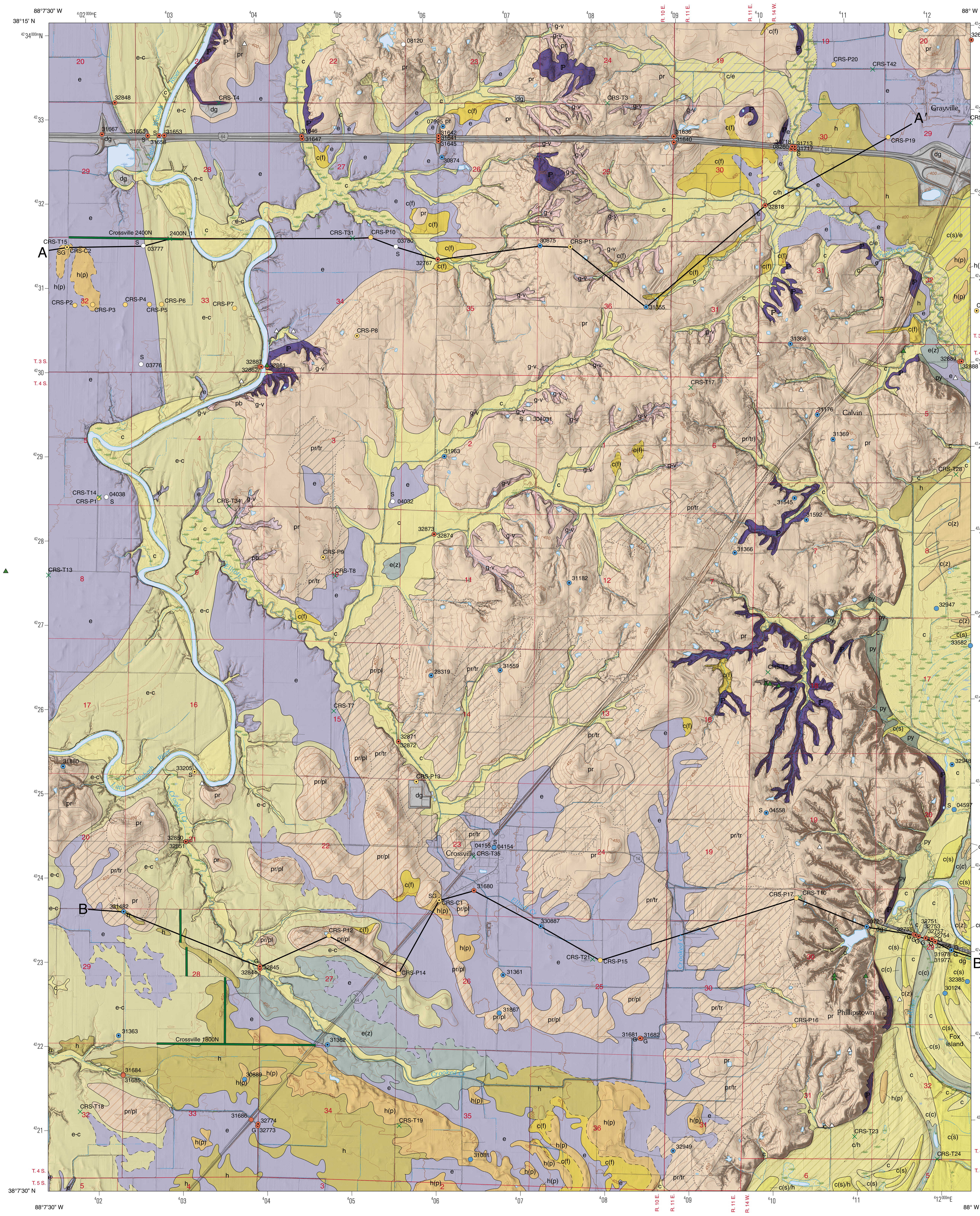
Prairie Research Institute
ILLINOIS STATE GEOLOGICAL SURVEY

SURFICIAL GEOLOGY OF CROSSVILLE QUADRANGLE

WHITE COUNTY, ILLINOIS

A.C. Phillips, K. Mandera, T.H. Larson, and R. Balikian
2020

STATEMAP Crossville-SG



QUATERNARY DEPOSITS

HUDSON EPISODE (~13,000 years before present (B.P.) to today)

Description	Unit	Interpretation
Dug, mounded, and filled earth	Disturbed Ground (dg)	**Pits** and terraced land excavated for road fill and leveled for water treatment plants; fill differentiated along I-64 and eastern IL-14; both coarse and fine sedimentary deposits were exploited; also differentiated in bridge cones of cross sections.
Silt loam; massive to weakly bedded; yellow brown; less than 10 ft thick	Peyton Formation (py)	**Colluvium;** based on Drury soils and geomorphology; fan-shaped mounds and banks along Wabash River valley wall and direct tributaries; interfinger with alluvial units; derived from loess-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 in the Wabash River valley, less than 20 feet thick in the Little Wabash River valley, and less than 10 in tributaries	Cahokia Formation (c)	**Alluvium;** where undifferentiated, may include channel and overbank deposits
Silty clay loam to silty clay; massive to weakly stratified; brown to olive brown to black; leached; less than 10 feet thick and more typically 5 ft thick	Cahokia Formation (clayey facies) (c(c))	**Flooplain lake, abandoned channel fil, and overbank deposits;** differentiated in the Wabash River valley
Silt loam to silty clay loam over loamy sediment to sand; massive to weakly stratified, may include loamy interbeds; brown to yellow brown; leached; mostly a veneer, but as much as 10 feet thick	Cahokia Formation (silty facies) (c(z))	**Stream deposits**; scroll bars and levee deposits; differentiated in the Wabash River valley.
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, levee, and crevasse splay deposits**; differentiated in the Wabash River valley, typically in terraced deposits
Silt loam and silty clay loam; laminated to weakly bedded; leached; yellow brown to brown; typically a veneer up to 5 feet thick, but thicker in fan-shaped deposits	Cahokia Formation (fan facies) (c(f))	**Colluvium (slope deposits):** fan-shaped and some sheet deposits but differentiated from Peyton Formation by finer texture; derived from loess

