Prairie Research Institute
ILLINOIS STATE GEOLOGICAL SURVEY

Surficial Geology of Lawrenceville Quadrangle

Lawrence County, Illinois

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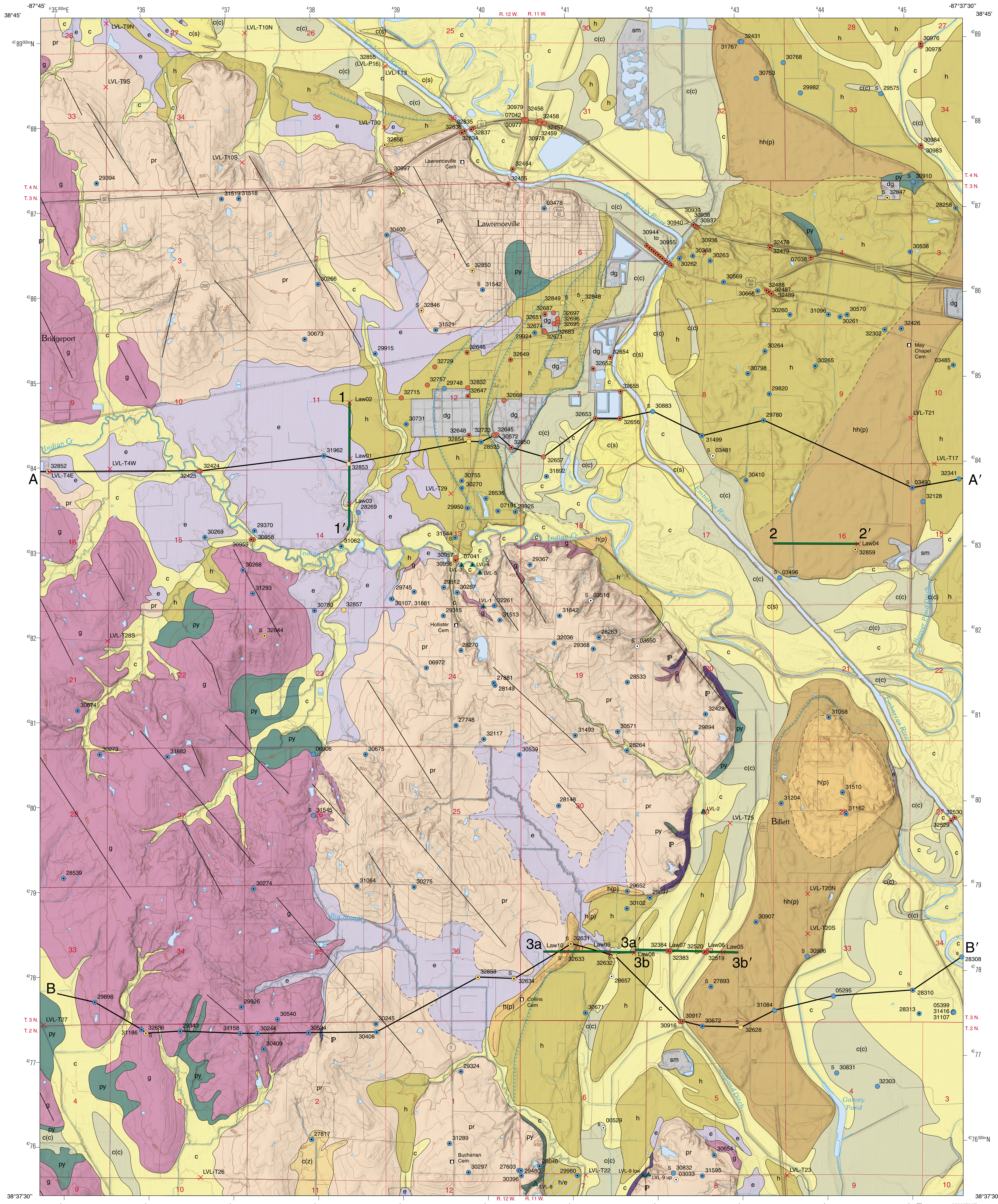
2019

STATEMAP Lawrenceville-SG



Base map compiled by Illinois State Geological Survey from digital data (2018 US Topo) provided by the United States Geological Survey. Shaded relief derived from 2011 Lidar elevation data.

North American Datum of 1983 (NAD 83)
Projection: Transverse Mercator
1,000-meter ticks: Universal Transverse Mercator grid system, zone 16

Recommended citation:
Phillips, A.C., T.H. Larson, J.F. Thomason, A.C. Anderson, and K.M. Mandera, 2019, Surficial geology of Lawrenceville Quadrangle, Lawrence County, Illinois: Illinois State Geological Survey, USGS-STATEMAP contract report, 2 sheets, 1:24,000

SCALE 1:24,000

1 MILE — 7000 FEET — 1 KILOMETER

BASE MAP CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1988

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Illinois State Geological Survey

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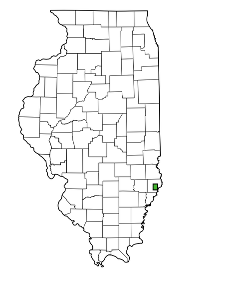


1	2	3
4		5
6	7	8

ADJOINING QUADRANGLES
1 Chauncey
2 Birds
3 Russellville
4 Sumner
5 Vincennes
6 Lancaster
7 Saint Francisville
8 Decker

3½°
TRUE NORTH
MAGNETIC NORTH
APPROXIMATE MEAN DECLINATION, 2019

Geology based on field work by A. Phillips, T. Larson, J. Thomason, K. Mandera, and S. Lohman, 2018–2019.

