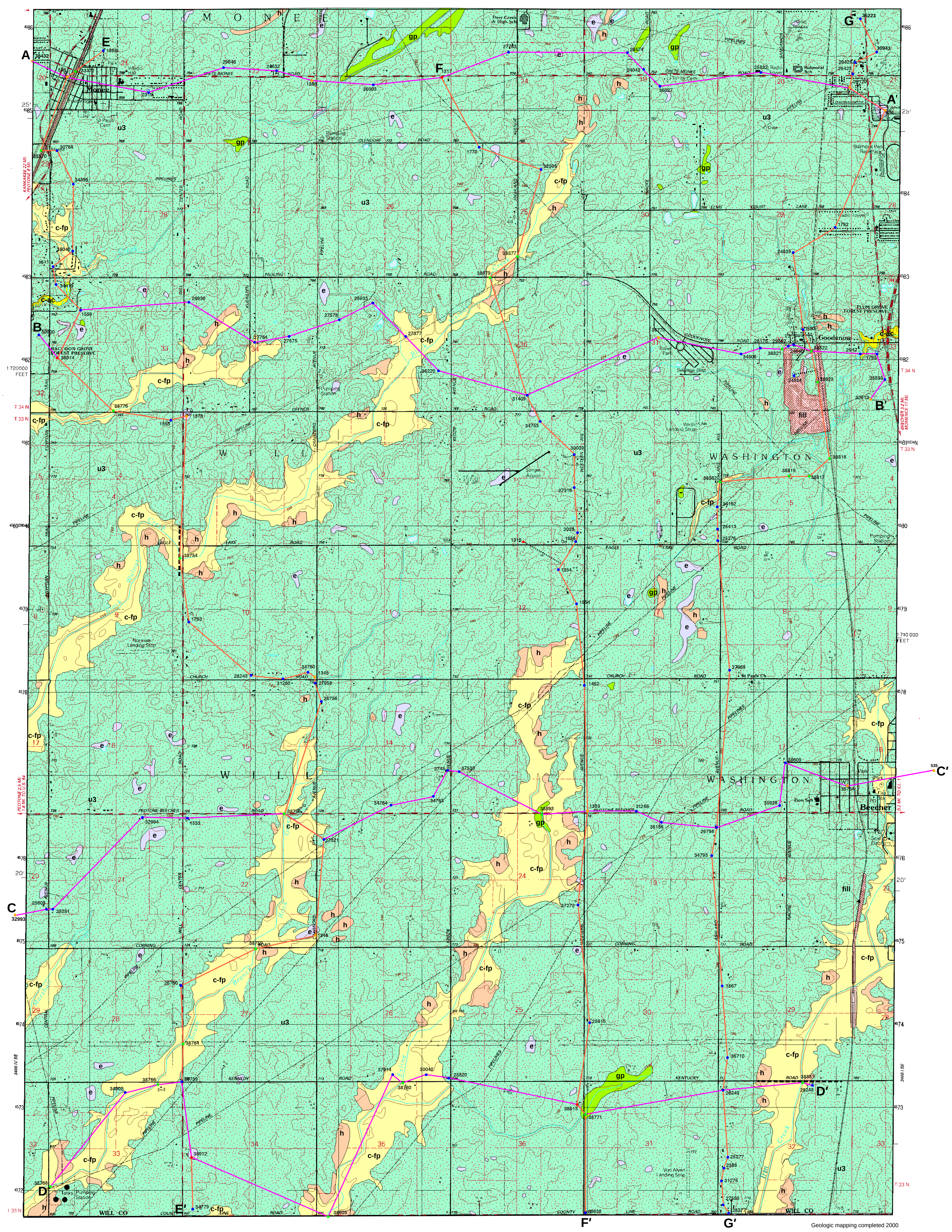
George H. Ryan, Governor

Department of Natural Resources
Brent Manning, Director
ILLINOIS STATE GEOLOGICAL SURVEY
Illinois Geological Quadrangle Map: IGQ Beecher West-Steger-SG
William W. Shilts, Chief
2001

SURFICIAL GEOLOGY MAP

Northern Beecher West and Southern Steger 7.5-minute Quadrangles, Will County, Illinois

B. Brandon Curry and David A. Grimley



Geologic mapping completed 2000

Base map produced by the United States Geological Survey
Control by USGS and NOS/NOAA

Topography by photogrammetric methods from aerial photographs taken 1987. Field checked 1988. Map edited 1990 (Steger Quad.); taken 1987. Field checked 1989. Map edited 1990 (Beecher West Quad.).

