Bedrock Geology of Welge Quadrangle
Randolph and Jackson Counties, Illinois

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

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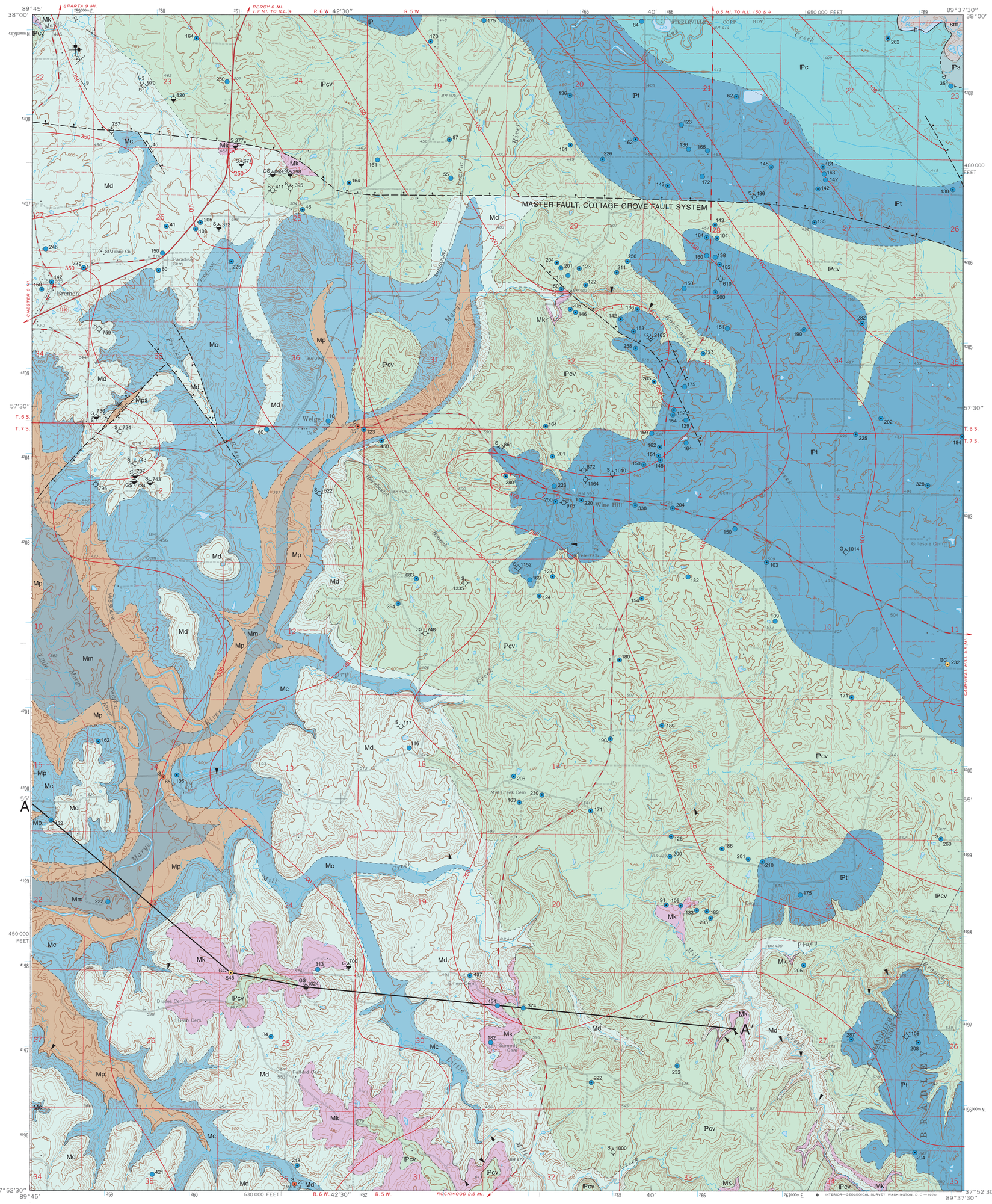
2007

Illinois Geologic Quadrangle Map
IGQ Welge-BG



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 1965. Field checked 1968.

