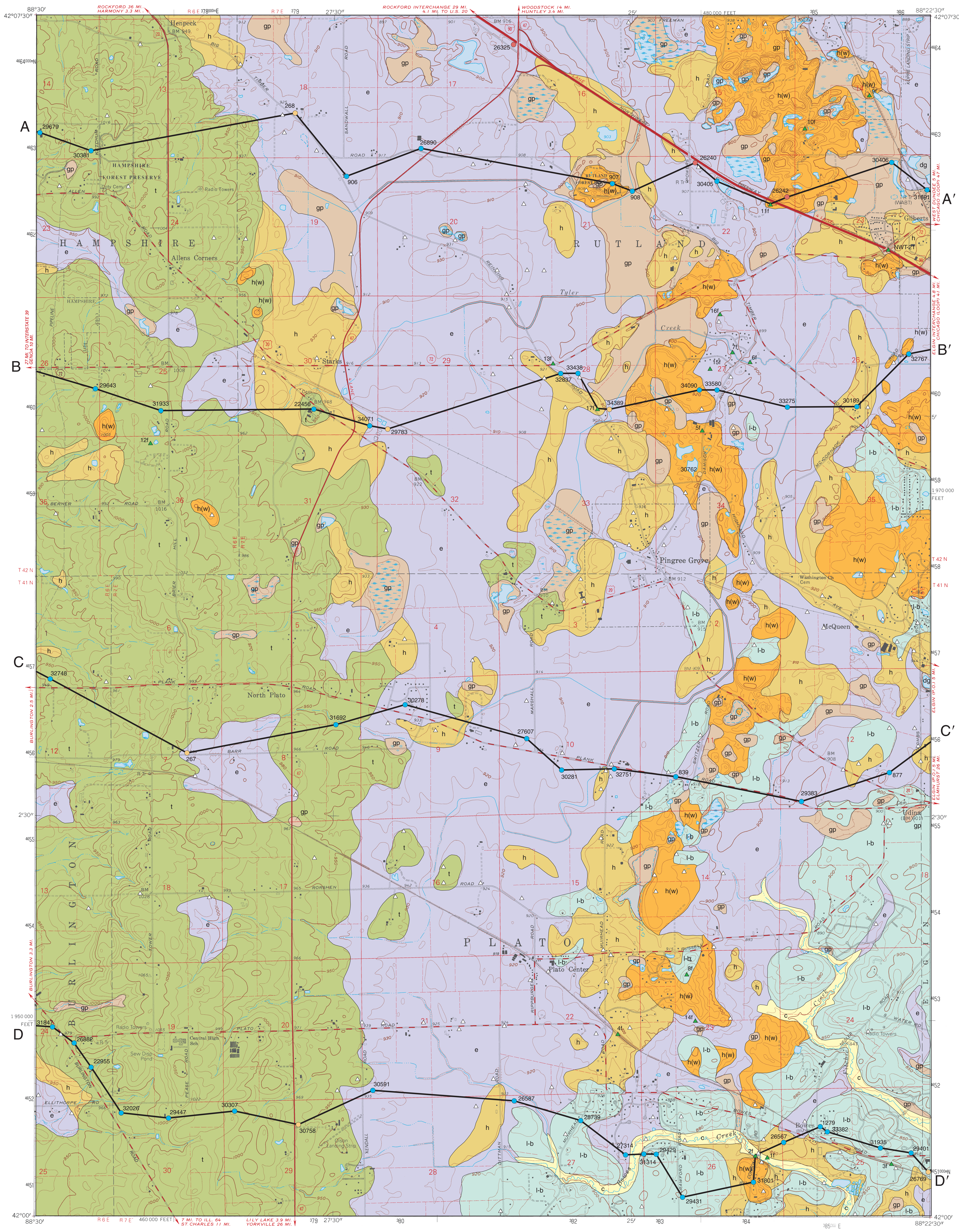
Illinois Department of Natural Resources
ILLINOIS STATE GEOLOGICAL SURVEY
William W. Shilts, Chief

