BEDROCK GEOLOGY OF FREEBURG QUADRANGLE
ST. CLAIR COUNTY, ILLINOIS

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

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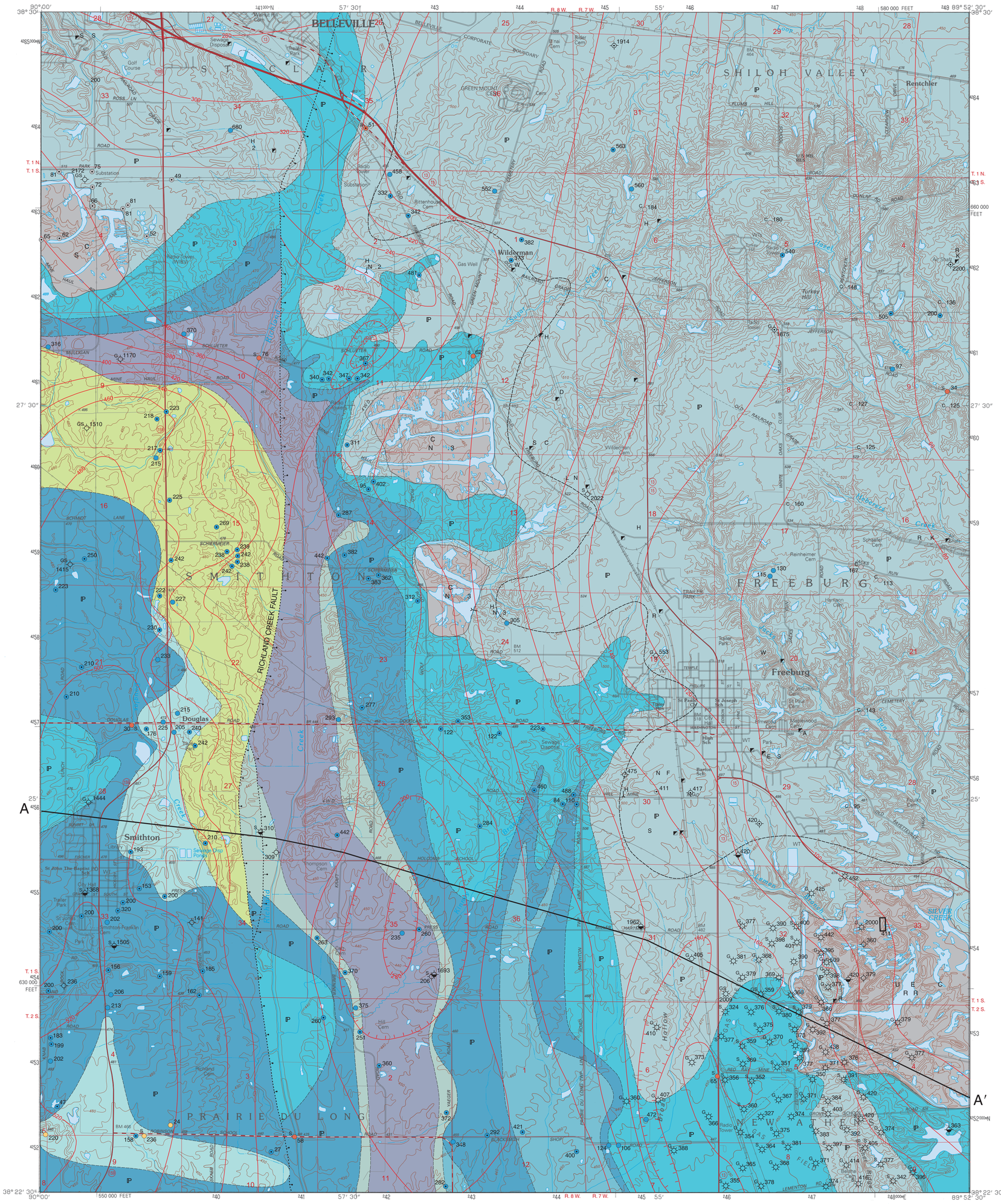
2005