Projection and 10,000-foot grid ticks: Illinois coordinate system, east zone (Transverse Mercator)

1000-meter Universal Transverse Mercator Grid, zone 16
1927 North American Datum

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 — 2,000 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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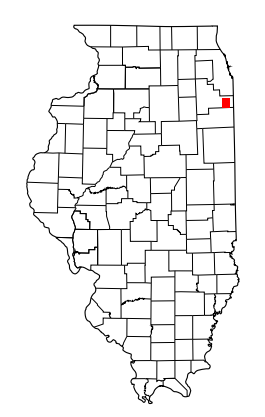
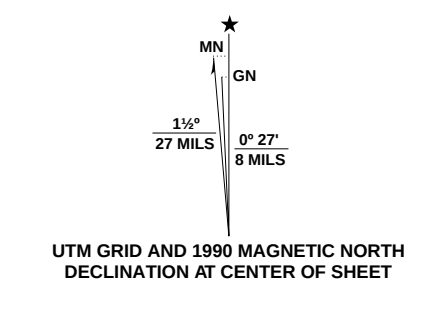
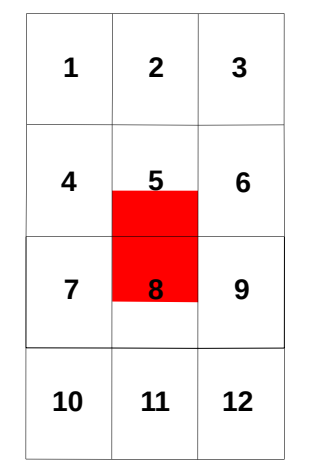




UTM GRID AND 1990 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET



1 Tinley Park
2 Harvey
3 Calumet City
4 Frankfort
5 Steger
6 Dyer
7 Peotone
8 Beecher West
9 Beecher East
10 Bradley
11 Momence
12 Illiana Heights

ADJOINING 7.5-MINUTE QUADRANGLES

Introduction

Fine-grained glacial sediments that include matrix-supported silty and clayey diamicton, silt, and clay constitute the bulk of the surficial sediments in the area covered by this map. Associated with continental glaciers that repeatedly covered the region, these sediments were likely deposited as till, as mudflows, and in lakes. Layers and lenses of gravel and sand are interbedded with the diamicton at depth in most areas. This coarse, sorted sediment was likely deposited by meltwater streams associated with alluvial fans or fan deltas that formed at the edge of the ice. The glacial sediment was deposited during the last glaciation (Wisconsin Episode) between about 17,500 and 13,500 radiocarbon years ago (Hansel and Johnson 1992, 1996).

The mapping area is located about 20 miles from the southern shore of Lake Michigan and southern Chicago. The largest communities in the mapping area include the villages of Beecher and Monee with populations of 2,033 and 2,924, respectively (2000 census values). Communities just outside the mapping area include Peotone (to the west) and University Park (to the north). Interstate 57 passes just west of the study area.

The hilly topography, readily observed on the shaded relief map (fig. 1), is typical of the Valparaiso Morainic System (Willman and Frye 1970). However, the three moraines that constitute the Valparaiso Morainic System in this area (the Westmont, Wheaton, and West Chicago Moraines) are not able to be easily differentiated in the mapped area. South of the Valparaiso Morainic System is the gently rolling Wilton Center Moraine. Shallow valleys that crosscut the moraines likely were formed by submarginal enclosed meltwater channels that evolved, during downwasting of the ice, to proglacial open meltwater channels (Menzies 1995).

Mapping Methods

The surficial geology map is based primarily on the soils map of Wascher et al. (1962). We verified their mapping at several localities by examining exposures along creeks and ditches and by sampling with a Giddings soil probe. Positions of some map boundaries and descriptions of some units were modified based on logs from the Will County Highway Department and our stratigraphic tests. The areal extent of surficial lake sediment (map unit e) was based on interpretation of color infrared aerial photography done in 1988 by the U.S. Geological Survey's National Aerial Photography Program (NAPP).

The data sources used for the cross sections include detailed studies of five stratigraphic test holes (including three drilled for this project) drilled by the Illinois State Geological Survey (ISGS), 93 water-well logs, eight logs from test holes drilled for site investigations for the Beecher facility (a closed landfill in the village of Goodenow, Section 32, T. 34 N., R. 14 E., and Section 5, T. 33 N., R. 14 E.), 24 bridge and foundation borings, six shallow ISGS cores (<18 feet long), and two electrical earth resistivity profiles done by the ISGS. The data sources and their interpretation are indicated on the cross sections; the locations of all data sources were shown by Curry et al. (2001). The records for all data sources are on file at the Geological Records Unit at the ISGS. For the test holes that we drilled, physical characteristics of the stratigraphic units were characterized by determining the particle-size distribution, water content, and clay mineralogy of several subsamples. Some representative results of the tests are shown in figure 2 on the left margin of the map. The hydrometer method was used to analyze the particle-size distribution. Gravel-sized fragments are >2 mm in diameter; sand, 0.064–2 mm; silt, 0.004–0.064 mm; and clay, <0.004 mm. Methods used for the mineralogical analyses are discussed by Wickham et al. (1988).