Digital cartography by Deette Lund and Emily Bunse, Illinois State Geological Survey.

This geologic map was funded in part by the USGS National Cooperative Geologic Mapping Program under StateMap award number G18AC00290, 2018. The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U.S. Government.

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

U.S. Route
State Route
Local road

QUATERNARY DEPOSITS

Description	Unit	Interpretation
HUDSON EPISODE (~13,000 years before present (B.P.) to today)		
Removed earth	Surface Mine (sm)	**Small aggregate pits** exploited channel and outwash gravels, now filled with water
Dug, mounded, and filled earth	Disturbed Ground (dg)	**Removed or reclaimed land**, mapped south of Lawrenceville on abandonded Texaco/Indian Point site and in areas graded for industrial parks. Also shown in cross sections in bridge cones
Silt loam to loam, with local gravel; massive to weakly bedded; yellow brown; less than 10 ft thick	Peyton Formation (py)	**Colluvium;** thin units occur along many foot slopes and can interfinger with alluvial units; derived from loess and till-covered upland
Loam, silt loam, and silty clay loam; local basal sand or pebbly sand beds; fine portion typically massive, but locally laminated or thin bedded; graded upwards; brown to yellow-brown; typically leached; as much as 30 feet thick	Cahokia Formation (c)	**Alluvium;** Less than 10 feet thick in tributary stream valleys draining bedrock uplands; up to 30 feet thick where mapped as undifferentiated alluvium in larger valleys; where lithology of underlying unit is similar, contact is gradational and recognized by buried paleosol
Silty clay loam to silty clay, intercalated with minor loam; massive to weakly stratified; brown to olive brown to black; leached; less than 12 feet thick and more typically 5 ft thick	Cahokia Formation (clayey facies) (c(c))	**Backswamp, flooplain lake, and overbank deposits**
Silt loam to loose silt over loamy sediment to sand; massive, may include loamy interbeds; olive brown to gray brown; leached near surface; as much as 10 feet thick	Cahokia Formation (silty facies) (c(z))	**Alluvium**; single unit mapped in first-order tributary draining loessial upland.
Sand, loamy sand, and sandy loam; very fine to coarse; laminated to thick bedded to massive; fine gravel lenses; yellow brown to brown; leached near surface; typically 5 but as much as 25 feet thick	Cahokia Formation (sandy facies) (c(s))	**Channel, point bar, and levee deposits**; mapped within Embarras River valley; forms terraces along valley walls and buried below other Cahokia Fm facies
WISCONSIN EPISODE (~55,000–13,000 years B.P.)		
Silt loam to clay loam; upper unit massive with gradational contact, brown to yellow brown; lower unit sandier with granules, massive to crudely bedded, brown to reddish brown, leached; upper and lower units as much as 9 feet and 2 foot thick, respectively	Peoria and Roxana Silts (pr)	**Loess;** mapped over all upland surfaces where more than 5 feet thick, intercalates with some of the valley fill; lower Roxana Silt is loess intermixed with colluvium
Sand to sandy loam; fine to coarse; thin bedded to massive, silty and coarse gravel lenses; brown and light brown to gray; locally leached but typically calcareous; as much as 50 feet thick in Embarras Valley	Henry Formation (h)	**Outwash;** comprises the surficial unit on terraces or where dissected by Hudson Episode alluviation, and is buried below Cahokia Fm in Embarras Valley; intercalates locally with Equality Fm; as valley-filling deposit, originally formed sediment dams blocking tributary valleys, where prograding delta facies intercalated with slackwater lacustrine facies; incision by late-glacial flood flows, left veneers of sheet sand on terraces and constructed landforms; low terraces also reworked by post-glacial overbank flows in trunk valleys; local deposits along base of slopes in upper tributary valleys with slackwater fill
Fine sand to loamy fine sand and silt loam; thin-bedded to massive, yellow brown to brown; upper portion leached, as much as 15 feet thick	Henry Formation-(Parkland facies) (h(p))	**Eolian dunes;** reworked from outwash deposits; occur on terraces and bedrock uplands near Embarrass and Wabash Valleys; landforms include parabolic and complex dunes formed by westerly winds; includes small areas of or intercalate with loess
Fine sand to silt loam and coarse sand; thin-bedded to massive, yellow brown to brown; upper portion leached, as much as 15 feet thick	Henry Formation - Henry Formation (Parkland facies) complex (hh(p))	**Eolian dunes, fluvial dunes, and flood channels;** terraces partly incised by late-glacial or early-Hudson Episode flooding; differentiation of eolian and fluvial dunes requires detailed lithological and geomorphic study
Silty clay loam to clay, few silty and sandy interbeds; laminated to massive, fossiliferous zones with gastropod, mussel and ostracode tests, peaty horizons, generally calcareous; gray to gray brown to olive brown; as much as 90 feet thick	Equality Formation (e)	**Shallow to deep slackwater lake deposits** from damming of tributary valleys by outwash of the Wabash Valley train**;** comprises extensive low-relief surficial units in tributary valleys; buried by Cahokia Formation or Henry Formation in river valley fills; inset into Teneriffe Silt in the subsurface; mixed with loess at surface; upper elevations as high as 440 ft asl in Indian Creek valley, but as high as 465 ft asl in Big Slough valley
ILLINOIS EPISODE (~190,000 to 130,000 years B.P.)		
Silt loam to clay; laminated to massive; includes fine sand lenses 1-5 feet thick; olive brown to gray; as much as 30 feet thick	Teneriffe Silt (cross sections only) (tr)	**Lacustrine sediment** in slackwater valley fills; found only in boreholes below surficial unit or below Equality, Henry, or Cahokia Formations; recognized by remnants of eroded Sangamon Geosol developed in upper portion; upper elevations ~405 feet asl
Sand, gravelly sand, and sandy gravel, silty interbeds; medium to poorly sorted; thin bedded; light brown to gray; leached to calcareous; as much as 30 feet thick	Pearl Formation (cross sections only) (pl)	**Outwash;** found in core in tributary valley fills, upper portion may intercalate with Teneriffe Formation, lowermost portion lies above or intercalates with Glasford Formation or lies directly on bedock; may include remnants of eroded Sangamon Geosol in upper portion
Sandy loam to clay loam diamicton; brown to gray; leached to calcareous; generally less than 10 feet thick, but may be thicker where uneroded in bedrock valley bottoms	Glasford formation (g)	**Till;** veneers bedrock hills below Peoria and Roxana Silt Formations, locally exposed in gullies and stream valley walls; mostly eroded from bedrock valleys and may intercalate with Pearl Formation where it was deposited as debris flow; truncated Sangamon Geosol may be developed in upper portion
TERTIARY AND EARLY QUATERNARY		
Sand, loam, and loamy diamicton; gray to olive brown; common fragments of weathered sedimentary rock; leached; less than 5 feet thick	Oak formation (cross sections only) (o)	**Weathered bedrock and associated colluvium;** isolated patches above bedrock