North American Datum of 1927 (NAD 27)
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 1/2 0 1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 .5 0 1 KILOMETER

BASE MAP CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

Released by the authority of the State of Illinois: 2007

Geology based on field work by J. Nelson, 2005–2006.

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

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1	2	3
4		5
6	7	8

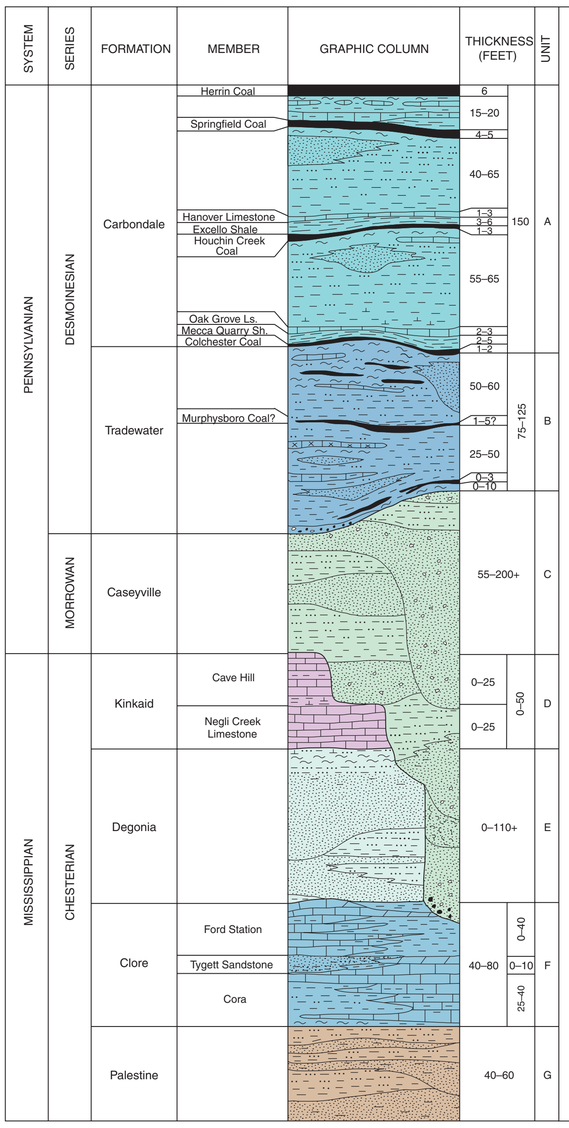
ADJOINING QUADRANGLES
1 Walsh
2 Steeleville
3 Percy
4 Chester
5 Willisville
6 Belgique
7 Rockwood
8 Raddle

APPROXIMATE MEAN DECLINATION, 2007

ROAD CLASSIFICATION

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

Outcropping and Subcropping Strata



A Carbondale Formation Shale, siltstone, sandstone, limestone, coal, and claystone. Shale is medium to dark gray, clayey to silty, micaceous, carbonaceous, and sideritic. Siltstone is light to medium gray, quartzose, micaceous, and carbonaceous. Sandstone is light to medium gray, very fine- to medium-grained lithic arenite, with plentiful mica and carbonaceous debris. Shale, siltstone, and sandstone commonly are interlaminated and interbedded. Clastic intervals commonly coarsen upward. Black, fissile, phosphatic shale units overlie the Colchester and Houchin Creek Coals. Limestone is light to dark gray, argillaceous lime mudstone to skeletal wackestone and packstone. Coal is bituminous and bright-banded, with laminae of claystone, fusain, and pyrite. The Springfield and Herrin Coals have been almost entirely removed by surface mining. Claystone (underclay) that underlies coal seams is olive- to greenish gray, massive to blocky, and slickensided; it contains fossil roots. Information on the Carbondale Formation within the Welge Quadrangle is scanty; descriptions are based largely on boreholes and mine exposures outside the map area.