SURFICIAL GEOLOGY OF PINGREE GROVE QUADRANGLE

KANE COUNTY, ILLINOIS

Illinois Geologic Quadrangle Map
IGQ Pingree Grove-SG

David A. Grimley
2005



QUATERNARY DEPOSITS

Description	Unit	Interpretation
HUDSON EPISODE (~12,000 years before present (B.P.) to today)		
Areas of **fill or removed earth materials**	Disturbed ground (dg)	**Disturbed land;** includes former gravel pits and major areas of construction
Fibrous peat, muck, organic silt and clay; interbedded with sand, silt, and clay in some places; up to 20 feet thick	Grayslake Peat (gp)	**Organic debris deposited in depressions and lake basins;** intertongues with the Equality and Cahokia Formations
Sand, silt, and clay, stratified, locally containing beds of sandy gravel; generally less than 10 feet thick	Cahokia Formation (c)	**Alluvium** in floodplains and channels of modern rivers and streams
WISCONSIN EPISODE (~41,000–12,000 years B.P.)		
Clay and silt, containing some fine to medium sand beds; laminated to massive; up to 25 feet thick in glacial Lake Pingree	Equality Formation (e)	**Lake sediment;** intertongues with other units in Mason and Wedron Groups; occurs in proglacial, supraglacial, slack-water, and some modern lake basins
Sand and gravel containing beds of silt, clay, and diamicton; stratified to massive; generally well sorted; cross-bedded to plane-bedded; typically less than 35 feet thick	Henry Formation (except Wasco facies) (h)	**Outwash;** intertongues with Equality Formation, Wasco facies, and Wedron Group units; present in many places below Batestown Member; deposited in glacial meltwater channels, outwash plains, deltas, and bars
Sand, gravel, sandy silt, silt, and sandy loam to loam diamicton; irregularly bedded and moderately well sorted, 5 to 70 feet thick	Henry Formation, Wasco facies (h(w))	**Ice contact deposits;** interstratified and associated with Batestown Member and undivided Henry Formation; includes a covering of 2 to 10 feet of loose, loamy ablation till in many places; occurs in kames and kamic moraines
Diamicton, pebbly silt loam to loam with common sand and gravel lenses; gray to gray-brown, oxidizing to yellow-brown, orange-brown, or pale pinkish brown; generally massive but may be stratified and interbedded with silt and sand; up to 30 feet thick	Batestown Member, Lemont Formation (l-b)	**Till and ice-marginal sediment;** lower portion is typically more uniform subglacial till; sand and gravel lenses were deposited by meltwaters flowing within or proximal to melting glacial ice
Diamicton, pebbly loam to clay loam; gray to reddish brown; locally contains thick beds of sand and gravel; in some places stratified in upper portions; up to 275 feet thick in the Marengo Moraine	Tiskilwa Formation (t)	**Till and ice-marginal sediment;** largely subglacial till; stratified sand and gravel lenses were deposited by meltwaters flowing within or proximal to the melting ice
Silt, clay, organic silt, and peat; brown, black, gray, and blue-gray; stratified, leached; generally less than 10 feet thick	Robein Member, Roxana Silt (cross sections only) (r-r)	**Organic-rich sediment** deposited and preserved in low-lying areas or depressions, overlain by Henry Formation or Wedron Group units
ILLINOIS EPISODE (~200,000–130,000 years B.P.)		
Silt, silty clay, and fine sand; upper weathered surface is commonly described as "green clay" by drillers	Berry Clay Member, Glasford Formation (cross sections only) (g-bc)	**Depressional sediments and lake sediment;** commonly contains a zone of weathering (Sangamon Geosol–last interglacial soil); may include some Teneriffe Silt (late glacial lake sediment)
Diamicton, pebbly loam to clay loam, pinkish-brown to brown; contains some beds of sorted sediment, especially at the base of the unit	Glasford Formation (cross sections only) (g)	**Till and ice-marginal sediment and channel deposits**

Data Type

- Outcrop or hand auger (author's field note)
- Outcrop or hand auger (ISGS archived field note)
- Stratigraphic boring (ISGS)
- Water well
- Engineering boring
- Contact
- A—A′ Line of cross section
- Water

Note: Data symbol 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.

Base map compiled by Illinois State Geological Survey from digital data provided by the United States Geological Survey. Topography by photogrammetric methods from aerial photographs taken 1958. Field checked 1962. Revised from aerial photographs taken 1988. Field checked 1991. Base map edited 1992.

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 ticks: Universal Transverse Mercator grid system, zone 16

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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
SUPPLEMENTARY CONTOUR INTERVAL 5 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

Released by the authority of the State of Illinois: 2005

Geology based on field work by D. Grimley, 1997–1998.

Digital cartography by M. Barrett and A.Tovey, Illinois State Geological Survey.

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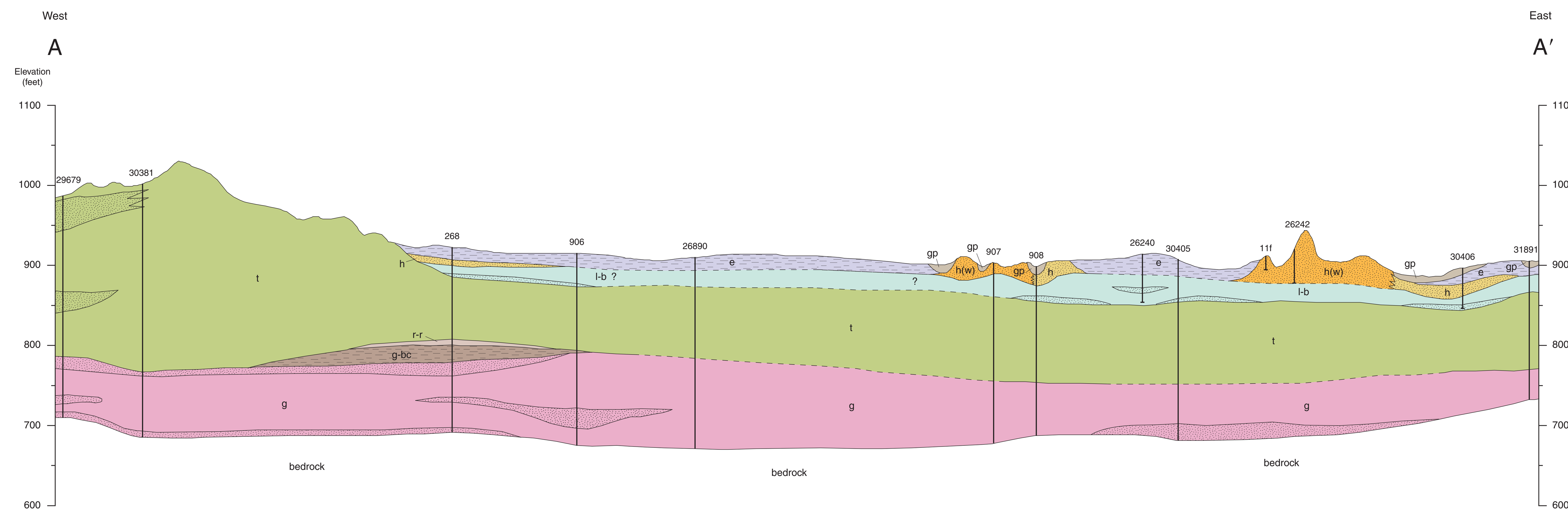
4		5
6	7	8