Illinois Preliminary Geologic Map
IPGM Freeburg-BG



EXPLANATION

	sm — Surface mine (coal)	
Quaternary	Q — Quaternary (cross section only)	
Unconformity		
Pennsylvanian	IPs — Shelburn Formation, p, Piasa Limestone Member	Desmoinesian
	IPc — Carbondale Formation	Desmoinesian
	IPt — Tradewater Formation	Desmoinesian / Atokan?
Unconformity		
Mississippian	Mgd — Glen Dean Limestone	Chesterian
	Mh — Hardinsburg Formation	Chesterian
	Mg — Golconda Formation	Chesterian
	Mcy — Cypress Formation	Chesterian
	Mpc — Paint Creek Formation	Chesterian
	Myra: Myr — Yankeetown and Renault Formations (cross section only)	Chesterian
	Myra: Mav — Aux Vases Formation (cross section only)	Chesterian
	Msgsl — Ste. Genevieve Limestone and St. Louis Limestone (cross section only)	Valmeyeran

Symbols

- Shaft mine
- Slope mine
- Drift mine

Drill Holes
from which subsurface data was obtained. Numbers indicate total depth of boring in feet.

- Stratigraphic boring (ISGS)
- Water well
- Engineering boring
- Coal boring
- Oil well
- Dry hole
- Dry hole - show of oil
- Dry hole - show of oil and gas
- Gas well
- Other boring
- CSG — Boring with samples (s), geophysical log (g), or core (c); dot indicates location accurate within 100 feet

Line Symbols
dashed where inferred, dotted where concealed

- Contact
- Normal fault: bar and ball on downthrown side
- 440 — Elevation of base of Beech Creek (Barlow) Limestone, contour interval 20 feet
- A—A′ — Line of cross section

Base map compiled by Illinois State Geological Survey from digital data provided by the United States Geological Survey. Hypsography and topography updated from imagery dated 1998.

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
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 KILOMETER

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

Released by the authority of the State of Illinois: 2005

Geology based on data analysis by W. John Nelson, 2004–2005.

Digital cartography by A. Tovey and T. Goeppinger, Illinois State Geological Survey.

This Illinois Preliminary Geologic Map (IPGM) is a lightly edited product, subject to less scientific and cartographic review than our Illinois Geological Quadrangle (IGQ) series. It will not necessarily correspond to the format of IGQ series maps, or to those of other IPGM series maps. Whether or when this map will be upgraded depends on the resources and priorities of the ISGS.

The Illinois State Geological Survey, the Illinois Department of Natural Resources, and the State 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.