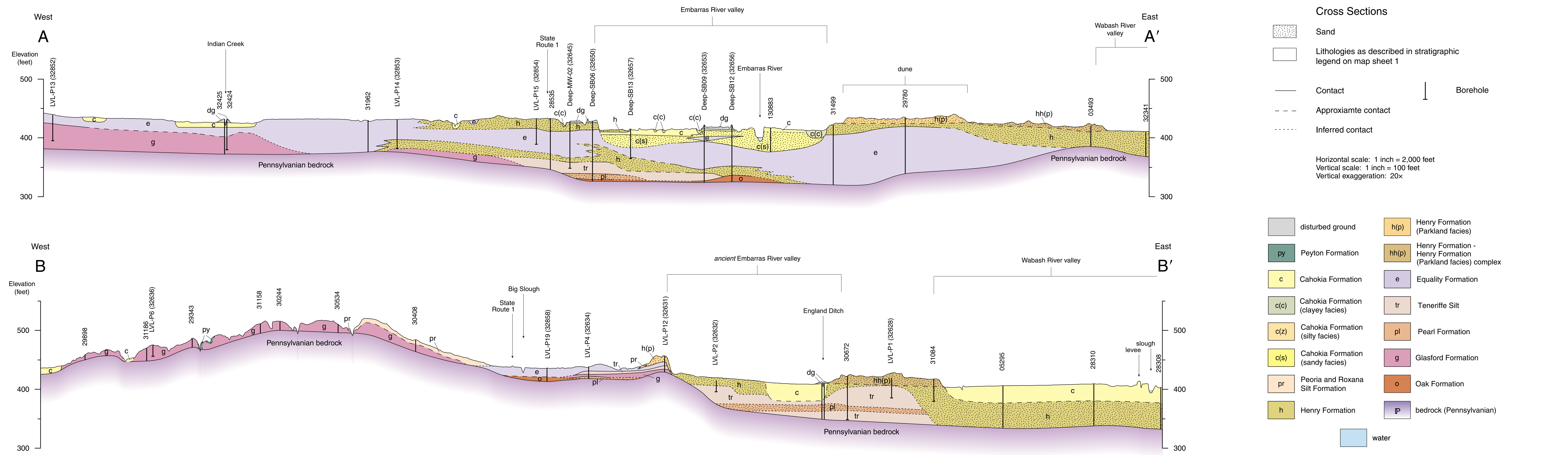
PRE-QUATERNARY DEPOSITS

Description	Unit	Interpretation
PENNSYLVANIAN SUBSYSTEM (323 to 299 million years B.P.)		
Sandstone, shale, limestone, coal	Pennsylvanian Bedrock (IP)	**Sandstone and shale** are most common outcrop and subcrop; mapped as the Oak Formation where deeply weathered

Point Data Type	Line Data Type
Stratigraphic boring	Contact
Water-well boring	Inferred contact
Engineering boring	Terrace scarp
Coal boring	Dune crests
Oil and gas boring	Glacial lineament
Outcrop	A—A′ Line of cross section
Passive seismic sounding	Z—Z′ Electrical resitivity profile line

SG 26211 Labels indicate samples (s) or geophysical log (G).
Boring labels indicate the county number.
Outcrop labels indicate geologist's field number.
Dot indicates boring or outcrop is to bedrock.