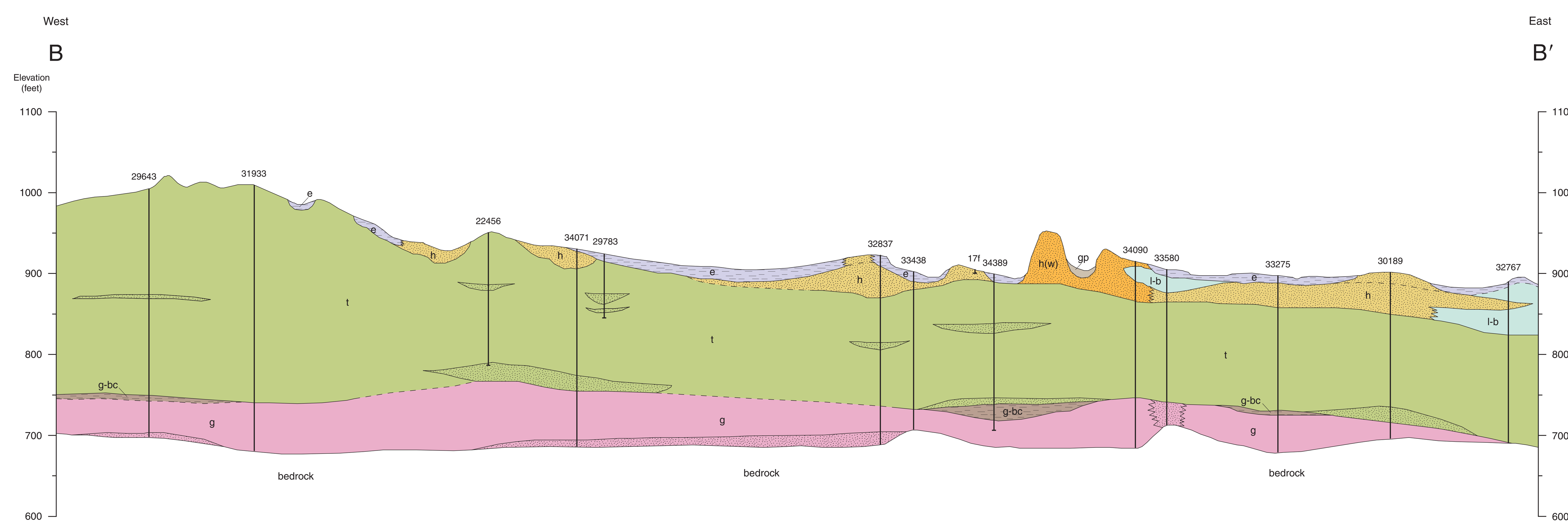
ADJOINING QUADRANGLES
1 Marengo South
2 Huntley
3 Crystal Lake
4 Hampshire
5 Elgin
6 Maple Park
7 Elburn
8 Geneva