Glacial sediment. Three glacigenic sediment units were mapped in upland areas (map units u1, u2, and u3). Most of the larger valleys are underlain by sand and gravel alluvium, and there are scattered deposits of peat and fine-grained lake sediment. Upland diamicton units u1 and u3 are separated by middle unit u2, composed primarily of fine to very fine sand and sand and gravel. The diamicton is very poorly sorted, meaning that it contains particles that range in size from clay to boulders. In the southern Great Lakes region, most diamicton has bimodal particle-size distribution in which the >2-mm fragments (i.e., gravel and larger) are matrix-supported, "floating" in a matrix of sand, silt, and clay. The >2-mm particles mostly are fragments of shale and dolomite eroded from the local bedrock, and a few far-traveled crystalline rocks (e.g., granite, gneiss). Diamicton is classified according to the particle-size distribution of the <2-mm matrix, following the nomenclature of the U.S. Department of Agriculture (Buol et al. 1980). Most glacigenic diamicton in the map area is considered to be overconsolidated and is classified by civil engineers as CL (low plasticity inorganic fines; Holtz and Kovacs 1981). Moisture contents of diamicton in the area range from about 10 to 22%. Diamicton samples with moisture contents ranging from about 18 to 22% were interpreted as silty clay, whereas diamicton samples with lower moisture contents (10 to 13%) were sandy loam to loam. Analysis of samples for their clay mineralogy using x-ray diffraction indicated that the diamicton is uniformly rich in illite and has smaller amounts of kaolinite, chlorite, and swelling clay minerals. The three glacial sediment units, as well as surficial lake sediment and coarse outwash (map units e and h, respectively), are capped by 2 to 3 feet of silty clay loess (known as Peoria Silt; Hansel and Johnson 1996). The loess is generally organic-rich and has been altered by development of the modern soil. Because loess is ubiquitous, its extent was not mapped.

The lowest unit 1 (u1) is composed of laminated or massive silt and clay with scattered lenses of fine-grained sand, or diamicton, and a basal layer of sand and gravel. The average and maximum known thicknesses of the lower unit are about 30 feet and 65 feet, respectively. The matrix texture of the diamicton is variable (fig. 2); accordingly, moisture contents are variable and typically range from 12 to 22%.

The middle unit 2 (u2) is composed primarily of well-sorted fine to very fine sand, poorly sorted sand and gravel, brown silty and sandy diamicton, and scattered lenses of silty and clayey diamicton. The average and maximum known thicknesses of the middle unit are about 45 feet and 80 feet, respectively. In sample sets, the greater gravel content and browner color of the middle unit were used to distinguish it from the glacial units above and below.

The upper unit 3 (u3) is a matrix-supported, silty and clayey diamicton with some lenses of silt, silty clay, or sand and gravel. The average and maximum known thicknesses of the upper diamicton unit are 60 feet and 110 feet, respectively. The matrix texture varies substantially, both vertically and from one place to another. The upper 10 to 20 feet of the unit are weathered yellowish brown to olive; the unit is gray where it is unweathered.

The bottoms of most large valleys are infilled with channel sand, sand and gravel, and, in some places, by sequences of silty and clayey sediment, and peat. The cross sections show sand and gravel as unit h (Henry Formation). Unit h generally does not show on the surficial map because it is mantled by as much as 30 feet of fine-grained postglacial alluvium (map unit c-fp), lake sediment (map unit e), and peat (map unit gp). Interpretations of the breadth, thickness, and composition of the channel fills shown in the cross sections were based on data from two transects where there were logs of bridge borings and electrical earth resistivity profiles of the valley fill materials. One transect was where cross section E–E' crosses the valley of Black Walnut Creek (Sections 3, 4, 9, and 10, T. 33 N., R. 13 E.). The other transect was across the valley of Trim Creek (Section 29, T. 33 N., R. 14 E) on the east side of cross section D–D'. Here, the sand and gravel fills a channel about 70 feet deep and <500 feet wide.

Postglacial sediment. Deposits of silt and clay, peat, sandy gravel, and sand overlie the glacial units filling the valleys throughout the mapped area and many low spots scattered across the uplands. The extent of the floodplain unit (map unit c-fp) is loosely based on mapping of the Drummer Soil Series by Wascher et al. (1962). Bridge boring data indicate that these sediments are generally <10 feet thick and are as much as 25 feet thick in some places. Unit c-fp consists of gleyed silt and clay, thin beds of fossiliferous fine sand, and some beds of sand and gravel. The extent of the active channel unit (map unit c-ac), which coincides with the Otter Soil Series (Wascher et al. 1962), is composed of loose sand with some gravel. It is present only along two stream segments in the northern portion of the mapping area, and its thickness was not determined. Like the floodplain unit, the active channel unit is considered to be part of the Cahokia Formation.

