Bedrock Geology of Kaskaskia Quadrangle
Randolph County, Illinois, and
Ste. Genevieve and Perry Counties, Missouri

Prairie Research Institute
ILLINOIS STATE GEOLOGICAL SURVEY

Illinois Geologic Quadrangle Map
IGQ Kaskaskia-BG

Mary J. Seid
2013

EXPLANATION

	af	Artificial fill	
Quaternary	Qc(s)	Cahokia Formation, sandy deposits	Holocene
	Qc(c)	Cahokia Formation, clayey deposits	
	Qc(t)	Cahokia Formation, terrace deposits	
	Qe	Equality Formation	Pleistocene
Unconformity			
Pennsylvanian	IPcv	Caseyville Formation	Morrowan
Unconformity			
Mississippian	Mp	Palestine Sandstone	Chesterian
	Mm	Menard Limestone	
	Mwvt	Waltersburg Formation, Vienna Limestone, and Tar Springs Formation	
	Mgdh	Glen Dean Limestone and Hardinsburg Formation	
	Mg	Golconda Formation	
Units not exposed on Illinois part of quadrangle			
	My	Yankeetown Sandstone	
	Mr	Renault Formation	
	Mav	Aux Vases Sandstone	
Unconformity			
	Msg	Ste. Genevieve Limestone	Valmeyeran
	Msl	St. Louis Limestone	
	Msm	Salem Limestone	

Symbols

- 40 — Strike and dip of bedding; number indicates degree of dip
- Vertical joint
- Abandoned pit or quarry
- Outcrop of special note, shown where contact or map unit was well exposed at time of mapping

Drill Holes

- Water well
- Dry oil-test hole
- 214500 — Numeric label indicates county number of boring.

Line Symbols

dashed where inferred

- Contact
- A—A′ — Line of cross section

Note: Well and boring records in Illinois are on file at the ISGS Geological Records Unit and are available online from the ISGS website.

Base map compiled by Illinois State Geological Survey from digital data (2011 TIGER/Line Shapefiles) provided by the United States Census Bureau. Shaded relief and contours derived from 2012 ISGS LiDAR source data.

North American Datum of 1983 (NAD 83)
Projection: Transverse Mercator
10,000-foot ticks: Illinois State Plane Coordinate system, west zone (Transverse Mercator)
1,000-meter ticks: Universal Transverse Mercator grid system, zone 16

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SCALE 1:24,000

1 MILE — 1/2 — 0
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 KILOMETER — .5 — 0

BASE MAP CONTOUR INTERVAL 10 FEET
SUPPLEMENTARY CONTOUR INTERVAL 5 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

Illinois geology based on field work by Mary J. Seid, 2011–2012. Missouri geology from Amos (1985), with slight modifications.

Digital cartography by Jane E. Johnshoy Domier and Coy E. Potts, Illinois State Geological Survey. Shaded relief by Donald E. Luman.

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ILLINOIS STATE GEOLOGICAL SURVEY
PRAIRIE RESEARCH INSTITUTE
ILLINOIS
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Prairie Research Institute
Illinois State Geological Survey
615 East Peabody Drive
Champaign, Illinois 61820-6918
(217) 244-2414
http://www.isgs.illinois.edu

1	2	3
4		5
6	7	8

ADJOINING QUADRANGLES
1 Prairie du Rocher
2 Evansville
3 Walsh
4 Sainte Genevieve, MO
5 Chester
6 Minnith, MO
7 Lithium, MO
8 Belgique, MO