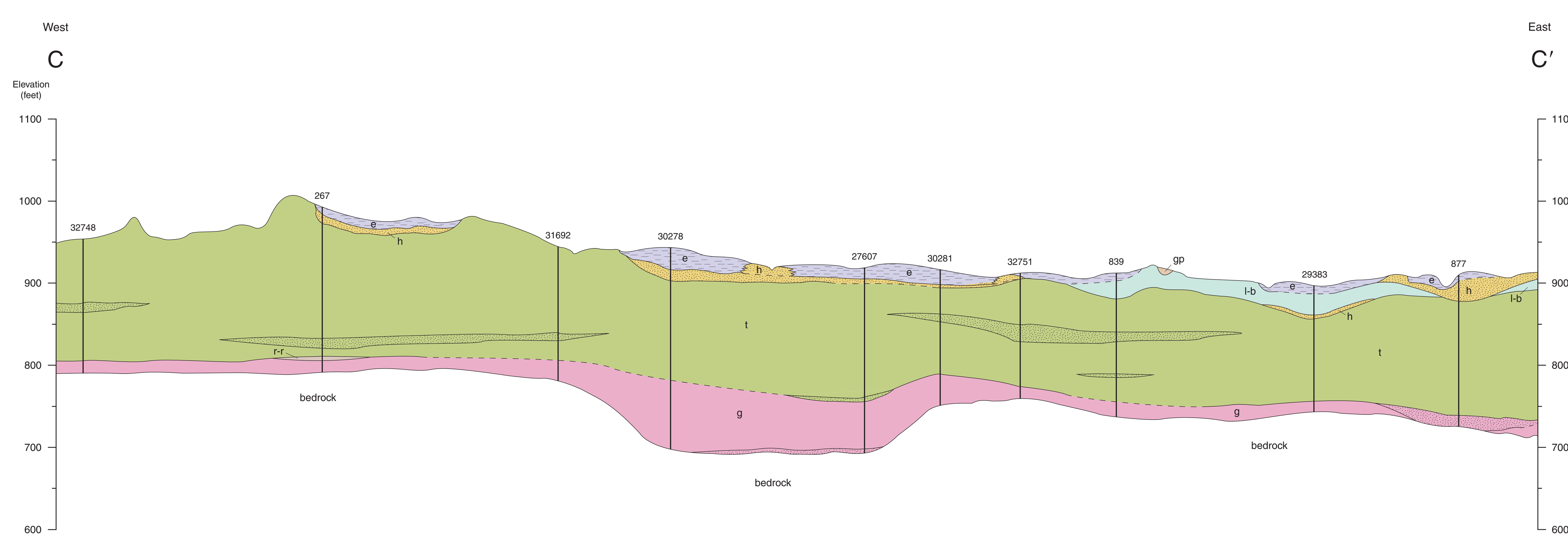
APPROXIMATE MEAN DECLINATION, 2005

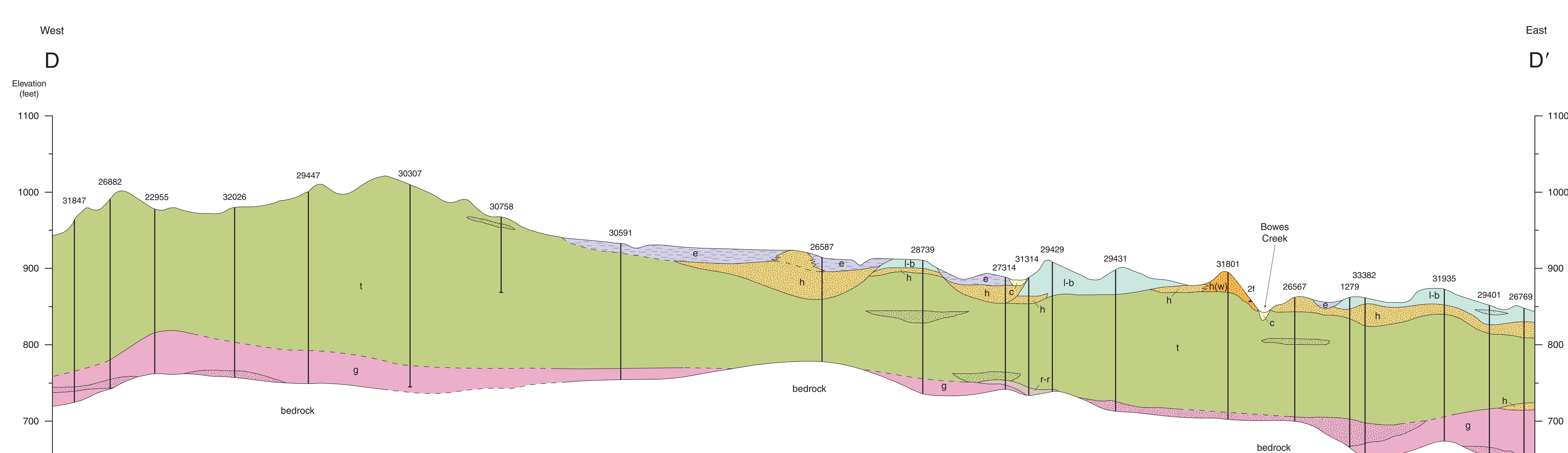
ROAD CLASSIFICATION

- 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; may contain some silt or diamicton
- Laminated silt and clay
- Diamicton, massive silt, or other fine-grained sediment
- Contact
- Inferred contact

Horizontal scale: 1 inch = 2,000 feet
Vertical scale: 1 inch = 100 feet
Vertical exaggeration: 20×

Introduction

This map of the Quaternary (glacial and postglacial) surficial geology of the Pingree Grove 7.5-minute Quadrangle, located in north-central Kane County (fig. 1), provides an important framework for land and groundwater use, engineering assessment, and economic development in a rapidly growing area. This study is part of a broader geologic mapping effort by the ISGS in recent years in the county (Curry et al. 1999, Grimley and Curry 2001, Curry et al. 2002).

Regional Setting

The map area can be subdivided into three geomorphic regions (fig. 2): the Marengo Moraine in the western third, glacial Lake Pingree (Willman and Frye 1970) in the middle, and the Elburn Complex, a kamic stagnation moraine that includes a complex assortment of surficial deposits, in the eastern third. The thickest Quaternary deposits occur in the Marengo Moraine, where the drift is up to 340 feet thick (B–B′ cross section).

Unconsolidated deposits above bedrock consist of a variety of glacial sediments (150 to 340 feet thick) deposited during the Wisconsin and Illinois Episodes of continental glaciation. The major thickness of glacial drift consists of an unsorted mixture of clay, silt, sand, and gravel (diamicton); however, water-laid sand and gravel from glacial meltwater streams and silty lake deposits are also common. Thin wind-blown silt (loess) and patchy organic deposits also are present.

Between about 25,000 and 16,000 radiocarbon years ago, during the Wisconsin Episode, glacial ice of the Lake Michigan Lobe advanced and deposited many different till units and associated sorted sediments in Kane County (Hansel and Johnson 1996, Curry et al. 1999). The temporary stabilization of glacial ice was marked by deposition of end moraines representing the former position of the ice front. The Pingree Grove Quadrangle was traversed by both the Harvard and Princeton Sublobes, which at times probably coalesced (fig. 1).