Well-sorted silt and clay (map unit e) and peat (map unit gp) were mapped in some upland depressions, flat areas, and in floodplains. The thickest deposit of this normally consolidated well-sorted silt and clay (20 feet) was sampled in boring 38822 (Section 32, T. 34 N., R. 14 E.). The thickest peat deposit (22 feet) was reported in a bridge boring along Exline Slough (boring 38593, Section 24, T. 33 N., R. 13 E.). Thick peat and clay deposits also probably occur below the wide floodplain in the headwaters of Deer Creek in the north-central portion of the mapping area (Section 34, T. 34 N., R 13 E.). The silt and clay is assigned to the Equality Formation and the peat to the Grayslake Formation.

Geologic Interpretations

The three upland glacial units appear to be associated with at least three ice advances of the last glaciation dating from about 17,500 to 13,500 radiocarbon years ago. The lowest unit (u1) comprises two lithogenetic successions. Because of their fine-grained nature, however, the two successions generally are not distinguishable in most of the available logs and other data. The lower succession includes the gray silty and clayey diamicton that is typical of the Yorkville Member of the Lemont Formation. If this stratigraphic assignment is correct, then sediments from earlier activity of the Wisconsin Episode—such as the Batestown and Tiskilwa units of Hansel and Johnson (1996)—and pre-Wisconsin Episode units have been eroded. The upper of the two successions in unit 1, which is assigned to the Equality Formation, includes mud layers intercalated with thin beds of fine sand and diamicton. This younger succession was likely deposited in lakes distal from a glacier that eventually advanced over the map area and deposited the bulk of the overlying middle unit described below.

Much of unit u2 was deposited as outwash and mudflows in proximal to medial proglacial alluvial fans and fan deltas; diamicton in the upper part of the middle unit may be till. In accord with the most recent lithostratigraphic classification of Hansel and Johnson (1996), the sorted sediment is assigned to the Henry Formation, and the capping diamicton is assigned to the upper part of the Lemont Formation. The proglacial sediment and capping debris flows and till are similar to the Lemont drift described at the type section (Johnson and Hansel 1985, 1989), which is located about 25 miles to the northwest of the map area (fig. 3). There, the Lemont drift is clay-poor and dolomite-rich. In this map area, the proglacial sediment is, in general, finer grained than at the Lemont type section, for two reasons. First, the bulk of the proglacial sediment in the map area was deposited well beyond the glacial margin. Second, the glacial sediment in the map area contains more fragile shale fragments that were easily broken apart and crushed during transport. The differing clast lithologies are attributed to the inferred flow of the Lake Michigan Lobe (shown as red arrows in fig. 3). The glacial sediment in the map area contains more shale fragments than regions to the west and north because the glacier flow path to the area traversed regions where shale formed most of the bedrock surface. The Lemont drift contains less shale at the type section because the glacier did not flow across as much shale bedrock to get there (fig. 3).

Unit u3 consists of till and debris flows and is assigned to the Wadsworth Formation. In places where the succession of units has been interpreted from water-well logs and is less certain, the lower part of the unit may correlate with diamicton or sorted silt and clay of the undivided Lemont Formation. Available data are inconclusive with regard to the mode of diamicton deposition. The bedding of the diamicton and the hilly topography of the Valparaiso Morainic System are consistent with deposition by debris flows. Some beds, however, may have been deposited by separate advances of a rapidly oscillating ice margin. Whatever the origin of the bedded diamicton, the moisture content data indicate that the material is overconsolidated and was dewatered during ice loading and shearing. Unlike the diamictons of units u1 and u2, diamicton of unit u3 is not associated with thick deposits of proglacial outwash (Johnson and Hansel 1989).

Groundwater and Aggregate Resources

Available records indicate that none of the significant deposits of saturated glacial sand and gravel in the mapping area are used as a source of drinking water. Instead, most private wells draw groundwater from the uppermost Silurian dolomite bedrock just below the glacial drift. Groundwater in the sand and gravel aquifers is not utilized, possibly because of the relatively shallow depth to bedrock where water wells can be developed without a screen. Several municipal wells in Monee and Beecher obtain their water from deep sandstone aquifers.

Channel-fill deposits of the Henry Formation (map unit h) provide the most direct way for surface pollution to reach the shallow bedrock aquifers. This situation is most likely to occur where the drift is thin; drought conditions would promote the vertical hydraulic gradients necessary to transport near-surface pollutants to the shallow bedrock aquifer. Unit u2 also is capable of rapidly transmitting water, but this unit is generally covered by the fine-grained diamicton of unit u3. There are some areas, however, where water-well drillers' logs indicate that the protective layer of the upper unit is thin, such as in the northeastern corner of the map area. A summary of the factors that effect the potential for contamination of shallow aquifers in Illinois is provided by Berg et al. (1984).