ILLINOIS DEPARTMENT OF NATURAL RESOURCES

1905-2005 ISGS Illinois State Geological Survey

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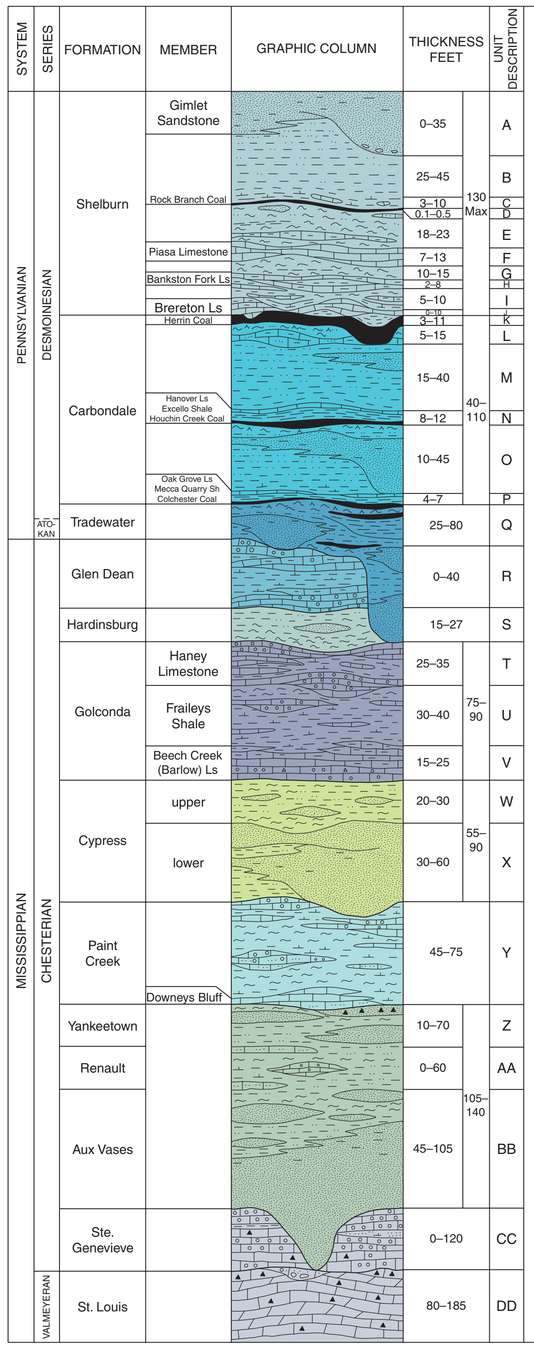
1	2	3
4		5
6	7	8

ADJOINING QUADRANGLES
1 French Village
2 O'Fallon
3 Lebanon
4 Millstadt
5 Mascoutah
6 Paderborn
7 New Athens West
8 New Athens East

APPROXIMATE MEAN DECLINATION, 2005
1½° EAST
MAGNETIC NORTH
TRUE NORTH

ROAD CLASSIFICATION

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



A Sandstone Mostly fine-grained, micaceous, friable, somewhat shaly, coarsens upward and has gradational lower contact. Channel facies exposed along Jack's Run east of Freeburg is fine to coarse, fining upward, micaceous lithic arenite, crossbedded, lower part contains coalified stems of *Cordaites* and *Calamites* along with rip-up clasts of shale and ironstone. Lower contact erosional.

B Shale Medium gray, silty, upper part contains laminae and lenses of sandstone, lower contact gradational.

C Shale Dark gray to black, fissile, calcareous, slightly silty; contains lenses and discontinuous layers of very argillaceous limestone or dolomite. Very fossiliferous. H.R. Wanless and M.W. Fuller (1931, ISGS open files) report the pelecypods *Nuculopsis*, *Edmondia*, *Astartella*, *Aviculopecten*, and *Leda*; the gastropods *Pharkidonotus*, *Meekospira*, *Pleurotomaria*, *Trepospira*, *Bellerophon*, and *Euphemis*; the nautiloid cephalopod *Orthoceras*, the rugose coral *Lophophyllum*, the brachiopod *Ambocoelia*, and crinoid stems. In places there is a foot or more of dark gray to black, thinly fissile shale at the base.

D Rock Branch Coal Typically bright banded, impure and shaly in places.

E Claystone Upper part largely greenish gray and mottled, massive to weakly bedded, slickensided. Impure sandstone, siltstone, or silty limestone commonly occurs a few feet below the top. Black, unevenly laminated, pyritic shale occurs locally 4 to 10 feet above base. Below the black shale (or its position) is slickensided claystone variegated in red, green, and gray. Limestone 1 to 3 feet thick occurs 1 to 5 feet above the base of the interval. Limestone is medium gray to brown, argillaceous lime mudstone with few fossils; its bedding is thin, even, and slabby. At base of interval is claystone that is light brownish gray, soft and calcareous, grading to weakly fissile shale.

