Prepared in cooperation with the U.S. Geological Survey,
Dallas L. Peck, Director, under the Cooperative
Geologic Mapping Program (COGEOMAP)

Illinois Department of Energy and Natural Resources
ILLINOIS STATE GEOLOGICAL SURVEY
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Champaign, Illinois

Geologic Map of the
JONESBORO AND WARE QUADRANGLES, ILLINOIS
IGQ-14

EXPLANATION

Pleistocene and Holocene	Qal	Alluvial deposits	QUATERNARY
	Qt	Terrace deposits	
		unconformity	
Upper Cretaceous	Km	McNairy Formation	CRETACEOUS
	Kt?	Tuscaloosa (?) Formation	
		unconformity	
Chesterian	Mp	Pope Group	MISSISSIPPIAN
Valmeyeran	Mgl	Ste. Genevieve and St. Louis Limestones	
	Msm	Salem Limestone	
	Mu	Mu, Ullin Limestone	
	Mfp	Mfp, Fort Payne Formation	
		unconformity	
Kinderhookian	Ms	Ms, Springville Shale and Chouteau Limestone	
		unconformity	
Upper Devonian	Dna	Dna, New Albany Shale	
		unconformity	
		MD, Missippian and Devonian strata, undivided	
Middle Devonian	Dsl	Dsl, St. Laurent Formation	DEVONIAN
	Dgt	Dgt, Grand Tower Limestone	
	Dsg	Dsg, St. Laurent and Grand Tower, undivided	
Lower Devonian	Dcc	Dcc, Clear Creek Formation	
	Dgk	Dgk, Grassy Knob Chert	
	Dcg	Dcg, Clear Creek and Grassy Knob, undivided	
Caycugan and Niagaran	DSb	Bailey Limestone	SILURIAN
Alexandrian	Sbs	Bainbridge Formation and Sexton Creek Limestone	
		unconformity	ORDOVICIAN
Cincinnatian	Om	Maquoketa Formation	

MD = Mississippian and Devonian undivided; Dsg = Dsl, Dgt, undivided

LINE SYMBOLS: Dashed where inferred; dotted where concealed

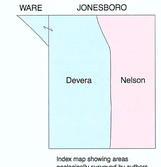
- Contact
- Fault: ball and bar on downthrown side
- Axial trace of anticline
- A — A′ Line of cross section
- 300 Structure contour (drawn on top of Springville Shale; elevation in feet)
- Border of area of altered lithologies and complex structure

SYMBOLS

- Strike and dip of bedding (representative sample); number indicates degree of dip. Where number is lacking, dip is variable or approximate
- Vertical bedding
- Horizontal bedding
- Joints (vertical)
- Megabreccia
- Outcrop of special note, shown where contact, map unit, or fault was well exposed at time of mapping
- Active mine or quarry
- Inactive mine, quarry or prospect pit: La = limestone, Ma = manganese, S = silica, Sh = shale

DRILL HOLES FROM WHICH SUBSURFACE DATA WERE OBTAINED

- Oil test hole with ISGS county number
- Water well with ISGS county number
- COGEOMAP test hole



Index map showing areas geologically surveyed by authors

STRUCTURAL GEOLOGY

The Jonesboro and Ware Quadrangles are on the boundary between the Ozark Dome on the west and the Illinois Basin on the east. The boundary is approximately the limit of Mississippian strata. Regional dip is a few degrees east to east-northeast from the Ozark Dome toward the Illinois Basin.

The Harrison Creek Anticline, in the southwest quarter of the Jonesboro Quadrangle, was first mapped by Savage (1920) and named by Weller and Ekblaw (1940). Its structural apex is near the center of Section 16, T13S, R2W, where the Maquoketa Formation (Ordovician) comes to the surface. The anticline continues southward into the Mill Creek Quadrangle. It is a nearly symmetrical fold; but toward the north, the eastern flank is truncated by the Atwood Fault. Contrary to the interpretation of Weller and Ekblaw (1940), the Harrison Creek structure does not continue north of Dutch Creek.

Gravity surveys by Segar (1965) and Nelson and Lumm (1985) indicate that a basement high underlies the Harrison Creek Anticline. Like other anticlines of the Ozark Dome and western Illinois Basin, the Harrison Creek is probably the surficial expression of a horst in Precambrian crystalline basement.

