# GEOLOGY OF MASSAC COUNTY, ILLINOIS

Prairie Research Institute
**ILLINOIS STATE GEOLOGICAL SURVEY**

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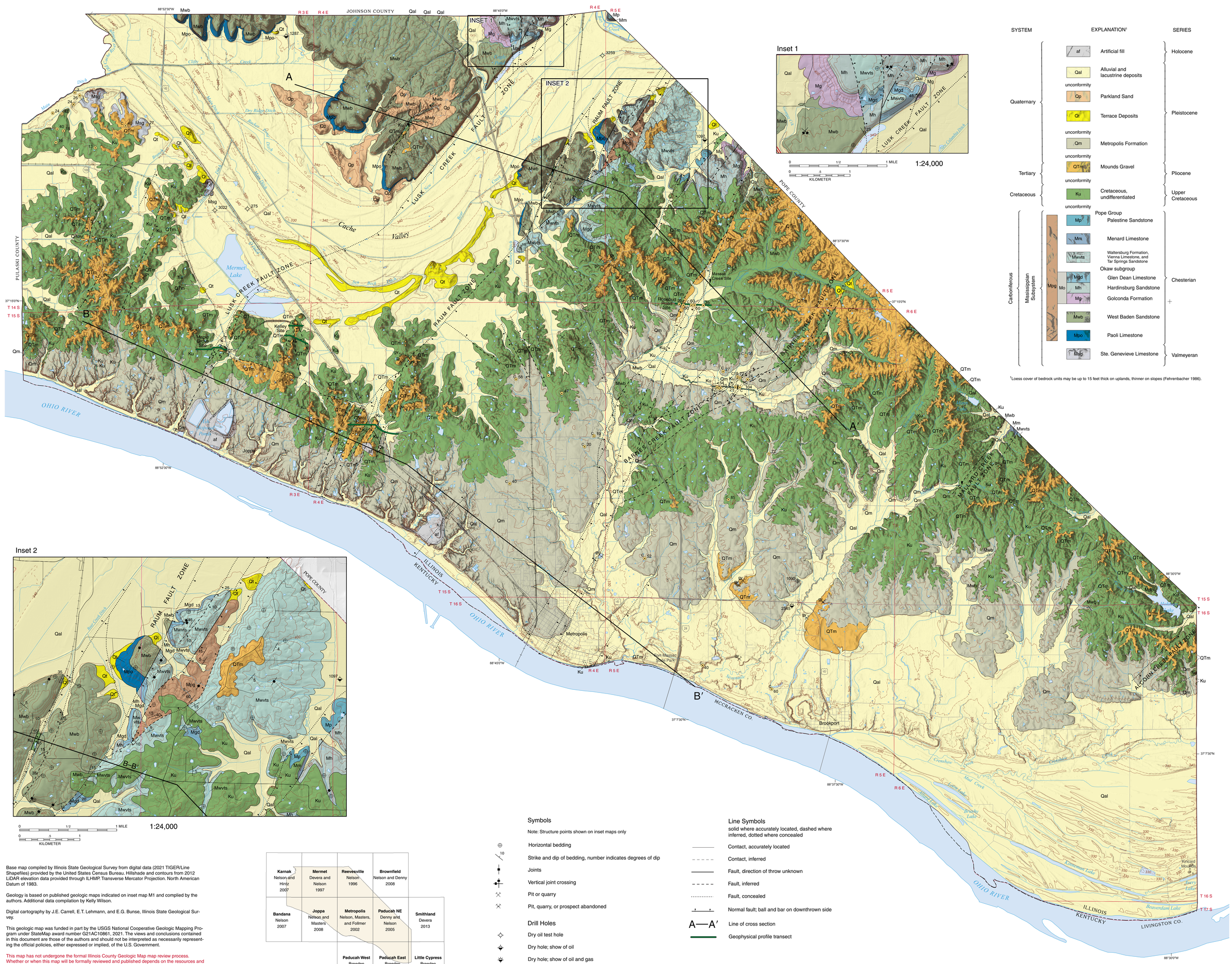
2022