Note: 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.



Introduction

The Lawrenceville 7.5' quadrangle includes the confluence of the Embarras River with the Wabash Valley and the surrounding uplands, about 70 river upstream from the mouth of the Wabash River. Both rivers occupy large bedrock channels cut by pre-glacial and glacial rivers. Two small streams drain the upland. Indian Creek flows west-east across a low relief plain to the Embarras River. Big Slough flows southward through an narrow bedrock channel that was abandoned by the Embarras River. Lawrenceville is the County Seat. The Lawrenceville-Vincennes International Airport is 3 miles north of Lawrenceville, and the regional Mount Carmel Airport is 2 miles south of the quadrangle. The main economic activities are health care and manufacturing, but the landscape is dominated by agriculture and petroleum production activities. A large Superfund site in southern Lawrenceville occupies upland and Embarrass River floodplain. This surficial geologic map is part of a long term surficial geologic mapping project (Phillips 2017; Phillips 2016; Phillips et al. 2014; Phillips et al. 2013; Phillips and Gemperline 2012; Bryk et al. 2012) in the lower Wabash River valley region that includes the Illinois-Indiana border. The map adjoins Vincennes Quadrangle, one of the 3D mapping pilot projects that became the Great Lakes Geological Mapping Coalition. The Quaternary geology depicted here represents preliminary results and interpretation from this mapping effort. The map builds upon the existing geologic framework and supports studies of water and aggregate resources, seismic hazard, glacial processes, river processes, and geologic history.

Methods

The surficial geology was analyzed from compilations of boring records archived at the Illinois State Geological Survey (ISGS), unpublished geologic field notes from the ISGS, aerial imagery, and USDA soil surveys (Soil Survey Staff 2018). One hundred eighty nine new geotechnical borings from the Illinois Department of Transportation were added to the ISGS enterprise database. Locations of the water well (n = 148) and geotechnical borings (n = 83) shown on the surficial map were confirmed with the best available data. The geotechnical boring locations are within 1–50 ft of their true locations, whereas the accuracy of most water well locations ranges from 10 to 330 ft. Some of the petroleum wells (n = 10 on surficial map) have sample sets that include Quaternary sediments, and their locations were assumed reasonably accurate. New data were generated by study of 28 sample sets in the ISGS Samples Library, a coring program, electrical resistivity tomography (ERT) surveys, bedrock sounding using passive seismicity, interpretation of recent high-resolution elevation data (Illinois Height Modernization Program 2002-2019), and 22 outcrop descriptions. Coring with hydraulic push methods to depths of 9 to 44 feet totaling 513 ft at 20 sites targeted valley fills, terrace assemblages, and loess thickness. Four sites were explored for geotechnical properties by cone penetrometer and hydraulic profiling (CPT-HPT). Data collected on core samples included particle size analyses by laser diffraction and hydrometer (n = 75), elemental and clay mineral analysis by Energy Dispersive X-Ray Fluorescence, and X-Ray Diffraction (n = 35), and water content (n = 40). Ages of 3 samples were obtained by optically stimulated luminescence. Three ERT transects totaling 3 miles in length imaged the upper 200 m of the subsurface.

The bedrock topography map (Fig. 1) was constructed by machine contouring of point observations and contour interpretations with the Topo to Raster tool in ArcGIS. In addition to the 242 point data shown, and another 63 points within a mile-wide buffer surround the map area were included. Further, because of low data density relative to relief, overall thin sediment thickness, and common outcrop areas, additional synthetic contour data of the bedrock surface elevation were created according to inferred geologic interpretations. The bedrock topography map was constructed from these data as a 30 m raster grid. The unconsolidated sediment thickness map (Fig. 2) was constructed by the same data, but using thickness instead of elevation. Contours derived from the resulting raster were further generalized and smoothed to account for the low density of the primary point data.