The Atwood Fault on the east flank of the Harrison Creek Anticline is apparently a high-angle, dip-slip normal fault. The subparallel Cape Road Fault to the east has an unusually wide zone of breccia and passes into a zone of en echelon faults south of the Jonesboro Quadrangle (Devera et al. 1994). These features imply a significant component of strike-slip displacement in addition to dip-slip, down-to-the-east displacement.

A structurally downdropped area occurs in the Mississippi River bluffs southwest of Dutch Creek. Mapped faults strike northeast and outline a complex graben within which strata as young as the Springville Shale are preserved at the same elevation as the Clear Creek Formation northeast of Dutch Creek. A northwest-trending fault may underlie the alluvium of Dutch Creek. Another fault may exist under the floodplain of Dutch Creek in Sections 35 and 36, T12S, R2W. Abrupt offset of structure contours across Dutch Creek in this area suggests right lateral strike-slip.

ALTERED STRATA

Lithologies of all Paleozoic formations are altered in a large area of the Jonesboro Quadrangle. As shown on the geologic map, the border of the area of altered strata roughly follows Illinois route 127 on the east, Green Creek on the north, and the Atwood Fault on the west. The altered strata continue southward into the Mill Creek Quadrangle.

In this area, all carbonate minerals are leached out and the rocks silicified. The Clear Creek Formation is altered to chert and microcrystalline silica (tripoli) with occasional clay partings. The Grand Tower Limestone is largely dissolved away, except for the basal Dutch Creek Sandstone Member, which is brecciated. The St. Laurent Formation is altered to punky, cherty, laminated, low-density rock that contains no calcite or dolomite. The Springville Shale is transformed to a multihued, chertlike material called "calico rock," and the Ullin Limestone is dissolved, leaving only chert and clay residuum.

All altered rocks are thoroughly fractured and faulted. Most faults are too small to portray at the 1:24,000 scale of mapping. Bedding attitudes are highly variable; many small chevron folds are present. Prevalent fault and fracture trends are north to south, north-northeast to south-southwest, east to west (less common), and northwest to southeast (least common). A broad zone of chaotic megabreccia borders the east side of the Cape Road Fault.

Two or more episodes of faulting, including strike-slip, are indicated in the area. Small-scale structures show that the area underwent divergent wrench faulting, which created pull-apart or collapse structures. Intensely shattered rocks were highly susceptible to leaching and alteration by formation water. We agree with Berg and Masters (1994) that alteration is of hydrothermal origin. A mafic pluton at depth, indicated by high gravity and magnetic values, was probably the heat source.

ECONOMIC GEOLOGY

The tripoli mined in southern Illinois is a white, soft form of microcrystalline silica used in manufacturing various polishing and abrasive compounds, fillers and extenders for paint, and other products. Tripoli occurs in the Clear Creek Formation (Devonian) in the area of altered lithologies in the Jonesboro Quadrangle. In the southern part of the Jonesboro Quadrangle are several abandoned tripoli mines—small open-pit and shallow drift operations. More extensive tripoli mining has taken place south of the study area in the Mill Creek Quadrangle (Berg and Masters 1994, Devera et al. 1994). No accurate estimates of tripoli resources are available.

Limestone has been quarried on a small scale from the Ullin and St. Louis Limestones (Mississippian) in the Jonesboro Quadrangle. Large quarries are active in the Ullin and Ste. Genevieve Limestones just east of the study area. The Ullin is a light gray, relatively soft limestone that is suitable for agricultural lime, road stone, and dimensional stone. The Ste. Genevieve contains alternating layers of light gray oolitic limestone and darker gray, fine grained harder and somewhat cherty limestone. The light gray oolitic stone has properties and uses similar to those of Ullin limestone. The dark fine grained Ste. Genevieve stone can be used for aggregate in concrete. The St. Louis Limestone is similar to the dark phase of the Ste. Genevieve, although its chert content may be detrimental for use as agricultural lime as well as for aggregate. The Salem Limestone is largely medium to dark gray, relatively hard limestone that contains little chert; it may be usable as aggregate.

