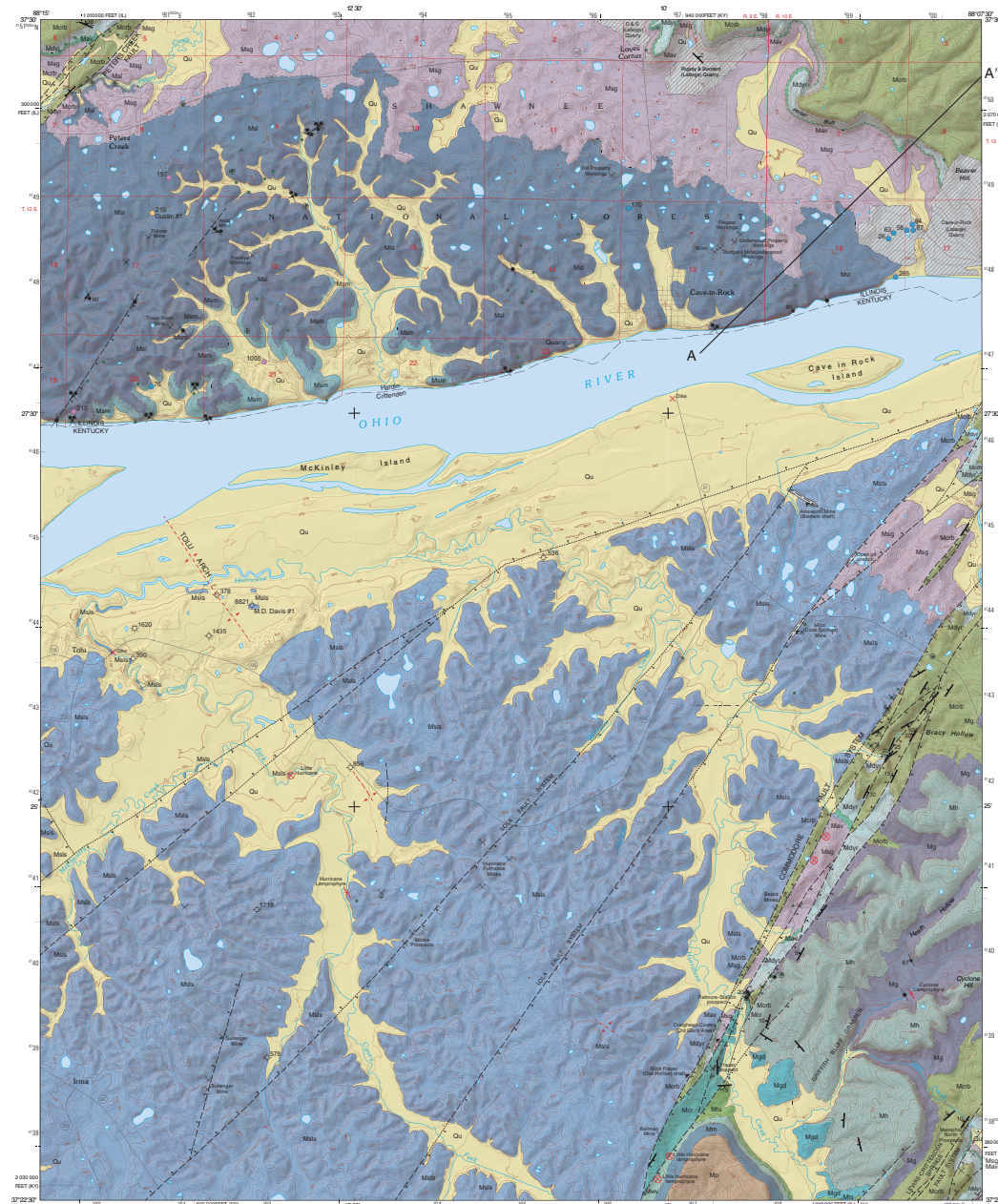


BEDROCK GEOLOGY OF CAVE-IN-ROCK QUADRANGLE HARDIN COUNTY, ILLINOIS, AND CRITTENDEN COUNTY, KENTUCKY

Prairie Research Institute
ILLINOIS STATE GEOLOGICAL SURVEY

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2013

STATEMAP Cave-in-Rock-BG



- EXPLANATION**
- Quaternary**
- Quaternary undifferentiated
- Permian**
- Unconformity
 - Igneous dikes
 - Paletine Sandstone
 - Menard Limestone
 - Wallerburg Formation and Vienna Limestone
 - Tar Springs Sandstone
 - Glen Dean Limestone
 - Hardinsburg Sandstone
- Mississippian**
- Goldsboro Formation
 - Undifferentiated (Mcr)
 - Cypress Sandstone, Ridenhower Formation, and Bethel Sandstone
 - Downs Bluff Limestone, Yanketown Formation, and Renault Limestone
 - Aux Vases Sandstone
 - St. Genevieve Limestone
 - Undifferentiated (Msl)
 - St. Louis Limestone
 - Salem Limestone
- Symbols**
- Dike
 - Dike with trend
 - Dike in core hole
 - Strike and dip of bedding; number indicates degree of dip; approximate orientation where no dip number is given
 - Horizontal bedding
 - Vertical joint
 - Inclined joint
 - Abandoned pit (fluorite, barite, iron, or lead)
 - Abandoned shaft mine
 - Abandoned barite or fluorite open pit
 - Field notes
 - Drill Holes
 - Stratigraphic boring
 - Water well
 - Mineral boring
 - Gas well
 - Dry hole
 - Numeric label indicates total depth of boring in feet.
- Line Symbols**
- Contract
 - Anticline crest, inferred
 - Fault, displacement unknown
 - Normal fault; bar and ball on downthrown side
 - A-A' Line of cross section
- Note: Well and boring records are on file at the USGS Geological Records Unit and are available online from the USGS website. Well and boring records in Kentucky are available on the Kentucky Geological Survey website.

