Prairie Research Institute
ILLINOIS STATE GEOLOGICAL SURVEY

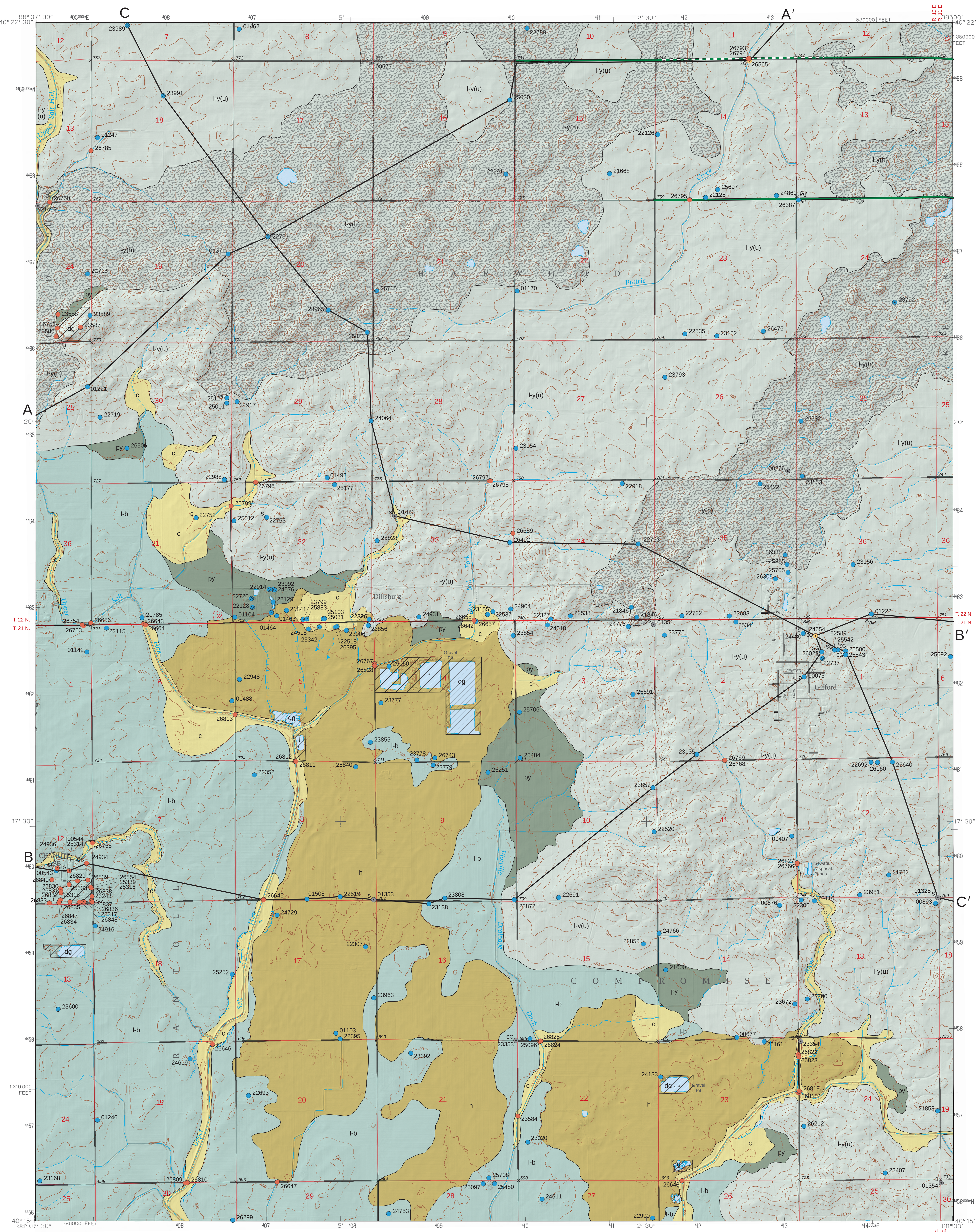
Surficial Geology of Gifford Quadrangle

Champaign County, Illinois

Andrew J. Stumpf

2011

STATEMAP Gifford-SG



QUATERNARY DEPOSITS

HUDSON EPISODE (~14,600 years before present (B.P.) to today)[2]

Description	Unit	Interpretation[1]
Areas of disturbed and/or removed geologic materials; grain size ranges from clay to gravel and may include waste or other rubble	Disturbed ground (dg)	**Deposits disturbed or modified by human activity** in gravel pits, landfills, and other excavations
Sand, silt, clay, and gravel; massive to stratified; locally oxidized; poorly sorted; contains beds of organic material; up to 15 feet thick	Cahokia Formation (undivided) (c)	**Alluvium (stream deposits)** mapped in floodplains along creeks and drainage ways and in fan-shaped deposits where streams emerge from the moraines onto lower gradient slopes
Diamicton; massive to crudely stratified; sandy loam to silty clay; yellowish brown to gray; texture and composition similar to the materials lying upslope; 5 to 20 feet thick	Peyton Formation (py)	**Postglacial (modern) slopewash and debris flow deposits** lying on nearly flat to moderately inclined slopes (typically <8 degrees in gradient) along the western edge of the Gifford Moraine,

