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

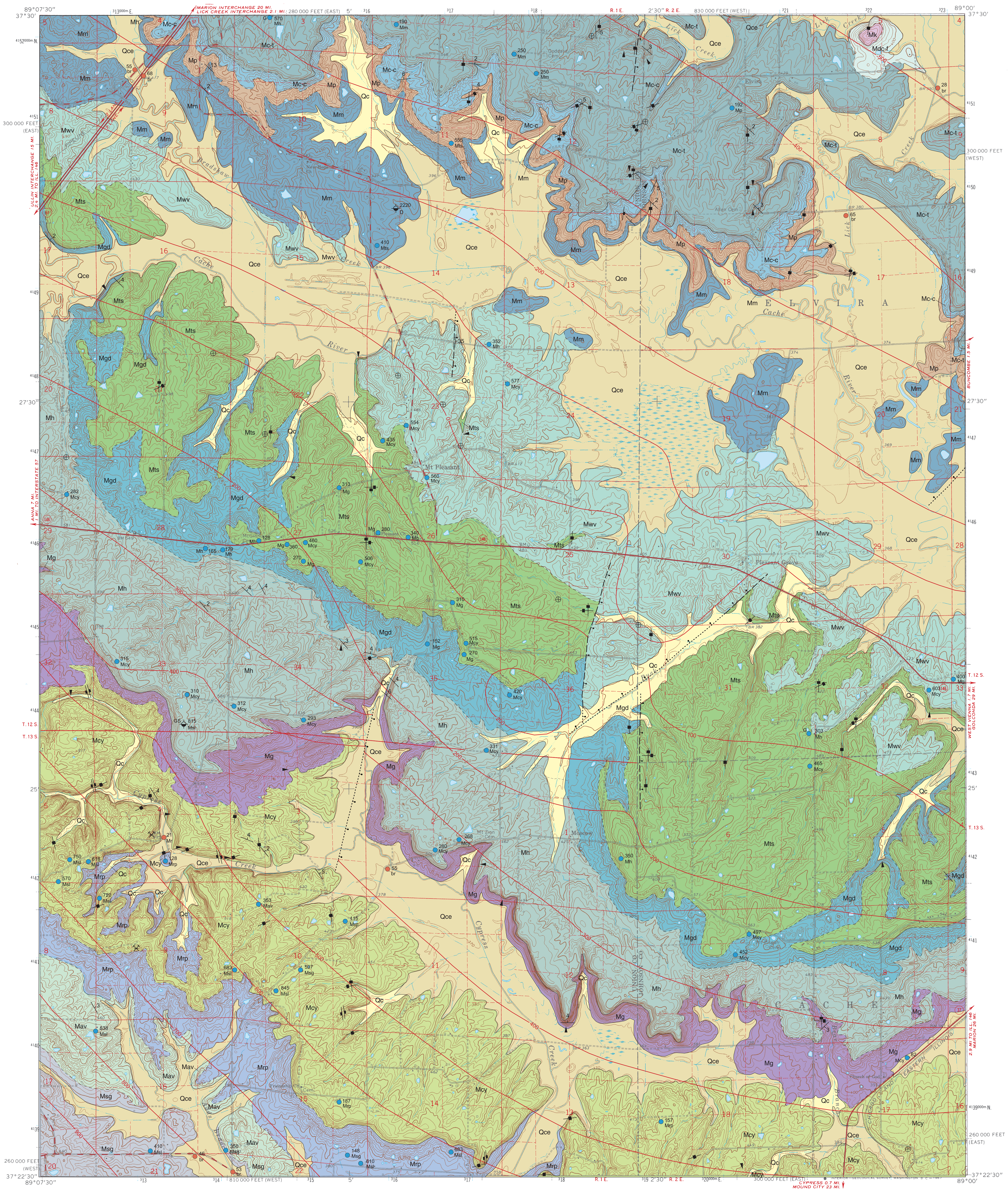
Bedrock Geology of Mt. Pleasant Quadrangle