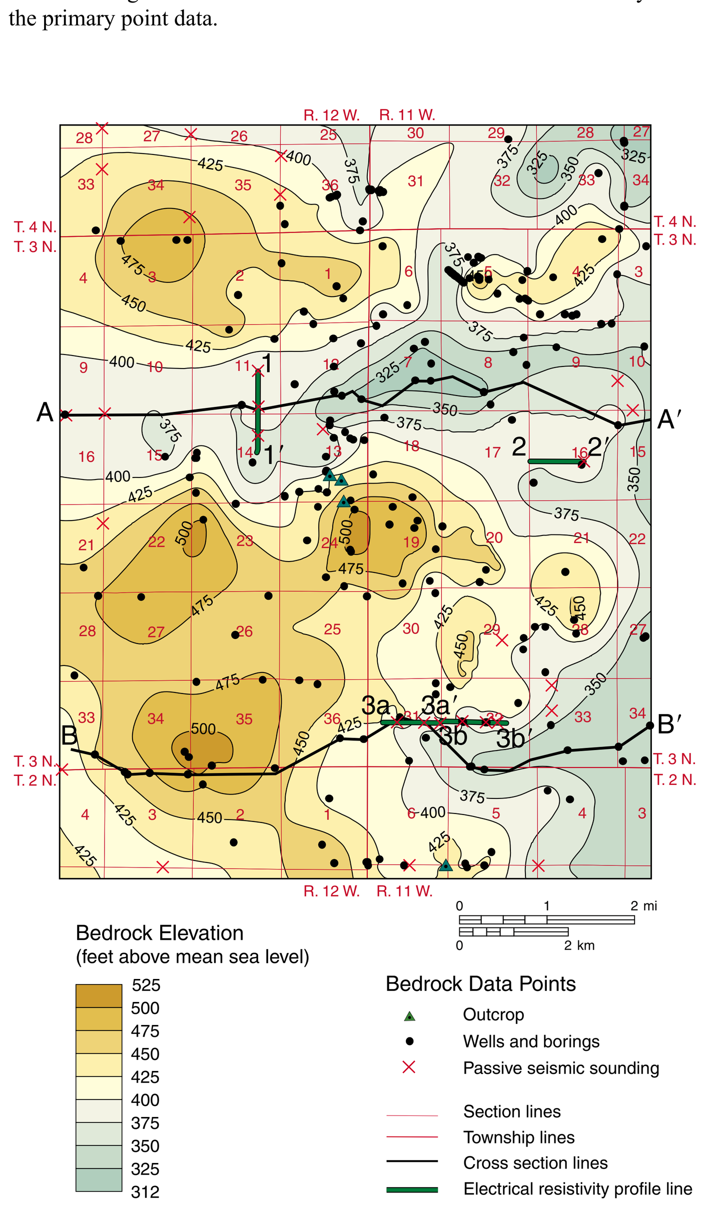


Figure 1 Bedrock Topography. This map was digitally modeled from well log data, sample set studies, outcrop studies, geophysical measurements, and judgement. Some contours were smoothed manually. Map scale is 1:100,000.

Geologic Setting

The Embarras Valley was tributary to the Wabash Valley throughout the Quaternary Period. Faulting and downwarping within the Wabash Valley Fault System (Bristol and Treworgy 1979; Woolery 2005; Hermann et al. 2008) were likely conducive to formation of the Wabash Valley. Ancient seismicity is evident from mapping of liquefaction dikes (Hajic et al. 1995; Munson and Munson 1996) and ongoing seismicity includes the M5.4 Mount Carmel Earthquake, the largest-ever recorded event in Illinois, about 30 miles south of the Lawrenceville (Hermann et al. 2008). Southeastward-flowing ice during the Illinois Episode glaciation, ~160-130 ka, advanced over the area to reach its terminal moraine on highlands in Indiana, ~25 mi to the SE (Grimley et al. 2017; Gray 1988). The iceflow is evident in strong NW-SW glacial lineation across the landscape. As shown on the map, during deglaciation, the Embarras Valleys and the larger Wabash Valley were major meltwater outlets of different lobes of the ice sheet. Outwash deposition filled the valleys and thus dammed tributary valleys to form slackwater lakes. Erosion during the ensuing Sangamon Episode interglacial, ~130–60 ka, removed much of the sediment from the uplands and valleys to expose bedrock. During the Wisconsin Episode, ice of the Huron-Erie lobe first entered the drainage basin ~50 ka. It reached its maximum extent about 60 miles N of Lawrenceville at ~22 ka, and finally retreated from the drainage basin ~13 ka (Dyke 2004; Curry et al 2011). During the deglaciation, aggrading outwash again dammed tributaries valleys to form slackwater lakes that reached nearly the same surface elevations as during the Illinois Episode. Dry and windy climate towards the end of the Wisconsin Episode was conducive to the generation of loess and dunes from extensive unvegetated outwash plains; the thickest deposits accumulated on the eastern side of the Wabash Valley, but a thin blanket of loess covers uplands and intermingles with alluvial deposits, and extensive dunes occur on outwash terraces. Huge floods cascaded episodically down the Wabash Valley during the glacial-interglacial transition when proglacial lakes burst their dams (Fraser 1993; Curry et al. 2014). The floods eroded much of the fill in the Wabash Valley, but bedrock knobs protected some of the deposits. Extensive outwash plains near Lawrenceville were deposited during the wane of the last flood, the Maumee Torrent (Bleuer and Moore 1971). The flood flows left scarps along the border of upper slackwater lake deposits in the lower Embarras Valley and deposited a veneer of fluvial sand on top. The rivers developed into meandering systems during the Hudson Episode postglacial, ~13 ka–present. Repeated episodes of valley fill incision followed by reaggradation resulted overlapping deposits that can be difficult to differentiate (Autin 1996).