WISCONSIN EPISODE (~60,000–14,600 years B.P.)[2]

Description	Unit	Interpretation[1]
Sand and gravel; contains some beds of silt, and pebbles; brown to yellowish brown; calcareous; well to poorly sorted; up to 25 feet thick	Henry Formation (h)	**Glaciofluvial sediment (outwash)** deposited by glacial meltwater in streams and rivers that drained the former ice sheets
Diamicton, silt and clay or sand and gravel; the diamicton has a silt loam to silty clay texture; found on steep-sided hillocks and hollows with multidirectional slope faces having slope angles between 15 and 35 degrees; 10 to 60 feet thick	Yorkville Member, Lemont Formation (hummocky) (l-y(h))	**Till and associated sediment** derived directly from glacial ice and meltwater that displays an overall hummocky surface expression; includes lake sediment and outwash that accumulated in low-lying areas; present in areas trending from southwest to northeast from the western edge of the Gifford Moraine
Diamicton; silt loam to silty clay; gray to brown calcareous; contains beds of sand and gravel; found on gently sloping hillocks and hollows with multidirectional slope faces having slope angles generally up to 15 degress; 10 to 60 feet thick	Yorkville Member, Lemont Formation (undulating) (l-y(u))	**Till and associated sediment** derived directly from glacial ice; displays an undulating surface expression; present east of the western edge of the Gifford Moraine
Diamicton; sandy loam to silt loam; gray to grayish brown; calcareous; contains beds of sand, silt, and gravel; 25 to 75 feet thick	Batestown Member, Lemont Formation (l-b)	**Till and associated sediment** derived directly from glacial ice; present west of the western edge of the Gifford Moraine
Diamicton; loam; grayish brown to reddish gray; calcareous; very stiff; 10 to 50 feet thick	Tiskilwa Formation (cross section only) (t)	**Till and associated sediment** derived directly from glacial ice; encountered in the subsurface only, underlying till of the Batestown Member
Sand and gravel with silt; contain pebbles and cobbles; brown to grayish brown; calcareous; well to poorly sorted; 5 to 75 feet thick	Ashmore Tongue, Henry Formation (cross section only) (h-a)	**Glaciofluvial sediment (outwash)** deposited by glacial meltwater in streams and rivers that flowed from an advancing Tiskilwa ice margin; not consistently differentiable from underlying sand and gravel correlated to the Glasford Formation
Silt and fine sand; massive to crudely stratified; very dark grayish brown; leached; may contain humus, peat, wood, and/or fossil snails: 5-20 feet thick	Robein Member, Roxana Silt (cross section only) (r-r)	**Proglacial eolian (wind-deposited) silt (loess)** containing a cool-climate paleosol (Farmdale Geosol) deposited on a former land surface that was well to poorly drained; conformably overlies deposits of the Glasford Formation; distinctive mapping unit, but only locally preserved in the subsurface

ILLINOIS EPISODE (~190,000–130,000 years B.P.)[3]

Description	Unit	Interpretation[1]
Sand with some gravel; sand is fine to coarse; locally includes intervals of silt and clay or diamicton; upper part weathered in profile of Sangamon Geosol; 15 to 115 feet thick	Unnamed unit 1, Glasford Formation (cross section only) (g-u1)	**Proglacial or ice-contact sediment** deposited by glacial meltwater or sediment gravity flows (debris flows) along former Vandalia ice margins; contains the Sangamon Geosol in the upper part except where eroded
Diamicton; silt loam to loam; grayish brown; calcareous; contains beds of sand, silt, and gravel; hard; 5 to 85 feet thick	Vandalia Member, Glasford Formation (cross section only) (g-v)	**Till and associated sediment** derived directly from glacial ice; overlain by deposits that accumulated along the Vandalia ice margins during deglaciation
Sand and gravel; pebbly; grayish brown; contains some beds of silt or diamicton; calcareous; well to moderately well sorted; 10 to 40 feet thick	Unnamed tongue 1, Pearl Formation (cross section only) (pl-u1)	**Glaciofluvial sediment (outwash)** deposited over the Mahomet Bedrock Valley by glacial meltwater flowing from an advancing Vandalia ice margins, or outflow from lakes ponded behind these ice margins; not consistently differentiable from underlying deposits of the Mahomet Sand Member when intervening tills are absent

PRE-ILLINOIS EPISODE (781,000[4]–430,000 years B.P)[3]