HUDSON - WISCONSIN EPISODE (~17,000–10,000 years B.P.)

Description	Unit	Interpretation
Clay, silt loam, silty clay loam, fine sand, laminated to massive, calcareous in lower portions, up to 5 feet thick	Equality – Cahokia Complex (e-c)	**Terraces on lacustrine plain;** encompassing border of modern Little Wabash River valley, descending terraces and scroll bars were constructed by incising post-glacial river

WISCONSIN EPISODE (~55,000–13,000 years B.P.)

Description	Unit	Interpretation
Silt loam to gritty silt loam; upper unit massive with gradational contact, brown to yellow brown; lower unit sandier with granules, massive to crudely bedded, brown to strong brown, leached; upper and lower units as much as 9 feet and 2 foot thick, respectively	Peoria and Roxana Silts (pr)	**Loess (windblown silt);** mapped over most upland surfaces where more than 5 feet thick, thinner along ridges where it was eroded; 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; upper part may be leached but typically calcareous; as much as 50 feet thick in the central Little Wabash and Wabash River valleys, up to 20 fit thick in other landscape positions	Henry Formation (h); (where buried)	**Outwash (proglacial meltwater deposits);** comprises the surficial unit on terraces, is buried below other units in the trunk valleys, and intercalates with Equality Fm locally; outwash filled the Wabash River valley to form sediment dams that blocked tributary valleys, where prograding delta facies intercalated with slackwater lacustrine facies; in the Little Wabash River valley, outwash also originated from upstream; low terraces were reworked by post-glacial overbank flows in trunk valleys
Fine sand to loamy fine sand; 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 and lake deposits; occur on terraces and in the Little Wabash Valley; landforms include parabolic and complex dunes formed by westerly winds; older deposits intercalate with loess
Silty clay loam to clay, few silty and sandy interbeds; laminated to massive, fossiliferous zones with gastropod, mussel and ostracode tests and plant fragments, peaty horizons, generally calcareous; gray to gray brown to olive brown; as much as 40 feet thick	Equality Formation (e); (where buried)	**Slackwater lake deposits;** shallow to deep lakes were formed by damming of tributary valleys by outwash of the Wabash Valley train; comprises extensive plain in Lower Wabash Valley, where it intercalates with Henry Fm and Peoria and Roxana Silts; buried by Cahokia Fm or Henry Formation in lower valley fills; also occurs in terraces with upper elevations as high as 410 ft asl in smaller tributary valleys. Likely deposited during early and late intervals of the Wisconsin Episode.
Silt loam to silty clay loam, laminated, gray brown, calcareous, less than 10 feet thick	Equality Formation (silty facies) (e(z))	**Shallow water or shoreface facies;** interpreted from Uniontown and Henshaw soils; intercalates with undifferentiated Equality Fm

ILLINOIS EPISODE (~190,000 to 130,000 years B.P.)

Description	Unit	Interpretation
Silt loam to clay; laminated to thick bedded to massive; olive brown to gray; leached within paleosol; gastropod shell and wood fragments where calcareous; typically thin but up to 10 feet thick	Teneriffe Silt (tr); (where buried)	**Lake sediment and loess;** found in boreholes below surficial units, and as outcrop in steep tributaries to the Wabash River; recognized by remnants of eroded Sangamon Geosol developed in upper portion; upper elevations ~440 feet asl
Sand, gravelly sand, and sandy gravel, silty interbeds; medium to poorly sorted; thin bedded; light brown to gray; leached to calcareous; up to 70 feet thick in Little Wabash bedrock valley thalweg, up to 40 feet thick elsewhere	Pearl Formation (cross sections only) (pl)	**Outwash;** occurs in bedrock valley fills, and as incised terraces forming hills on the Little Wabash River valley plain, where it is capped by loess and surrounded by Wisconsin Episode lacustrine sediment or outwash; covers bedrock or till; includes remnants of eroded Sangamon Geosol in upper portion
	(where buried)	occurs on hills protruding from Little Wabash River valley plain
Clay loam, loam, or sandy loam diamicton; local sand lenses; may include wood fragments or organic smell; rare granitic boulders; brown to gray; leached to calcareous; up to 20 feet thick on uplands, up to 70 feet thick where buried.	Vandalia Member Glasford Formation (g-v)	**Till;** veneers bedrock hills below Peoria and Roxana Silt, Teneriffe Silt, or Pearl Formations, but locally eroded from hilltops, exposed in gullies and stream valley walls; interpreted to extend across much of Little Wabash Valley, eroded from Wabash Valley; intercalates with tongue of Petersburg Silt; truncated Sangamon Geosol developed in upper portion
Si**lt loam to silty clay**; few sand lenses; laminated, thick bedded, or massive; wood, needles, seeds, and gastropod fossils in some zones; dark gray to gray brown; up to 50 feet thick may include clay loam to silty clay load diamicton up to 16 feet thick	Petersburg Silt (cross sections only) (pb)	**Proglacial slackwater lacustrine sediment;** interpreted as extensive across the lower Little Wabash River valley; may include diamicton interpreted as debris flow
Sand, gray, 10 to 60 ft thick	Grigg Tongue - Pearl Formation (cross sections only) (pl-g)	**Proglacial meltwater stream sediment** deposited during ice sheet advance; May have dammed valleys to form slackwater lakes

PRE-ILLINOIS EPISODE (~700,000 - 420,000 years B.P.)

