 1981, An introduction to geotechnical engineering: Englewood Cliffs, New Jersey, Prentice-Hall, 733 p.

Illinois Census 2000, http://illinoisgis.ito.state.il.us/census2000.

Jennings, R.L., 1985, Report of hydrogeological investigations, proposed Pyott Road sanitary landfill, submitted to Laidlaw Waste Systems, Inc., Hinsdale, Illinois, 107 p.

Kesich, P.M., 1999, Groundwater flow in a succession of fine-grained glacial deposits, *in* T. Kemmis and D. Kelleher, eds., Advances in characterizing ground water movement through glacial sequences: Naperville, Ilinois, Midwest GeoSciences Group.

Lund, C.R., 1965, Data from controlled drilling program in McHenry County, Illinois: Illinois State Geological Survey, Environmental Geology Notes 7, 64 p.

Masters, J.M., 1978, Sand and gravel and peat resources in northeastern Illinois: Illinois State Geological Survey, Circular 503, 11 p.

Ray, B.W., and H.L. Wascher, 1965, McHenry County soils: Urbana-Champaign, University of Illinois, Agricultural Experiment Station, Soil Report 81, 132 p.

Wickham, S.S., W.H. Johnson, and H.D. Glass, 1988, Regional geology of the Tiskilwa Till Member, Wedron Formation, northeastern Illinois: Illinois State Geological Survey, Circular 543, 35 p.

Willman, H.B., and J.C. Frye, 1970, Pleistocene stratigraphy of Illinois: Illinois State Geological Survey, Bulletin 94, 204 p.