There may be economical deposits of sand and gravel in the Henry Formation underlying the surficial valleys. These deposits probably have only limited economic potential as sources of construction aggregate materials because of their textural variability and limited lateral extent. Sources of high-quality aggregate materials are available from large dolomite quarries near the village of Manteno, about 10 miles west-southwest of the mapping area.

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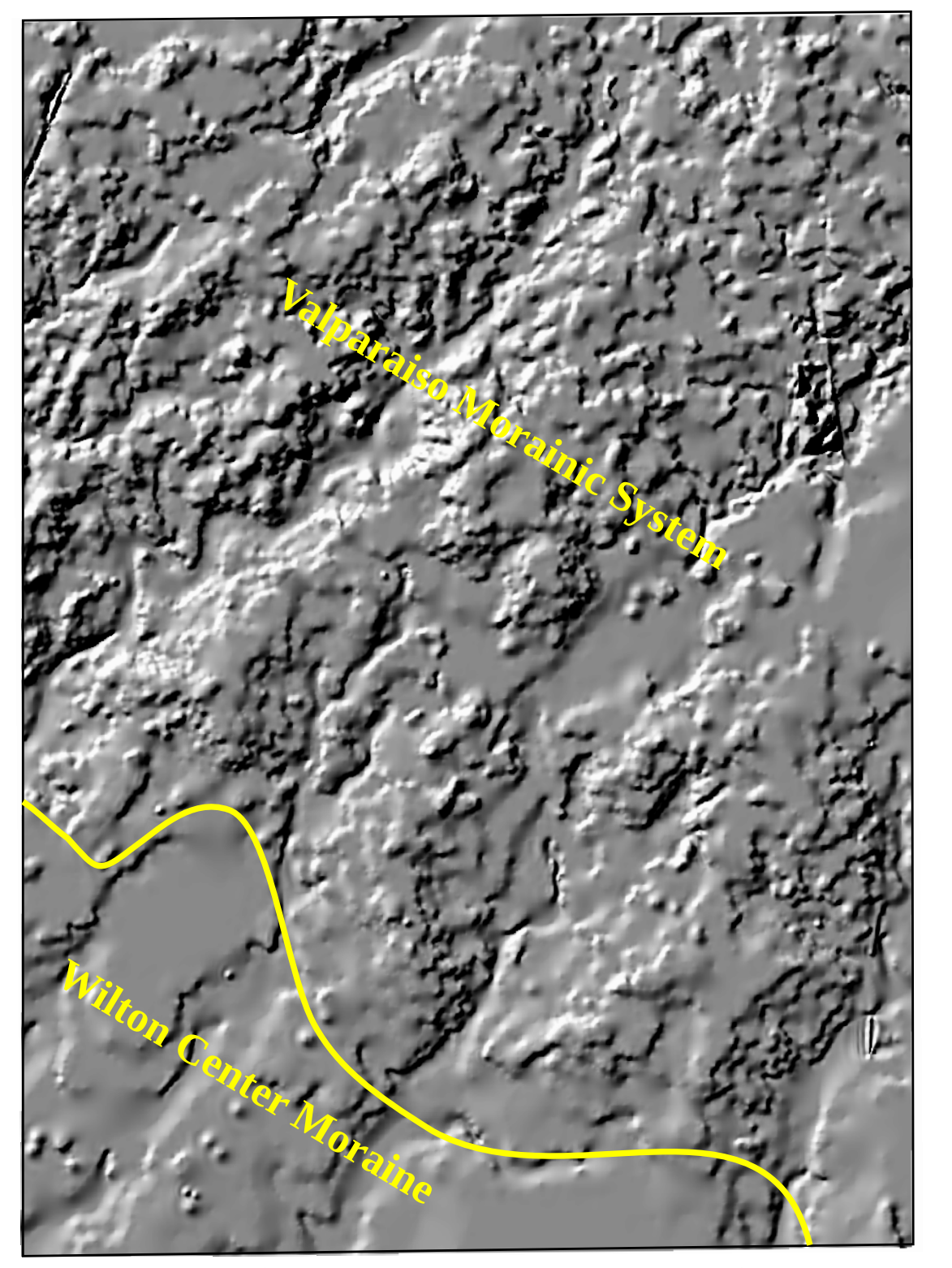


Figure 1 Shaded relief and boundary between the hilly topography of the Valparaiso Morainic System and the subdued topography of the Wilton Center Moraine (after Willman and Frye 1970).

