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
Morris W. Leighton, Chief
Champaign, Illinois

Geologic Map of the
MILL CREEK AND McCLURE QUADRANGLES, ILLINOIS
IGQ-15

EXPLANATION

Pleistocene and Holocene — Qal — Alluvial and lacustrine deposits — QUATERNARY
Eocene? — Tw? — Wilcox (?) Formation — TERTIARY?
Upper Cretaceous — Km — McNairy Formation — CRETACEOUS
Upper Cretaceous — Kt? — Tuscaloosa (?) Formation — CRETACEOUS
Valmeyeran — Mu — Ullin Limestone — MISSISSIPPIAN
unconformity
Valmeyeran — Mfp — Fort Payne Formation — MISSISSIPPIAN
unconformity
Valmeyeran — Ms — Springville Shale — MISSISSIPPIAN
unconformity
MD — MD, Mississippian and Devonian strata, undivided — MISSISSIPPIAN–DEVONIAN
Upper Devonian — Dna — New Albany Shale — DEVONIAN
unconformity
Middle Devonian — Dsg — St. Laurent and Grand Tower Formations — DEVONIAN
Lower Devonian — Dcc — Dcc, Clear Creek Formation — DEVONIAN
Lower Devonian — Dcg — Dgk, Grassy Knob Chert — DEVONIAN
Dcg, Clear Creek and Grassy Knob, undivided — DEVONIAN
Lower Devonian — Dgk — ooooooo, Ledge-forming chert — DEVONIAN
Cayugan — DSb — Bailey Limestone — SILURIAN
Niagaran Alexandrian — Sbs — Bainbridge and Sexton Creek Formations — SILURIAN
unconformity
Ordovician — Om — Maquoketa Formation — ORDOVICIAN

LINE SYMBOLS: Dashed where inferred; dotted where concealed
Contact
Fault: ball and bar on downthrown side; dip of fault surface in degrees
Fault: direction of throw uncertain
Strike-slip fault
Reverse fault: triangle on upthrown side; dip of fault surface in degrees
Axial trace of anticline
Axial trace of syncline
Monocline with degree of maximum dip
Border of area of altered lithologies and complex structure
A — A′ Line of cross section

SYMBOLS
Strike and dip of bedding; number indicates degree of dip. Where no number is given, the dip is irregular or variable.
Horizontal bedding
Vertical joints
Joints, direction of dip indicated
Clay dikes
Fracture with horizontal slickensides
Outcrop of special note, shown where contact, map unit, or fault was exposed at time of mapping
Quarry or open-pit mine: Ch = chert, G = ganister, Gv = gravel, L = limestone, no symbol = tripoli
Open adit or drift mine: G = ganister, no symbol = tripoli
Caved adit or drift mine: G = ganister, no symbol = tripoli
Sm — Surface-mined area

DRILL HOLES FROM WHICH SUBSURFACE DATA WERE OBTAINED
Oil test hole with ISGS county number
Water well with ISGS county number
COGEOMAP test hole

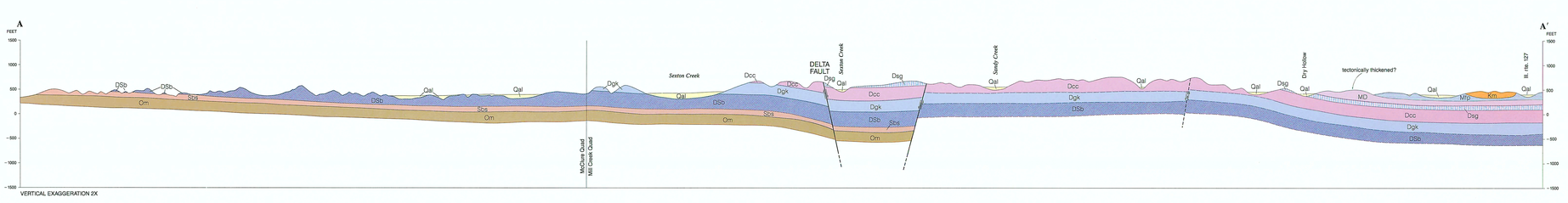
McClure / Mill Creek
not mapped; Devera; Nelson; Berg and Masters 1994; Masters; Devera
Index map showing areas geologically surveyed by authors