B Tradewater Formation Shale, claystone, sandstone, limestone, coal, and conglomerate. Shale is mostly medium to dark gray, clayey to silty, micaceous, and laminated. It forms upward-coarsening sequences, grading upward to siltstone. Claystone is greenish to olive-gray; some layers are mottled and variegated with reddish and purplish gray. Claystone is massive to blocky and contains abundant slickensides, root traces, and streaks of carbonaceous shale or impure coal. Much claystone occurs in the upper Tradewater. Sandstone is light to medium gray, very fine- to medium-grained sublitharenite and litharenite, micaceous and clay-rich; iron oxide is plentiful.

Silicified limestone 2 to 5 feet thick, observed at Wine Hill and in a ravine near center of Sec. 22, T7S, R5W, is off-white to buff and yellowish orange, chalky, and porous. Molds of fossils are abundant, including *Dictyoclostus, Mesolobus, Spirifer*, and other brachiopods along with bryozoans and echinoderm fragments. Limestone 2 to 4 feet thick, at Wine Hill 15 feet below the silicified limestone, is fossiliferous wackestone with thin, nodular bedding, brecciated texture, and algal mats. A variety of brachiopods, echinoderms, bryozoans, and rugose corals are present. Dunbar and Henbest (1942) reported the fusulinids *Fusulina pumila* and *Fusulina* cf. *F. leei (Fusulina* is now called *Beedeina)* and *Wedekindellina euthysepta*(?). These fusilinids are confined to Lower Desmoinesian strata between the Mitchellsville Limestone and the Oak Grove Limestone elsewhere in the Illinois basin. Abundant at Wine Hill, *Beedeina pumila* is characteristic of the Seahorne Limestone (Dunbar and Henbest 1942, Douglass 1987).

Coal seams of the upper Tradewater range from a streak to 1 foot thick and are discontinuous. A coal seam 1 to 2½ (possibly 5) feet thick near the middle of the formation is reported on many well logs. This seam is likely the Murphysboro Coal. Another coal seam, as thick as 3 feet, is widespread near the base of the formation.

Sandstone at or near base is commonly rusty to dark red (hematitic) and coarse and poorly sorted; the sand grains are heavily coated with clay and iron oxide. Quartz granules (reworked from the Caseyville) are common as are clasts of shale, ironstone, chert, and sandstone. Basal Tradewater sandstone in SE SE SW, Sec. 26, T7S, R5W contains breccia clasts of Caseyville sandstone as large as 12 inches. Conglomerate composed of angular clasts of flint-clay in a matrix of fine sandstone marks the base of the Tradewater Formation in the ISGS No. 1 Sickmeyer drill core from Sec. 11, T7S, R5W.

Fossils from the limestone beds, correlation of the coal beds, and characteristics of basal Tradewater strata indicate that a major break in deposition occurs between basal Tradewater (early Desmoinesian) and Caseyville (presumably Morrowan) strata of the map area. Apparently the entire Atokan series is missing in the study area.

C Caseyville Formation Sandstone, siltstone, shale, and conglomerate. Sandstone is white to light gray (fresh), weathering yellow to orange and dark brown and forming prominent cliffs and ledges. Outcrops can be heavily encrusted by iron oxide and display Liesegang bands. The sandstone is quartz arenite that ranges from very fine- to very coarse-grained and commonly contains well-rounded quartz clasts as large as 1 inch across. The sugary texture is enhanced by sparkly quartz overgrowths on sand grains. Caseyville sandstone tends to be highly permeable and is an important aquifer. It is laminated to massive. Thinly layered sandstone displays planar, wavy, ripple, ripple-cross, flaser, and micro-cross-lamination. Small load casts and ball-and-pillow structures are present.

Many Caseyville outcrops show unidirectional, tabular planar cross-bedding in sets as thick as 6 feet; foreset beds typically dip south, southeast, and southwest. Trough cross-bedding occurs in smaller sets and has more diverse orientations. Massive sandstone may show convolute lamination, suggesting slumping or rapid dewatering of the sand. Sandstone bodies are lenticular; some fine upward, whereas others coarsen upward. Large-scale scour-and-fill structures are common.