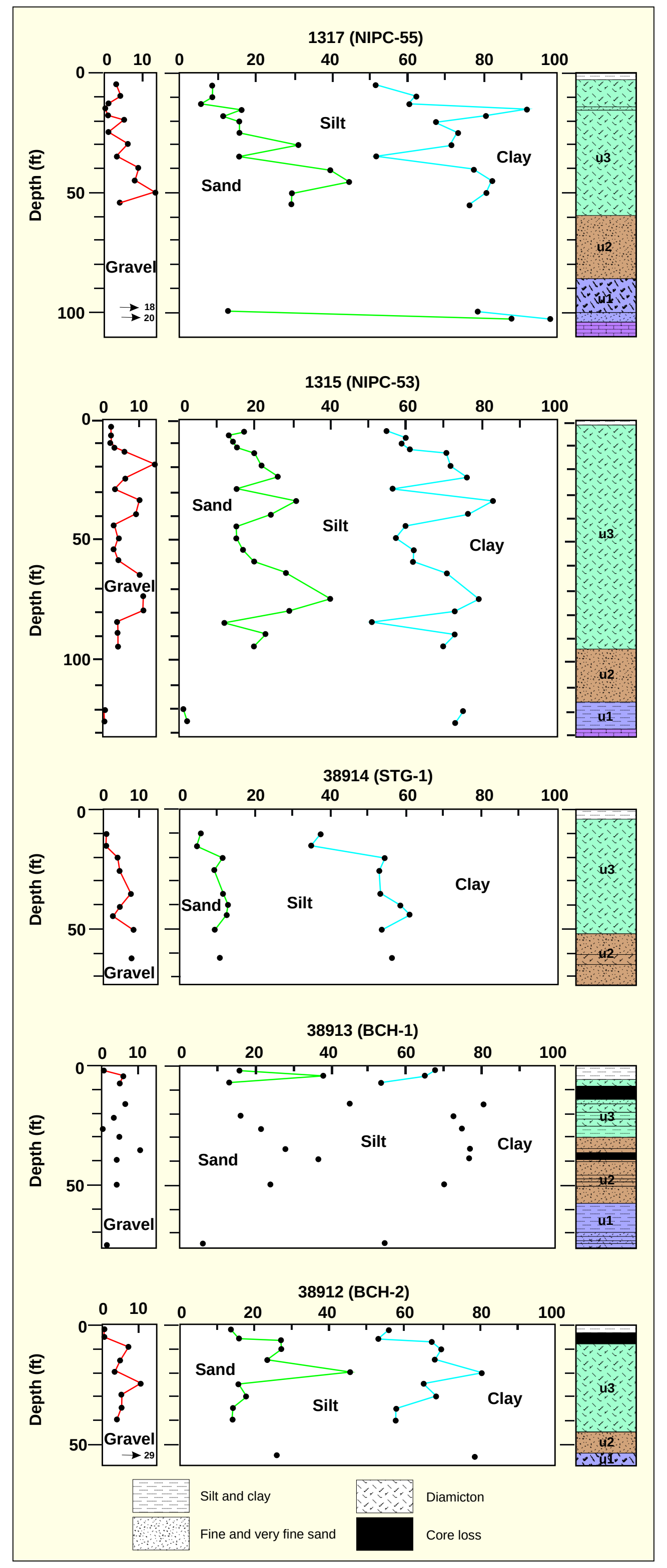


Figure 2 Sand-silt-clay distribution (percent) of <2-mm-diameter matrix subsamples from stratigraphic borings. Gravel values are based on whole samples (including the matrix). Lines connect data points from uniform layers of diamicton. A capping layer of silt and clay is shown in white for each boring. This unit is loess (wind-blown silt) known as the Peoria Silt. Because of its ubiquity, the Peoria Silt was not mapped.

Materials		Genetic interpretations and lithostratigraphy
Postglacial units		
Fill	fill	Material reworked by construction for road embankments and landfill cover
Peat with some marl and silty clay	gp	Marsh sediment of the Grayslake Formation
Silt and clay with some seams of fine sand, uniform or laminated	e	Lake sediment of the Equality Formation often overlain by 2 to 3 feet of silty clay (Peoria Silt)
Sand with some gravel, loose	c-ac	Active channel facies (coarse allluvium) of the Cahokia Formation
Fine sediment, sand, and some peat	c-fp	Floodplain facies (fine alluvium) of the Cahokia Formation
Glacigenic units in valleys		
Predominantly sand and gravel with some lenses of diamicton, silt, and silty clay	h	Primarily outwash, with debris flows, and lake sediment of the Henry Formation overlain by 2 to 3 feet of silty clay (Peoria Silt)
Glacigenic units of upland areas		
Matrix-supported diamicton (matrix textures of silty clay, silty clay loam, and loam) with scattered lenses of sand, sand and gravel, and silty clay; gray where unweathered; olive to yellowish brown where oxidized	u3	Till and debris flows of the Wadsworth Formation overlain by 2 to 3 feet of silty clay (Peoria Silt)
Sand and gravel, and sand with some lenses of diamicton or silt and clay (cross sections only)	u2	Proximal to medial outwash of the Henry Formation, and till of the undivided Lemont Formation
Silt and clay; laminated; and silty clay diamicton underlain by sand and gravel (cross sections only)	u1	Distal outwash, lake sediment, and debris flows of the Equality Formation; also till of the Yorkville Member, Lemont Formation, and associated proglacial sediment