Union and Johnson Counties, Illinois

Illinois Geologic Quadrangle Map
IGQ Mt. Pleasant-BG

W. John Nelson and Joseph A. Devera

2007



GEOLOGIC UNITS

Quaternary	Qc	Cahokia Formation	Pleistocene and Holocene
Quaternary	Qce	Cahokia and Equality Formations	Pleistocene and Holocene
Mississippian	Mk	Kinkaid Limestone	Chesterian
Mississippian	Mdc-f	Degonia Formation and Ford Station Member of Clore Formation	Chesterian
Mississippian	Mc-t	Tygett Sandstone Member of Clore Formation	Chesterian
Mississippian	Mc-c	Cora Member of Clore Formation	Chesterian
Mississippian	Mp	Palestine Formation	Chesterian
Mississippian	Mm	Menard Limestone	Chesterian
Mississippian	Mwv	Waltersburg Formation and Vienna Limestone	Chesterian
Mississippian	Mts	Tar Springs Sandstone	Chesterian
Mississippian	Mgd	Glen Dean Limestone	Chesterian
Mississippian	Mh	Hardinsburg Formation	Chesterian
Mississippian	Mg	Golconda Formation	Chesterian
Mississippian	Mcy	Cypress Formation	Chesterian
Mississippian	Mrp	Ridenhower Shale and Paoli Limestone	Chesterian
Mississippian	Mav	Aux Vases Formation	Chesterian
Mississippian	Msg	Ste. Genevieve Limestone	Chesterian

Symbols

15 Strike and dip of bedding; number indicates degree of dip

Apparent or approximate strike and dip of bedding

Horizontal bedding

Outcrop of special note, shown where contact or map unit was well exposed at time of mapping

Vertical joints

Inclined joints; box on down–dip side

Abandoned stone quarry

Drill Holes

from which subsurface data were obtained.

Water well

Engineering boring from Illinois Department of Transportation

Dry hole with show of oil

SG 210 br — Labels indicate samples (s) or geophysical log (g). Numeric label indicates total depth of boring in feet. Formation at bottom of hole indicated. br = bedrock, formation unidentified. Msl = St. Louis Limestone. D = Devonian.

Line Symbols

dashed where inferred, dotted where concealed

Contact

Normal fault: bar and ball on downthrown side

400 Structure contour on top of Cypress Formation; contour interval 100 feet

Note: Well and boring records are on file at the ISGS Geological Records Unit and are available online from the ISGS Web site.

Base map compiled by Illinois State Geological Survey from digital data provided by the United States Geological Survey. Topography by photogrammetric methods from aerial photographs taken 1963. Field checked 1966.

North American Datum of 1927 (NAD 27)
Projection: Transverse Mercator
10,000-foot ticks: Illinois State Plane Coordinate system, east and west zones (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 1929

Released by the authority of the State of Illinois: 2007

Geology based on field work and data analysis by W.J. Nelson and J.A. Devera, 1994–1995; revised 1997 and 2005.

Digital cartography by J. Domier and M. Widener, Illinois State Geological Survey.

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1	2	3
4		5
6	7	8

ADJOINING QUADRANGLES
1 Makanda
2 Lick Creek
3 Goreville
4 Anna
5 Vienna
6 Dongola
7 Cypress
8 Karnak

1° TRUE NORTH, MAGNETIC NORTH
APPROXIMATE MEAN DECLINATION, 2007

ROAD CLASSIFICATION

Primary highway, hard surface
Light-duty road, hard or improved surface
Secondary highway, hard surface
Unimproved road
Interstate Route
State Route

Structural Geology

The Mt. Pleasant Quadrangle is located along the southern margin of the Illinois Basin, east of the Ozark Dome and a few miles north of the Mississippi Embayment. Bedrock strata at and near the surface regionally dip northeast toward the center of the Basin. The average dip in the Mt. Pleasant Quadrangle (shown by structure contour lines on the map) is about 140 feet per mile or 1½°. Local attitudes, indicated by strike and dip symbols on the map and by variable dip of mapped contacts, commonly deviate from the regional dip. Local dips may result from differential compaction around lenticular rock bodies, soft-sediment deformation caused by slumping and loading, solution collapse, and other non-tectonic causes.