Base map compiled by Illinois State Geological Survey from digital data (2011 US Topo) provided by the United States Geological Survey. Hypsographic and contours derived from USGS National Elevation Dataset.

North American Datum of 1983 (NAD 83)
Projection: Transverse Mercator
15,000-foot scale; Illinois Coordinate System of 1983, east zone 16
1-meter resolution; Universal Transverse Mercator grid system, zone 16

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SCALE 1:24,000
NATIONAL GEODETIC VERTICAL DATUM OF 1985
BASE MAP CONTOUR INTERVAL 10 FEET
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Illinois geology based on field work by Mary J. Seid, F. Brett Denny, and Joseph A. Devera, 2012-2013. Kentucky geology based on Tracy (1947) and Martin (2002).

Digital cartography by Jennifer E. Carrell, Coy E. Potts, and Jane E. Johnson-Domier, Illinois State Geological Survey.

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This map has not undergone the formal Illinois Geological Quadrangle map review process. Whether or when this map will be formally reviewed and published depends on the resources and priorities of the USGS.

The Illinois State Geological Survey and the University of Illinois make no guarantee, expressed or implied, regarding the correctness of the interpretations presented in this document and accept no liability for the consequences of decisions made by others on the basis of the information presented here. The geologic interpretations are based on data that may vary with respect to accuracy of geographic location, the type and quantity of data available at each location, and the scientific and technical qualifications of the data sources. Maps or cross sections in this document are not meant to be enlarged.



1	2	3
4	5	6
7	8	9

ADJOINING QUADRANGLES
1. Karlov Ridge
2. Salsburg Mine
3. Jackson
4. Rockcastle
5. Ripley
6. Little
7. Salem
8. Marion