About 12 oil and gas test holes have been drilled in the study area. (Records conflict as to whether some holes were oil tests or water wells.) The deepest test was the Ohio Oil Company Cross No. 1 well drilled near the structural apex of the Harrison Creek Anticline in the north part of Section 21, T13S, R2W. This well was abandoned at a total depth of 1,500 feet in the Ordovician Everton Formation. No other well in the Jonesboro Quadrangle penetrated deeper than 1,000 feet. No shows of oil or gas were reported. The nearest oil production is in Williamson County, Illinois, about 20 miles northeast of the study area.

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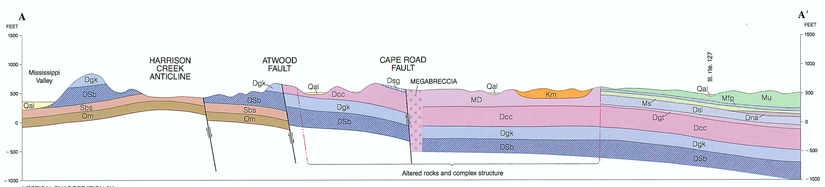
Base from U.S. Geological Survey, 1947
Photorevised 1990

SCALE 1:24 000
1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 KILOMETER
CONTOUR INTERVAL 20 FEET
DASHED LINES REPRESENT 10-FOOT CONTOURS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

UTM GRID AND 1990 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

ILLINOIS
QUADRANGLE LOCATION



VERTICAL EXAGGERATION 2X

GEOLOGIC MAP OF THE JONESBORO AND WARE QUADRANGLES UNION COUNTY, ILLINOIS

W. JOHN NELSON AND JOSEPH A. DEVERA

1994

Cartography by Williams and Heintz Map Corp.

SYSTEM	SERIES	GROUP	FORMATION	MEMBER and BED	GRAPHIC COLUMN	THICKNESS ft (m)	DESCRIPTION UNIT
QUATERNARY	Pleistocene and Holocene					0-100 (0-30)	A
CRETACEOUS	Upper		McNairy			0-120 (0-36)	B
			Tuscaloosa?				C
MISSISSIPPIAN	Chesterian	Pope	Yankeetown Sandstone (?) and Renault Limestone			60-80 (18-24) / 100 (30)	D
			Aux Vases			20-40 (6-12)	
	Valmeyeran	Mammoth Cave	Ste. Genevieve Limestone			220-275 (67-84)	E
			St. Louis Limestone			70-140 (21-42)	F
			Salem Limestone			285-435 (87-133)	G
			Ullin Limestone			250-450 (76-137)	H
			Fort Payne			10-110 (3-33)	I
			Springville Shale			1-6 (.3-1.5) / 20-85 (6-26)	J
				State Pond Sh. Mbr.		0-1 (0-.3)	
	Kind.		Chouteau Ls.				
DEVONIAN	Upper		New Albany Shale	Sylamore Ss. Bed		0-1 (0-.3) / 0-80 (0-26)	K
	Middle		St. Laurent			125-200 (38-61)	L
				Rendleman Oolite Bed		0-4 (0-1.2)	
			Grand Tower			15-125 (4.5-36)	M
				Dutch Creek Ss. Mbr.		10-25 (3-8)	N
	Lower		Clear Creek			300-350 (91-107)	O
			Grassy Knob Chert			200-250 (61-76)	P
			Bailey Limestone			325-350 (99-107)	Q
SILURIAN	Caycugan		Bainbridge	Moccasin Springs Member		90 (27) / 115 (35)	R
	Niagaran			St. Clair Ls. Mbr.		25 (8)	S
	Alex.		Sexton Creek Limestone			30-40 (9-12)	T
ORDOVICIAN	Cincinnatian		Maquoketa	Girardeau Ls. Member		20-30	U
				Orchard Creek Shale Member		(6-9) / 20-30 (6-9) / 140-200 (43-61)	V
				Thebes Sandstone Member		25-60 (8-18)	W

A Alluvium and loess. *Alluvium* is massive to crudely stratified clay, silt, sand, gravel, and rock fragments mapped on floodplains. Terrace remnants are present in the Ware Quadrangle. *Loess* is yellowish brown to brownish gray, massive, clayey silt blanketing uplands; it was not mapped. The lower contact is unconformable.