STATEMAP Massac County-G




Inset 1



0 1/2 1 MILE
0 .5 1 KILOMETER
1:24,000

Inset 2



0 1/2 1 MILE
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1:24,000

| SYSTEM | | EXPLANATION[1] | | SERIES |
|---|---|---|---|---|
| Quaternary | | af | Artificial fill | Holocene |
| | | Qal | Alluvial and lacustrine deposits | |
| | unconformity | | | |
| | | Qp | Parkland Sand | Pleistocene |
| | | Qt | Terrace Deposits | |
| | unconformity | | | |
| | | Qm | Metropolis Formation | |
| | unconformity | | | |
| Tertiary | | QTm | Mounds Gravel | Pliocene |
| | unconformity | | | |
| Cretaceous | | Ku | Cretaceous, undifferentiated | Upper Cretaceous |
| | unconformity | | | |
| Carboniferous | Mississippian Subsystem | Mpg | Pope Group | |
| | | | Mp — Palestine Sandstone | Chesterian |
| | | | Mm — Menard Limestone | |
| | | | Mwvts — Waltersburg Formation, Vienna Limestone, and Tar Springs Sandstone | |
| | | Mo | Okaw subgroup | |
| | | | Mgd — Glen Dean Limestone | |
| | | | Mh — Hardinsburg Sandstone | |
| | | | Mg — Golconda Formation | |
| | | | Mwb — West Baden Sandstone | |
| | | | Mpo — Paoli Limestone | |
| | | | Msg — Ste. Genevieve Limestone | Valmeyeran |

[1]Loess cover of bedrock units may be up to 15 feet thick on uplands, thinner on slopes (Fehrenbacher 1986).

| Karnak | Mermet | Reevesville | Brownfield |
|---|---|---|---|
| Nelson and Hintz 2007 | Devera and Nelson 1997 | Nelson 1996 | Nelson and Denny 2008 |
| **Bandana** Nelson 2007 | **Joppa** Nelson and Masters 2008 | **Metropolis** Nelson, Masters, and Follmer 2002 | **Paducah NE** Denny and Nelson 2005 | **Smithland** Devera 2013 |
| | | **Paducah West** Breeden unpublished | **Paducah East** Breeden unpublished | **Little Cypress** Breeden unpublished |

**M1** 7.5-minute quadrangle maps in Massac County. Full citations for published and released maps are on map sheet 2.

### Symbols

Note: Structure points shown on inset maps only

- Horizontal bedding
- 10 — Strike and dip of bedding, number indicates degrees of dip
- Joints
- Vertical joint crossing
- Pit or quarry
- Pit, quarry, or prospect abandoned

### Drill Holes

- Dry oil test hole
- Dry hole; show of oil
- Dry hole; show of oil and gas
- Stratigraphic boring
- C 109 — Label (c) denotes core. Numeric label indicates total depth of boring in feet. Dot indicates location accurate within 100 feet.

### Line Symbols

solid where accurately located, dashed where inferred, dotted where concealed

- Contact, accurately located
- Contact, inferred
- Fault, direction of throw unknown
- Fault, inferred
- Fault, concealed
- Normal fault; ball and bar on downthrown side
- A—A′ — Line of cross section
- Geophysical profile transect

Base map compiled by Illinois State Geological Survey from digital data (2021 TIGER/Line Shapefiles) provided by the United States Census Bureau. Hillshade and contours from 2012 LiDAR elevation data provided through ILHMP. Transverse Mercator Projection. North American Datum of 1983.

Geology is based on published geologic maps indicated on inset map M1 and complied by the authors. Additional data compilation by Kelly Wilson.

Digital cartography by J.E. Carrell, E.T. Lehmann, and E.G. Bunse, Illinois State Geological Survey.

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This map has not undergone the formal Illinois County Geologic Map map review process. Whether or when this map will be formally reviewed and published depends on the resources and priorities of the ISGS.



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ADJACENT COUNTIES
1 Pope
2 Livingston, KY
3 McCracken, KY
4 Ballard, KY
5 Pulaski
6 Johnson

SCALE 1:48 000
1 1/2 0 1 2 3 4 MILES
1 .5 0 1 2 3 4 5 KILOMETERS

CONTOUR INTERVAL 25 FEET
SUPPLEMENTAL CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1988