Description	Unit	Interpretation[1]
Diamicton; loam; reddish brown to grayish brown; calcareous; contains beds of sand, silt, or gravel; hard; upper part weathered in profile of Yarmouth Geosol; 5 to 35 feet thick	Hillery Member, Banner Formation (cross section only) (b-hl)	**Till and associated sediment** derived directly from glacial ice; may contain Yarmouth Geosol weathering profile in upper 10 feet (typically truncated)
Diamicton; loam to silt loam; grayish brown to light olive brown; calcareous; contains beds of sand, silt, or gravel; contains numerous clasts of the local bedrock; hard; 5 to 40 feet thick	Harmatton Member, Banner Formation (cross section only) (b-hm)	**Till and associated sediment** derived directly from glacial ice

PRE-ILLINOIS EPISODE (>1,200,000–781,000[4] years B.P.)[3]

Description	Unit	Interpretation[1]
Sand, diamicton, and silt; sandy loam to silty clay loam; very dark gray to greenish gray; leached to weakly calcareous; may contain humus, peat, wood, and/or fossil snails; hard; 5 to 20 feet thick	Unnamed unit 3, Banner Formation (cross section only) (b-u3)	**Fluvial or lacustrine sediment** deposited on a former floodplain of a river flowing in the Mahomet Bedrock Valley; the land surface was poorly drained and occasionally covered by overbank deposits or slopewash
Sand and gravel; brown to grayish brown; contains some beds of silt; calcareous; well to moderatley well sorted; 20 to 90 feet thick	Mahomet Sand Member, upper unit, Banner Formation (cross section only) (b-m1)	**Glaciofluvial sediment (outwash)** deposited in the Mahomet Bedrock Valley by glacial meltwater flowing from an advancing/retreating ice margin located to the northeast of the map area
Diamicton; sandy loam to clay loam; brown to pinkish gray; calcareous; contains intervals of sand and gravel or silt and clay; hard; 5 to 40 feet thick	West Lebanon Member[5], Banner Formation (cross section only) (b-wl)	**Till and associated sediment** derived directly from glacial ice flowing into the area from a northern or eastern ice source
Sand and gravel; pebbly to cobbly; brown; locally contains beds of silt or diamicton; calcareous; well to moderately well sorted; 30 to 60 feet thick	Mahomet Sand Member, lower unit, Banner Formation (cross section only) (b-m2)	**Glaciofluvial sediment (outwash)** deposited in the Mahomet Bedrock Valley by glacial meltwater flowing from an advancing ice margin located to the northeast of the map area

TERTIARY AND EARLY QUATERNARY DEPOSITS[3]

Description	Unit	Interpretation[1]
Diamicton, silt, clay, and sand and gravel; crudely stratified; olive brown; contains beds of silt or diamicton; calcareous or leached; contains a higher proportion of fragments of the local bedrock; 30 to 60 feet thick	Unnamed unit 4, Banner Formation (cross section only) (b-u4)	**Fluvial and lacustrine sediment, slopewash, or weathered bedrock** that accumulated in the Mahomet Bedrock Valley prior to the latest pre-Illinois Episode glaciation

PALEOZOIC BEDROCK

Description	Unit	Interpretation[1]
Shale, siltstone, claystone, and underclay; upper part is soft, fissile, and fractured; locally contains siderite nodules, plant macrofossils, and slickenslides	Pennsylvanian or Mississippian bedrock (cross section only) (Pz)	**Bedrock;** includes strata having a marine or terrestrial origin that form an irregular surface with valleys and uplands, shaped by multiple cycles of erosion from water and glacial ice

[1] The materials mapped at the land surface may be overlain by 1 to 5 feet of wind-deposited silt (loess).

[2] The time periods for the Wisconsin Episode and the Hudson Episode are reported as calibrated radiocarbon years and can be directly compared to calendar years before 1950 (Stuiver et al. 2005).

[3] The character of the Illinois, pre-Illinois, and older deposits is based on research conducted for the Illinois American Water Company (IAW) to study the Mahomet Aquifer in Champaign County and adjacent areas.

[4] The subdivison of the pre-Ilinois Episode is correlative to the Matuyama-Brunhes polarity chron boundary (see Cohen and Gibbard 2011).

[5] The West Lebanon "Till" Member was previously only mapped in western Indiana by Bleuer (1976).

Point Data Type

- Stratigraphic boring
- Water well boring
- Water well boring for irrigation and industry
- Engineering boring
- Coal boring
- Oil and gas boring
- 26211 Boring and outcrop labels indicate the county number. Dot indicates boring is to bedrock

Line Data Type

- Contact
- Edge of glacial meltwater channel
- Glacial meltwater flow direction
- A—A′ Line of cross section
- Earth electrical resistivity survey
- P-wave seismic survey

The county number is a portion of the 12-digit API number on file at the ISGS Geological Records Unit. Most well and boring records are available online from the ISGS Web site.