APPROXIMATE MEAN DECLINATION, 2013
1° TRUE NORTH MAGNETIC NORTH

Road Classification
- U.S. Route
- State Route
- Other paved roads

SYSTEM	SERIES	FORMATION	MEMBER	GRAPHIC COLUMN	THICKNESS (feet)	UNIT
QUATERNARY	HOLOCENE	Cahokia			0–103	A
	PLEISTOCENE	Equality			0–30	B
PENNSYLVANIAN	MORROWAN	Caseyville			0–65	C
MISSISSIPPIAN	CHESTERIAN**	Palestine Ss			0–35	D
		Menard Limestone	Allard Ls		80–90	E
			Scottsburg Ls			
			Walche Ls			
		Waltersburg			50–60 / 20–25	F
		Vienna Ls			8–10	G
		Tar Springs			20–25	H
		Glen Dean Limestone			90–110 / 65–85	I
		Hardinsburg			16–24	J
		Golconda	Haney Limestone		20+	K
		Units concealed by Mississippi River alluvium				
		Yankeetown Sandstone			15–25	L*
		Renault Formation	Upper		55–85	M*
			Lower			N*
		Aux Vases Sandstone			35–60	O*
		Ste. Genevieve Limestone			45–110	P*
	VALMEYERAN	St. Louis Limestone			75–120	Q*
		Salem Limestone			120+	R*

A Cahokia Formation Sand, silt, and clay. **A_1 Cahokia Formation** Sandy deposits. Shown on the map as Qc(s). Sandy alluvium is brown and friable and occurs in upland streams, as sandbars along the Mississippi River, and in abandoned channels in the Mississippi River bottoms. **A_2 Cahokia Formation** Clayey deposits. Shown on the map as Qc(c). Clay-rich alluvium is dark grayish brown and occurs in backswamps of the Mississippi River floodplain. **A_3 Cahokia Formation** Terrace deposits. Shown on the map as Qc(t). Terrace deposits are composed of gray and brown clay and silt. The upper surfaces of Cahokia terraces occur at an elevation of 380 feet. Erosional unconformity with the unit below.

B Equality Formation The Equality Formation is clay that occurs as terraces whose upper surfaces are at elevations of 410 to 420 feet. Erosional unconformity at the base.

C Caseyville Formation Sandstone, conglomerate, siltstone, and shale. Light brown, fine- to medium-grained sandstone, massive beds (1 to 2 feet thick), contains shale rip-up clasts in places. Conglomerate consists of red, light brown, and white subrounded to angular chert fragments; pink and white subrounded quartzite pebbles, which range in size from granules to cobbles (up to 4 inches in diameter); a sandstone matrix; and heavy iron-staining in places. Of note, a few of the clasts are composed of chalky white silica that resembles tripoli and that contains fenestrate bryozoans; such clasts were probably originally composed of limestone and were later replaced by silica. The source of the quartzite pebbles is unclear, although the presence of marine fossils in the silicified limestone clasts may indicate active scour of the local Mississippian units. Gray and olive brown slightly micaceous siltstone and shale, in thin flaggy beds, contain plant fragments. Major erosional unconformity with the units below.

D Palestine Sandstone Sandstone, siltstone, and shale. Light brown when fresh; fine-grained quartz arenite. Bedding is predominantly thin to medium and planar with low-angle cross-bedding. Lenticular beds with high-angle cross-beds occur in Secs. 4 and 9, T7S, R7W, where the formation is well exposed. Siltstone and shale are gray and very poorly exposed. The top of the unit has been removed by pre-Pennsylvanian erosion. Sharp contact with the unit below.

E Menard Limestone Limestone and shale. Gray to brownish gray lime mudstone and wackestone, with occasional packstone; beds are 1 to 8 inches thick and contain 2- to 4-inch-diameter brownish gray chert nodules in places. The Walche Limestone Member contains cross-bedding and planar, rhythmically bedded tidalites, abundant fenestrate bryozoans and disarticulated crinoids, and less abundant *Pentremites* (blastoids). The Scottsburg Limestone Member is limestone with interbedded dark gray shale containing plant fragments and myalinid bivalves. The Allard Limestone Member contains lime mudstone beds that are dark brownish gray and argillaceous to light gray, pure, and thin-bedded. Some sinkholes are developed in the Menard. In places, the top of the unit has been removed by pre-Pennsylvanian erosion. Gradational contact at the base.

F Waltersburg Formation Shale and minor amounts of siltstone. Gray shale with abundant plant fragments and thin siderite layers. Siltstone is gray, partly calcareous and partly fossiliferous. The Waltersburg Formation is poorly exposed in the quadrangle. Gradational contact at the base.