2½° TRUE NORTH MAGNETIC NORTH
APPROXIMATE MEAN DECLINATION, 2022

ROAD CLASSIFICATION
Interstate Route — State Route
U.S. Route — Local road



ILLINOIS
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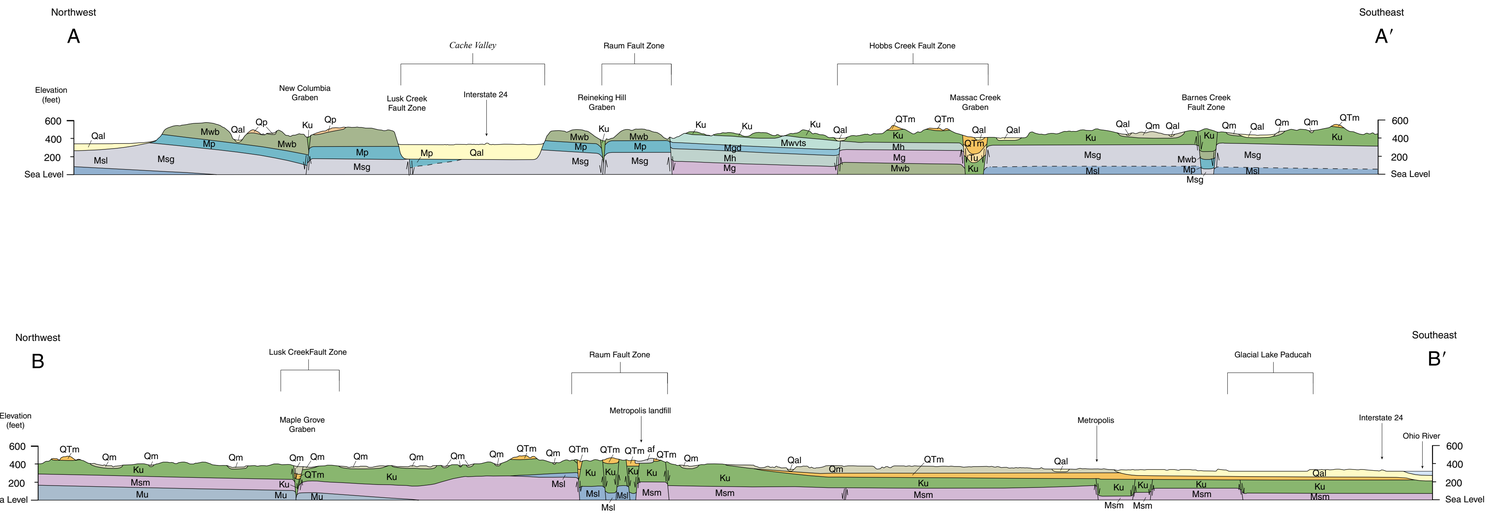


Horizontal scale: 1 inch = 4,000 feet
Vertical scale: 1 inch = 800 feet
Vertical exaggeration: 5×

| | |
|---|---|
| af | Artificial fill |
| Qal | Alluvial and lacustrine deposits |
| Qp | Parkland Sand |
| Qm | Metropolis Formation |
| QTm | Mounds Gravel |
| Tu | Tertiary, undifferentiated; Porters Creek and Clayton Formations in Massac Creek Graben |
| Ku | Cretaceous, undifferentiated |
| Mp | Palestine Sandstone |
| Mwvts | Waltersburg Formation, Vienna Limestone, and Tar Springs Sandstone |
| Mgd | Glen Dean Limestone |
| Mh | Hardinsburg Sandstone |
| Mg | Golconda Formation |
| Mwb | West Baden Sandstone |
| Msg | Ste. Genevieve Limestone |
| Msl | Saint Louis Limestone |
| Msm | Salem Limestone |
| Mu | Ullin Limestone |