Description	Unit	Interpretation
Loam to clay loam diamicton; massive; angular to subangular granules to pebbles of sandstone, dolomite, and chert; dark gray to olive brown; leached to dolomitic to calcareous; up to 14 feet thick	Banner Formation (cross sections only) (b)	**Till;** recognized by strong paleosol developed in upper 8 feet, including a fine-grained cumulic facies; occurs as remnant in bedrock-protected area; observed in CRS-P15, but possibly correlates to nearby geotechnical boring
Sand; fine to medium, trace fine to medium pebbles with sedimentary and crystalline lithologies; weakly bedded; olive brown; up to 5 ft thick	Banner Formation, sand facies (cross sections only) (b(s))	**Outwash;** observed in CRS-P15, may correlate to nearby geotechnical borings

PRE-QUATERNARY DEPOSITS

PENNSYLVANIAN SUBSYSTEM (323-299 million years B.P.)

Description	Unit	Interpretation
Sandstone and shale	Pennsylvanian Bedrock (ℙ)	**Sandstone and shale** occur as outcrop on steep hillslopes and in upland stream valleys and as subcrop; near surface and covered only by loess on some uplands

Base map compiled by Illinois State Geological Survey from digital data (2018 US Topo) provided by the United States Geological Survey. Shaded relief and contours 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

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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
NATIONAL GEODETIC VERTICAL DATUM OF 1988

Geology based on field work by A.C. Phillips, K. Mandera, S. Lohman, and A. Sanchez, 2020.

Digital cartography by Emily Bunse, Deette Lund, and Katie Mandera, 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.

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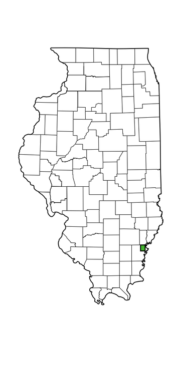


1	2	3
4		5
6	7	8

ADJOINING QUADRANGLES
1 Golden Gate
2 Albion South
3 Grayville
4 Centerville
5 New Harmony
6 Carmi
7 Maunie
8 Solitude