Five small faults that strike north-south to slightly east of north have been mapped. All have the east side downthrown. No fault surfaces are exposed; all faults are inferred from indirect evidence. (1) Near the north edge of the quadrangle (SE¼, Sec. 1, T12S, R1E), marker beds in the Clore Formation are displaced 20 to 30 feet down to the east. North-south jointing is prominent near the inferred fault and in line with it to the south. (2) On the south side of the Cache River along the border of Sections 14 and 23, T12S, R1E, sandstone of the Waltersburg Formation exposed in a roadbed dips 35° east. A linear north-south valley is just east of the dipping sandstone outcrop. (3) On the north side of Buck Run just east of the center of the quadrangle, the Waltersburg Formation is juxtaposed with the Tar Springs Formation and Glen Dean Limestone on the west. The indicated displacement is as large as 100 feet. Sandstone near the inferred fault contains closely spaced orthogonal joints that strike north-south and east-west. Weller and Krey (1939) previously mapped this fault. (4) On the south side of Buck Run, a fault is inferred along the boundary between R1E and R2E. Evidence includes a linear valley, well-developed north-south jointing, and displacement of the Tar Springs-Glen Dean contact 30 to 40 feet down to the east. (5) Southwest of the center of the map, the top of the Cypress Formation is at least 50 feet higher on the west side of a linear valley. Steeper than normal dips (4° to 6° northeast) were measured on sandstone outcrops near the northeast end of this valley.

Additional north-trending faults occur in the nearby Makanda (Jacobson and Weibel 1993), Anna (J.A. Devera and W.J. Nelson, unpublished map), Vienna (Nelson et al. 2004), Creal Springs (Trask and Jacobson 1990), and Jonesboro Quadrangles (Devera and Nelson 1995). All of these are high-angle normal faults that displace Pennsylvanian and older rocks. Striations, drag folds, and fracture patterns imply dip-slip movements. There is no indication that any north-south faults have been active since late Paleozoic time.

A northeast-trending fault is inferred to underlie Quaternary alluvium along Buck Run in the east-central part of the quadrangle. Our interpretation of this fault is nearly the same as that of Weller and Krey (1939). The Glen Dean Limestone and Tar Springs Formation southeast of Buck Run are uplifted roughly 100 feet relative to the Waltersburg Formation and Vienna Limestone northwest of the stream. This fault is in line with a small northeast-trending fault near the west edge of the adjacent Vienna Quadrangle (Nelson et al. 2004).

The Mt. Pleasant Quadrangle lies along a northeast-trending zone of magnetic and gravity highs known as the Commerce Geophysical Lineament (CGL), which extends from northeastern Arkansas to near Vincennes, Indiana. In southern Illinois, a series of small, discontinuous northeast-trending faults line up with the CGL. The fault along Buck Run is one of these faults. The CGL has been interpreted as a series of dense, highly magnetic igneous bodies possibly emplaced during Precambrian time along a rifted margin or plate boundary (Langenheim and Hildenbrand 1997; Hildenbrand et al. 2002). Holocene faulting has been documented along the CGL in Missouri just across the Illinois border, and the CGL is implicated in ongoing seismic activity within Illinois (Harrison and Schultz 1994; Harrison et al. 1999; Hildenbrand et al. 2002).

Groundwater

In the northeast corner of the quadrangle (T12S, R2E) all water wells are relatively shallow (100 to 200 feet) and yield 1.5 to 3 gallons of water per minute. Aquifers are sandstone in the Palestine Formation and the Tygett Sandstone Member of the Clore Formation and limestone at the top of the Cora Member of the Clore Formation.

Most wells in the central part of the quadrangle were completed in sandstone in the lower half of the Cypress Formation. These wells commonly yield 30 to 60 gpm at depths as great as 600 feet. Some water from the Cypress reportedly is salty. Shallower sandstones in the Tar Springs and Hardinsburg Formations generally yield less than 10 gpm. A few wells were finished in limestone aquifers of the Menard, Glen Dean, and upper Golconda formations; these wells have outputs of a few gallons per minute.

In the southwestern part of the quadrangle, where the Cypress is at the surface or eroded, wells are drilled as deep as 870 feet in search of water in the Ste. Genevieve and St. Louis (not shown) Limestones. Some of these wells failed to find potable water; others were plugged back for shallow production of a few gallons per minute from the Paoli Limestone. The Aux Vases Formation apparently is not an aquifer in this area.

Water production from limestone is sporadic, depending on fracture systems and solution cavities. Large quantities of water may flow in solution channels, but such water is vulnerable to contamination from surface runoff.

Quaternary valley fill along the Cache River, Lick Creek, and Cypress Creek is dominantly silty clay. This material has low permeability and generally does not yield useful amounts of water.