B Sand, silt, clay, gravel, and sandstone. *Sand* is varicolored gray, yellow, red, orange, and brown, fine to coarse grained, and poorly sorted. It is composed of quartz with minor lithic fragments, mica and dark minerals; the deposits are generally massive but may be locally laminated or crossbedded. *Silt and clay* are light to dark gray and sandy; they occur mainly as irregular veins and pockets in sand. *Gravel* of light to dark gray, subangular to well rounded chert pebbles as much as 6 inches in diameter occurs as lenses and stringers in sand. *Sandstone* is white, very fine to fine grained quartz arenite with rounded and frosted grains; it is crossbedded to massive and lacks fossils. Sandstone was observed only as float. The lower contact is unconformable.

C Gravel and conglomerate. *Gravel* is light to medium gray, subangular to rounded chert pebbles, most of which are less than 3 inches in diameter. Conglomerate occurs locally; it consists of sand and gravel (as above) cemented with silica and iron oxide. Little of this material was observed in place; its assignment to the Tuscaloosa is questionable.

D Limestone, sandstone, and shale. *Limestone* is variable. Common types include light gray oolitic grainstone; purplish gray, coarse grained, sandy skeletal packestone and grainstone with hematitic oolites; and medium to dark gray dolomitic, argillaceous lime mudstone. *Sandstone* is light brownish gray to light greenish gray, very fine grained, quartzose, calcareous, and glauconitic. Mostly thin bedded, it bears ripple marks, mud cracks, and horizontal burrows. *Shale* is variegated greenish gray to red, soft, calcareous, and blocky to fissile. Lithologies apparently intergrade laterally. Formations in this interval cannot be mapped separately. Sandstone at the base of the interval is the Aux Vases overlain by the Renault Limestone and possibly the Yankeetown Sandstone. The interval does not crop out; the description is based on well records and outcrops in adjacent quadrangles. The lower contact is gradational and intertonguing.

E Limestone, sandstone, and shale. *Limestone* is mostly light gray oolitic grainstone and fine to coarse grained skeletal packestone and grainstone, commonly crossbedded. Intervals of medium to dark gray, dolomitic and cherty lime mudstone and skeletal wackestone are common in the middle and lower parts of the unit. *Sandstone* is light gray to greenish gray, very fine grained, calcareous, and thinly bedded. *Shale* is greenish gray to black, fissile, calcareous, and partly silty. Sandstone and shale occur as lenses less than 5 feet thick in the upper part of the unit. The abundant open-marine fauna includes echinoderms, brachiopods, bryozoans, and corals. The lower contact is gradational and intertonguing.

F *Limestone* is largely medium gray to brownish gray, microcrystalline to lithographic lime mudstone that breaks with conchoidal fracture. Commonly dolomitic, the unit contains numerous lenses and bands of dark bluish gray to black vitreous chert. Interbeds of medium to medium dark gray, very fine to medium grained skeletal wackestone and packestone are also present. Upward the limestone becomes lighter gray and packstone becomes more common. Silicified "finger corals," *Acrocythus proliferus*, are abundant in the basal St. Louis and uppermost Salem Limestone. The lower contact is gradational and intertonguing.

G *Limestone* The upper two-thirds to three-fourths of the unit is dominantly medium to dark gray and brownish gray, dark-weathering, fine to coarse grained skeletal packstone and wackestone that contains poorly sorted, rounded fossil grains and occasional oolites. Bedding is thick and chert nodules uncommon. The lower one-third to one-fourth of the Salem consists of light to medium gray skeletal and oolitic packstone and grainstone intercalated with medium to dark gray, dolomitic, cherty skeletal wackestone and lime mudstone. The lower contact is gradational and intertonguing.

H *Limestone* is dominantly fine to very coarse tan echinoderm fragments in a dull white matrix of bryozoan fragments. The speckled rock is laminated and has common planar crossbedding. Light gray ovoid chert nodules are scattered in the lower part of the unit, but rare in the upper part. Near the base the limestone becomes darker, finer grained, glauconitic, and slightly siliceous. The lower contact is gradational, and the Ullin intertongues with the Fort Payne.