F Piasa Limestone Light to medium brown and gray, weathering nearly white; dense and sublithographic. Fossils include *Squamularia perplexa* and other brachiopods, gastropods, and the large fusulinid *Fusulina piasaensis*. Bedding varies from massive to nodular; the upper part is commonly brecciated and bears polygonal fractures that resemble dessication cracks.

G Claystone Upper part is white to yellowish and greenish gray; lower part is variegated in red, green, and gray. Entire unit is massive, thoroughly slickensided, non-calcareous, and contains irregular limonitic masses. This unit is a paleosol succession. A streak of carbonaceous shale in the lower part may represent coal.

H Bankston Fork Limestone One to five benches of limestone separated by claystone and silty shale. Limestone is light gray, greenish gray and brownish gray, silty and argillaceous, texture varies from sublithographic to skeletal wackestone. Bedding can be massive, but typically is nodular. Fossils include crinoid fragments and brachiopods, especially *Mesolobus mesolobus*, *Chonetes granulifer*, *Marginifera splendens*, *Derbyia crassa*, and *Ambocoelia planoconvexa*. Claystone and shale are light gray to greenish gray, calcareous, partly silty, fossiliferous, and contain limestone nodules. Commonly two limestone beds 1 to 2 feet thick separated by 2 to 3 feet of claystone with limestone nodules; another nodular limestone layer a few inches thick is widely present at base.

I Lawson Shale, Conant Limestone, and Jamestown Coal Upper part of Lawson is non-fissile, soft mudstone strongly mottled in light greenish gray and dark gray. Mottles outline a patchwork or mosaic pattern, with veins of light green extending into lower unit. Lower Lawson is dark gray to black, silty, calcareous, moderately fissile shale that contains small septarian limestone concretions. Fossils include productid brachiopods, *Dunbarella* and other pelecypods, and *Orbiculoidea*, along with plant fragments. Lawson Shale is 5 to 10 feet thick. Below Lawson is Conant Limestone, a medium to dark gray, argillaceous wackestone and fossiliferous lime mudstone. Septarian concretions of dense, dolomitic limestone are common. Large productid brachiopods, especially *Productus cora*, are characteristic; other fossils include the brachiopods *Composita argentea*, *Mesolobus mesolobus*, *Derbyia*, *Lingula*, and *Orbiculoidea*; the pelecypods *Acanthopecten carboniferus*, *Aviculopecten*, *Deltopecten*, *Parallelodon*, *Edmondia*, and *Pteria*; the gastropods *Phanerotrema* and *Trepospira*, the cephalopod *Metacoceras*, echinoderm fragments, and foraminifera. Limestone is normally a few inches to 3 feet thick, but locally as thick as 8 feet. Jamestown Coal comprises thin, shaly coal interlayered with carbonaceous shale and claystone and lenticular limestone. Commonly one coal layer is at the top and another near the base. Shale and claystone are dark gray to black, massive to moderately fissile, and contain pyrite and siderite nodules. Limestone occurs as lenses and elongate lenses a few inches thick; it is very argillaceous and contains echinoderm, brachiopod, and pelecypod fragments. Shale or claystone at the base contains abundant *Lingula* (brachiopod) and *Anthracosites* (pelecypod) along with stigmarian root casts. Jamestown unit is 0 to 1.6 feet thick and locally lies directly on Herrin Coal.