Key Findings

Landscape-sediment Assemblages

Landscape-sediment assemblages relate the origin and composition of the landforms. Four main landscape-sediment assemblages were differentiated within the quadrangle. (1) Bedrock-controlled uplands dominate the west half of the quadrangle. The uplands are covered by thin to thicker loess over a veneer of till. The bedrock was exposed by erosion in steeper gullys and along much of the Wabash Valley wall. Incised river valleys include the Embarras Valley at Lawrenceville and the lowermost reach of the Big Slough valley. (2) Broad, flat plains between bedrock uplands are slackwater lacustrine sediment deposits, especially Indian Creek upper Big Slough. The slackwater deposits include alluvial and nearshore sediment along the margins. (3) Outwash terraces dominate the eastern portion of the quadrangle. Late-glacial meltwater flows eroded outwash and slackwater sediments to creating eastward-facing scarps. Sandy ridges topping slackwater terrace edges are interpreted as levee deposits that spilled into the shallow lakes that still occupied the slackwater basins. The sandy deposits are partly reworked into eolian dunes, which also occur on the upland east of Lawrenceville and on the north portion of the high terrace between the Embarras River and England Ditch. The age of the dune at LVL-P12 is ~15 ka. Previous mapping also dated dunes as old as 22 ka (Phillips and Gemperline 2012; Phillips et al. 2013; Phillips 2016). Terraces at about 430 elevation were partially reworked by latest glacial flooding. Terraces at about 420 elevation may represent the channel bed of those flows. (4) Active floodplain and channels of the Embarras River include several small terraces and meander cutoffs. Although the Embarras is largely controlled over this reach, it is not leveed above the Wabash Valley, so flood flows still advance over the floodplain. Some of the crevasse splay and scroll bar morphology is subdued by a veneer of fine overbank sediment in swales. Fine-textured alluvium in smaller tributaries is reworked from older deposits with varied texture

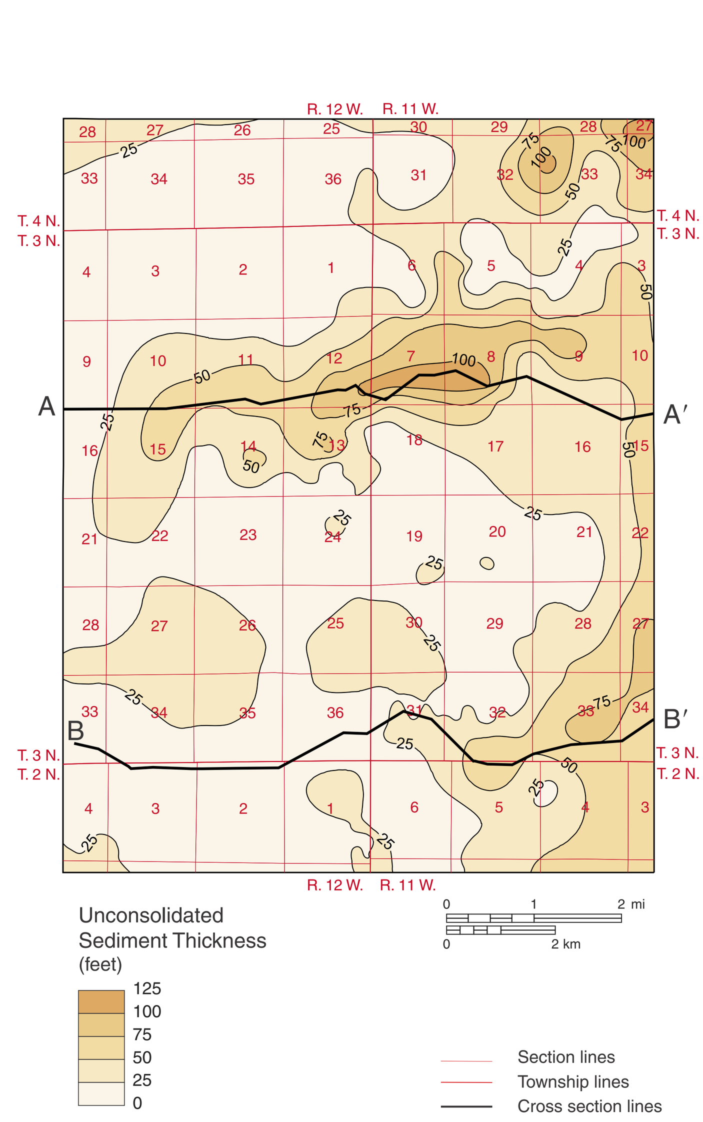


Figure 2 Unconsolidated Sediment Thickness. This map was digitally modeled from well log data, sample set studies, outcrop studies, geophysical measurements, and judgement. Some contours were smoothed manually. Map scale is 1:100,000.