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

SCALE 1:24 000
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 MILE
1 0 1 KILOMETER
CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT 10-FOOT CONTOURS
NATIONAL GEODETIC VERTICAL DATUM OF 1929
UTM GRID AND 1995 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

ILLINOIS — QUADRANGLE LOCATION

Cartography by Williams and Heinitz Map Corp.



GEOLOGIC MAP OF THE MILL CREEK AND McCLURE QUADRANGLES, ALEXANDER AND UNION COUNTIES, ILLINOIS

JOSEPH A. DEVERA, W. JOHN NELSON, AND JOHN M. MASTERS

1994

SYSTEM	SERIES	GROUP	FORMATION	MEMBER and BED	GRAPHIC COLUMN	THICKNESS (ft)	DESCRIPTION UNIT
QUATERNARY	Pleistocene and Holocene			Alluvial and lacustrine deposits		0-150	A
TER.	Eoc.		Wilcox?			0-50?	B
CRETACEOUS	Upper		McNairy			0-150?	C
			Tuscaloosa?			0-50?	D
MISSISSIPPIAN	Valmeyeran	Mammoth Cave	Ullin Limestone			0-150	E
			Fort Payne			80-140	F
			Springville Shale	State Pond Member		35-90	G
	Upper		New Albany Shale			0-60	H
DEVONIAN	Middle		St. Laurent	Rendleman Oolite Bed		50-160	I
			Grand Tower	Dutch Creek Ss. Member		10-30	J
	Lower	Tamms	Clear Creek			200-300	K
			Grassy Knob Chert			200-250	L
			Bailey Limestone			300-325	M
SILURIAN	Cayugan		?				
	Niagaran	Bainbridge	Moccasin Springs Member			75-90 100-110	N
			St. Clair Ls. Member			25	O
			Seventy-Six Sh. Mbr.			14	P
	Alex.	Sexton Creek				30-40	Q
ORDOVICIAN	Cincinnatian	Maquoketa	Girardeau Ls. Mbr.			20-30	R
			Orchard Creek Shale Member			20-30	
			Thebes Sandstone Member			25-60	S

A *Alluvial and lacustrine deposits* of massive to crudely stratified clay, silt, and sand and gravel were mapped on floodplains but not examined in detail. The lower contact is unconformable.

B *Gravel* is light gray to nearly black, rounded, polished chert pebbles, most smaller than 2 inches, mixed with occasional granules and small pebbles of quartz and jasper. The deposits are locally cemented by silica and iron oxide; the matrix is quartz and chert sand. Little of this material is in place; most gravel has slumped downhill from its original position. Assignment to the Wilcox Formation is questionable.

C *Sand, gravel, silt, clay, sandstone, and conglomerate. 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 in a clay matrix. Most of the sand is massive to poorly stratified. *Gravel* is mostly light to medium gray, subangular to well rounded chert pebbles up to about 6 inches in diameter and in a sand matrix. It occurs as stringers and lenses in sand. *Silt and clay* are light to dark gray and sandy, occurring as irregular pockets and veins in sand. Light gray, partly lithified, siliceous siltstone with floating quartz grains, chert pebbles, plant fragments, and root impressions crops out in the SW¼ of Section 25 and the NW¼ of Section 36, T13S, R2W. This material is believed to be silcrete or silicified paleosol. *Sandstone* is white, very fine to medium grained quartz arenite with rounded and frosted grains. It is crossbedded to massive and lacks fossils. *Sandstone* occurs only as float in boulders up to 20 feet across. *Conglomerate* is composed of chert gravel, as above, with a quartz sand matrix and cement of silica and iron oxide; it occurs mainly as float. Wilcox (?) and Tuscaloosa (?) lithologies occur locally in areas mapped as McNairy. The lower contact is unconformable on Paleozoic rocks but may intertongue with Tuscaloosa (?) gravel.