Mineral Resources

Stone
No commercial stone quarries are active in the Mt. Pleasant Quadrangle. Several small, abandoned quarries in sandstone of the bluff-forming lower portion of the Cypress Formation were observed during mapping. These quarries probably furnished stone for local construction projects.

Lamar (1959) reported that the Menard, Glen Dean, Golconda, Downeys Bluff/Renault (Paoli) (not shown), and Ste. Genevieve formations contain commercially valuable limestone in southern Illinois. Most of these units contain numerous shale interbeds in the study area, rendering them undesirable for most purposes. The Glen Dean contains limestone as thick as 25 feet with little shale or chert and could support small quarries. The Glen Dean currently is being mined underground north of Chester, Illinois.

The best unit for quarrying in the area is the Ste. Genevieve Limestone. Large quarries in the Ste. Genevieve are currently active in the nearby Anna and Cypress Quadrangles. Stone from these quarries is used for aggregate, agricultural lime, and road surfacing. The Ste. Genevieve crops out at the southwest corner of the Mt. Pleasant Quadrangle and extends beneath the entire quadrangle in the subsurface.

Oil and Gas
Only two oil and gas test holes are on record in the quadrangle. The Henry Leschen No. 1 Schenker test, in the NE¼ NW¼ NW¼, Sec. 14, T12S, R1E, was drilled to a total depth of 2,220 feet. The date of drilling was not recorded, no samples are on file, and the only log available is a driller's log that provides scanty geologic information. A show of oil was reported in limestone (Middle Devonian?) near the bottom of the hole.

The Maloney No. 1 Osman test hole was drilled in 1970 to a total depth of 815 feet in the St. Louis Limestone (Mississippian). The well site was SE¼ SW¼ SE¼, Sec. 33, T12S, R1E. A gamma-ray log and two sample studies are on public file at the ISGS. The driller recorded "good shows of oil" in the Ste. Genevieve Limestone and "dead oil" in the Aux Vases Formation and St. Louis Limestone (not shown). The Osman well was dry and abandoned.

The nearest producing oil fields are in Williamson County, approximately 20 miles north of the study area.

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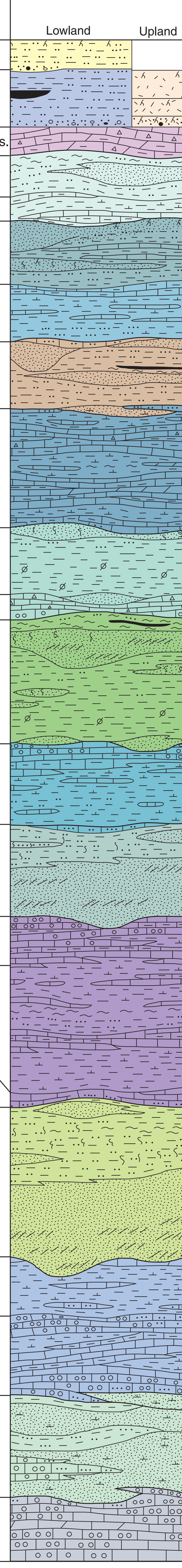

SYSTEM	SERIES	GROUP	FORMATION	MEMBER	THICKNESS (FEET)		UNIT DESCRIPTION
QUATERNARY	HOLOCENE		Cahokia		0–65		A
	PLEISTOCENE		Equality	loess		0–20	B
MISSISSIPPIAN	CHESTERIAN	POPE	Kinkaid Ls.	Negli Creek Ls.	8 exposed		C
			Degonia		30–40		D
			Clore	Ford Station	20–30		E
				Tygett Sandstone	50–60	15–20	F
						10–12	G
						25–30	H
				Cora	25–60	5–8	I
						20–55	J
			Palestine		47–75		K
			Menard Limestone		108–140		L
			Waltersburg		41–88		M
			Vienna Ls.		5–29		N
			Tar Springs		90–120		O
			Glen Dean Limestone		65–120	15–45	P
						50–75	Q
			Hardinsburg		53–90		R
			Golconda	Haney Limestone	90–190	30–60	S
				Fraileys Shale		5–40	T
						10	U
						20–30	V
						20–40	W
				Beech Creek Limestone		5–10	X
			Cypress		125–190	50–90	Y
						50–100	Z
			Ridenhower Shale		60–70		AA
			Paoli Limestone		50–120		BB
			Aux Vases		90–140		CC
		MAMMOTH CAVE	Ste. Genevieve Limestone		60 exposed; 190 total		DD