Base map compiled by Illinois State Geological Survey from digital data provided by the Champaign County GIS Consortium.

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

Recommended citation:
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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 5 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

Geology based on field work by Andrew J. Stumpf, 2008–2009.

Digital cartography by Jennifer E. Carrell and Jane E.J. Domier, Illinois State Geological Survey.

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This map has not undergone the formal Illinois Geologic Quadrangle map review process. Whether or when this map will be formally reviewed and published depends on the resources and priorities of the ISGS.

ROAD CLASSIFICATION

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

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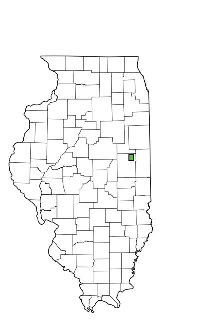

1	2	3
4		5
6	7	8

ADJOINING QUADRANGLES
1 Perdueville
2 Paxton
3 Rankin
4 Rantoul
5 Penfield
6 Thomasboro
7 Flatville
8 Royal

3°
TRUE NORTH
MAGNETIC NORTH
APPROXIMATE MEAN DECLINATION, 2011

Purpose

Detailed geologic mapping on the Gifford USGS 7.5-minute Quadrangle was undertaken to better understand the distribution of geologic materials over the Mahomet Bedrock Valley area in east-central Illinois (figs. 1 and 2). This work also supports the ISGS' geologic mapping program to produce 1:24,000-scale three-dimensional maps of the glacial geology from land surface to the top of bedrock for the entire state. This geological information will be accessible to decision-makers in the area to address a wide variety of local and county-wide issues that include water-supply planning, remediation of contaminated sites, identifying potential aggregate resources, designing and constructing foundations and structures, and preserving natural areas.

The geologic materials found at the land surface and in the subsurface have a complex but mappable pattern of occurrence, and are the source of important earth and water resources. The surficial geology map in combination with information on the subsurface distribution of geologic materials can be used to identify opportunities and limitations for future development as well as determining the environmental consequences of past and future land-use decisions. This mapping is a basis upon which other derivative maps can be produced for specific purposes such as assessment of groundwater resources, mineral resources, and geologic hazards.

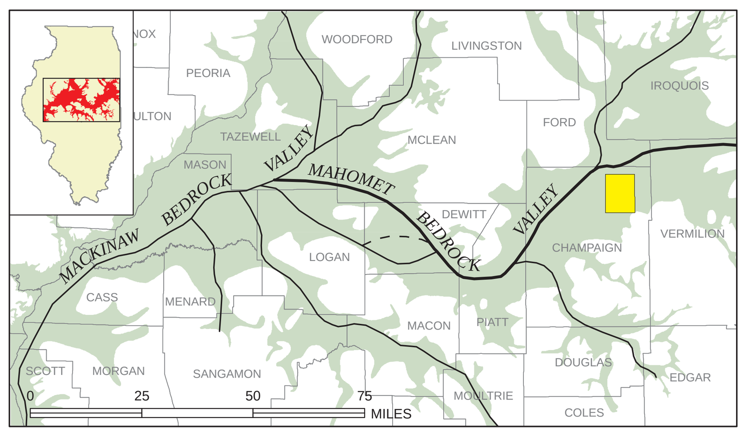

Figure 1 General axes (black lines) and configuration (green shade) of bedrock valleys in central Illinois. The extent of the Gifford USGS 7.5-minute Quadrangle is shown by the yellow-filled box.