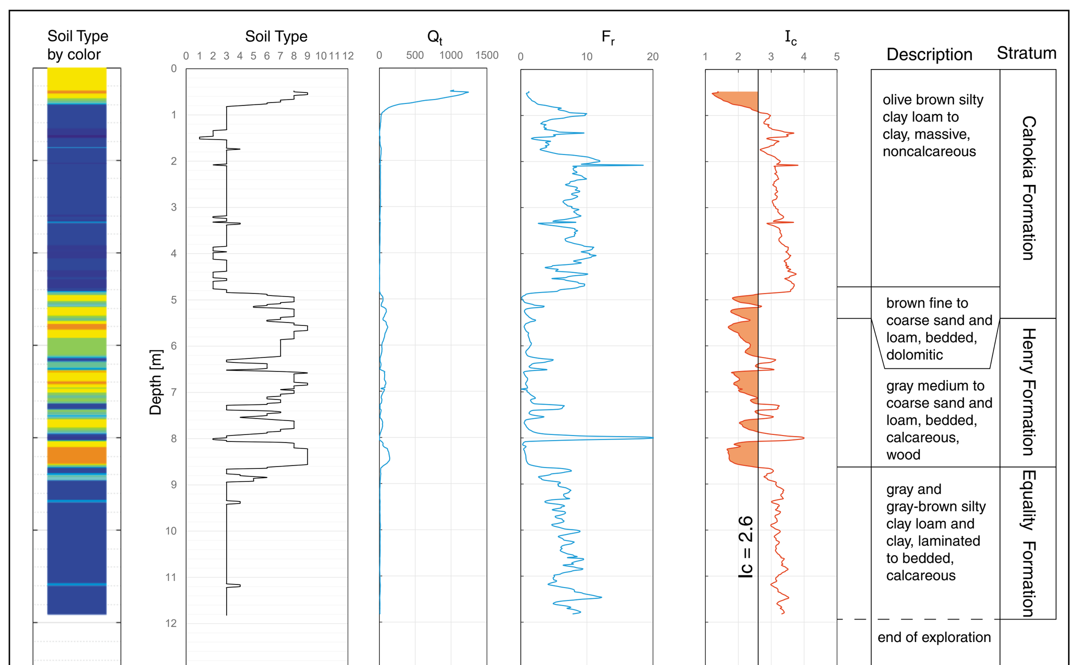


Figure 3 Results from probing and CPT-HPT characterization at the site of LVL-P16 (API # 32855) on the Embarras River floodplain. Q_t = normalized dimensionless tip friction; F_r = normalized dimensionless sleeve friction; I_c = soil behavior type index.

Bedrock Uplands and Buried Valleys

Bedrock, mostly Pennsylvanian sandstone, supports the ridged uplands. Bedrock valleys underlie the Indian Creek and Big Slough terrace and Wabash Valley, but are not coincident with modern stream valleys channels. The tributary valleys were incised before the Illinois Episode.

Bedrock uplands are covered by an 8-10 foot thick blanket of loess, mainly Wisconsin Episode Peoria Silt, over a thin veneer of till of the Illinois Episode Glasford Formation. The till was evidently eroded off the hilltops during the Sangamon Episode, but thin beds were encountered in more sheltered settings. Bedrock, mostly sandstone, is exposed along steep slopes across the quadrangle, and is deeply weathered.

There is regionally strong lineation of ridges trending SSE (Fig. 1; also see Grimley et al. 2017). The lineation includes overall upland valley orientations, narrow ridges on bedrock-supported uplands, and also landforms of unlithified sediment. The SSE orientation parallels the flowpath of the Illinois Episode glaciation, and extends across the Wabash Valley towards the Illinois Episode terminal moraine in Indiana. Although previous researchers had mapped alignment of some ridges (D. McKay, unpublished GIS data), the extent of the lineation could not have been appreciated before the availability of regional lidar elevation data in 2011. The generally weak, uniform shale, sandstone, and coal bedrock with shallow dip provides little obvious structural control. The lineaments were likely caused by glacial erosion. However, landforms of unlithified sediment are also part of the lineation. These could not be explored in this mapping project, so how the landforms could persist through Sangamon Age erosion is uncertain. Imaging of lineaments by ERT by Phillips (2016) showed similar sculpting of bedrock in one ridge, but of unlithified sediment in another.

Illinois Episode Units

The Glasford Formation was mostly eroded off this area. It occurs as only a relatively thin unit, typically <10 ft thick, over the uplands (western cross section B-B′), and was largely removed from the lowlands. In mapping of the Wabash Valley to the south, most occurrences of the Glasford Formation were gray and loamy diamicton where unweathered (Phillips and Gemperline, 2012; Phillips 2016). Borehole LVL-P13 (cross section A-A′), by contrast, may have penetrated two facies. There, 15 ft of gray, loam-clay loam diamicton overlies at least 15 ft of of chocolate brown silt loam diamicton with common wood inclusions and lenses of silt loam. At the boundary between the two are sandy and silty zones. The wood in the lower facies along with inclusions of clast-free fine sediment may reflect incorporation of proglacial lacustrine or alluvial deposits. However, preliminary clay mineralogy results show the upper unit to be higher in illite (61%>45%) and more carbonate rich with more dolomite than calcite (1.45:1 vs. 1:1). Grimley et al. (2018) described similar differentiation of the Vandalia and Smithboro facies of the Glasford Formation.