Methods

Surficial Map

Map unit contacts are based in part on soil series parent materials data compiled from the *Soil Survey of Kane County* (Goddard 1979). Soil parent material boundaries were adjusted in accordance with new field observations and surface topography. Early unpublished data, field notes, and regional 1:62,500-scale geologic maps (Leighton et al. 1928–1930) were also used to further delineate and modify surficial unit contacts. The locations of most important data sources used are shown on the map and described in detail in an ISGS manuscript (Grimley 2002). Original water-well and engineering boring descriptions are available at the ISGS Geologic Records Unit. (The numbers on the map are the county numbers used for archiving data.) The stratigraphic nomenclature is from Hansel and Johnson (1996).

Cross Sections

The four cross sections show vertical slices through unconsolidated sediments that are present between the ground surface and bedrock. The cross sections are based on data and concepts originating from new drill cores (obtained as part of this project), water-well log descriptions, Illinois Department of Transportation records, consultant engineering boring data, a doctoral dissertation (Gross 1969), ISGS-supervised geotechnical exploration borings (Kempton et al. 1987, Graese et al. 1988), and unpublished notes of other ISGS geologists. Sand and gravel lenses (stippled areas on the cross sections) within the Glasford, Tiskilwa, and Batestown units are shown where water wells, test holes, or outcrops indicate their presence. Additional sand and gravel bodies are undoubtedly distributed within these units, but their occurrence is unpredictable. A 2- to 4-foot-thick surficial cover of loess at the ground surface is not shown, nor are most other geologic units less than 5 feet in maximum thickness. Many water wells penetrate deeply into bedrock, and their full extent is not shown. Dashed lines in the cross sections indicate areas where boring descriptions are insufficiently detailed.

Surficial Deposits

Postglacial Sediments

Postglacial organic-rich sediments (Grayslake Peat), up to 20 feet thick (but typically much thinner), are common in depressions and low-lying areas within and adjacent to lake plains on this relatively young landscape. Peat and organic silts were deposited in current and former poorly drained depressions, where organic materials are preserved because of anoxic conditions due to high water tables.

Modern stream sediment (Cahokia Formation), primarily sand and silt deposits, is inset into outwash, lake deposits, or till deposits along the floodplains of Bowes and Fitchie Creeks. This quadrangle has not experienced significant dissection by stream erosion because it is located in an area of low relief, is far from the base level influence of major rivers, and has had less than 17,000 years for landscape development (Curry et al. 1999). Thus, constructional landforms (moraines, kames, lake plains, and kettle holes) dominate the landscape.