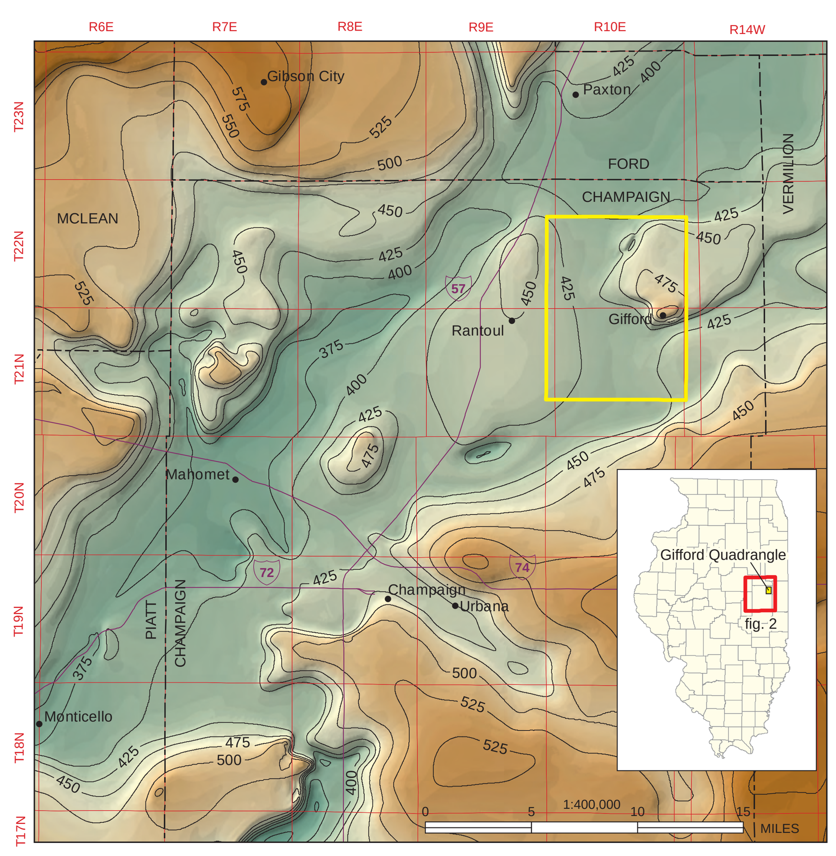

Figure 2 Bedrock topography of east-central Illinois. The extent of Gifford Quadrangle is shown by the box outlined in yellow. The map scale is 1:400,000. The extent of the Illinois American Water (IAW) project is outlined in red on the inset map.

Funding

This mapping was supported in part by a grant from the United States Geological Survey (USGS) National Cooperative Geologic Mapping Program, STATEMAP subprogram, under award number G10AC00418. These funds were used to develop the detailed map of the surficial geology, the cross sections and the extensive database that is required to accomplish the three-dimensional mapping, and laboratory analyses. The Gifford Quadrangle lies within the area of a multi-year project funded by the Illinois-American Water Company (IAW) to study the Mahomet aquifer in Champaign County and adjacent areas (fig. 2). Funding from the IAW supported the collection of continuous core and downhole geophysical data from one borehole to bedrock and acquisition of near-surface geophysical data along approximately 6 miles of survey line located in the northeastern part of the map area in 2008 and 2009. The interpretations of the subsurface geology in the Gifford Quadrangle are in part based on research for the IAW project. General Revenue funds from the State of Illinois were used to support field logistics and geophysical logging of water wells.

Introduction

The Gifford Quadrangle is located in the northeastern part of Champaign County and includes the City of Rantoul, Village of Gifford, and other unincorporated areas (fig. 3). The land surface ranges in elevation (above sea level) from a minimum of approximately 680 feet in the south central part of the map area to greater than 820 feet on the Gifford Moraine. The map area contains a variety of landforms including end moraines, undulating to hummocky morainal uplands, glacial outwash plains, and flat to undulating floodplains. Glaciers flowed into the map area from ice sources located over Canada north and northeast of the Great Lakes (fig. 4)

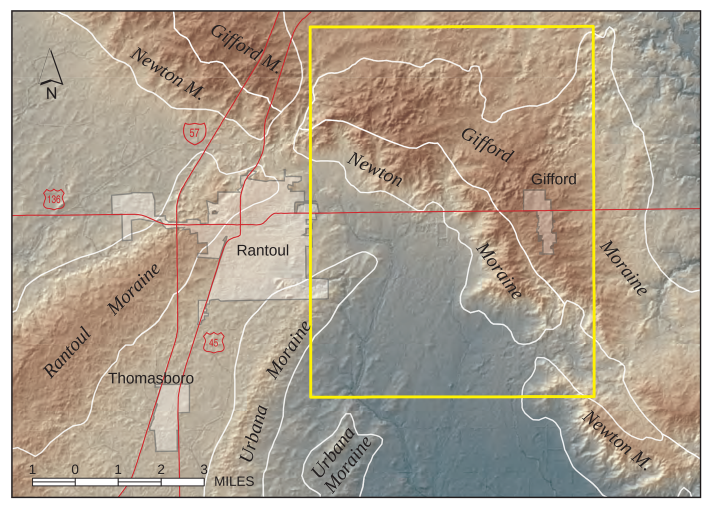

Figure 3 Location of the Gifford Quadrangle in east-central Illinois. The planimetric and moraines layers overlie a shaded relief map compiled from a digital elevation model (DEM) with a 2-foot resolution.

Mapping Techniques

A preliminary surficial geology was compiled from soil-parent material data published for Champaign County by the United States Department of Agriculture, Natural Resources Conservation Service (Endres 2003). A digital database accompanying the soil survey was queried to classify the parent material for each soil horizon. The parent material classes of the lowest-most horizon of each soil were used to construct the surficial geology map.