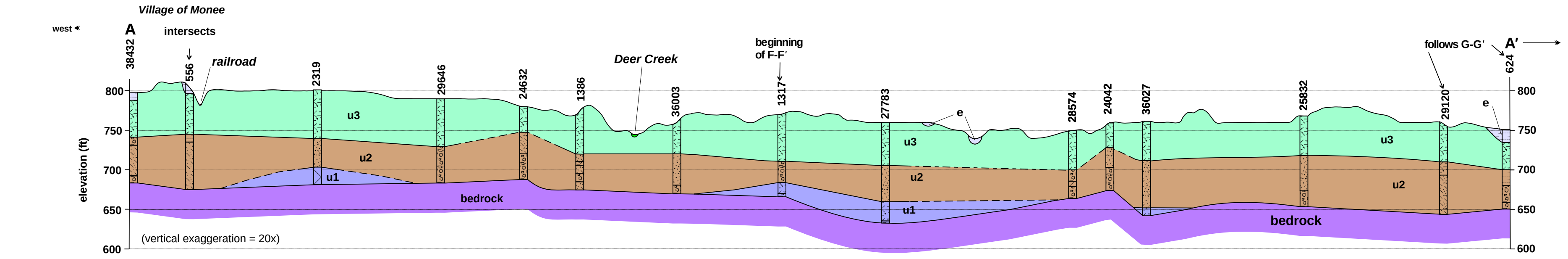
▢	water (map only)
▨	moraine (map only)

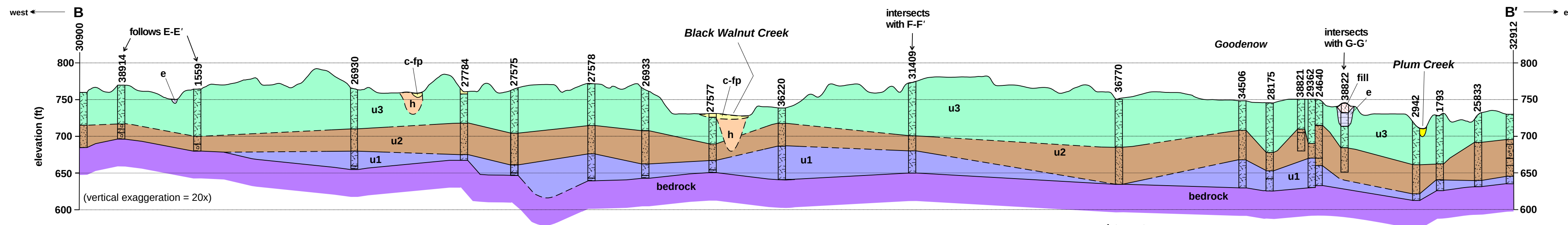
Lithology symbols for cross sections

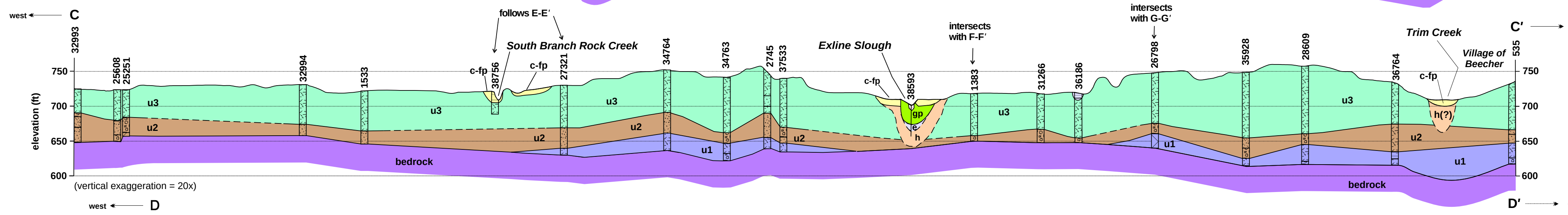
▨	Silty and clayey diamicton; gray where unweathered; called clay and muddy sand in water well drillers' logs
▤	Silt and clay
▨	Silty and sandy diamicton; brown; called muddy sand, sandy clay, etc., in water-well drillers' logs
░	Sand
▩	Sand and gravel; gravel