I Dolomitic limestone and bedded chert. *Carbonate rock* is medium to dark gray, olive and brownish gray, glauconitic, highly siliceous dolomitic lime mudstone to fine grained skeletal wackestone and packstone that occurs in thin to medium, wavy beds. It contains as much as 20% to 30% chert nodules and bands; small quartz geodes are common. *Bedded chert* commonly occurs at the base of the unit; it is light to medium brownish gray, porous, dull textured, and coarsely laminated, resembling wood grain. In some areas the entire Fort Payne is altered to bedded chert (as above) and ganister—a granular, pelletal, and very porous type of microcrystalline silica. Although mostly reddish orange to dark brown, some nearly white ganister was formerly mined for making firebrick. The lower contact is sharp and probably disconformable.

J Siltstone and shale. Most of the unit is greenish to bluish gray, blocky to slightly fissile, silty shale and siltstone in very thin irregular, lenticular beds. This partly calcareous rock contains occasional burrows and trails, but no body fossils. The rock contains upward. The State Pond Shale Member near the base is 1 to 5 feet of green to dark olive gray, mottled, soft, slightly calcareous clay shale. The discontinuous Chouteau Limestone Member at the base is medium brownish gray, argillaceous lime mudstone with bluish green clay inclusions; the Chouteau is no more than 1 foot thick. The basal contact is disconformable, marked by a local lag deposit of quartz sand and phosphate pellets. In places the Springville Shale is altered to a hard, dense, siliceous rock (commonly called "calico rock") that is light gray with magenta, pink, and orange brown bands and mottles (or blotches). It occurs in tabular beds 4 to 18 inches thick and separated by thinner intervals of ripple-laminated siliceous shale.

K *Shale* is dominantly black, hard, brittle, highly fissile, noncalcareous, slightly silty, and pyritic. It contains *Tasmanites* (algal spores). The uppermost 1 foot or so is typically less fissile shale mottled in greenish and olive gray. Locally, the Sylamore Sandstone Bed occurs at base; it is light gray, fine to medium grained, well rounded quartz sandstone that is generally a few inches thick. The lower contact is disconformable.

L Limestone, dolomite, siltstone, and shale. *Carbonate rocks* are mostly medium to dark olive and brownish gray, very argillaceous and silty, dolomitic lime mudstone and skeletal wackestone. Up to 30% dark gray to black, slightly vitreous chert occurs as thin layers and lenses. Siltstone and shale are light to dark gray, olive gray and brownish gray, calcareous, and dolomitic. They have well developed planar to wavy laminations and common burrows and escape structures. Some siltstone approaches very fine sandstone. The Rendleman Oolite Bed is a thin (2 to 5 feet) but widespread layer of light gray oolitic and crinoidal grainstone or packstone near the middle of St. Laurent. The upper St. Laurent is mostly unfossiliferous. Limestone in the lower part contains abundant corals, brachiopods, bryozoans, trilobites, and echinoderm fragments. The "button coral," *Microcyclus discus*, is diagnostic of the basal St. Laurent. The lower contact is sharp and at least locally disconformable. In places the St. Laurent is altered to light gray, very porous siliceous rock of low density. This rock occurs in very thin tabular beds and contains common dark gray to brown vitreous chert nodules. Some altered St. Laurent closely resembles "calico rock" derived from the Springville Shale.

M *Limestone*, in the lower part of the unit, is dominantly white to light gray, fine to coarse grained, crinoidal grainstone in medium to thick beds. The upper part contains light to medium gray skeletal packstone, wackestone, and lime mudstone with abundant brachiopods. Some limestone beds are sandy, but contain little clay and silt. Corals and trilobite fragments are common. A few lenses of light gray chert are distributed throughout the unit. The lower contact is gradational. In the area of altered strata (see section, Structural Geology), the Grand Tower is largely dissolved away, leaving a thin interval of clay-silt residuum with broken nodules of light gray porous chert.

N *Sandstone* is white (weathering medium to dark gray), fine to medium grained, well sorted quartz arenite with rounded, frosted grains. It is calcareous in the subsurface but generally leached in outcrop. Molds of brachiopods, corals, bivalves, and other fossils are abundant. The lower contact was not observable. In adjacent areas, it appears to be variably disconformable or gradational. In the area of altered strata, the Dutch Creek is commonly bleached and heavily impregnated with iron and manganese oxides.