Fine grained sediment of the Illinois Episode above the Glasford Formation is included in the Teneriffe Silt. Although originally conceived as a loessial unit (Willman and Frye 1970, although mapping practice since Hansel and Johnson 1996 has been to classify solely by lithologic and not genetic criteria), the Teneriffe Silt includes slackwater lake and alluvial facies. It was encountered in 4 probes along cross section B-B′, attesting to original widespread occurrence. Base level control by the Wabash Valley is evident because a thick sequence of Teneriffe Silt extends through the subsurface to where it was scarped in the Wabash. Late-glacial flood flows eroded down to the Teneriffe surface in the Embarras/Big Slough valley. Similar distribution and landforms were mapped in the next drainage downstream by Phillips (2017). Only thin units of the Pearl Formation were encountered in probes or interpreted from logs. Sand and gravel of the Pearl Formation would have been the sediment dam in the Wabash Valley that supported the slackwater lakes. In the eastern portion of B-B′, the Pearl Formation lies on more fine-grained sediment as interpreted from logs. That unit is interpreted as a tongue of the Teneriffe Formation, indicating an episode of incision and re-forming of slackwater conditions.

Slackwater Terraces

The Wabash Valley was a meltwater outlet for several glacial episodes. During each episode, outwash filled the main valley to dam tributary valleys and form slackwater or proglacial lakes, which in turn filled with lacustrine sediment (Heinrich 1982; Fraser 1993). The drainage basins of many of the tributary valleys were quite small. The accumulating sediment may have been directly deposited as loess or in flooding events from the trunk valleys. Horizons with weak soil development and concentrations of plant matter are evidence of episodic drainage. Colluvial and alluvial sediment was deposited along lake margins. The sequence depicted in cross section A-A' is interpreted as several episodes of slackwater lake filling and incision over the Illinois and Wisconsin Episode. Similar sequences were found tributary bedrock valleys to the south (Phillips 2016; Phillips 2017).

The Indian Creek valley fill was explored by coring and EER profiling (cross Section A-A′). Two major episodes of slackwater lake sedimentation were encountered. Ice covered the valley during part of the Illinois Episode. The Henry Formation shown west of the Wabash bedrock valley includes both slackwater lake – forming deposits as the sand prograded up the tributary valleys, as well as deposits left from the highest flood flows in the Wabash Valley during deglaciation (the Maumee event was ~15 ka).

Embarras Valley

The northern portion of the quadrangle includes only the southern margin of the Embarras Valley on the north. The lowermost reach is restricted to a narrow bedrock valley. Bedrock is near-surface and exposed along the several reaches of the valley walls. The configuration of the valley was likely condition by base level control in the Wabash Valley. At one time the Embarras coursed through the even narrower bedrock valley west of Billet, now the course of Big Slough, but the timing is not known. Bedrock elevations >400 ft are higher than the Sangamon Geosol developed in Teneriffe Silt encountered just upstream (cross section B-B′), indicating that the valley is more recent than the Illinois Episode.

Economic and Groundwater Resources

Abandoned sand and gravel pits dot the floodplain. The nearest active aggregate operation is just north of the quadrangle. Sands of the Henry Formation are accessible, but no extensive near-surface gravel deposits were encountered within the quadrangle. That the Embarras and Wabash valley fills provide abundant water is evident by the many municipal wells of Lawrenceville and nearby towns. No significant potential Quaternary aquifer units were found in tributary valley fills. Thicker aquifer materials occur in the Wabash Valley east of the quadrangle.

Seismic Hazard

Four sites were characterized with a cone penetrometer and hydraulic profiling system (CPT-HPT). This system collects the standard geotechnical data gathered by a CPTu system and with the addition of a constant rate fluid injection system (HPT), a relative measure of permeability is also determined. At these sites, twelve CPT soil behavior types were identified that correlate to clay to gravel textural classes (Robertson et al. 1986; Robertson and Campanella 1985). The soil behavior type index, I_c, is utilized as a simplified CPT-based liquefaction triggering criterion: $I_c < 2.4$ are potentially liquefiable, and I_c between 2.4 and 2.6 are potentially liquefiable and require soil testing as defined by Youd et al. 2001. The Robertson and Wride (1988) definition of I_c was applied and is defined in terms of two normalized dimensionless cone parameters, Q and F, derived from tip and sleeve friction measurements, respectively. Potential for liquefaction was found near LVL-P13 (32855) on the Embarras River floodplain (Fig. 3). There, 16 ft of fine-grained floodplain deposits of the Cahokia Formation overlie 13 ft of interbedded fine to coarse sand and silty clay loam, channel deposits. Those, in turn, overlie at least 10 ft of more fine-textured deposits, possibly Equality or Teneriffe Formation. Bedrock was sounded by passive seismic measurements at about 80 ft depth. Most of the sand package had I_c values below 2.6 and thus possible susceptible to liquefaction. Additional geotechnical studies need to be completed to assess the actual hazard of liquefaction.

Acknowledgements

We thank the several landowners who graciously allowed access to their property, especially where drilling was involved. Leaders and staff of the City of Lawrenceville, especially Mayor Don Wagner, the Lawrenceville School District, and the City of Bridgeport were especially helpful. The ISGS drill team accommodated a challenging schedule. Tim Larson's geophysics crew made quick work of their profiling. ISGS staff Shaina Lohman and Katie Mandera assisted with some fieldwork, sample description, and well quality assurance. Deette Lund and Emily Bunse constructed the cartography. CPT-HPT studies were completed under Illinois Department of Transportation award number PTS 1680400101. This map was made possible by the USGS National Cooperative Geologic Mapping Program under STATEMAP award number G18AC00290.

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