APPROXIMATE MEAN DECLINATION, 2013

ROAD CLASSIFICATION



SYSTEM	SERIES	FORMATION	MEMBER OR BED	GRAPHIC COLUMN	THICKNESS (feet)	UNIT
QUATERNARY	HOLOCENE	Pleistocene			0-100	A
PENMAN	ZACHRYNE	Palestine Ss	Allard Ls		50-70	B
MISSISSIPPIAN	CRETACEAN	West Baden Ss	Menard Limestone		110-130	D
			Watersburg		30-50	E
			Vienna Limestone		15-20	F
			Tar Springs Sandstone		70-100	G
			Glen Dean Limestone		50-65	H
			Hardinsburg Ss		110-130	I
			Golconda		30-40	J
			Cypress Sandstone		130-160	K
			Ridenhower		0-10	L
			Bethel Sandstone		50-60	M
VALLEYTAN		St. Louis Limestone	Downs Bluff Ls		25-35	N
			Vienna Limestone		30-38	O
			Renaud Ls		15-22	P
			Leaves Ls		15-25	Q
			Aux Vases Ss		10-20	R
			St. Genevieve Limestone		125-135	S
			St. Louis Limestone		105-110	T
			St. Louis Limestone		350-400	U
			St. Louis Limestone		70-90	V
			Salem Limestone		>400	T

A Undifferentiated fluvial, colluvial, lacustrine, and terrace deposits Sand, clay silt, and gravel. Clay is medium gray to light gray and may be silty. The sand is light brown medium to coarse-grained quartz. The gravel in the upland areas is pre-dominantly chert and sandstone pebbles and cobbles derived from nearby outcrops. The sand and gravel along the Ohio River may have been transported considerable distances. There is a lower terrace usually occurring between 340 and 350 feet and an upper terrace above 350 feet. Several other terraces may occur as a result of flooding along the Ohio River. The terraces in higher elevations may be the remnants of dissected Pleistocene age units, whereas the lower younger terraces are Holocene age. These terraces are recognizable as flat geomorphic surfaces but are not distinguished from other surficial deposits on the map. Loess is present in the upland hills and is commonly 5-10 feet thick. Colluvium derived from bedrock is common on the upland surfaces.

B Igneous dikes and sills The igneous rocks are dark colored "ultramafic" lamprophyres. These rocks have been extensively altered, making classification of these rocks difficult. The texture of the rocks is fine grained where highly altered to porphyritic with 1/4-inch phenocrysts. The rocks have a green tint that probably results from alteration of primary minerals to serpentine and chlorite. Replacement by calcite is extensive and the rocks will readily effervesce when dilute hydrochloric acid is applied. Calcite veining is also common. These rocks were examined through geochemical methods and the results of these analyses can be obtained in the report that accompanies this map. The igneous dikes and sills form intrusive contacts with the sedimentary strata.

C Palestine Sandstone Sandstone, siltstone, shale, mudstone, and minor coal. Sandstone is light gray to white, very fine to fine grained. In most places the upper part is cross-bedded, and the lower portion has thin, wavy, and ripple-bedded bedding. Siltstone is dark olive gray and thinly laminated. At the top of the Palestine, carbonaceous black shale and coal overlie a rooted siltstone that grades downward into laminated shaly sandstone. The basal contact was not observed.

D Menard Limestone Limestone and shale. The upper limestone is called the Allard Limestone Member. It is usually a gray lime mudstone and fine to coarse skeletal wackestone and packstone with thin shale interbeds and scattered chert nodules. The Scottsburg Limestone Member is a light to dark gray, sub-olitic, graphic lime mudstone separated by thin shale layers. The lowest member is the Walch Limestone Member, which is composed of argillaceous micritic limestone. Fossils within the Menard include brachiopods, bryozoans, and disarticulate crinoid stems. Where found in the shale layers above the Walch, the crinoid *Pentamerites* sp. is diagnostic of the Menard.

E Watersburg Formation Shale, siltstone, and sandstone. The unit is mainly dark gray, thinly laminated clay shale that becomes silty upward and grades into siltstone. Sandstone is olive-gray to brownish gray, very fine grained, shaly, and thinly bedded. Thin coal and greenish shale may be present near the top of this unit.

F Vienna Limestone Limestone, shale, and chert. Limestone is largely dark gray to brownish gray, siliceous lime mudstone and wackestone. A few thin interbeds of sandy dark gray shale are present. Dark brown chert nodules are numerous and commonly weather with a porous rind. The thin brown weathered, porous blocks of fossiliferous chert are diagnostic.