G Vienna Limestone Shale, claystone, and limestone. Noncalcareous gray shale and claystone with limestone lenses. Limestone lenses are composed of light gray crinoidal and brachiopod-rich packstone. Gradational contact at the base.

H Tar Springs Formation Claystone, siltstone, shale, and minor amounts of sandstone. Olive gray claystone, siltstone, and shale are typically poorly exposed. Where sandstone occurs, it is fine-grained quartz arenite, is partly bioturbated, is very thinly bedded, and contains sedimentary structures from dewatering. Gradational contact at the base.

I Glen Dean Limestone Limestone and shale; a persistent ledge former along Kaskaskia Road. Light gray to light brownish gray, partly shaly packstone to partly cross-bedded grainstone, contains some dark gray fossiliferous chert and oolites. Lime mudstone beds are less common, break with conchoidal fracture, weather smooth and light brown, and contain irregularly shaped chert nodules. Beds range from 1 to 18 inches thick. Shale is dark gray or greenish gray; is calcareous in part; and may contain bivalves, brachiopods, echinoderm fragments, and fenestrate bryozoans. Many sinkholes are developed in the upper part of the Glen Dean. Gradational contact with the unit below.

J Hardinsburg Formation Shale and siltstone. Greenish gray fissile shale with 1-centimeter-thick lime mudstone nodules scattered throughout. Parts of the unit may contain siltstone, carbonaceous fragments, limestone-filled burrows, micro-cross-bedding, and dewatering structures. Red shale and claystone are diagnostic in the uppermost part of the unit. Sharp contact with the unit below.

K Golconda Formation Limestone and shale. The low bench-forming unit near the top consists of light brownish gray cross-bedded pelletal and oolitic packstone to grainstone; sheets of limestone spall off of weathered faces (exfoliating). Some portions of the unit consist of brownish gray shaly lime mudstone to wackestone. Shale is light greenish gray when fresh, light brown when weathered, and bryozoan rich. The base is not exposed in the quadrangle.

***L Yankeetown Sandstone** Siltstone, fine-grained sandstone, and subordinate shale: Siltstone and sandstone, light-gray and light-brown to light-reddish-brown, locally white, thin- to thick-bedded, even-bedded; laminations within beds common; siliceous cement; some weathers to an orthoquartzite or fine-grained chert. Shale, medium- to dark-greenish-gray, medium-reddish-gray, and medium-green; locally, some brick-red beds at base of formation; some silty. Unit yields abundant residuum of rectangular slab-like fragments. Unconformable with underlying formation.

***M Renault Formation (Upper part)** Limestone and shale [and thin sandstone]: Limestone, medium- to light-gray and dark-bluish-gray, medium- to fine-grained; some beds medium- to coarsely crystalline; thick- to thin-bedded; some beds arenaceous and thinner ones commonly argillaceous. Shale [and thin sandstone] medium- to dark-gray and greenish-gray; some calcareous. Unit fossiliferous; mostly crinoid fragments, brachiopods, and bryozoans.

***N Renault Formation (Lower part)** Shale, limestone, and sandstone: Shale, dark- to medium-gray and purplish-gray; some beds silty and a few calcareous. Limestone, light- to dark-gray; few medium to thin, brick-red beds; fine- to medium-grained; some beds medium-crystalline; thin- to medium-bedded; commonly silty; thinner beds argillaceous. Sandstone, light-brown, fine-grained, medium- to thin-bedded, commonly calcareous. Unconformity at base of formation.

***O Aux Vases Sandstone** Sandstone and shale: Sandstone, light-yellowish-brown to light-gray, fine- to medium-grained, well-sorted, locally case-hardened, massive- to medium-bedded; some thin-bedded near top and base of unit; locally cross-bedded; few ripple marks. Shale, medium-gray to greenish-gray; silty at and near base of unit. The type section of the Aux Vases Sandstone is in outcrops on the bluffs near the mouth of the River Aux Vases in the N½ NW¼ Sec. 13, T37N, R9E (Keyes 1892, p. 295). Prominent unconformity at base of formation.