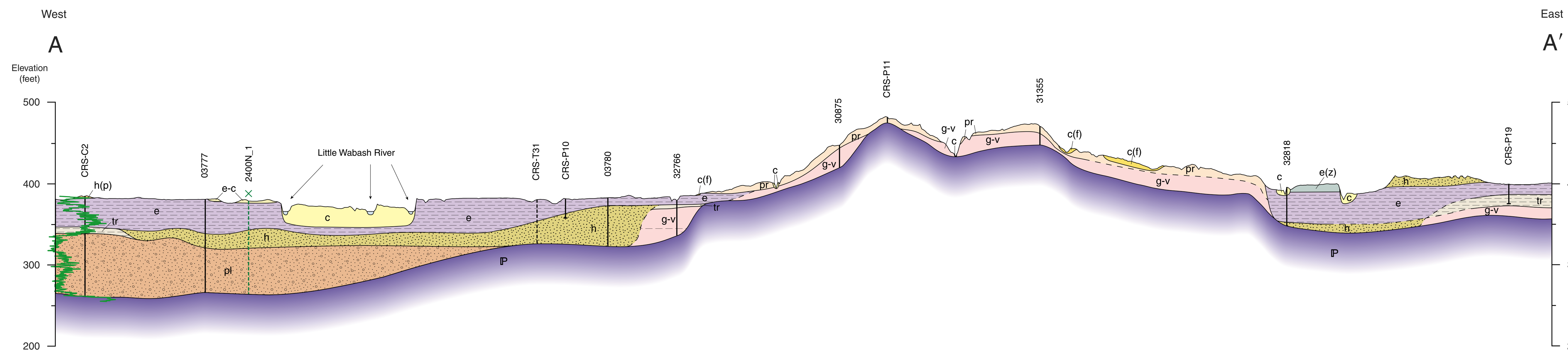
3°
TRUE NORTH
MAGNETIC NORTH
APPROXIMATE MEAN DECLINATION, 2019

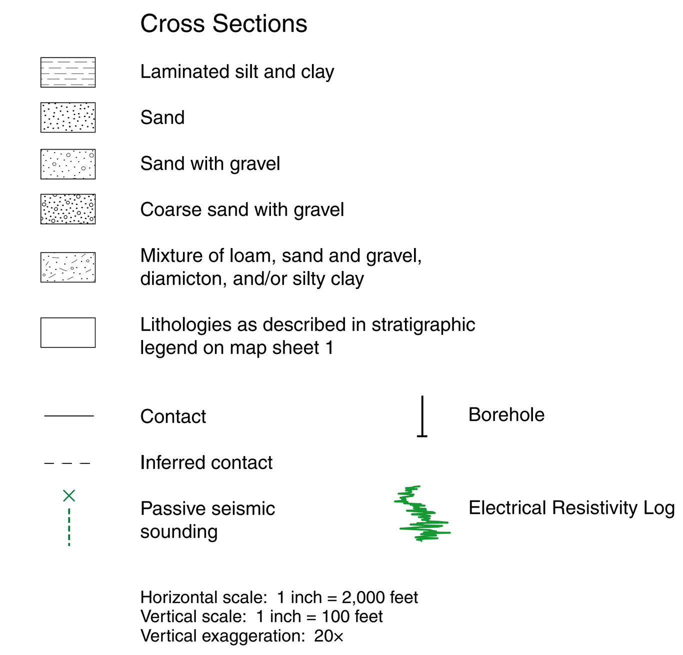
ROAD CLASSIFICATION
Interstate Route — Local road
State Route

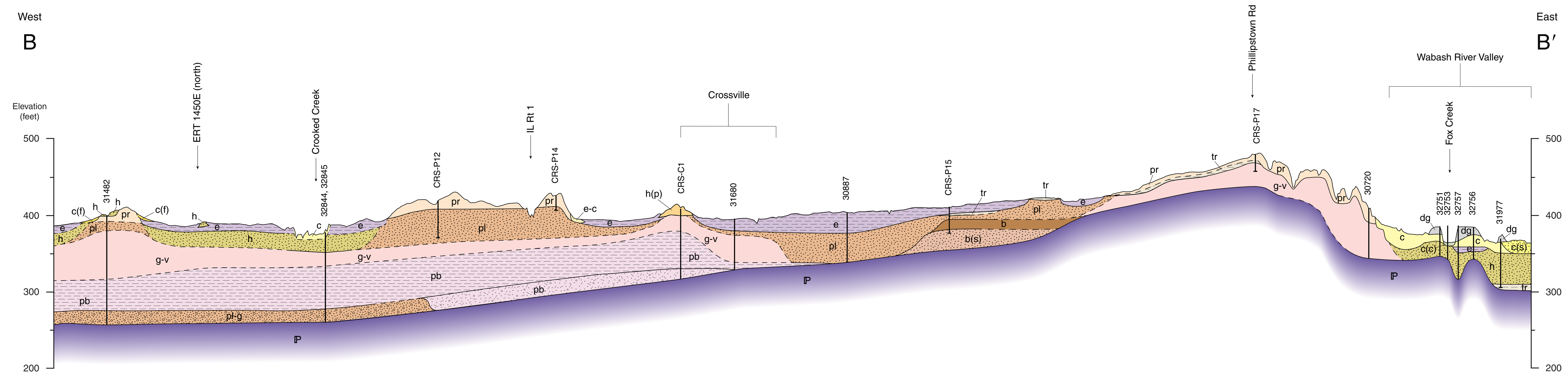
Point Data Type
- Stratigraphic boring
- Engineering boring
- Oil and gas boring
- Outcrop
- Water-well boring
- Coal boring
- Passive seismic sounding
- Historical outcrop

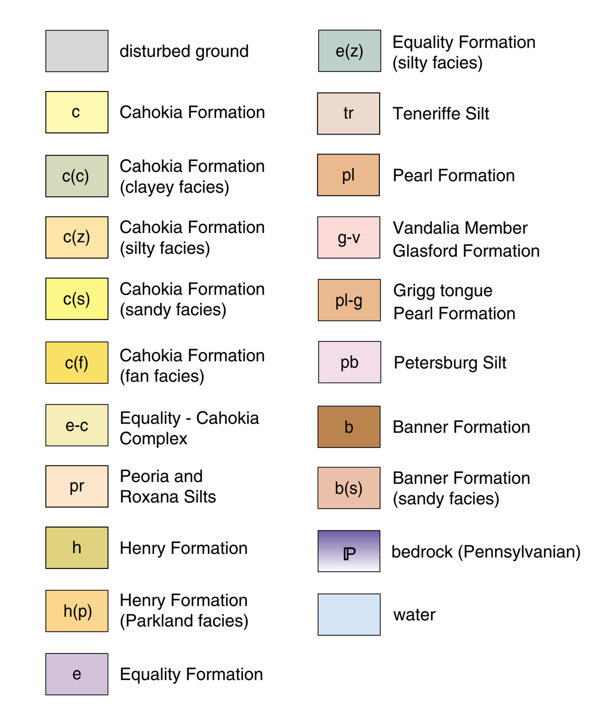
SG 31681 — Labels indicate samples (S) or geophysical log (G). Boring labels indicate the county number. Dot indicates boring or outcrop is to bedrock. Note: The county number is a portion of the 12-digit API number on file at the ISGS Geological Records Unit. Most well and boring records are available online from the ISGS Web site.