G Tar Springs Sandstone Sandstone, siltstone, shale, and thin coal. Sandstone is white to light gray and greenish gray, very fine to medium-grained quartz that is slightly micaceous. It varies from thinly bedded to massive and displays ripple marks, cross-bedding, small load casts, indistinct burrows, and shale rip-up clasts. Shale and siltstone are medium to dark gray, micaceous, and thinly laminated. Thin coal commonly less than one foot thick occurs near the top; the coal rests on dark gray mudstone. Dark gray claystone also occurs in the lower part of the unit. The lower contact is sharp in some localities, but may grade into the underlying unit.

H Glen Dean Limestone Limestone and shale. The unit is generally composed of an upper limestone, middle shale, and a lower limestone. The upper limestone is light brownish gray with a reddish tint, coarsely crinoidal packstone to grainstone, and may be oolitic. Fossils include crinoidal debris, fenestrate bryozoans, brachiopods, blastoids, and corals. The middle shale is thin, medium to dark gray and greenish gray, fossiliferous, and calcareous. The middle shale beds grade into the lower limestone. The lower limestone is medium gray wackestone, containing crinoids and bryozoans, and is distinguished by a dwarfed crinoid fauna in the basal 5 feet. The lower contact is sharp.

I Hardinsburg Sandstone Sandstone, siltstone, and shale. Sandstone is light brownish gray to white, very fine to fine-grained quartz arenite that is thinly bedded to massive. Ripple marks and cross-bedding are common. Siltstone and shales are light brown to medium gray and are commonly interbedded, rippled, and laminated. The lower contact is generally conformable with the underlying unit.

J Golconda Formation Limestone, shale, and mudstone. The formation is divided into three members: the Harney Limestone Member at the top is largely light to dark brownish gray, fine to coarse crinoidal wackestone to cross-bedded grainstone and is oolitic in places. *Pentamerites* is highly characteristic of the Harney Limestone Member, and the wing plates of this crinoid are commonly found in the shaly part of this member. The lower part of the Harney comprises limestone and shale interbedded in roughly equal proportions, which grade into the underlying Frailey Limestone Member. The Frailey Limestone Member is largely olive to greenish gray to dark gray, calcareous, finely fissile clay shale with limestone beds of varied texture as thick as several feet. Red shale or mudstone may occur near the top. The Beech Creek Limestone Member at the base is dark gray to brown, partly dolomitic, argillaceous limestone. The lower contact is sharp.

K Cypress Formation Sandstone, shale, and siltstone. The sandstone is light gray to light brown fresh, dark brown to dark reddish brown weathered, fine to medium-grained subangular quartz sandstone. The upper portion contains well-exposed bluff-forming sandstone in massive, rounded beds with conspicuous soft-sediment deformation; it also contains thin beds of siltstone and inter-bedded sandstone and shale. The lower portion is primarily thick beds of sandstone. A red and green shale may be present near the top of the formation. Locally, the contact with the underlying unit is unconformable and this unit may lie directly on the Bethel Sandstone.

L Ridenhower Formation Shale, sandstone, and limestone. This unit is highly variable but is dominantly dark gray shale with interbeds of gray-green siltstone and fine-grained sandstone containing molds of brachiopods. It is thinly bedded and silty to finely sandy. Limestone up to several feet thick is locally present at the top of this formation.

M Bethel Sandstone Sandstone with minor shale. Sandstone is white to light brown, quartz arenite, fine- to coarse-grained, in coarsening-upward sequences. Beds are thin and laminar, but low-angle cross bedding is also present. The greenish-gray shale occurs as thin interbeds between thicker beds of sandstone. Near the base, shale and quartz pebbles may be present. Basal contact is gradational to erosional.

N Downes Bluff Limestone Limestone, dolostone, shale, and chert. The limestone is light to dark gray crinoidal packstone to grainstone; the dolostone is brownish gray. Disarticulate crinoids may be replaced by pink chert, which is diagnostic for this unit. The upper portion is generally cherty, and the lower part may be silty. Shale occurs in thin interbeds and constitutes a minor portion of the unit. Bedding-parallel stylolites occur at approximately a 1-foot spacing. The lower contact is gradational.