Siltstone of the Caseyville is light to dark gray, massive to laminated, and commonly interlaminated with shale. Shale is dark gray, clayey to silty, fissile, and well laminated. The only fossils observed are remains of land plants, which occur as casts in sandstone and as carbonized impressions in shale.

Quartz-pebble conglomerate occurs locally as lenses within sandstone and as lag deposits at the bases of sandstone bodies. Shale-pebble conglomerate occurs in lenses as thick as 20 feet in Piney Branch Ravine Nature Preserve. Shale and siderite pebbles are angular to rounded, randomly oriented or flat to bedding; they float in a matrix of fine quartz sandstone.

The Caseyville is thickest in the northeastern part of the quadrangle and thinnest in the east-central area; thinning there is likely the result of erosion beneath the Tradewater Formation. The lower contact is unconformable, and paleochannels are incised into Mississippian strata. A paleochannel about 1 mile wide runs south-southeast from Sec. 6, T7S, R5W to Secs. 32 and 33, same township; and continues to the Mississippi River bluff in the Rockwood Quadrangle (Jacobson et al. 2005). This channel is shown on the cross section below.

D Kinkaid Formation Limestone is medium to dark gray (weathering olive-gray to yellowish gray) and is largely lime mudstone to skeletal wackestone and packstone. Only the basal Negli Creek Limestone Member is exposed on outcrop. The Negli Creek coarsens upward from lime mudstone at the base to crinoidal packstone and grainstone, having rounded grains, at the top. Beds are mostly 3 to 12 inches thick and separated by wavy, argillaceous partings. Fossils include brachiopods and, in the lower part, bellerophontid gastropods and *Girvanella* oncoids. The Kinkaid exhibits ancient karst features, including springs, sinkholes, and small caves. The lower contact is gradational through an interval of calcareous, fossiliferous shale less than one foot thick.

E Degonia Formation Sandstone, siltstone, shale, and claystone. Sandstone is the dominant lithology and forms ledges and bluffs in the southern part of the map area. Sandstone is white to light gray, weathering light yellowish gray. Honeycomb weathering is prominent; Liesegang bands are present but less conspicuous than in the Caseyville. Degonia sandstone is well-sorted, very fine to fine quartz arenite that contains scattered shale rip-up clasts but no quartz granules. The rock is permeable and partly calcareous, laminated to massive. Planar, ripple, flaser, and micro-cross-laminations are commonly rhythmic, suggestive of tidal activity. Trough cross-bedding occurs in sets a few inches to about 2 feet thick and shows northeast to northwest paleocurrents; some outcrops have bidirectional cross-bedding. Along Mill Creek in the southeastern part of the map area, tabular planar cross-bedding in sets as thick as 6 feet shows paleocurrents directed south, southwest, and west. Massive sandstone is present, as is sandstone having contorted lamination, suggesting slumping or dewatering of soft sand. Degonia sand bodies are typically tabular and may either coarsen or fine upward. Siltstone and shale vary from light to dark gray and are commonly interlaminated with sandstone.

The upper 10 to 15 feet of the Degonia includes claystone that is bluish to greenish gray, locally with red mottling; and shale that is interlaminated with sandstone and burrowed. The lower contact is generally sharp, but where it is exposed, it is not noticeably erosional.

F Clore Formation Limestone, shale, siltstone, sandstone, dolomite, and claystone. Limestone is mostly medium to dark gray (fresh), weathering olive-gray to yellowish gray. Lime mudstone and wackestone dominate; packstone and grainstone occur locally. Fossils are common, and some beds are crowded with whole specimens, including spiriferid, compositid, and productid brachiopods; *Archimedes* and other fenestrate and ramose bryozoans, *Pentremites* and other echinoderms, and rugose corals. Bedding typically is wavy to hummocky, most beds being a few inches to 1 foot thick and defined by shaly partings. Lenses of dark gray to black, vitreous chert are abundant in places.