O Limestone, chert, and tripoli. Outside the area of altered strata, this unit is dominantly white to light gray and brownish gray, very siliceous lime mudstone in thin, wavy and nodular beds. Near the top the *limestone* contains quartz silt and very fine sand, and is locally cross laminated. *Chert*, commonly 20% to 30% of the unit, is dull white to light gray nodules and discontinuous layers up to about 4 inches thick. The upper part of unit is fossiliferous with the brachiopods *Eodevonaria* and *Amphigenia curta*, spiriferid and strophomenid brachiopods, the trilobite *Dalmanites pratteni*, pelmatozoan fragments, and rare graptolites. Limestone and chert that contain abundant spiriferida and pelmatozoans at the base of the unit may represent the Backbone Limestone. In the area of altered strata, the Clear Creek consists of interbedded chert and tripoli. Altered chert is white to light gray, red- to orange-stained, dense to porous, dull to slightly vitreous; it occurs in thin irregular layers with some thicker beds of porous, brecciated chert. Tripoli is white to very light gray, soft microcrystalline silica. Altered Clear Creek is gently folded and thoroughly fractured. The lower contact is gradational.

P *Chert* is white to light gray, dense to porous, novaculitic to tripolitic (microcrystalline), mostly medium bedded, and sparsely fossiliferous. Brecciated chert occurs throughout the formation, but it is most common near the top. Stylolitic partings are common. Highly porous, popcorn-textured chert, riddled with what appear to be horizontal burrows, occurs at the top of the Grassy Knob. The middle part of the unit is nearly massive, forming ledges in some areas. The lower contact is gradational.

Q Limestone and minor shale. *Limestone* is light brown to yellowish gray, partly dolomitic, argillaceous lime mudstone in mostly thin, wavy beds. Gray chert nodules and stringers that have white rinds are abundant. Sponge spicules occur throughout; crinoid and trilobite fragments and the trace fossil *Zoophycos* occur near the top. The uppermost Bailey, transitional to the Grassy Knob, is a leached interval of clay and silt layers with chert nodules. In the lower Bailey, the limestone becomes greenish gray and increasingly argillaceous and has interbeds of soft green calcareous shale. The lower contact is gradational.

R Mudstone and limestone. *Mudstone* is brick red to greenish gray, mottled and variegated, silty, and calcareous. *Limestone*, also brick red with greenish gray and purple mottling, is highly argillaceous to silty lime mudstone (marlstone). The two rock types are interbedded; the lower part of the formation is mostly limestone and the upper part mostly shale. Nautiloids are common in limestone near the base. The lower contact is sharp but probably conformable.

S *Limestone*, a lime mudstone and skeletal wackestone, is light gray with pale red and green mottling, and contains coarse pink to red calcite crystals (some of which are echinoderm fragments). Bedding is thick and tabular with stylolitic partings. The upper part of the unit is argillaceous. There have been reports of ostracods and *Ammodiscus* (foraminifera) in well cuttings. The lower contact is sharp.

T *Limestone* is light to medium brownish gray lime mudstone and wackestone. This argillaceous limestone contains shale laminae. Numerous regular layers of green to caramel-colored chert occur throughout. Near the top are small nodules and spheres of pyrite and the colonial coral *Favosites*. The lower contact is disconformable.

U *Limestone* is dark gray lime mudstone in thin, wavy, lenticular beds with dark gray chert nodules in the upper part. Laminae and interbeds of greenish gray calcareous shale become thicker and more numerous downward. The lower contact is gradational.

V *Shale* and limestone. *Shale* is light to medium greenish gray, soft and fissile, and clayey to silty. The upper part is strongly calcareous; the lower part is less so. Interbeds and nodules of *limestone*, lithologically similar to limestone in the overlying unit, are common in the upper part of the member. The lower contact was not observable; it is sharp but apparently conformable in neighboring areas.

W Sandstone and siltstone. The *siltstone* to very fine *sandstone* is light to medium gray and brownish gray, argillaceous, thinly bedded, quartzose, and partly calcareous. Most of it is laminated to thinly bedded. The unit is poorly exposed and the base concealed. Thickness was determined from well logs.