O Yanketown Shale Shale, limestone, and siltstone. The shale is dark gray, red, and green fossiliferous shale with interbedded dolomitic siltstone and thin beds of lime mudstone. The contact with the underlying unit is gradational.

P Renaud Limestone Limestone, siltstone, and shale. The Renaud is predominantly a fossiliferous light gray to brown-gray, sandy to oolitic limestone. Fossils include brachiopods, bryozoans, and echinoderms. The siltstone is coarse grained and calcareous and occurs near the base. The shales are calcareous and interbedded with limestone and siltstone. Numerous *Pentamerites* sp. along with the crinoids *Talarocrinus* (in the Sheterville Mbr.) and *Platycrinus* (in the Levas Mbr.) occur in the Renaud. The contact between the Sheterville and Levas Members is sharp and may be unconformable.

Q Aux Vases Sandstone Sandstone, shale, and siltstone. The sandstone is light greenish-gray, fine-grained, and calcareous. It is thin to medium-bedded and ripple-marked; the thicker beds are usually cross-bedded. Siltstones are also greenish-gray and interbedded with the sandstone and dark gray shale. The lower contact can be sharp to gradational.

R Ste. Genevieve Limestone Limestone, dolostone, shale, and chert. The limestone is light gray to medium gray, oolitic to micritic, and sandy in places. Beds are thick to thin-bedded, and the oolitic beds are usually cross-bedded. The Spar Mountain Sandstone Member, a sandy limestone, is locally present about 60 feet below the base of the Aux Vases Sandstone. The dolomite portion of the unit is fine-grained, and the shale is gray. The entire formation is composed of a diverse marine fauna, with crinoidal debris and oolites being the most common. Concentrically banded chert nodules occur occasionally and become more common lower in the unit. The Ste. Genevieve weathers to a soil that is dark reddish brown with oolitic white chert. The unit is well-exposed in several quarries in the NE 1/4 of the quadrangle—ONS (Lafarge), Rigby and Barnard (Lafarge), and the Cave in Rock (Lafarge) quarries. The lower 60-80 feet of this unit is gradational with the underlying St. Louis Limestone, which contains more lime mudstone, dolostone, and chert.

S St. Louis Limestone Limestone, dolostone, shale, and chert. The limestone is medium to dark gray lime mudstone to wackestone, although packstone beds occur locally. It is thick to massive-bedded, and few bedding-parallel stylolites occur. The unit is cherty with blue-gray chert nodules along bedding planes and contains a diverse marine fauna including brachiopods, crinoids, and corals (colonial and solitary). *Archocyathus* sp., a colonial coral, is common in this unit. Shales are thin and occur as thin partings between the thick limestone and dolostone beds. The St. Louis weathers to a dusky red soil with abundant white chert nodules. It is well-exposed in the Ohio River bluffs at Cave in Rock State Park near the center of Sec. 13, T12S, R9E. The lower 70-90 feet of this unit is gradational with the underlying Salem Limestone, which is darker gray and contains a greater percentage of coarse bioclasts.

T Salem Limestone Limestone, dolostone, siltstone, shale, and chert. The limestone is light brown to very dark gray lime mudstone to grainstone composed of rounded and broken fossil fragments. The upper portion of this unit contains cherty gray lime mudstone and is very similar to the overlying St. Louis Limestone. Bedding is tabular to undulatory. The beds range in thickness from several inches to a few feet. The fossils are primarily small rounded disarticulate echinoderm and fenestrate bryozoan fragments. Other macro fossils include brachiopods, and pentamerites. Peloidal limestone is present and portions may be dolomitic. Chert is light gray, nodular, and may be bioclastic. The chert may weather into concentric porous rinds. Dolostone is light brown and crystalline. Siltstone is brown to light gray and thin bedded. The shale is gray to green-gray and may be fossiliferous. The Salem weathers to a reddish brown soil with abundant white chert. It is well-exposed in the Ohio River bluffs at Lower Rock near the west edge of Sec. 21, T12S, R9E. The lower contact is not exposed in the quadrangle.