Line Data Type
- Contact
- Buried contact
- Inferred contact
- A—A′ Line of cross section
- Electrical resitivity profile line









Introduction

The Crossville 7.5' Quadrangle includes the confluence of the Little Wabash River valley (LWRV) with the Wabash River valley (WRV), and the intervening uplands, about 25 miles upstream from the mouth of the Wabash River. The Little Wabash and Wabash rivers occupy bedrock valleys cut by pre-glacial and glacial rivers. Small streams drain the uplands. Tributaries along much of the WRV wall are steep and largely intermittent, whereas most others have gentle gradients and low energy. Most of the quadrangle has a low population has low density, although the southernmost portions of Grayville are included. Across the landscape, the main economic activities are agriculture and petroleum production. Interstate 64 traverses the northern boundary, where around the interchange in the northeast corner businesses supporting travel have sprouted. This surficial geologic map is part of a long term surficial geologic mapping project (Phillips et al. 2019; Phillips, 2017; Phillips 2016; Phillips et al. 2014; Phillips et al. 2013; Phillips and Gemperline 2012; Bryk et al. 2012) in the lower WRV. The Quaternary geology depicted here represents preliminary interpretations 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 soil surveys (Soil Survey Staff 2018). Locations of the water well (n = 38) and geotechnical borings (n = 63) shown on the surficial map were confirmed with the best available data, including engineering drawings, historic plat maps, tax records, and aerial photographs. Most of the water well locations shown range from 10 to 330 ft of their true locations, though some may be yet further afield because of generalized plat map information. Geotechnical boring locations are within 1-50 ft of their true locations. Some of the petroleum wells (n = 8 on surficial map) have sample sets that include Quaternary sediments, and their locations were assumed reasonably accurate. Fieldnotes from previous geologists provided additional insight on bedrock occurrences and Quaternary deposits (n = 23). New data were generated by study of the 8 sample sets in the ISGS Samples Library, a coring program, electrical resistivity tomography profiling, bedrock sounding using passive seismicity, interpretation of recent high-resolution elevation data (Federal Emergency Management Agency, 2012), and 9 outcrop descriptions. Coring with hydraulic push methods to depths of 8 to 53 feet totaling 470 feet at 20 sites targeted valley fills, terrace assemblages, and loess thickness. Coring with wireline methods at 2 locations (95 feet and 120 feet depth, respectively) were able to penetrate the entire fill of the LWRV and reach bedrock. Natural gamma logs were collected at those sites. Data collected on core samples included particle size analyses by laser diffraction and hydrometer (n = 38), elemental and clay mineral analysis by Energy Dispersive X-Ray Fluorescence (n=18), and X-Ray Diffraction (n = 3), and water content (n = 40). Plant and shell remains in 14 samples were dated with radiocarbon, and the age of 1 sample was obtained by optically stimulated luminescence. The horizontal to vertical spectral ratio passive seismic technique was used to sound bedrock depth at 21 locations with generally good results. A series of earth electrical resistivity transects (ERT) totaling 3.8 miles in length imaged the upper 200 m of the subsurface (Larson et al. 2020).

The bedrock topography map (Fig. 2) was constructed by machine contouring of point observations and contour interpretations with the Topo to Raster tool of ArcGIS. In addition to the 168 data points shown, and another 54 points in a mile-wide buffer surround the map area were included. Further, because of low data density relative to relief, thin sedimentary cover with common outcrop areas on the uplands, 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. 3) was constructed with the same locations 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.

Geologic Setting

The landscape of the Crossville Quadrangle was constructed by pre-glacial erosion of the major river valleys, glaciation during the pre-Illinois Episode (about 700,00 to 420,000 years ago) and the Illinois Episode (about 190,000 to 130,000 years ago), slackwater lake deposition during periods when outwash filled the WRV, and erosion of those deposits during intervening periods. Proglacial sedimentation during the Wisconsin Episode (about 55,000 to 13,000 years ago) resulted in much of the low relief landscape seen today. Central to the Crossville landscape is a north-south bedrock-support ridge which separates the Little Wabash and Wabash river valleys. To the west of the ridge lies a portion of the LWRV lacustrine plain. Protruding from portions of this plain east of the Little Wabash River are hills formed of either bedrock or eroded sediment. Relict parabolic sand dunes also contribute relief, especially south of Crooked Creek. By contrast, portions of the plain are nearly featureless, such as in the far northwest corner. Bounding the Little Wabash River, a series of descending levees mark episodes of downcutting by the post-glacial river. To the east of the bedrock ridge, only the very edge of the WRV is included in the map area. Geomorphic elements there include glacial- and post-glacial terraces, and tracts of meandering river deposits.

Bedrock topography

The bedrock is mostly shale and sandstone, with, perhaps, sandstone predominating under the uplands. There is as much as 200 feet of relief on the surface, and up to 75 feet of relief along the upland that dominates the central portion of the quadrangle. Upland hilltops are covered by as much as 25 feet of sediment, but some hilltops have been eroded to 5 feet or less. To the east, the upland descends sharply to the WRV and rock crops out in many steep tributaries. To the west, a broad plain covered by 25-50 ft of sediment occurs. The western slope then descends to the wide and flat bottom of the LWRV. Still uncertain at the conclusion of this project is how that thalweg connects with the bottom of the WRV. Borings and ERT data within map area, as well as south of map boundary (e.g., MNE-C1, API 121933319500) show bedrock as deep as 275 feet asl and lower. However, other nearby well-located and well-described borings in the path of possible thalweg configurations show bedrock over 325 feet asl. Any thalweg passing through would be tortuous and narrow.

Depositional systems

Pre-Illinois Episode Deposits

The boring CRS-C1 (cross section B) encountered 14 feet of olive brown to dark gray loam to clay loam diamicton, interpreted as till. The upper 5 feet was leached of calcite where it was included in a paleosol, interpreted as the Yarmouth Geosol. That unit overlay olive brown fine to medium sand. This is the first time pre-Illinois Episode deposits have been encountered since we began mapping the lower Wabash Valley. They appear to have been preserved from erosion by shelter along the bedrock valley wall.