D *Gravel and conglomerate. Gravel* is white, light gray and medium gray, subangular to rounded chert pebbles and cobbles up to 6 inches in diameter. Chert is commonly tripolitic; much of it is probably derived locally. *Conglomerate* is gravel (as above), in places cemented with silica or iron oxide. Assignment to the Tuscaloosa Formation is debatable.

E *Limestone* is light yellowish to brownish gray, fine to coarse, light brown echinoderm fragments in a matrix of dull white bryozoan fragments. This speckled rock is laminated and has common planar crossbedding. Light gray ovoid chert nodules occur in the lower part. Near the base the limestone becomes darker, finer grained, glauconitic, and slightly siliceous, grading into and intertonguing with the underlying unit.

F *Dolomitic limestone and bedded chert. Carbonate rock* is medium to dark gray, olive to brownish gray, glauconitic, highly siliceous dolomitic lime mudstone that contains up to 30% dark chert in highly irregular, angular nodules intricately intergrown with the limestone. Layering is thin, planar to slightly irregular, and indistinct in fresh exposures but accentuated by weathering. Where altered, the Fort Payne is either bedded chert or ganister. *Bedded chert* ("Hartline chert" of previous authors) is brownish gray, slightly vitreous, and vesicular; it weathers to jagged surfaces. *Ganister* is a granular, pelletal, very porous form of silica that is commonly reddish orange to dark brown but locally white. The lower contact is sharp and probably disconformable.

G *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 ostracode burrows and trails, but no body fossils. The unit coarsens upward. The State Pond Shale Member at the base is green to dark olive gray, mottled, soft, slightly calcareous clay shale. Where altered, the Springville Shale is a hard, dense, siliceous rock (commonly called "calico rock") that is light gray with magenta, pink, and orange brown bands and mottles. It occurs in tabular beds 4 to 18 inches thick and separated by thinner intervals of ripple-laminated siliceous shale. The lower contact is disconformable.

H *Shale.* Black, hard, brittle, highly fissile, noncalcareous, slightly silty, pyritic shale predominates. The unit is poorly exposed and known mainly from records of wells in the eastern part of the Mill Creek and adjacent Dongola Quadrangle. The New Albany Shale is missing in places because of erosion at the base of the Springville Shale. The lower contact is disconformable.

I *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. Small lenses and thin layers of dark gray to black, slightly vitreous chert constitute as much as 30% of the rock. *Siltstone and shale* are light to dark gray, olive gray and brownish gray, calcareous, and dolomitic. They have well developed planar and wavy laminations and common burrows and escape structures. Some siltstone approaches very fine sandstone. The *Rendleman Oolite Bed* is a thin but widespread layer of light gray oolitic and oncoidal packstone or grainstone near the middle of the St. Laurent. Where altered, the St. Laurent is mostly light gray, very porous siliceous rock of low density and in very thin tabular layers that contain common dark gray to brown, vitreous chert nodules. Portions are variegated and resemble "calico rock" derived from altered Springville Shale. Exposures of St. Laurent are small and discontinuous. The lower contact is sharp, and at least locally disconformable.

J *Sandstone, minor limestone, chert, and clay.* The Grand Tower is represented largely by the basal *Dutch Creek Sandstone Member*, which is white (weathering dark gray), fine to medium grained, well sorted quartz arenite composed of rounded, frosted grains. Molds of corals, brachiopods, and other fossils are locally abundant but not ubiquitous. Much of the Dutch Creek is instrahumicrobial breccia cemented with silica and dark brown iron oxides. No limestone of the Grand Tower crops out; but thin, light gray, sandy oncoidal limestone overlies the Dutch Creek in wells near the eastern edge of the study area. A thin interval of light gray *chert* fragments in a sticky clay matrix was observed in outcrops; it may be insoluble residuum of the limestone. The lower contact is sharp and at least locally disconformable.