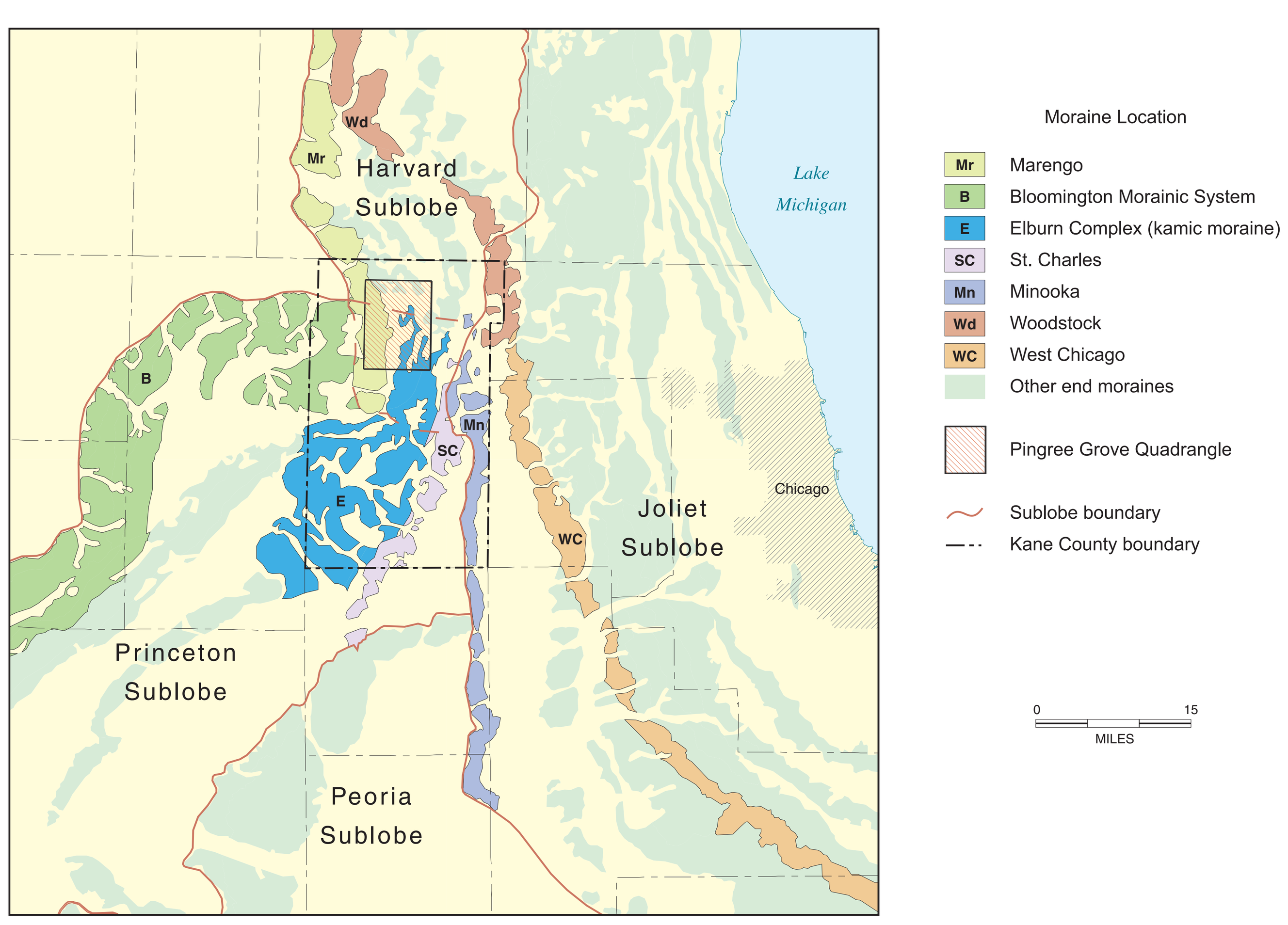


Figure 1 Wisconsin Episode moraines in northeastern Illinois, modified from Willman and Frye (1970). Moraines were formed near the terminus of glacial ice during various positions of the Lake Michigan Lobe. Ice of the Lake Michigan Lobe advanced in westerly and southwesterly directions into Illinois from the Lake Michigan basin. Thus, the older moraines on this figure occur generally to the west, and the younger moraines occur generally to the east bordering Lake Michigan.

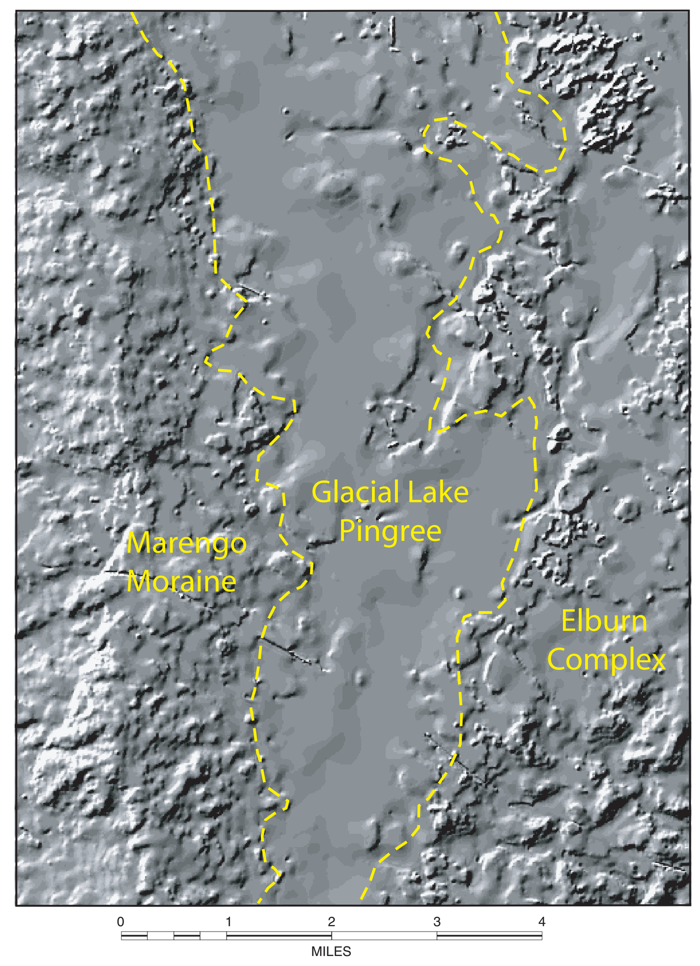


Figure 2 Geomorphic divisions within the Pingree Grove 7.5-minute Quadrangle. This shaded relief map displays three generalized areas of contrasting topography. The Elburn Complex contains irregular, hummocky topography; Glacial Lake Pingree is a relatively flat, former lake plain; and the Marengo Moraine is a north-south–trending ridge. Gray shading is based on a computer-simulated light source from the northwest directed on the surface landscape.

Wisconsin Episode Deposits

The western third of the Pingree Grove Quadrangle is dominated by the Marengo Moraine. This terminal moraine is the earliest moraine of the Wisconsin Episode preserved in Illinois (Hansel and Johnson 1996). The moraine forms a north-south ridge, underlain by a distinctive pink loam to clay loam diamicton and contains some sand and gravel bodies. This unit, the Tiskilwa Formation, constitutes the majority of the Quaternary deposits in the subsurface (see cross sections) and is underlain by either the Robein Member of the Roxana Silt or the Glasford Formation. In addition to its distinctive reddish-brown color and stratigraphic position, samples of Tiskilwa till have the following diagnostic physical properties in Kane County; on average 35 ± 7% sand (0.063–2.0 mm), 40 ± 5% silt (0.004–0.063 mm), 25 ± 6% clay (<0.004 mm), and 65 ± 3% illite in the clay mineral fraction, based on hundreds of samples (Wickham et al. 1988). Although composed predominantly of dense, uniform subglacial till, coarse-textured sand and gravel bodies are also common within and below the Tiskilwa Formation diamicton.