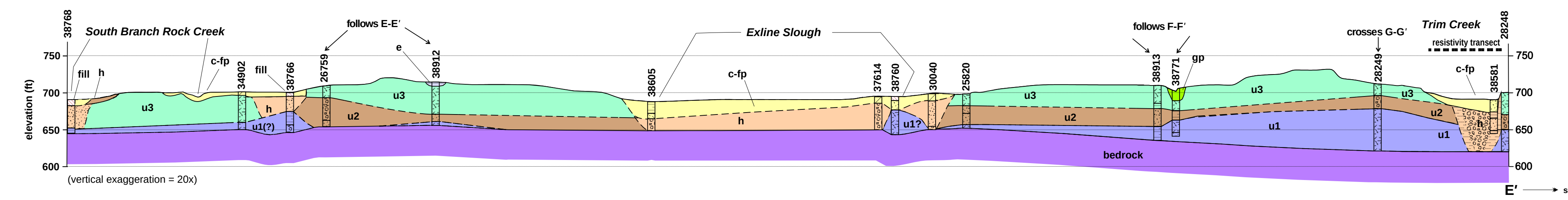
Other symbols in cross sections

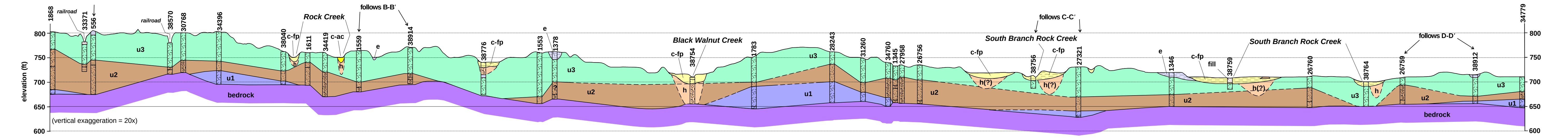
―	Unit contact
- - -	Approximate or queried unit contact

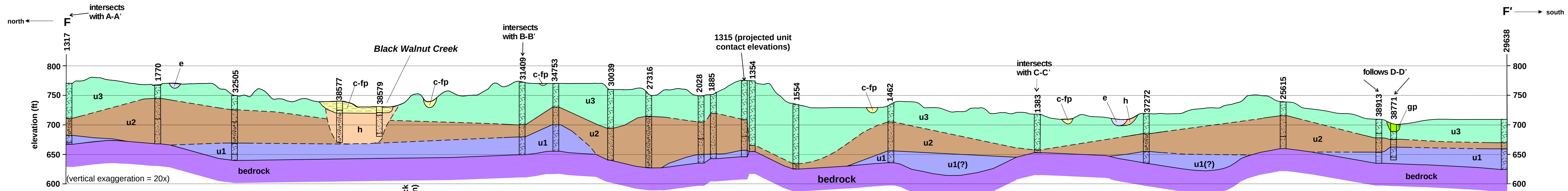


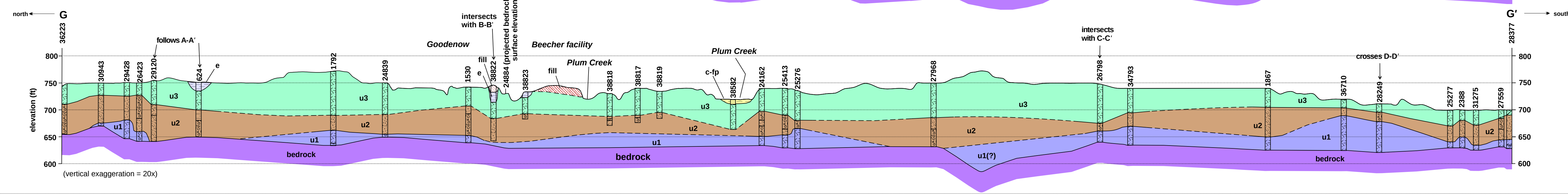












Types of data points

●	Water wells
●	Water wells with sample sets
●	Engineering borings
●	Stratigraphic borings with particle-size and other data
▪ ▪ ▪ ▪ ▪	Electrical earth resistivity (EER) transects (2)
―	Lines of north-south cross sections
―	Lines of east-west cross sections
⋯⋯	Projected unit contact elevations

Data points are labeled with county API numbers, unique numbers that identify records of water wells and borings available at the Geological Records Unit at the Illinois State Geological Survey. The locations of the water wells and sample sets were not field verified, but many locations were confirmed by street address.

Acknowledgments

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▤	Subcrop of Devonian shale. Other areas in the figure are underlain by Paleozoic rocks that contain much less shale (primarily dolomite, limestone, and sandstone)
↙	Hypothetical flow of Lake Michigan Lobe
🟩	Valparaiso Morainic System
🟩	Other end moraines
🟨	Other land areas once covered by glaciers
―	Approximate ice margin during Crown Point Phase
- - -	Inferred ice margin during Crown Point Phase

Figure 3 Location of moraines in southern Lake Michigan region. In the quadrangle area, the Valparaiso Morainic System formed during the Woodstock and Crown Point Phases from about 16,000 to 13,500 radiocarbon years ago (Hansel and Johnson 1996). Flow lines indicate that more Devonian shale was encountered by the Lake Michigan Lobe flowing to the mapping area than to the type section of the Lemont Drift. The subcrop pattern of Devonian shales is from Wold et al. (1981). Moraine mapping is modified from ISGS (2000) and Lineback et al. (1983).