## References


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| SYSTEM | SUB-SYSTEM | SERIES | STAGE | GROUP | FORMATION | MEMBER (Bed) | GRAPHIC COLUMN | THICKNESS (Feet) | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| QUATERNARY | | HOLO. | | | alluvial and lacustrine deposits | | | 0–30 | A |
| | | PLEISTOCENE | Wisconsinan | EMBAYMENT | Equality/Henry | | | 0–30 | B |
| | | | | | Terrace Deposits | | | 0–50 | C |
| | | | | | Parkland sand | | | 0–50 | D |
| | | | Illinoian | | Metropolis | | | 0–80 | E |
| | | | Pre-Illinoian | | Mounds Gravel | | | | F |
| TERT. | | MIO. - PLIO. | | | | | | | |
| CRETACEOUS | | UPPER | MAASTRICHTIAN | | McNairy | | | 0–200 | G |
| | | | CAMP. | | Post Creek | | | 0–60 | H |
| CARBONIFEROUS | MISSISSIPPIAN | CHESTERIAN | ELVIRAN | POPE | Palestine | | | 70–90 | I |
| | | | | | Menard Limestone | Allard | | 90–140 | J |
| | | | | | | Scottsburg | | | |
| | | | | | | Walche | | | |
| | | | | | Waltersburg | | | 35–85 | K |
| | | | | | Vienna Limestone | | | 8–35 | L |
| | | | | | Tar Springs Sandstone | | | 70–130 | M |
| | | | HOMBERGIAN | | Glen Dean Limestone | | | 40–85 | N |
| | | | | | Hardinsburg | | | 80–110 | O |
| | | | | | Golconda | Haney Limestone | | 105–175 | P |
| | | | | | | Fraileys Shale | | | |
| | | | | | | Beech Creek Ls. | | | |
| | | | GASPERIAN | | West Baden Sandstone: Cypress | | | 150–270 | Q |
| | | | | | West Baden Sandstone: Ridenhower and Sample Sandstone | | | | |
| | | | | | West Baden Sandstone: Bethel Sandstone | | | | |
| | | | | | Paoli Limestone | Downeys Bluff Ls. | | 120–150 | R |
| | | | | | | Yankeetown | | | |
| | | | | | | Shetlerville Ls | | | |
| | | | | | | Levias Limestone | | | |
| | | | GENEVIEVAN | | Aux Vases | | | 15–25 | S |
| | | | | MAMMOTH CAVE | Ste. Genevieve Limestone | Spar Mountain Ss. | | 200+ | T |

HOLO., Holocene; TERT.,Tertiary; PLIO., Pliocene; MIO., Miocene; CAMP., Campanian

**A Alluvium** is composed of stratified silt, sand, and gravel. Silt is mottled, light to medium gray and brown; sand is mostly light gray to buff and fine to coarse-grained. Sand is mostly unlithified, but some is cemented with iron oxide. Alluvium can be as thick as 30 feet in the Cache River Valley.

**B Equality and Henry Formations** the **Equality Formation** is composed of clay, silt, and gravel that is dominantly brownish to bluish gray, stiff to plastic, massive and laminated clay. Lenses of sand and gravel are present mainly in the lower part of the unit. In the Metropolis Quadrangle, this unit represents deposits of Lake Paducah, a lake that existed in what is now the Ohio Valley during the Wisconsinan age (Finch et al. 1964, Olive 1966). It also exists in tributaries to this lake as slack water or over bank deposits. The **Henry Formation** intercalates laterally to the Equality Formation. It is composed of fluvial sand and gravel in the Cache Valley.

**C Terrace Deposits** are composed of clay, silt, sand, and gravel. The clay and silt fraction, which is commonly mottled dark gray and light orange and is laminated and burrowed in places, contains organic-rich layers that contain wood fragments. Gravel is composed of rounded to angular pebbles of chert, quartz, and sedimentary rocks. Sands are yellow orange to gray and very fine to coarse grained.

**D Parkland sand*** is composed of gray, fine to coarse, cross-bedded quartz sand which overlies bedrock on uplands near New Columbia in the Mermet Quadrangle. This is an **informal** unit defined based on genesis and morphology that consists of windblown sand in dunes and sheet-like deposits that commonly occurs above post-glacial fluvial and lacustrine deposits (Hansel and Johnson 1996).

**E Metropolis Formation** contains silt, sand, and gravel. Silty sand and sandy silt are strongly mottled in gray, brown, yellow, and orange. Gravel is found mostly near the base of the unit and is composed of rounded to well-rounded, dull gray chert and quartz pebbles derived from the Mounds Gravel. Pebbles have largely lost the glossy brown patina that is characteristic of the Mounds Gravel. This unit typically comprises a series of upward-fining sequences with weakly developed stratification. Portions are calcareous and contain abundant small calcite concretions. This unit underlies terraces along the Ohio River. The type section for the Metropolis Formation is in Massac County in sec. 28, T15S, R4E.

**F Mounds Gravel** is composed of gravel and sand. Gravel is composed mostly of well-rounded chert pebbles that have a distinctive glossy bronze to yellowish brown patina of iron oxide that permeates outer layers of the pebbles. Quartz granules are common in the finer fraction. Sand is red to brownish orange, coarse, poorly sorted, and commonly cross-bedded. The lower Mounds is dominantly gravel; the upper Mounds is mostly sand containing scattered pebbles. This unit is crudely stratified, with lenticular bedding and low-angle accretion surfaces. The Mounds caps uplands south of the Cache Valley, where it is mantled by loess; and underlies Metropolis Formation in lowlands.