The Tiskilwa Formation is rarely less than 80 feet thick in the quadrangle, and its maximum thickness is about 275 feet at the crest of the Marengo Moraine (see cross sections). The general lack of continuous sand and gravel bodies within this thick till unit suggests that glacial ice stabilized at this moraine for a long time. One scenario is that glacial ice remained at the position of the Marengo Moraine from about 25,000 to 19,000 radiocarbon years before present, during both the Marengo and Shelby Phases (Hansel and Johnson 1996), and reorganization of glacial ice from the Harvard to Princeton Sublobe occurred as the ice front pivoted about this portion of the moraine, without a major retreat.

The middle third of the Pingree Grove Quadrangle is covered by sediments deposited in glacial Lake Pingree (fig. 2), which formed when meltwaters ponded between westward-advancing Batestown ice and the Marengo Moraine. Stratified fine sand, silt, and clay (Equality Formation) occur as a veneer (up to 25 feet thick) in north-central portions of this proglacial lake (A–A′ cross section). Many coarse-grained deposits that formed sand bars, beach deposits, deltas, and outwash complexes around glacial Lake Pingree are mapped as the Henry Formation. Near-surface sandy deposits in former lake shore beaches, bars, and spits of glacial Lake Pingree would have been deposited concurrently with fine-grained lake deposits (shown intertongued in cross sections B–B′, C–C′, and D–D′). However, deeper and coarser sand and gravel deposits of the Henry Formation may have been deposited during earlier events associated with glacial meltwaters of the Batestown ice. The estimated contact between older and younger strata of the Henry Formation is indicated by a dashed line in cross sections, but the contact is speculative.

In the eastern third of the quadrangle, a stagnation (kamic) morainic area (Elburn Complex) is composed of silt loam to loam diamicton (Batestown Member, Lemont Formation), sand and gravel (Henry Formation), stratified fine-grained sediment (Equality Formation), and peat (Grayslake Peat). Together these deposits are up to 70 feet thick and overlie the Tiskilwa Formation. Although Batestown Member diamicton in Kane County contains less clay and tends to have more erratic pebbles than it does in its type area of central Illinois (Hansel and Johnson 1996), the till occupies the same stratigraphic position above the Tiskilwa Formation (Curry et al. 1999) and is likely the same age. Batestown diamicton in Kane County was formerly classified as the Malden Till Member (Willman and Frye 1970). Sand and gravel found is some places between Batestown Member and Tiskilwa Formation diamictons (cross sections A–A′, and D–D′) could represent a retreat of ice between deposition of these units.

In kames and other hills and ridges (fig. 3) in the Elburn Complex (cross sections A–A′ and B–B′), sand, gravel, and sandy silt intermixed with loamy diamicton (Wasco facies, Henry Formation) are up to 60 feet thick. The Wasco facies laterally intertongues with the undivided Henry Formation, but it is more poorly sorted and irregularly bedded, contains more lenses of diamicton, and occurs mainly in higher, hummocky landscapes than the undivided Henry Formation.

Figure 3 Kame and kettle topography in NW, Sec. 34, T42N, R7E. The hills are mapped as Wasco facies of the Henry Formation and are composed of poorly to moderately sorted silt, sand, and gravel, with some diamicton beds.

In areas immediately south of the Pingree Grove Quadrangle, the Wasco facies and Batestown Members commonly intertongue and were essentially deposited synchronously (Grimley and Curry 2001). In the northern part of Pingree Grove Quadrangle, however, the Wasco facies typically overlies the Batestown Member (cross section A–A′) and therefore likely was deposited as the last of the Batestown ice melted. In much of the Elburn Complex, fine-grained lake deposits (Equality Formation) are found at the surface (fig. 4). Some lakes were formed on top of glacial ice or in backwater lake environments, whereas other lakes were interconnected with glacial Lake Pingree (fig. 2). Based on water-well records, outwash sand and gravel is up to 40 feet thick underneath some lake deposits within the Elburn Complex.

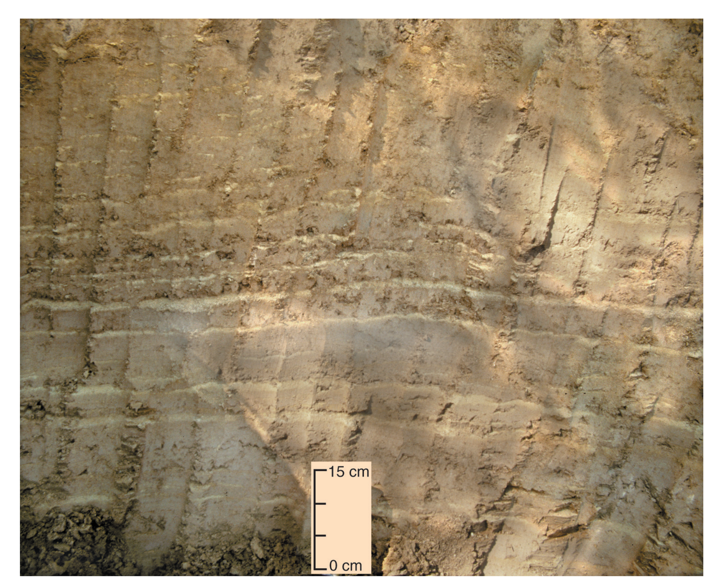


Figure 4 A closeup of laminated lake sediment (Equality Formation) at exposure site 16f (SE, NE, NW, Sec. 27, T42N, R7E). The sediment consists of silt loam (thicker beds) interlaminated with very fine sand. Laminations occur rhythmically every inch or two and probably represent seasonal or diurnal variations in glacial discharge energy.