J Brereton Limestone, Anna Shale, and Energy Shale Brereton is medium to dark gray lime mudstone to wackestone with dark argillaceous bands that create a "swirly" or "bouldery" appearance. Common fossils are brachiopods such as *Dictyoclostus*, *Juresania*, and *Derbyia*; *Ammodiscus* and fusulinid foraminifera; pelecypods, and echinoderm fragments. The Brereton occurs as irregular lenses up to 10 feet thick. Where thick the limestone becomes increasingly shaly upward, grading to hard, calcareous shale containing bands of broken fossils. The lower surface, as observed in mines, may be flat but more commonly is knobby. Soft calcareous claystone (called "clod" by miners) a few inches thick commonly is at the base. The Anna Shale is black and hard, thinly fissile, highly organic shale containing 20% or more disseminated carbon. It has low density and produces very high readings on gamma-ray logs. Small pyrite and phosphate nodules and laminae are common. Septarian concretions of dense, pyritic black limestone range up to several feet in diameter. *Dunbarella* (pelecypod) and *Orbiculoidea* (brachiopod) are common, along with scattered fish scales and bone fragments. The upper Anna typically is dark gray, faintly mottled, weakly fissile shale that contains burrows filled with limy sediment. Highly argillaceous, fossiliferous black limestone ("bastard limestone" of drillers and miners) occurs as lenses at the base of the Anna, especially around the margins of Energy Shale lenses. The Anna is lenticular, typically 0 to 3 feet thick but locally reaching 7 feet. The Energy Shale is medium to dark gray, weakly fissile, silty and carbonaceous, pyritic shale that contains plant fragments and pelecypods. It occurs as isolated lenses less than 5 feet thick and a few tens of feet to a few hundred feet across. Energy Shale lenses commonly fill topographic depressions on top of the Herrin Coal; the shale may interfinger with the coal.

K Herrin Coal Bright-banded coal with well-developed cleat and laminae of fusain, pyrite, and claystone. The persistent "blue band" claystone layer is ½ to 2 inches thick and 18 to 28 inches above the base. The coal has high (3 to 5%) sulfur content; pyrite occurs as laminae, cleat facings, and lenses up to one foot thick mostly near the top of the seam. Local areas of coal thicker than 10 feet were reported in several mines. At the Star Mine (Sec. 30, T1S, R7W), coal 9 to 11 feet thick occupied a depression. The "blue band" was more than 4 feet above the base of the seam, and dips as steep as 30° occurred on the margins of the trough. The Anna Shale thickened to 10 feet in the same area (G.H. Cady, ISGS mine notes, 1918). Coal 8 to 11 feet thick also occupied swales at the Red Ray surface mine in Sec. 4, T2S, R7W (H.R. Wanless, 1931, ISGS open files). Abnormally thin (less than 3 feet) coal was encountered in northern workings of the River King Underground mine in Sec. 4, T1S, R7W. Thin coal lay in sinuous, branching, or dendritic belts 50 to 100 feet wide. Upper layers of the coal were truncated; the "blue band" was in its usual position. Thin coal was dull and hard and showed disturbed bedding along with many clay stringers. Also the coal was replaced by large nodular masses of dark brownish-gray to black chert. Danner and Nelson (1982) proposed that peat was eroded and partially oxidized in shallow channels shortly after deposition.

L Claystone and limestone Claystone is olive gray, massive, and slickensided. It contains abundant roots; its lower part calcareous and contains limestone nodules. Limestone is light gray to brown, largely microgranular, pure to highly argillaceous and silty, and massive to nodular.

M Shale Medium to dark gray, partly silty, containing laminae and lenses of light gray siltstone and sandstone. The interval generally coarsens upward.

N Hanover Limestone, Excello Shale, and Houchin Creek Coal The limestone, a few inches to 2 feet thick, is dark gray and argillaceous. The shale is 2 to 6 feet thick and black, hard, and thinly fissile; large pyritic limestone concretions are present. The coal is bright-banded and 2 to 4 feet thick, but may be absent west of the Richland Creek Fault.

O Claystone, shale, siltstone, and sandstone At the top is rooted claystone. The rest of the interval is gray shale, siltstone, and sandstone. In some wells these strata coarsen upward from dark gray, calcareous clay shale at the base to siltstone or sandstone at the top; elsewhere, sandstone at the base has an erosional lower contact and grades upward to siltstone or shale.