***P Ste. Genevieve Limestone** Limestone; very light-gray to white and light-yellowish-brown, coarsely to finely crystalline; some fine- to medium-grained; many beds silty to sandy; thick- to medium-bedded; less commonly thin-bedded; rarely shaly; commonly cross-bedded. Locally fossiliferous; mostly the crinoid *Platycrinites* and representatives of the gastropod *Bellerophon*. Unit possibly slightly unconformable with the underlying St. Louis.

***Q St. Louis Limestone** Limestone, chert, and shale: Limestone, light- to dark-gray, fine-grained to sublithographic and fine- to medium-crystalline, thick- to medium-bedded; few thin beds; commonly even-bedded; some beds argillaceous and a few, dolomitic; certain beds fossiliferous, distinctive being the coral *Lithostrotion proliferum* [now referred to as *Acrocyathus*]; locally fragments of crinoid columnals. Chert, medium- to dark-gray, less commonly light gray, in part color-banded, dense-textured; as nodules and thin, discontinuous layers restricted to certain beds or sets of beds. Shale, medium-gray to dark-bluish-gray; as partings and thin interbeds. Unit yields residuum of angular chert fragments with white outer surfaces. Conformable with underlying formation.

***R Salem Limestone** Limestone and shale: Limestone, light-gray to light-bluish-gray, some medium-gray, medium- to finely crystalline; commonly fine-grained in upper part of formation; many beds oolitic; medium- to thick-bedded; thicker beds commonly cross-bedded; few beds in upper part of unit dolomitic or argillaceous; fossiliferous, mostly containing bryozoans and crinoid fragments. Shale, medium-gray; as thin partings in the upper part of unit. Lowermost part of Salem not present at surface in quadrangle.

*Unit descriptions marked with an asterisk are from Amos (1986). Used by permission of the Missouri Geological Survey. Bracketed text indicates author's additions.
**The base of the Chesterian is placed at the base of the Ste. Genevieve Limestone (Maples and Waters 1987).

Introduction

The Kaskaskia 7.5-minute Quadrangle contains portions of Randolph County in southwestern Illinois and Ste. Genevieve County in southeastern Missouri. The bedrock exposed in the quadrangle consists of Pennsylvanian siliciclastics and Mississippian sandstones, shales, and limestones of the Valmeyeran and Chesterian Series. On average, the bedding dips less than 1° into the Illinois Basin toward the east-northeast, which reflects the regional trend.

Deposits from the glacial and modern Mississippi River cover a significant portion of the bedrock. Combining soil maps (Soil Survey Staff 2012) with new light detection and ranging (LiDAR) surface topography permitted more detailed mapping of the Quaternary glacial and alluvial deposits.

History of Study of the Area

Early work was focused on stratigraphic correlations in the upper Mississippian System (i.e., Weller 1913, 1920, Ulrich 1922, Sutton 1934). On the Missouri side, Weller and St. Clair (1928) mapped Ste. Genevieve County on a 1:62,500 scale. On the Illinois side, the first 1:62,500-scale geologic maps were prepared by Weller and Weller (1939). These early maps established the stratigraphy of the area but lacked topographic base maps. Stratigraphic work in Illinois continued (Swann 1963, Willman et al. 1975, Maples and Waters 1987 and references therein). Amos (1986) produced a 1:24,000-scale map of the Missouri portion of this quadrangle. Within the past decade, mapping efforts were resumed (Denny 2004, Devera 2006).

Stratigraphy

The Mississippian rocks exposed in the quadrangle belong to the Valmeyeran and Chesterian Series, which are both contained within the Kaskaskia II subsequence (Sloss 1988). Valmeyeran limestone units reflect carbonate deposition in an ocean that became progressively shallower with time (Willman et al. 1975, Devera et al. 2010). Chesterian limestone units were deposited on the broad, shallow shelf between the Illinois Basin and the Ozark Dome. Chesterian sandstone bodies are interpreted as tidal sand bars or incised valley fills (Devera et al. 2010).