Illinois Episode Deposits

The oldest glacial deposits, from the Illinois Episode, are diamicton, silty clay, and gravelly sand (Glasford Formation) and are preserved beneath Wisconsin Episode deposits, primarily in bedrock lowlands or buried valleys at elevations generally below 800 feet (see cross sections). No exposures of Illinois Episode deposits are known in this quadrangle; however, these deposits were encountered in many stratigraphic test borings and water wells. In the highest-quality deep stratigraphic test borings (e.g., 26769, 268, 267), Glasford Formation deposits consist of loam to sandy loam diamicton but also include many sand and gravel lenses and scattered beds of sand, silt, and clay (Kempton et al. 1987, Graese et al. 1988). The upper 5 to 10 feet of Glasford deposits was intensely weathered during the Sangamon interglacial episode (about 130,000 to 55,000 years before present). This physically and chemically weathered zone, known as the Sangamon Geosol, is commonly described as “green clay” in water-well drillers’ logs. Where redeposited in low areas and lacking significant pebbles, such weathered clay and silt are mapped as the Berry Clay Member of the Glasford Formation. In a few low-lying areas, late glacial lake deposits (Teneriffe Silt) may have been deposited during the late Illinois Episode prior to Sangamon weathering, but these fine-grained sediments are difficult to distinguish from the Berry Clay Member from water-well records.

In some former depressions, the Sangamon Geosol, Teneriffe Silt and/or Glasford Formation are overlain by as much as 10 feet of peat and/or organic silts (Robein Member of Roxana Silt) that yield radiocarbon ages of 41,000 to 25,000 years B.P. in northeastern Illinois (Curry 1989). The Robein Silt in boring number 268 was radiocarbon dated at 27,000 ± 1,500 years B.P. (Wickham et al. 1988). When present, these organic or peat deposits are an excellent marker bed for distinguishing Wisconsin Episode glacial deposits from Illinois Episode glacial deposits.

Bedrock

Bedrock is not exposed at land surface anywhere in the quadrangle and is deeply buried by glacial deposits (see cross sections). Bedrock units below the Quaternary deposits consist of Silurian carbonate and Maquoketa Group shale and carbonate (Ordovician). These bedrock units are nearly flat-lying but regionally dip gently to the east. Maquoketa Group rocks are commonly encountered in bedrock lows and valleys where the Silurian units have been eroded.

Economic Resources

Sand and Gravel

Sources of economically minable sand and gravel in the Pingree Grove Quadrangle are limited to the Henry Formation (including the Wasco facies) because sand and gravel bodies within till units are limited in thickness and are not predictable in their dimensions. Sand and gravel deposits in central Kane County were excavated for construction material for many years (Leighton et al. 1928–1930, Block 1960). Many small pits once operated in kamic hills (Wasco facies, Henry Formation) and in glaciofluvial deposits on terraces and deltas (undifferentiated Henry Formation). As of 1998, few active pits remain in the Pingree Grove Quadrangle because of the rapid suburban growth in the eastern and southeastern quarter of this quadrangle. Wasco facies sand and gravel is used by some local farms for their own needs, but no active sand or gravel pits are known to exist at present. Commercial operators are mainly focusing on fewer but larger sand and gravel operations in other areas of the county (Curry et al. 2002). Sand and gravel is commonly used by the construction industry for concrete, asphalt, fill, and road base (Goldman 1994).

Groundwater

Groundwater is extensively used for household, public, and industrial water supplies in Kane County. Henry Formation sand and gravel and sand and gravel lenses within the diamicton units constitute the most significant Quaternary aquifers (see stippled areas of cross sections). Groundwater contained in former river valley deposits and buried under glacial diamictons provides some of the best water supply because silty or clayey diamicton deposits act as a confining layer or aquitard that protects the aquifer from surface contamination. In upland areas, the most common Quaternary groundwater aquifers are the Wasco facies of the Henry Formation and also sand and gravel bodies within till units. Many deeper wells obtain water from sand and gravel within and below the Glasford Formation deposits or from fractured dolomite bedrock. Curry and Seaber (1990) and Dey et al. (2004a, 2004b) provide a general overview of the groundwater resources in Kane County.

Environmental Hazards

Surface contaminants pose a potential threat to groundwater supplies in near-surface aquifers that are not overlain by a confining (clayey, unfractured) unit. Shallow sand and gravel aquifers, such as the Henry Formation (including Wasco facies), exposed at the surface or buried by a thin loess cap (< 4 feet), are most vulnerable to agricultural or industrial contaminants. Confining units, such as clayey till units or lake deposits, can protect aquifers. The Tiskilwa till, which averages 25 to 30% clay, is an excellent aquitard where it is uniform and does not contain sand bodies. The Batestown till, which contains 15 to 20% clay in this area, is a fair to poor aquitard because it has less clay than the Tiskilwa Formation in the quadrangle. The Batestown Member also is generally a poorer aquitard than the Tiskilwa Formation because it is more heterogeneous and contains numerous sand bodies and lenses—many of which are associated with areas of kamic topography (see cross sections). The factors used to determine the potential for contamination in shallow aquifers in Illinois are summarized by Berg et al. (1984).

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