A Clay, silt, sand, gravel, and peat Valley fill along larger streams is brownish gray, mottled silty clay that contains scattered lenses of sand and a thin gravel layer at the base. Organic matter is common; peat lenses are as thick as 10 feet. These sediments represent the Cahokia Formation (Holocene), lacustrine deposits of the Equality Formation (Wisconsinan), and possibly older alluvium, but the Cahokia and Equality are difficult to differentiate. Alluvium along small upland streams is a mixture of clay, silt, and rock fragments.

B Silt Silt is yellowish, brownish, and reddish gray, massive, and rooted. Loess blankets uplands; it is thickest near the Cache River and in the southwest corner of the quadrangle. At least three loesses are present: the Peoria Silt (late Wisconsinan), the Roxana Silt (early Wisconsinan), and the Loveland Silt (Illinoian). Loess is not shown on the map.

C Limestone Limestone is dark gray, argillaceous lime mudstone (Dunham 1962) in hummocky beds 2 to 14 inches thick. Fossils include bellerophontid gastropods, small brachiopods, and *Chaetetes*.

D Siltstone, sandstone, shale, and mudstone Siltstone and very fine sandstone are olive gray to greenish gray and have planar laminations separated by shale partings. In adjacent quadrangles the Degonia contains shale that is dark gray to greenish and olive-gray and, at the top, an interval of red and green variegated, blocky mudstone. Only small outcrops of siltstone and shale were found in the Mt. Pleasant Quadrangle.

E Limestone and shale Limestone is medium to dark gray (weathering olive-gray to yellowish gray) argillaceous lime mudstone that is massive to nodular. Only a few small exposures were found. Shale, exposed in adjacent quadrangles, is dark gray to olive-gray, calcareous, and fissile.

F Sandstone, Shale, and siltstone Gray silty shale at the base of the unit grades upward to laminated siltstone and thin-bedded sandstone in the middle. Thick-bedded sandstone at the top of the unit contains stigmarian root casts. In places, the upper sandstone cuts downward into the lower shale with an erosional lower contact. Cross-bedding in this channel-fill sandstone dips southwest. The lower contact is sharp.

G Limestone and shale Two limestone beds 2 to 4 feet thick are separated by 4 to 5 feet of shale. Limestone is dark gray argillaceous lime mudstone to skeletal wackestone that contains rugose corals, spiriferid brachiopods, and echinoderm fragments. Shale is olive-gray and contains lenses of siltstone and nodules of limestone. The lower contact is rapidly gradational.

H Shale, siltstone, and sandstone Dark gray to olive-gray clay shale at the base grades upward through ripple- and planar-laminated siltstone and sandstone in the middle, to thick-bedded sandstone at the top. The upper sandstone contains stigmarian root casts and the trace fossils *Planolites* and *Rhizocorallium*. The lower contact is sharp.

I Limestone Limestone is dark gray, argillaceous lime mudstone to skeletal wackestone that weathers yellowish gray to olive-gray. The upper part has thin shale interbeds. Thin siliceous bands in the lower part stand out as parallel ridges on weathered surfaces. Fossils include spiriferid brachiopods, rugose corals, and bryozoans. The lower contact is sharp.

J Shale with thin limestone interbeds Shale is dark gray to greenish gray and varies from fissile clay shale to blocky mudstone. Limestone is mottled gray to yellowish orange (when weathered) and highly fossiliferous; it contains trepostome and fenestrate bryozoans, echinoderm fragments, trilobites, and the brachiopods *Spirifer increbescens*, *Composita subquadrata*, *Diaphragmus elegans*, *Cliothyridina* sp., *Chonetes* sp., and productids. At the base a lenticular, dark reddish gray to brown, very sandy limestone grades laterally to calcareous, burrowed sandstone. The lower contact is gradational and intertonguing on a small scale.