These parent material classes then were grouped into more general geologic material classes comprising the mapping units used for this map, following Hansel and Johnson (1996) and Willman and Frye (1970). Diamicton of the Yorkville Member, Lemont Formation was further subdivided to incorporate mappable variations in its expression at the land surface and the presence of lake sediment and glacial outwash present in low-lying areas. It is assumed the thickness of each soil unit is at least 6 to 10 feet or more based upon the depth to which the soil scientists sampled during their mapping. The thickness of specific units was adjusted where our drilling, field observations, or records suggested otherwise. The parent material/surficial geology layer was draped over a shaded relief map of the land surface topography and orthophotography compiled from historical aerial photographs taken in 1940 to better define geologic map unit boundaries. From the orthophotography, patterns of surface drainage, in part controlled by geologic materials at the land surface, could be identified for a time period before widespread tile drainage systems were installed in many farm fields, which altered the natural drainage. For example alluvial fans were identified where the surface drainage flowed across gently-inclined slopes in front of the moraines. Comparison of the geologic materials with their geomorphic (landscape) position allowed the development of a sediment-landscape model that was used to interpret descriptions of geologic materials from boreholes used in the mapping.

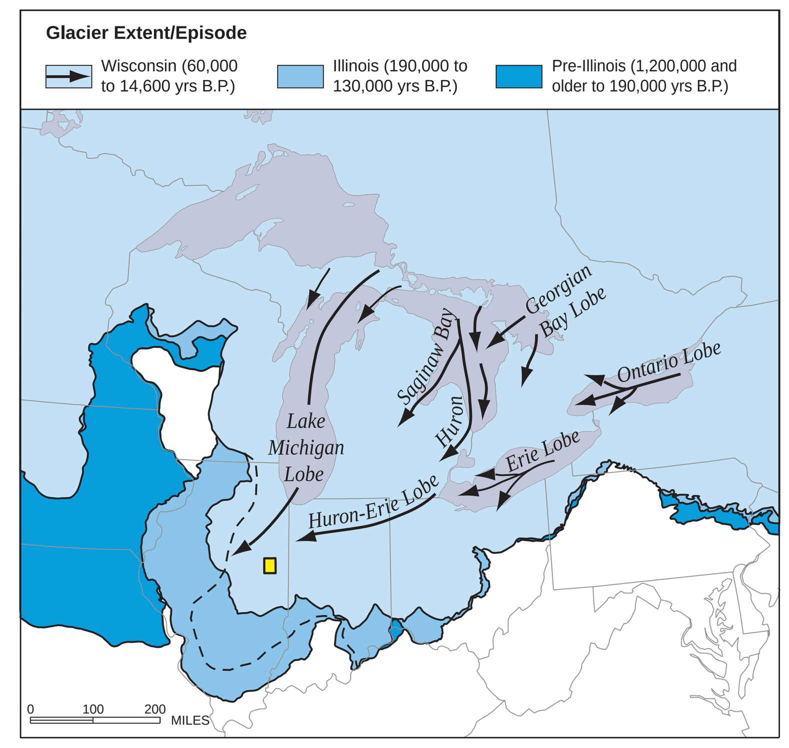

Figure 4 Approximate flow lines of glacial lobes of the south-central margin of the Laurentide Ice Sheet over east-central Illinois during the last glaciation (Wisconsin Episode). Modified after Gwyn and Dreimanis (1979). Glaciers during the Illinois and pre-Illinois Episodes followed similar flow paths. The mapped limits of the Wisconsin, Illinois, and pre-Illinois Episode glaciations are also indicated. The buried margin of pre-Illinois Episode ice lobes is denoted by the dashed line in black. State and provincial boundaries are denoted by the gray outlines. The extent of Gifford Quadrangle is shown in yellow.

Software were used to compile and analyze geologic data, to prepare the map, and publish in digital format three cross sections labeled A–A′, B–B′, and C–C′. The cross sections were constructed to portray the sequence of geologic materials in the subsurface above bedrock. A record of these materials encountered in each borehole site is available from the ISGS Geologic Records Unit and http://www.isgs.illinois.edu/maps-data-pub/isgs-quads/g/gifford.shtml.

Acknowledgments

Many individuals assisted in this project by providing information and services including database management and development, data entry, cartographic and graphic production, technical review, and in-depth discussions on geology. The Champaign County Regional Planning Commission (CCGIS) provided updates for various GIS layers of planimetric data. The CCGIS through the Illinois Height Modernization Program provided LiDAR topographic data to the ISGS, which staff member D. Luman processed to develop a 2-foot resolution DEM and associated shaded relief map of the land surface topography for the quadrangle. Other ISGS staff were instrumental in completing this map. J. Duncan and B. Stiff provided assistance with data entry and database management and J. Carrell, D. Heckman, and J. Domier compiled the cartography and graphics. L. Atkinson and M. Ross from the University of Waterloo, Waterloo, ON Canada assisted with the development of a 3-D geologic model from which the cross sections are based.