### Symbology

| | | | |
|---|---|---|---|
| Limestone | | Ripple Marks | |
| Sandstone | | Chert | |
| Sandstone with X-beds | | Calcareous | |
| Shale | | Group Clasts | |
| Conglomeritic Sandstone | | Root casts | |
| Silty Shale | | Clay | |
| Dolomite | | Fossil | |
| Argillaceous Limestone | | | |
| Cherty Limestone | | | |
| Dolomitic Limestone | | | |

**G McNairy Formation** comprised of sand, silt, and clay. The sand is white to light gray, buff, orange, and red; very fine to medium-grained, and weakly lithified to cemented by iron oxide. Silt and clay vary from nearly white through all shades of gray to black. Muscovite mica is abundant and characteristic of the McNairy. Sand, silt, and clay are commonly interlaminated; rhythmic planar laminations indicate tidal activity. Thicker sand bodies can be cross-bedded and in many cases, contain rip-up clasts of light-colored clay.

**H Post Creek Formation** is composed of gravel, sand, and clay. This unit is mostly gravel composed of sub-rounded to well-rounded chert pebbles that are white to light gray, opaque, slightly porous, and partly tripolitic. Less commonly gravel is medium to dark brown chert pebbles and well rounded small white quartz pebbles and granules. The matrix of this unit is fine to very coarse, unsorted quartz sand; the finer grains are subrounded and larger grains are well rounded. Sand is intermixed with dark gray, pyritic silt, and clay.

**I Palestine Formation** consists of sandstone, siltstone, and shale. Sandstone is light gray to light brown, fine to medium-grained quartz arenite. Siltstones and shale are dark gray and are commonly marked with interference ripples. The lower part of the formation consists mainly of sandstone grading upward into thin-bedded siltstone or shaley sandstone.

**J Menard Limestone** is composed of interbedded shales and limestones. Shales occur in the upper, middle, and lower parts of the formations and range from black, dark gray, medium gray, to greenish gray in color, are fissile, have thin interbeds of limestone and are fossiliferous. The middle shale has a characteristic greenish gray to bright green, non-fissile claystone. The **Allard Limestone Member** is medium to dark gray lime mudstone and wackestone with thin to medium, wavy to hummocky bedding. Brachiopods, bryozoans, crinoids, blastoids, and pelecypods are common. The **Scottsburg Limestone Member** is a dark gray, dense, and sublithographic limestone with wavy to hummocky beds about 2 feet thick. Some layers are dolomitic. Skeletal and pelletal wackestone also occurs in this member. The **Walche Limestone Member** is a single layer of limestone with similar lithologies as the Scottsburg Limestone Member but can be sandy or silty near the base.

**K Waltersburg Formation** is composed of shale, siltstone, and sandstone. In Massac County this unit consists of dark gray to olive gray pyritic siltstone, with interbedded dark gray shale and very fine-grained sandstone. Portions of the sandstone can be shaley and ripple-laminated or planar-laminated. Calcareous, burrowed sandstone that contains crinoid fragments can occur near the top of the formation.

**L Vienna Limestone** consists of medium to dark brown, argillaceous, and cherty limestone. The limestone can be micritic to wackestone. Chert weathers with a distinctive yellow-brown porous rind, contains fossil fragments of crinoids and bioclasts, and may have an oolitic appearance on fresh unweathered surfaces.

**M Tar Spring Formation** consists of sandstone, siltstone, and shale. The sandstone is a light gray, fine-grained quartz arenite that weathers to a sucrosic texture. Thicker sandstone beds are typically cross bedded. Siltstone and shale are medium to dark gray and laminated. Both upward-fining and upward-coarsening sequences are developed.

**N Glen Dean Limestone** is composed of limestone and shale. In the upper part of the unit, limestones are light to medium gray crinoidal grainstone, oolitic, and finely cross bedded. The lower part is composed of olive gray to dark gray, calcareous, fossiliferous shale with interbeds of argillaceous limestone. Crinoids, blastoids, bryozoans, brachiopods, and rugose corals are common.

**O Hardinsburg Formation** is composed of sandstone, siltstone, and shale. The sandstone is light brown, weathers light gray to dark brown, very fine grained, and thickly to thinly bedded, flaggy quartz arenite. Dark gray to greenish gray siltstones and shales are interbedded with sandstones in the upper part. Stigmarian root casts are found in the upper part of the unit. Two to three shaley, thin coal beds overlie rooted paleosols in the upper part of the unit. Sandstones in the lower part of the unit contain rip-up clasts and brachiopod casts and molds.