Illinois Episode Deposits

Glacial ice advanced to about 20 miles south of Crossville during the Illinois Episode. Outwash (Grigg Tongue, Pearl Formation; Grimley and Webb 2010) filled at least the lower portion of the LWRV and probably the WRV. Borehole CRS-C1 (cross section B) encountered two separate diamicton units separated by a 50-foot-thick fine-grained unit. The lowermost diamicton is a gray to dark grayish brown clay loam to silty clay loam with cobble and boulder clasts and relatively varied texture. The uppermost diamicton is loamy and hard with mainly medium to fine pebble-sized clasts, and is leached of calcite within the roots of the Sangamon Geosol. The intervening fine-grained unit is laminated to massive, with zones of gastropod and mussel fossil remains. Similarity of clay mineral contents between the upper and lower diamictons suggests that they are from the same source. Deposition of this sequence may have been initiated by blockage of the LWRV by outwash sedimentation in the WRV to form a slackwater lake, possibly in contact with the advancing ice. At some moment during filling of the lake with fine sediment, a debris flow spawned off of the ice front eroded along the valley bottom to be deposited as the lower diamicton. The upper diamicton was deposited as the ice overrode the LWRV. Till was simultaneously draped across the rest of the landscape, as well. In cross section B, the lower diamicton is classified as a facies within the fine-grained unit, the Petersburg Silt. The upper diamicton is classified as the Vandalia Member, Glasford Formation. Portions of the higher bedrock hills feature only Wisconsin Episode sediment over bedrock (cross section A). It is unclear whether till was never deposited on them or whether it was deposited but later eroded off. The second case would suggest that the till cover was not thick.

During deglaciation, meltwater again filled the valleys, eroding some older deposits and aggrading sand with some gravel to elevations above 420 feet (Pearl Formation). Very late glacial sedimentation included stream, lake, and loess deposits (Teneriffe Silt Formation) that further aggraded the valley to as much as 480 feet, as evident in borehole data (CRS-P17, cross section B) and outcrop (CRS-3, 2 miles northeast of Crossville).

The ensuing Sangamon Episode (about 130,000 to 60,000 years ago) was one of soil development and erosion of the landscape. As much as 50 feet of incision into the Teneriffe, Pearl, and Glasford Formations left terraces on valley walls and hills protruding from the LWRV plain. Some of the hills appear to be cored by till, whereas others are cored by outwash, similar to mapping by Lineback (1979). It is possible that some of the hills were constructional, formed by deposition of ice-contact deposits (Hagarstown Member, Pearl Formation), but gravels and sands encountered in this study were well sorted rather than exhibiting the expected textural variability of the Hagarstown Member including diamicton.

Wisconsin Episode Deposits

During the Wisconsin Episode, ice reached only as close as 80 miles north of the Crossville area. Proglacial sedimentation included the coursing of abundant outwash down the WRV, which again dammed tributaries form slackwater lakes (Fraser 1993). Deposits of sand and gravel outwash (Henry Formation) fill the mouths of the LWRV at the south end of the map, as well as the French Creek valley south of Grayville. Buried Henry Formation is shown in the LWRV, cross section A. The maximum thickness of 45 feet seems high so far from the LWRV mouth. However, outwash was likely not sourced from the upper Little Wabash because that stream does not reach the Wisconsin Episode terminal moraine (Lineback 1979).

Fine-grained deposits in the slackwater lakes occur as Equality Formation (Heinrich 1982). The lakes reached elevations up to 410 feet asl, and the deposits form the vast plain that fills much of the lower LWRV at about 385 feet. The lake reached about 50 miles upstream. Equality Formation is as much as 40 feet thick in the central LWRV, but more typically 5-20 feet thick where the lake interfingered with bedrock- and sediment-cored hills across the plain. Along the shores of the lake, wave energy was higher as the lake shallowed, so lake sediment was slightly coarser and is classed as Equality Formation, silty facies.

Slackwater lakes also occurred in the WRV. Borehole CRS-C18, obtained 1 mile south of the Grayville interchange, penetrated a long-lived lake within the WRV. There, under 9 feet of weathered, bedded clay, silty clay, clay loam, and sand, is a 41-foot-thick sequence of gray silt loam and clay with few sand interbeds. Included are zones of abundant aquatic fossils and dispersed plant fragments and seeds. Beds of plant matter up to 1 inch thick indicate episodes of low sedimentation. Nine (9) radiocarbon dates were obtained on organic matter from within this sequence (Table I). They reveal a 10,000-year sequence of deposition, from 32,300 +- 330 to approximately 26,600 +-100 calibrated years ago, preceding the last glacial maximum.

A date previously reported by Phillips et al. (2014) from an isolated outcrop of lake sediment about 0.4 miles north of Phillipstown (MNE-6, obtained in 2018) of 45,000 +/- 1,500 years ago (45,100 +/- 1,300 calibrated years ago) suggests early Wisconsin Episode glaciation of the watershed. The age is consistent with other documented early Wisconsin Episode lake deposition in a basin across the WRV (Phillips et al. 2019). The outcrop occurred at an elevation of 400 feet. We were not able to determine if the deposit correlates to the lake sediment at CRS-3. If so, the stratigraphic classification of that unit may need to be revised.

During dry and windy periods in the Wisconsin Episode, winds reworked sediment on the extensive valley plains. Sandy deposits were reworked into parabolic dunes (Parkland facies, Henry Formation), and dust was deposited on the uplands as loess (Peoria and Roxana Silt). The featureless plain in the northwest corner off the map indicates that lake sedimentation continued past the period of most active wind activity.