P Oak Grove Limestone, Mecca Quarry Shale, and Colchester Coal The limestone is less than 2 feet thick and is dark gray, argillaceous lime mudstone to wackestone with echinoderm fragments. The shale is 2 to 4 feet thick and black, hard, thinly fissile, highly carbonaceous, and pyritic. The coal is bright-banded and pyritic, ranging from a few inches to 2 feet thick.

Q Tradewater Formation A variable succession of sandstone, siltstone, mudstone, gray to black shale, and thin coal. Sandstone is gray to brownish gray, fine to coarse-grained, with subangular to rounded quartz grains and plentiful mica, siderite, pyrite, and carbonaceous debris. Sandstone bodies are lenticular; some fill small channels scoured into underlying rocks. Siltstone and shale are medium to dark gray, laminated, micaceous, and sideritic. Black, fissile shale that yields very high readings on gamma-ray logs is widespread in the upper Tradewater in the area of the Freeburg gas field, where it is as thick as 25 feet. Coal seams are less than 2 feet thick and lenticular; they occur at various positions within the unit. Claystone to silty mudstone is brownish to olive gray, massive, blocky, and slickensided. The lower contact is an angular unconformity, truncating tilted and faulted Mississippian strata.

R Glen Dean Limestone Limestone and shale. Limestone is light brownish-gray crinoid-bryozoan packstone and grainstone that is partially dolomitized and recrystallized to microgranular texture. Where Glen Dean is fully preserved (not eroded), it generally includes upper and lower limestone beds each 5 to 15 feet thick, separated by shale. The shale is mostly dark gray, fissile, and calcareous; but some sample logs report red and green mottled shale or claystone. The lower contact is sharp.

S Hardinsburg Formation Shale, mudstone, minor sandstone. Shale is dark gray, dark greenish to olive gray, and reddish gray; largely fissile clay shale, but portions are silty, grading to siltstone. Mudstone is mottled in the same colors; red shale or claystone most commonly occurs near the base. Lenses of sandstone as thick as 10 feet are indicated on a few well logs. The lower contact is sharp.

T Haney Member of Golconda Formation Limestone and shale. Limestone is mostly light-colored, oolitic, and skeletal grainstone and packstone, with echinoderm, brachiopod, and bryozoan fragments. Some limestone is partially dolomitized; the Haney includes layers of microgranular to sublithographic dolomite. A little light gray or white chert is present. Shale is dark gray to greenish gray, calcareous and fissile. Although limestone consistently occurs at the top of the Haney, limestone layers are discontinuous and vary in thickness. The lower contact generally is sharp, but picking its position can be arbitrary where the Haney is mostly shale.

U Fraileys Shale Member of Golconda Formation Shale and limestone. Shale, the prevalent lithology, is largely dark gray to dark olive and greenish gray, fissile, and calcareous. Fossils, especially bryozoans, are abundant. Greenish gray to red, purple, and ochre shale or claystone commonly occurs at the top of the member. Limestone varies from sublithographic to coarsely oolitic and fossiliferous. Limestone beds are discontinuous and vary in thickness. The lower contact is gradational.

V Beech Creek (Barlow) Limestone Member of Golconda Formation Limestone is dark gray to dark brownish-gray, and varies from dolomitic lime mudstone to wackestone and packstone having rounded and coated fossil grains and small, dark-centered oolites. The Beech Creek typically grades from relatively pure, bioclastic limestone in the lower part to micritic, argillaceous, and silty limestone in the upper part. Bluish-gray chert nodules are common in the lower part. This unit is continuous throughout the map area, except where eroded. The lower contact is sharp.

W Cypress Formation, upper part Shale, mudstone, siltstone, and sandstone. Shale and mudstone are gray to red and purplish gray, partly silty, and massive to weakly fissile. Sandstone, which occurs as lenses, is greenish gray and very fine-grained.