References

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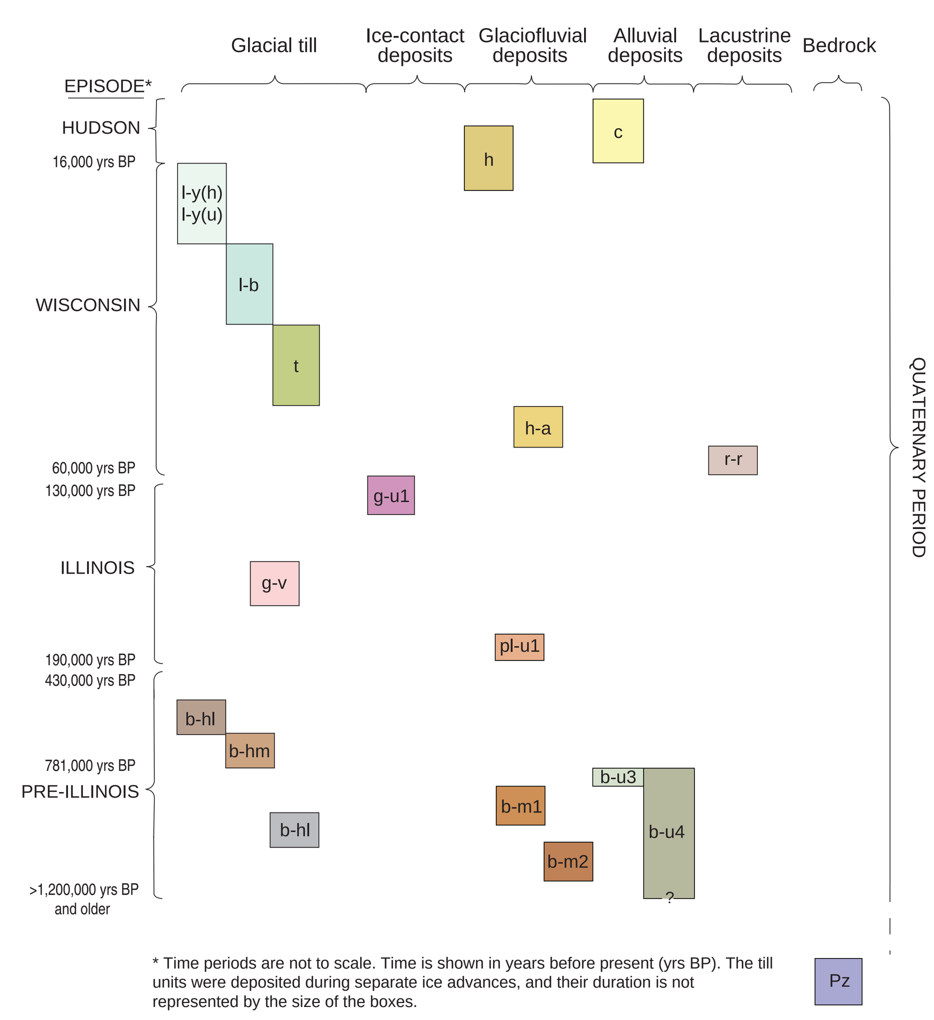
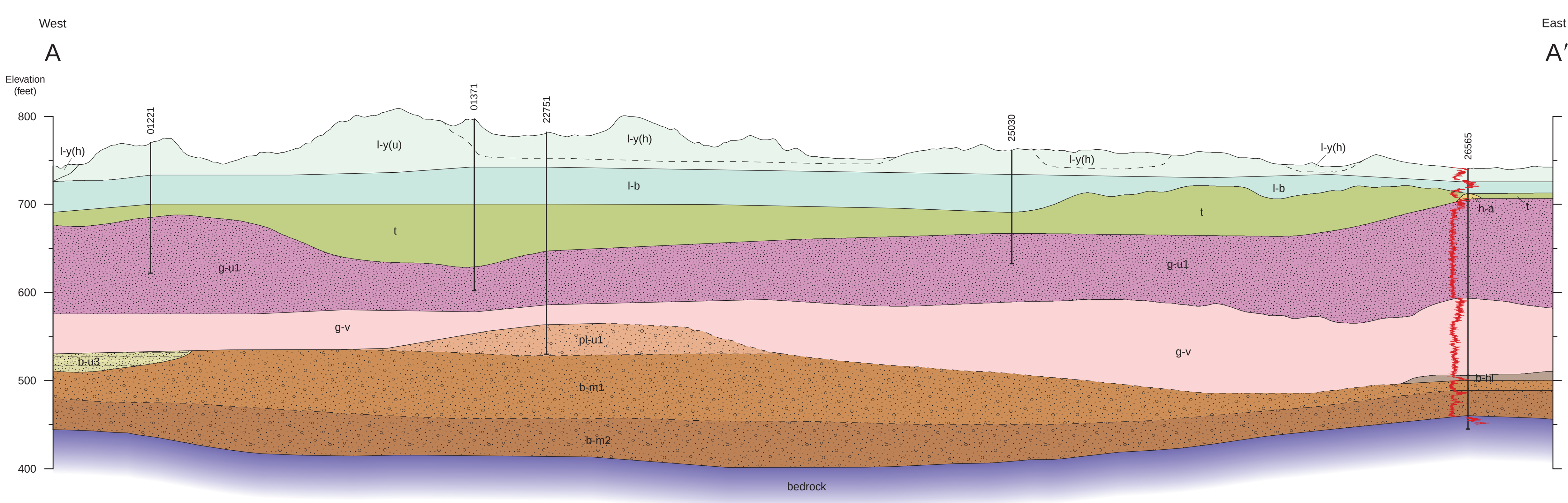
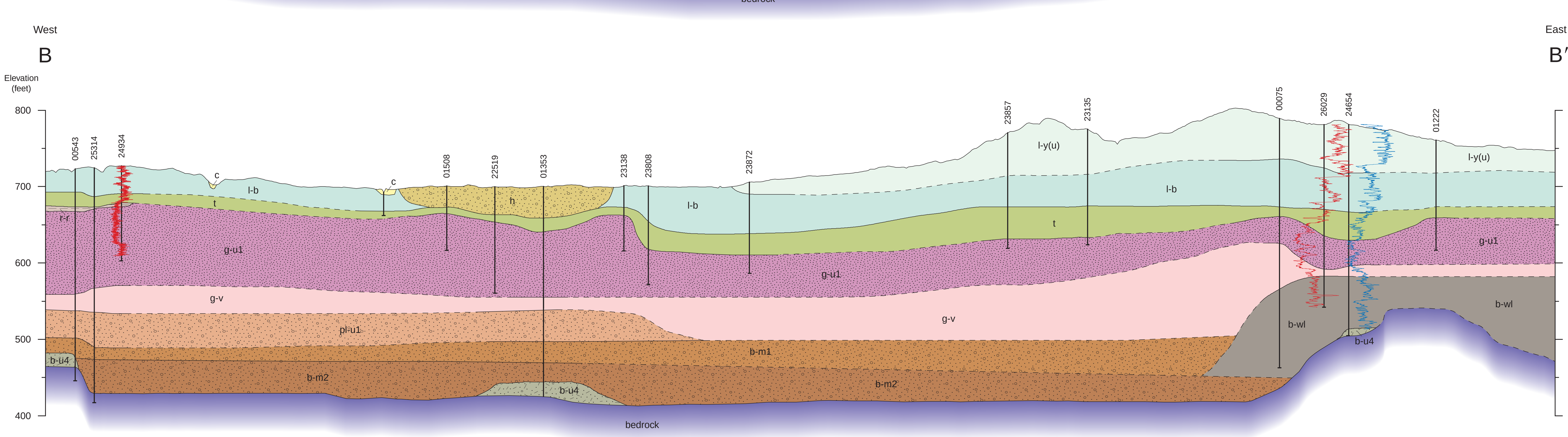
CORRELATION OF MAP UNITS