A major event to mark the end of glaciation was flooding of the WRV by the Maumee Torrent, which may have actually been several events culminating about 14,000 years ago (Bleuer and Moore 1971). Although huge quantities of outwash were transported by the flood waters, the cumulative effect in this region was to excavate older deposits in the WRV. This reduced the base level of the Little Wabash River.

Hudson Episode Deposits

The lowered base level of the Little Wabash River induced downcutting. This is evident in the series of descending scroll bars bordering the modern river (Equality-Cahokia complex). The scrolls are thin silty to sandy levee deposits separated by partly eroded slackwater lake sediment. Some tributaries have been blocked by more recent aggradation of the Little Wabash River, but neither the timing nor the cause were determined in this project.

Steeper hillslopes were conducive to mass failure. Coarser deposits are shown as Peyton Formation, whereas finer deposits, likely derived from loess, are shown as Cahokia Formation, fan facies. In the tributary valleys, active streams deposited sediment reworked from the loess and till on the hillsides (Cahokia Formation, undifferentiated).

Downcutting also occurred in the WRV, leaving terraces at the base of the valley wall. Several are included on this map. With the post-glacial reduction of sediment and water load, the Wabash River developed into a meandering system. The active stream constructed scroll bars and crevasse splay deposits (Cahokia Formation, sandy or silty facies) and isolated floodplain lakes or meander cutoffs (Cahokia Formation, clayey facies). Flood deposits (Cahokia Formation, undifferentiated) subdued the landscape.

Economic and Groundwater Resources

Abandoned sand and gravel pits occur, though were mainly associated with borrowing for the interstate construction and are abandoned. Sands of the Henry Formation are accessible but are largely fine sand. The Wabash valley fills provides abundant water for Crossville and, further north, Grayville (Phillips and Gemperline 2012). The 50-90-foot-thick deposits of Henry and Pearl Formation in the LWRV could provide local water supply, especially in the gravelly portions (west end of cross sections A and B). However, half of known water wells tap bedrock sources rather than surficial sources.

Seismic Hazard

Several liquefaction dikes were identified in stream cutbanks in the Crossville region (Hajic et al. 1995). The areas of buried fine sands covered by lacustrine sediment could be conducive to liquefaction. We were not able to search for additional liquefaction features because of pandemic restrictions during the annual period of low water.

Important Findings

1. Hills protruding from the LWRV plain are either bedrock-cored or remnants of incised Illinois Episode deposits.

2. Late Illinois Episode outwash and lake sediment were deposited at elevations as high as 420 feet and 480 feet, respectively,

3. In CRS-P17, Pre-Illinois Episode deposits were encountered for the first time in recent mapping of the WRV.

4. A series of radiocarbon dates through a 50-foot-thick section of CRS-P18 provide clear evidence of early Wisconsin Episode slackwater lake formation and thus glaciation of the watershed. The dates are consistent with finding in other slackwater lake deposits of the lower WRV (Phillips et al. 2018).

5. Electrical resistivity tomography profiles confirmed the thickness of Equality Formation in the LWRV, variable texture within the basal sand (Henry and Pearl Formations), and the contour of the bedrock surface (cross section A; Larson et al. 2020). In cross section B, ERT confirmed the thickness of the sand in the upper valley fill (Henry Formation), as well as confirming the contour of the bedrock surface.