**P Golconda Formation** is comprised of limestone and shale and has three distinct members. The **Haney Limestone Member** ranges from 25 to 65 feet thick and is composed of limestone and shale. The limestone is medium to light gray and argillaceous with interbedded calcareous shales and crinoidal grainstones. Chert within the limestones is dark gray and occurs in lenses. Fossils can be abundant and include brachiopods, crinoids, blastoids, and bryozoans. Shales are dark gray and commonly fossiliferous and calcareous. The **Fraileys Shale Member** ranges from 80 to 100 feet thick and is composed of dark gray shale with medium gray to light gray, thin bedded, fossiliferous limestone layers that are not laterally continuous. Shale and non-fissile claystone at the top of this member is commonly red. Fossils are dominantly pelmatozoan fragments and bryozoans. The lower part grades into a shale and calcareous shale sequence. The **Beech Creek Limestone Member** (known as the "Barlow" in industry) ranges from 0 to 10 feet thick and varies from a dolomitic lime mudstone to argillaceous crinoidal wackestone and packstone. Brachiopods and crinoids are common.

**Q West Baden Sandstone** comprises the **Cypress Sandstone** (youngest), **Ridenhower Formation**, **Sample Sandstone**, **and Bethel Sandstone** (oldest). It is composed of sandstone, shale, siltstone, and minor limestone. The **Cypress Sandstone** ranges from 90 to 110 feet thick, and the upper part of the unit contains greenish gray shale, interbedded siltstones, and sandstone. The lower part of the unit is mostly light gray, fine-grained to very fine-grained, well sorted quartz arenite that forms bluffs and ledges in outcrop and is well exposed. Ripple marks and cross bedding are common in the lower part of the unit. The lower contact is erosive. The **Ridenhower Formation** ranges from 0 to 100 feet thick and consists of interbedded dark gray fissile shale and sandy limestone to calcareous sandstone with crinoid and bryozoan fragments. Limestone occurs as lenses and thin interbeds and is mostly dark gray fossiliferous wackestone. The **Sample Sandstone** is a light gray, well sorted quartz arenite that ranges from 40 to 125 feet thick in Massac County. The upper part is fine to very fine-grained and thin bedded and is bioturbated and finely cross bedded. The lower part of the unit is medium to coarse grained, contains scattered quartz granules, weathers to a sugary texture, and commonly exhibits cross bedding and ripple marks. The lower contact is erosive. The **Bethel Sandstone** ranges from 15 to 25 feet thick and can be difficult to differentiate from the overlying Sample Sandstone. It is a white to light gray, medium to fine grained, calcareous quartz arenite that exhibits small-scale bedforms. The lower contact is erosive.

**R Paoli Limestone** comprises the **Downeys Bluff Limestone** (youngest), **Yankeetown**, **Shetlerville Limestone**, and **Levias Limestone Members** (oldest). The **Downeys Bluff Limestone** typically consists of medium gray oolitic limestone that is thin to thick bedded and has shale and siltstone interbeds and small amounts of chert. The **Yankeetown Member** contains shale, limestone, and claystone. Red, light greenish gray, and yellowish mottled shales and claystones are dominant at the top of the unit. The lower part is composed of interbedded limestones and claystones. The limestone is light gray and oolitic and the claystone is dark gray. The **Shetlerville Limestone** is dark greenish gray to gray, argillaceous limestone with thin shale layers in the upper part, grading into an oolitic grainstone and packstone in the lower part. The **Levias Limestone** is a white to light gray, oolitic grainstone with scattered red to pink oolites.

**S Aux Vases Formation** is composed of sandstone, siltstone, and limestone. The sandstone is light gray, calcareous, and very fine to fine grained. Siltstone may be present at the top of the unit grading laterally into silty and sandy limestones. The limestone resembles that of the underlying Ste. Genevieve.

**T Ste. Genevieve Limestone** contains limestone, sandy limestone, and chert. Light gray thick bedded oolitic limestone and crinoidal grainstones are dominant lithologies, but argillaceous, micritic, and dolomitic limestone is also present. Stylolites, shale partings, and cross bedding can are developed. The **Spar Mountain Sandstone Member** contains thin intervals of sandy limestone to calcareous sandstone like that of the Aux Vases Formation.