K Sandstone, siltstone, and shale The unit commonly comprises two upward-coarsening sequences of roughly equal thickness. A rooted mudstone (paleosol) and thin coal occur locally at the top of the lower sequence. Sandstone at the top of the upper sequence locally fills small channels; cross-bedding dips south or southwest. A thin ripple-laminated, calcareous sandstone at the base of the Palestine intertongues on a small scale with sandy limestone at the top of the Menard.

L Limestone and shale The limestone is mostly medium to dark gray lime mudstone and skeletal wackestone that contains echinoderm and brachiopod fragments; whole fossils are scarce. Bedding is tabular to hummocky, and most beds are a few inches to about 2 feet thick. Scattered beds of light gray crinoidal packstone and grainstone are present. Shale interbeds are dark gray to olive-gray and calcareous and contain limestone lenses. The uppermost 10 to 15 feet of the Menard consists of nodular-bedded limestone with many shale interbeds. The middle 40 to 50 feet is dominantly limestone, less argillaceous than above and containing fewer shale interbeds. The lower part of the Menard is covered by alluvium and is known only from well records.

M Shale and sandstone This poorly exposed unit is composed mostly of medium to dark gray, soft and platy clay shale. Sandstone at the top weathers orange-brown; it is very fine grained, thinly bedded, and contains horizontal burrows and trails. Locally, a thin sandstone occurs at the base of the Waltersburg.

N Limestone Limestone in the middle and upper part of the unit is largely dark gray lime mudstone to skeletal wackestone that is very siliceous and cherty. It weathers to a porous, punky residuum with angular blocks of chert. Fenestrate bryozoan fronds are abundant both in fresh limestone and residuum. The lower part of the Vienna is composed of light gray crinoid-bryozoan packstone and grainstone, some of which is oolitic and cross-bedded. This lower limestone contains little chert and is not siliceous. The lower contact is sharp.

O Sandstone, siltstone, and shale At the top is 5 to 10 feet of blocky, rooted mudstone with lenses of thin, shaly coal. Below this is mostly ripple-laminated and cross-bedded sandstone that forms bluffs up to 30 feet high. Paleocurrent directions are highly variable, and tidal rhythmites are present. Trace fossils include *Planolites*, *Lockeia*, and *Conostichus*. The lower Tar Springs contains up to 50 feet of shale that is medium-dark gray with an olive or greenish cast, platy and fissile, and contains small limonite lenses. A lenticular sandstone up to 10 feet thick is at the base of the Tar Springs. Interference ripples, load casts, and ball-and-pillow structures are common; shale rip-up clasts and plant fossils (*Sigillaria*) also are present in the basal sandstone. The lower contact is sharp or rapidly gradational.

P Limestone Limestone is mostly brownish gray, medium- to coarse-grained, crinoid-bryozoan packstone and grainstone. Light gray, cross-bedded oolitic grainstone is common near the top. Thin beds of silty to argillaceous, dolomitic lime mudstone and wackestone are present. Most fossils are disarticulate. The lower contact was not observed.

Q Shale with thin limestone interbeds The shale is medium to dark gray, greenish gray, and olive-gray, platy and fissile, and slightly calcareous. It is mostly clay shale, but some is silty. Limestone is dark reddish to brownish gray, coarse, crinoid-brachiopod packstone and grainstone. A bed of very sandy limestone or calcareous sandstone 2 to 3 feet thick is widespread at the base of the unit. The lower contact is gradational.

R Sandstone, siltstone, and shale Fine- to medium-grained, thick-bedded to massive sandstone at the base grades upward to thin-bedded and laminated siltstone and shaly sandstone at the top. The thin-bedded sandstone contains interference ripples, small load casts, and casts of plant stems and bark. Trace fossils are common, including *Lockeia*, *Aulichnites*, *Uchirites*, *Sclaratuba missouriensis*, and *Olivellites*. The lower contact is sharp and locally erosional.

S Limestone with shale interbeds Limestone is mostly brownish gray skeletal packstone to wackestone that is thin- to medium-bedded and interlayered with soft greenish gray shale. Whole calices of *Pentremites* and *Phanocrinus* are common along with diverse brachiopods and bryozoans. The crinoids *Zeacrinus* and *Pterotocrinus* also are present. The lower contact is gradational and intertonguing.

T Shale with limestone interbeds Shale is gray to greenish gray, calcareous, and fossiliferous; limestone is similar to that in the overlying unit. This unit is poorly exposed, and well logs lack detail.