Acknowledgements

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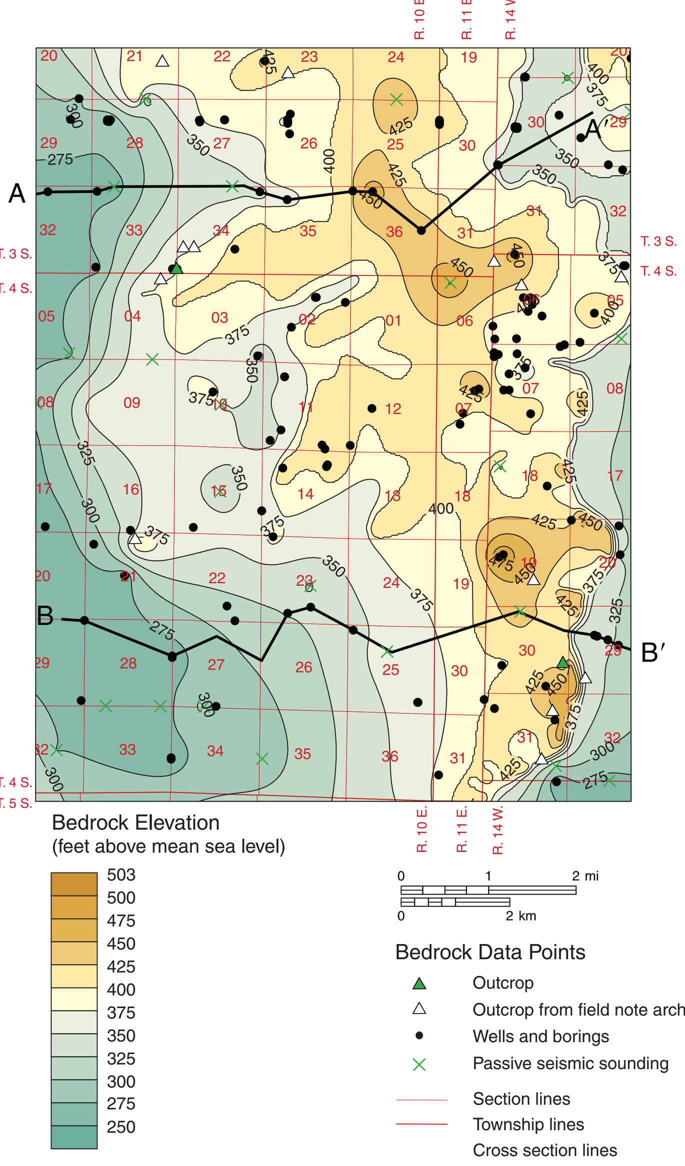
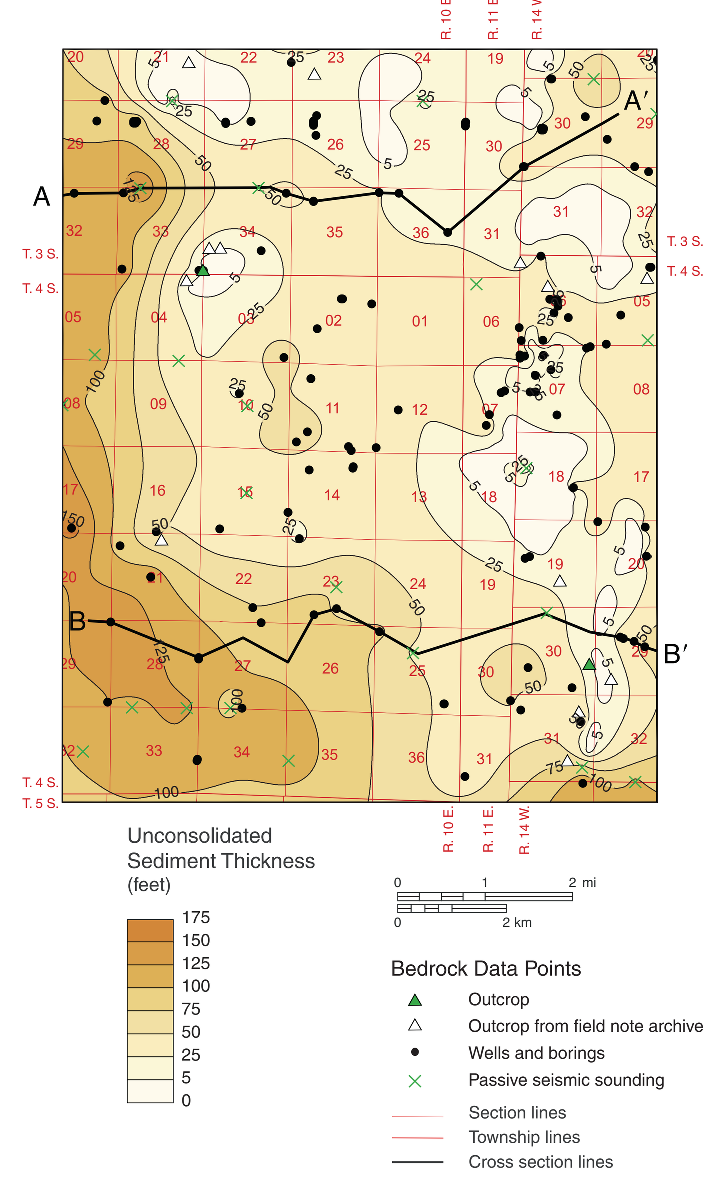


Bedrock topography. This map was digitally modeled from well log data, sample set studies, outcrop studies, geophysical measurements, and judgement. Some contours were smoothed manually. Map scale is 1:100,000.



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.

Table 1 Radiocarbon Dates

ISGS#	Sample Number	Depth (ft.)	Elevation (ft. asl)	Material	Radiocarbon Years B.P.	+-	Calibrated Years B.P.*	+-	Years B.P,**	+- (1σ)
A3146	MNE-6***	2	390	needles	45,000	1,500	48,400	1,550		
A4962	CRS-P18	10	370	plant macrofossils	22,350	110	26,535	85	26,800	110
A4963	CRS-P18	11.7	368.3	plant macrofossils	22,570	120	26,580	70	27,015	135
A4964	CRS-P18	15.7	364.3	wood fragments	23,900	120	27,990	170		
A4965	CRS-P18	20.4	359.6	blackened sedge	25,200	140	29,450	220		
A4966	CRS-P18	29.6	350.4	blackened sedge, moss	26,440	160	30,550	115	30,810	125
A4984	CRS-P18	30.4	349.6	plant macrofossils	26,920	180	31,090	90		
A4968	CRS-P18	32.6	347.4	wood fragments	28,320	200	32,240	190	32,650	205
A4969	CRS-P18	45.1	334.9	plant macrofossils	30,850	280	35,130	325		
A4970	CRS-P18	46.7	333.3	plant macrofossils	32,300	330	36,620	330		
A4982	CRS-C2	10.7	374.3	plant macrofossils	19,410	80	21,553	204	21,832	139
A4983	CRS-C2	37.7	347.3	shell	25,450	80	28,170	293		
735	CRS-C2	55	330	feldspar			76,800	6,000		

*Radiocarbon ages calibrated to calendar years before 1950 (Intcal20; Reimer et al., 2020) using CALIB v. 8.1.0 (Stuiver and Reimer 2020)
**Portions of the calibration curve include 2 possible ages
***previously reported in Phillips et al. (2014)