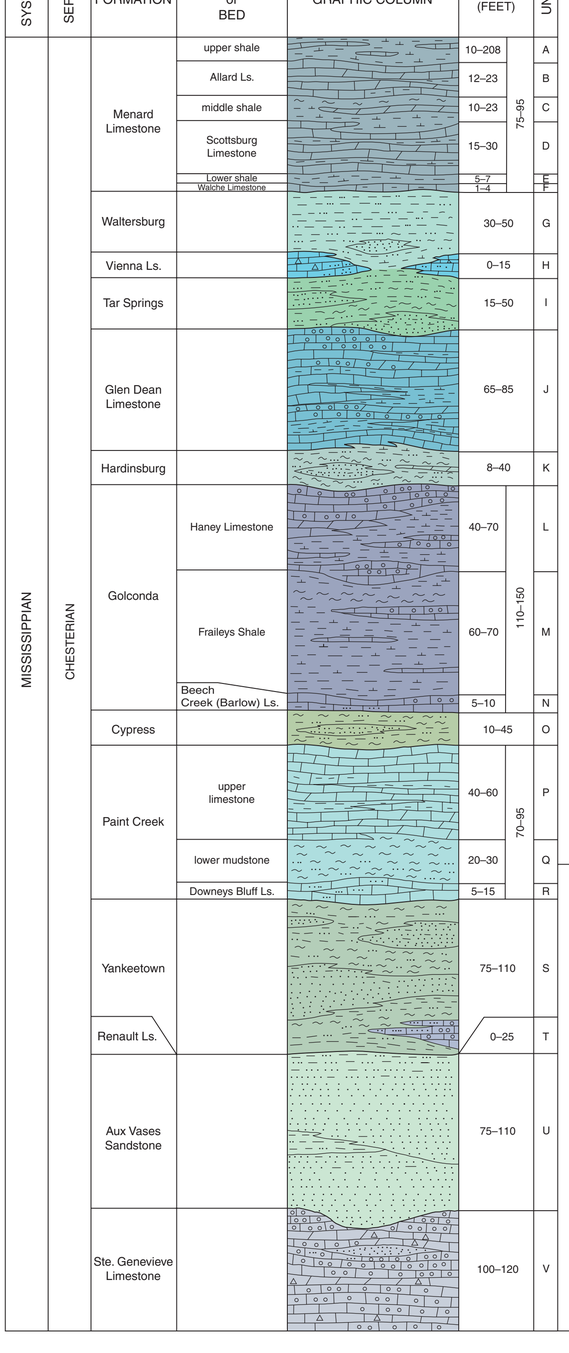
Shale of the Clore Formation is largely dark gray, thinly fissile, calcareous clay shale. Greenish and olive-gray shale and siltstone also are present. Sandstone is light gray to yellowish gray, very fine-grained, thinly bedded, and burrowed. Dolomite is light to dark gray, weathering orange; it is sublithographic and dense. Claystone is dark greenish to bluish gray, massive to blocky, and calcareous.

Regionally, the Clore is divided into three members: Ford Station Member of limestone and shale at the top, Tygett Sandstone Member in the middle, and Cora Member of shale and limestone at the base. The Tygett is confined to the northern part of the Welge Quadrangle, where it is thin and inconspicuous. Also in the northern part of the map area, thick cherty limestone is in the Ford Station Member, whereas the Cora Member is mostly shale with a few thin (1 to 5 feet) limestone layers. In the southern part of the quadrangle, the Ford Station is dominantly shale and the Cora dominantly limestone. Dolomite having nodular brecciation and root traces, indicating subaerial exposure, was observed at the top of the Cora in the southern area. The lower contact was not observed; it is probably gradational.