U Mudstone and shale The upper part is blocky mudstone that is variegated green, red, and gray and is probably a paleosol. The lower part is gray shale containing lenses and laminae of sandstone. This unit is equivalent to the Big Clifty Sandstone Member. The lower contact is gradational.

V Limestone and shale The limestone is mostly dark gray skeletal packstone and wackestone that weathers yellowish orange. The shale is gray to greenish gray and olive-gray and calcareous. Limestone and shale both are highly fossiliferous: brachiopods dominate, but bryozoans, crinoids, blastoids, and rugose corals also are common. The lower contact probably is gradational.

W Shale Shale is medium to dark gray and calcareous and contains fenestrate bryozoans. Thin lenses and interbeds of limestone are present. This unit is mostly concealed by alluvium along Cypress Creek.

X Limestone Limestone is medium to dark gray skeletal wackestone, packstone, and grainstone. In outcrops near the center of the N½, Sec. 3, T13S, R1E, dark gray argillaceous wackestone at the base grades to light gray, coarse-grained crinoidal grainstone at the top. Brachiopods and fenestrate bryozoans are common. The limestone forms wavy beds a few inches to 1½ feet thick. Sample logs from wells indicate that some of the limestone is sandy. The lower contact is sharp.

Y Sandstone, siltstone, and shale The unit is mostly very fine-grained, laminated to thinly bedded sandstone that contains interbeds and laminae of siltstone and silty shale. Planar laminations, interference ripples, and ladderback ripples are present. Some layers are intensely bioturbated. The lower contact is concealed.

Z Sandstone Sandstone is white to light gray, very fine- to fine-grained quartz arenite, forming cliffs and ledges. The lower part has prominent low-angle wedge-planar and tabular planar cross-bedding, along with ripple and planar lamination. Paleocurrents were mostly toward the west and northwest and, less commonly, toward the south and southwest. In one area, bidirectional northeast-southwest cross-bedding was observed. The upper 5 to 30 feet of the sandstone has pervasive slumped and distorted lamination and "healed" planar fractures that strike N5-20°W and dip steeply. These features possibly were produced by earthquakes during sedimentation. The lower contact is sharp and probably erosional.

AA Shale with thin limestone interbeds Shale is olive-gray to dark gray, platy to fissile clay shale. It is partly calcareous and commonly contains siderite lenses. Limestone is mostly dark gray to reddish gray, shaly to sandy, coarse-grained skeletal packstone and wackestone. Conglomerate composed of red, gray, green, and ochre mudstone clasts in a sandy limestone matrix was seen in several places. The Ridenhower (Butts 1917) is a shale-dominated unit that grades laterally to sandstone east of the study area and is equivalent to part of the Paint Creek Limestone west of the study area (Cole and Nelson 1995). The lower contact appears to be gradational.

BB Limestone and shale Limestone is variable in lithology. Light gray skeletal and oolitic grainstone and packstone are most widespread. Yellowish to greenish gray crinoidal wackestone and packstone contain pink crinoid grains and rip-up clasts of red and green shale. Fossils include bryozoans, brachiopods, crinoids, and blastoids. Cross-bedded oolitic and crinoidal grainstone is at the base. Thin interbeds and lenses of greenish gray, calcareous and fossiliferous shale are present. The Downeys Bluff Limestone, Yankeetown Formation, and Renault Limestone were not differentiated in this area. This unit is equivalent to the Paoli Limestone in Indiana (Droste and Carpenter 1990). The lower contact appears to be gradational and intertonguing.

CC Sandstone and limestone Sandstone is gray to greenish gray, very fine- to fine-grained, and commonly glauconitic and calcareous. It is mostly thin-bedded and contains laminae of green and purple shale. Oolites, calcareous bioclasts, and burrows are prominent. Limestone is light to medium gray oolitic and crinoidal grainstone that is sandy and glauconitic. Sandstone and limestone intertongue in a complex fashion within this unit and at the contact with the underlying unit. Outcrops are few; descriptions are based partly on well records and outcrops in adjacent quadrangles.

DD Limestone Limestone is white to medium brownish gray oolitic and skeletal grainstone with thinner interbeds of medium to dark gray, cherty lime mudstone and wackestone. Outcrops are few; descriptions are mainly based on well records and outcrops in adjacent quadrangles.