X Cypress Formation, lower part Sandstone, siltstone, and shale. Sandstone is light gray to light greenish-gray and very fine to fine-grained, angular to subangular, porous, and partly calcareous. Typically it is shaly near the top and becomes cleaner and coarser-grained downward. Locally, the sandstone grades laterally to medium and dark gray silty shale and siltstone. The lower contact is sharp and probably erosional on a small scale.

Y Paint Creek Formation Limestone, shale, and mudstone. Limestone is mostly light-colored, coarse crinoid-bryozoan and oolitic packstone and grainstone; but the Paint Creek includes lithographic limestone and dolomite. Some limestone is sandy, grading to calcareous sandstone. Limestone near the base (Downeys Bluff Member) contains distinctive silicified, red to pink crinoid fragments. Limestone units are lenticular to moderately continuous. Shale and mudstone in the Paint Creek are multi-colored: greenish, reddish, and purplish gray, olive-gray and ochre or mustard-yellow. The lower contact can be sharp in places but commonly is difficult to identify.

Z Yankeetown Formation Sandstone, siltstone, shale, and mudstone. The most characteristic feature is a layer 3 to 10 feet thick of silicified or cherty sandstone or sandy limestone at the top. This white to light gray rock is very hard and commonly described as "glassy" or "glossy" by drillers. The remainder of the Yankeetown consists of shale and claystone that are variegated in red, green, and gray; silty shale and siltstone that are gray to greenish gray and silty; and sandstone that is light gray to greenish gray, very fine to fine-grained, and calcareous. Bedding is lenticular; the Yankeetown intergrades laterally with the Renault Formation.

AA Renault Formation Limestone, shale, and mudstone. Limestone is mostly coarse crinoidal packstone and grainstone, but wackestone and lime mudstone occur along with highly fossiliferous, calcareous shale. Limestone is commonly sandy, containing well-rounded, fine to coarse quartz grains. Shale and mudstone of the Renault are multi-colored: gray, green, red, lavender, and ochre. Limestone bodies are highly lenticular and grade laterally to calcareous sandstone or siltstone of the Yankeetown and upper Aux Vases.

BB Aux Vases Sandstone Dominantly sandstone that is light gray, very fine to medium-grained, becoming coarse in the northwestern part of the quadrangle. Some sandstone has calcite cement whereas other sandstone is loose to weakly cemented. Clusters of tiny pyrite crystals are common, as are glauconite grains. Shows of oil and gas are reported in many wells. Dark green siltstone or silty shale occurs locally at the base. The lower contact is erosional. Aux Vases is thickest in the northwestern part of the quadrangle, where it fills a valley incised entirely through the Ste. Genevieve Limestone into the St. Louis Limestone.

CC Ste. Genevieve Limestone Limestone with minor shale and sandstone. Limestone is largely light gray to light brownish gray, oolitic and crinoidal grainstone. Glauconite grains are common, as are rounded, frosted quartz sand grains. Occasional layers of sublithographic limestone and dolomite are present. Also common are small lenses of light greenish gray, very fine grained, calcareous sandstone and thin interbeds of red, green, and gray shale. The lower contact is sharp and may be erosional, as suggested by a basal conglomerate of rounded limestone pebbles in a cored test hole (Sun Oil #1 Keck, Sec. 33, T1S, R8W).

DD St. Louis Limestone Limestone and dolomite. Limestone is mostly microgranular to finely granular, light to medium gray and brownish gray, and cherty. Dolomite is microsucrosic and slightly vuggy. Some beds are silty or argillaceous. Medium to coarse-grained, crinoidal and oolitic packstone and grainstone occur in the St. Louis rarely. The St. Louis thins toward the southwest, where the upper part is eroded beneath the Aux Vases Sandstone.

Note: descriptions are based on observations made by the author along with core descriptions and field notes from outcrops and coal mines by ISGS geologists from the 1920s to the present. Fossil identifications are largely unverified; some fossil names used by field-note authors may be obsolete.