G Palestine Formation Sandstone, siltstone, and shale. Sandstone is light to medium olive and brownish gray, weathering dark brown; it is very fine- to fine-grained and largely laminated to thinly bedded. Siderite, pyrite, and fine carbonaceous debris are common. Interference and ladderback ripples, ripple and flaser lamination, and small load casts were seen. Some layers are thoroughly burrowed. Siltstone and shale are medium to dark gray and laminated, commonly interlaminated with sandstone. The Palestine shows upward-coarsening sequences about 5 to 10 feet thick.

Note: See accompanying report for Reference section.

Subsurface Strata



The following descriptions are based on well records, including oil and gas test holes and deep water wells. Records include the core of the ISGS No. 1 Vasquez stratigraphic borehole, electric and gamma ray-density logs, sample studies by the author and other geologists, and detailed logs made by drillers.

A Menard Limestone, upper shale member Shale with thin limestone interbeds. Clay-shale is olive-gray to dark gray, calcareous and fossiliferous, and thinly fissile. Limestone includes coarse crinoidal and pelletal packstone.

B Menard Limestone, Allard Limestone Member Limestone is medium to dark gray and brownish gray and dominantly lime mudstone and wackestone with echinoderm and brachiopod fragments and pellets. Some beds are dolomitic. Crinoidal packstone occurs in the lower part. Thin shale interbeds are present.

C Menard Limestone, middle shale member Shale, claystone, and dolomite. Fissile clay-shale and blocky, slickensided claystone vary in color from gray to green with a little red mottling. Dolomite is buff to green and sublithographic.

D Menard Limestone, Scottsburg Limestone Member Limestone with thin shale interbeds. Limestone resembles that of the Allard (Unit B). Two evenly spaced shale interbeds commonly are present.

E Menard Limestone, lower shale member Shale is olive-gray to dark gray, thinly fissile, calcareous clay-shale.

F Menard Limestone, Walche Limestone Member Limestone is similar to that of Allard and Scottsburg Limestone Members.

G Waltersburg Formation Shale, siltstone, and sandstone. The unit is dominantly dark gray to dark olive-gray, thinly fissile shale that is partly silty and finely carbonaceous. Greenish gray to gray siltstone and very fine-grained sandstone occur in the lower part of this unit in some wells.

H Vienna Limestone Limestone varies from dark gray lime mudstone to light gray, coarse crinoidal packstone. In most wells, the upper part is micritic and impure (argillaceous to sandy), whereas purer, coarser limestone occurs in the lower Vienna. In some wells, the limestone is very sandy, suggesting lateral gradation with the lower Waltersburg or upper Tar Springs.

I Tar Springs Formation Sandstone, shale, and mudstone. Sandstone is light to medium gray, very fine- to fine-grained quartz arenite that is commonly interlaminated with dark gray shale. Shale and mudstone are largely dark gray to greenish gray, but red and green mottled shale or mudstone occur in the lower Tar Springs in many wells. This unit varies from entirely shale to mostly sandstone. Where sandstone is developed, shows of oil and gas are common.

J Glen Dean Limestone Limestone and shale. This formation is two-thirds to three-forths limestone that is largely light-colored, medium- to coarse-grained, skeletal and oolitic grainstone and packstone. Darker, more micritic limestone tends to occur in the middle to lower portion. Some sample logs record dolomite that is microgranular or microsucrosic. Shale, found mostly in the lower half of the Glen Dean, is olive-gray to dark gray, calcareous, and fossiliferous. The lower contact can be gradational through calcareous shale.

K Hardinsburg Formation Shale, mudstone, dolomite, siltstone, and sandstone. Fissile shale and blocky mudstone are mottled and variegated in gray, green, and red. Siltstone and very fine sandstone are light to medium gray, argillaceous, and calcareous. Dolomite is gray to greenish gray, microgranular, and brecciated.

L Golconda Formation, Haney Limestone Member Limestone and shale. Limestone is light-colored, oolitic, and skeletal grainstone and packstone; wackestone, lime mudstone, and microgranular dolomite are also present. Overall, the limestone becomes darker colored and more micritic downward. Shale is olive-gray to greenish gray and dark gray, calcareous, fissile, and highly fossiliferous, with brachiopods, bryozoans, and echinoderms. The proportions of limestone and shale vary greatly from one well to the next.