The Valmeyeran Series includes the Salem and St. Louis Limestones and is exposed in the Missouri portion of the quadrangle. The St. Louis Limestone is overlain by the Ste. Genevieve Limestone, and the boundary between these two units marks the base of the Chesterian Series (Maples and Waters 1987). The Aux Vases Sandstone, Renault Formation, and Yankeetown Sandstone units rest atop the Ste. Genevieve Limestone, with a minor erosional unconformity.

Units between the Yankeetown Sandstone and Haney Limestone Member attain 205 feet in thickness but are covered by Mississippi River alluvium. These units are, from oldest to youngest, the Paint Creek Formation (Downeys Bluff Limestone, Bethel Sandstone, Ridenhower Formation), the Cypress Sandstone, and the Beech Creek Limestone and Fraileys Shale Members of the Golconda Formation (Nelson et al. 2002).

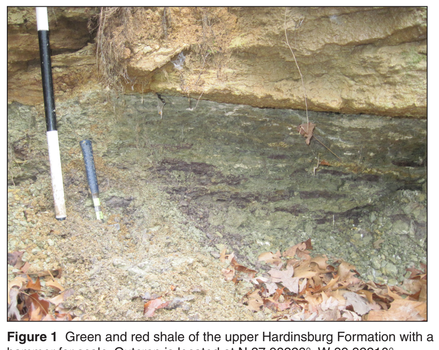

Figure 1 Green and red shale of the upper Hardinsburg Formation with a hammer for scale. Outcrop is located at N 37.98228°, W 89.92210°.

The Haney Limestone Member is the uppermost of three members within the Golconda Formation (Nelson 1995, Nelson et al. 2002). The upper part of the Haney Limestone Member is exposed along the northern edge of the quadrangle and forms a resistant ledge of cross-bedded, oolitic grainstone.

The Hardinsburg Formation (fig. 1) was combined with the Glen Dean Limestone to form a mappable unit. Likewise, the thin Tar Springs, Vienna Limestone, and Waltersburg Formations were combined. Adjacent maps have grouped these formations in identical ways (Denny 2004, Devera 2006, 2012). The Menard Limestone (fig. 2) and Palestine Sandstone represent the uppermost units of the Chesterian Series.

The Mississippian System is separated from the Pennsylvanian System by a major sequence boundary, the sub-Absaroka unconformity (Sloss 1988). The basal Pennsylvanian Caseyville Formation (Morrowan Series) is present in upland areas, and its base ranges from 530 to 620 feet in elevation.

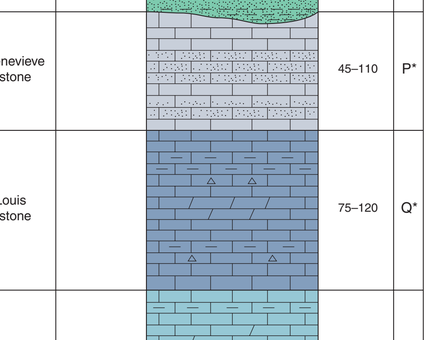

Figure 2 Cross-bedding in the Walche Limestone Member of the Menard Limestone located at N 37.95149°, W 89.88726°. Measuring staff is 5 feet tall.

Quaternary deposits include the Equality and Cahokia Formations. The Equality Formation is Pleistocene slackwater lake sediment and occurs as terraces at elevations of about 415 feet. The youngest deposits belonging to the Cahokia Formation consist of Holocene alluvium and are present in modern streams and in the floodplain of the Mississippi River. Because the Cahokia Formation covers a significant portion of the quadrangle, the sandy facies and clayey facies were divided into separate map units.

Pennsylvanian Sedimentation

Early Pennsylvanian rivers flowed from the Appalachian Mountains to the southwest, depositing coarse sediment into the Illinois Basin. A new core hole drilled in the Chester 7.5-minute Quadrangle (Roache No. 1) encountered Pennsylvanian sediments beneath surficial cover and to a depth of 98 feet, indicating that Pennsylvanian deposits extend farther southwest than previously thought. This fact is consistent with early reports (Weller and Weller 1939) that large areas of Pennsylvanian siliciclastics occupy the uplands.