* Time periods are not to scale. Time is shown in years before present (yrs BP). The till units were deposited during separate ice advances, and their duration is not represented by the size of the boxes.

HUDSON EPISODE	c	Cahokia Formation
	h	Henry Formation
WISCONSIN EPISODE	l-y(h)	Yorkville Member, Lemont Formation
	l-y(u)	Yorkville Member, Lemont Formation
	l-b	Batestown Member, Lemont Formation
	t	Tiskilwa Formation
	h-a	Ashmore Tongue, Henry Formation
	r-r	Robein Member, Roxana Silt
ILLINOIS EPISODE	g-u1	Unnamed unit 1, Glasford Formation
	g-v	Vandalia Member, Glasford Formation
	pl-u1	Unnamed tongue 1, Pearl Formation
PRE-ILLINOIS EPISODE	b-hl	Hillery Member, Banner Formation
	b-hm	Harmatton Member, Banner Formation
	b-u3	Unnamed unit 3, Banner Formation
	b-m1	Mahomet Sand Member, upper unit, Banner Formation
	b-wl	West Lebanon Member, Banner Formation
	b-m2	Mahomet Sand Member, lower unit, Banner Formation
	b-u4	Unnamed unit 4, Banner Formation
		Pennsylvanian or Mississippian bedrock





Cross Sections

- Sand and gravel
- Mainly sand with some gravel; locally includes intervals of silt and clay or diamicton
- Laminated silt and clay
- Mixture of loam, sand and gravel, diamicton, and/or silty clay
- Diamicton, massive silt, or other fine-grained sediment
- Contact
- Inferred contact
- Log of natural gamma radiation
- Log of neutron counts

Horizontal scale: 1 inch = 4,000 feet
Vertical scale: 1 inch = 200 feet
Vertical exaggeration: 20×