M Golconda Formation, Fraileys Shale Member Shale, limestone, and mudstone. At the top is variegated mudstone that is mottled reddish and greenish gray. The remainder of the unit is dominantly fissile clay-shale that is dark gray to olive-gray, calcareous, and pyritic. Siderite nodules and fossils, especially fenestrate bryozoans, are common. Thin limestone interbeds are common in the upper part of the member, just below the variegated mudstone.

N Golconda Formation, Beech Creek (Barlow) Limestone Limestone is typically medium to dark brownish gray wackestone to packstone with rounded fossil grains and scattered oolites present. The limestone can be argillaceous to finely sandy.

O Cypress Formation Shale, mudstone, siltstone, and sandstone. Shale and mudstone are variegated and mottled in red, green, gray, and mustard yellow. These rocks are commonly silty and vary from massive and blocky to fissile and laminated. Siltstone and sandstone are gray, greenish gray, and purplish red, quartzose, and partly calcareous. Yellow micritic dolomite was noted in one sample study.

P Paint Creek Formation, upper limestone member Limestone with shale interbeds. Limestone is generally light gray to buff and varies from coarse crinoidal and oolitic grainstone to skeletal packstone and wackestone. In some wells the limestone is dolomitic and partially recrystallized to microgranular texture. Fissile clay-shale is olive-gray, greenish gray, and reddish gray.

Q Paint Creek Formation, lower mudstone member Mudstone and shale. The upper part of the member is composed of massive claystone to fissile clay-shale that is variegated in reddish, greenish, and olive-gray. The lower part is brick-red or maroon massive mudstone that is silty and calcareous. The maroon mudstone marks the position of the Bethel Sandstone, seen elsewhere in Illinois.

R Paint Creek Formation, Downeys Bluff Limestone Member Limestone is white to light gray crinoidal grainstone that commonly contains quartz sand grains and oolites. Pink to red crinoid fragments are characteristic, but not always seen in samples.

S Yankeetown Formation Shale, mudstone, siltstone, and sandstone. Fissile shale and blocky mudstone are mottled and variegated in greenish gray, reddish gray, olive-gray, and purplish gray. Purple hues, seldom seen in other formations, are characteristic of the Yankeetown. Siltstone to fine-grained sandstone are light gray and greenish gray, quartzose, and calcareous. Recrystallized or silicified sandstone ("glassy" texture) commonly is found in the upper Yankeetown. Oil shows were reported in several wells; sandstone of the Yankeetown is commonly called the "Benoist sand" and is oil-productive elsewhere in Illinois. Sandstone bodies are lenticular and probably intergrade laterally with shale. Black, carbonaceous shale (with fossil plants) and impure coal were logged near the base of the formation in several wells.

T Renault Limestone Limestone and shale. Limestone is generally light brown to pinkish gray, crinoidal wackestone and packstone. It is very silty to finely sandy and intergrades with calcareous sandstone. Glauconite grains and oolites are common. Gray and variegated shale may be interbedded. Limestone bodies are lenticular and probably represent shallow marine shoals or bars locally developed in the lower part of the Yankeetown Formation, above its basal carbonaceous shale.

U Aux Vases Sandstone Sandstone, siltstone, and shale. The Aux Vases is dominantly sandstone that is light gray, very fine- to coarse-grained quartz arenite. It is typically weakly cemented and contains glauconite grains and calcite cement. Siltstone and shale occur chiefly at the top, grading downward to sandstone. The lower contact is sharp and likely erosional.

V Ste. Genevieve Limestone Limestone, dolomite, and minor sandstone. Light gray to buff, medium- to coarse-grained, oolitic and skeletal grainstone and packstone dominate. Lesser interbeds of darker, finer-grained wackestone and packstone are present, along with microgranular dolomite. These micritic intervals commonly are cherty. Sandstone or sandy limestone interbeds are logged in a few wells; sandstone is similar to that of the Aux Vases.