The base of the Pennsylvanian sandstone is marked by a chert conglomerate layer (fig. 3) that is about 10 feet thick throughout the quadrangle. Limestone clasts incorporated in the base of the conglomerate layer in the Roache No. 1 drill hole indicate that the Mississippian-Pennsylvanian contact is an erosional unconformity. In the majority of the quadrangle, the Pennsylvanian scours out the Palestine Sandstone and the upper part of the Menard Limestone, along with all the Clore, Degonia Sandstone, and Kinkaid Limestone Formations.

Structural Geology

The Kaskaskia Quadrangle is situated on the southwestern flank of the Illinois Basin (fig. 4). The gentle northeastward dip of strata reflects a regional dip into the basin. No evidence could be found that suggested any influence of the Ste. Genevieve Fault System or Cottage Grove Fault System, two major fault zones in the region. Strata dip 3° to the northeast on the Missouri side and reduce to 0.6° beneath the Mississippi River bottoms. Slightly steeper dips on the Missouri side may be explained by the proximity to the Ste. Genevieve Fault System. Rock units are nearly flatlying on the Illinois side but are locally tilted. Beds of the Waltersburg Formation, Vienna Limestone, and Tar Springs Formation interval locally dip 45° eastward in Sec. 4, T7S, R7W. The limited extent of this disturbance suggests that it is likely the result of recent or Pleistocene slumping.

Units between the Glen Dean Limestone and Menard Limestone Formations sag into a gentle syncline or basin with less than 1° of dip on the limbs—the center is located at the border of Secs. 4 and 9, T7S, R7W, about .75 mile from the eastern edge of the map. This feature is not marked on the map because the magnitude is not great enough to show at this scale.

Economic Resources

Oil
A show of oil was found in a stratigraphic core hole (Holloway No. 1) in the adjacent Evansville Quadrangle at a depth of 190 to 192 feet (Devera 2012). An unsuccessful exploratory oil-gas well (MO 12430) bottomed in the Kimmswick Limestone (middle Ordovician), with only a minor show of oil (Amos 1986).

Stone
In Missouri, road aggregate has been quarried from the Renault, Ste. Genevieve (Weller and St. Clair 1928), and St. Louis Formations. Building stone has been obtained from the Aux Vases Sandstone. The Salem Limestone is a potential source of chemical limestone and is quarried and mined extensively about 2.5 miles west of the quadrangle (Amos 1986).

Minerals
Fluorite, sphalerite, and millerite (NiS) have been encountered in one drill hole (MO 2977): fluorite in the Ste. Genevieve Limestone, St. Louis Limestone, and Salem Limestone Formations; sphalerite in the St. Louis Limestone and Salem Limestone Formations; and millerite in the St. Louis Limestone Formation (Amos 1986).

Acknowledgments

Joseph A. Devera aided in field studies and stratigraphic correlations. Geologic contacts in the Missouri portion were transferred from the 1:24,000-scale map of the Kaskaskia 7.5-minute Quadrangle by Dewey H. Amos (1986). Slight modifications to Amos (1986) include coloration of map unit polygons, more detailed interpretations of Quaternary deposits in the river bottoms, and slight adjustment of geologic contacts to make the lines and polygons fit the modern LiDAR topographic base map.

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Figure 3 Basal Pennsylvanian chert conglomerate layer with a penny for scale. Outcrop is located at N 37.95307°, W 89.88509°.

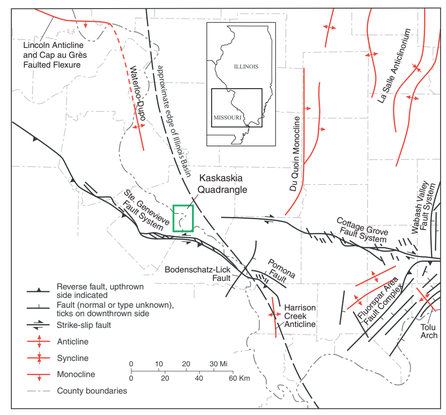

Figure 4 Regional structural context of the Kaskaskia Quadrangle, showing the traces of major faults and folds and the approximate edge of the Illinois Basin.

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