K *Chert*, microcrystalline silica, and minor limestone. *Chert* (largely silicified limestone) is a dull to semivitreous white with orange- and red-stained zones. Bedding is thin and wavy to tabular; red clay partings are common. The chert is mainly porous to microporous but some is dense. Brecciated chert occurs locally near tops of ridges. Ledge-forming chert is common throughout the unit; its occurrence appears to be partially stratigraphically controlled. *Chert* is gently folded in the Clear Creek Anticline. *Microcrystalline silica* is white to very light gray, orange- and red-stained, and relatively soft and porous. It has indistinct thin layering and some clay partings. *Limestone* in the Clear Creek is grayish brown, thin bedded lime mudstone. Fossils are abundant in upper part of unit, including the trilobites *Dalmanites portlocki*, *Odontocnile* sp., *Leonaspsis* sp., *Phacops cristata*, and *Cordania* sp., and the brachiopods *Eodevonaria arcuata*, *Stropholystus cancellatus*, and *Amphigenia curtie* along with abundant spirifertid and atrophesiod brachiopods and pelmatozoans. Ichnofossils include burrows (typically vertical), borings in brachiopod shells, and large *Gomichnia* cavities. Gray chert containing abundant spirifertid brachiopods and crinoid columnals at the base of the unit may represent the Backbone Limestone. The lower contact is poorly exposed but appears conformable.

L *Chert* and microcrystalline silica. *Chert* is white to very light gray with gray, yellow, and orange stains. Typically, it is dense, noxaculitic, and medium to thick-bedded. Fossils are rare. Brecciated chert occurs throughout the unit but is most common at the top. Below the upper breccia zone is an interval of very porous, popcorn-textured chert riddled with what appears to be horizontal burrows. The Grassy Knob contains less clay and more stylolitic partings than the Clear Creek. The lower contact is gradational. *Microcrystalline silica* is similar to that in the overlying unit, but it generally occurs in thinner layers and contains a greater proportion of chert.

M *Limestone*, chert, minor shale, and microcrystalline silica. *Limestone* is light brown to light yellowish gray, oolomitic, argillaceous lime mudstone; its thin wavy beds contain abundant gray chert nodules. The upper part of the unit, stained yellow to orange in some areas, includes chert with a "brain" texture interbedded with microcrystalline silica and dense, nodular *chert*. Sponge spicules increase in abundance upward. Fossils are common in the upper 100 feet; they include the trilobites *Huntonia palacea*, *Phacops* sp. and *Dalmanites* sp. along with crinoids and the trace fossil *Zoophycos*. The lower part of the unit is relatively unfossiliferous. Near the base is greenish gray cherty limestone and bedded chert with interbeds of green *shale*. The lower contact is gradational.

N *Shale and limestone. Shale* is brick red, mottled, and variegated with purple and green. Because it is very calcareous and silty, it could be called marlstone. It is typically burrowed. *Limestone* is brick red, greenish gray and purple mottled, argillaceous lime mudstone in blocky layers. Nautiloids are common in limestone near base. The upper part of the unit is mostly shale and the lower part mostly limestone. The lower contact is sharp but conformable.

O *Limestone*, a lime mudstone and skeletal wackestone, is light to medium gray with pale red and green mottling and contains coarse pink to red calcite crystals (largely pelmatozoan fragments). The thick, tabular bedding has stylolitic partings. The upper part is argillaceous. There have been reports of *Ostracods* and foraminifera (*Ammodiscus* sp.) in well cuttings. The lower contact is sharp.

P *Limestone* is light to medium brownish gray lime mudstone and wackestone that has numerous regular layers of green to caramel-colored chert throughout, along with shaley partings scattered throughout the unit. Near the top are small nodules and spheres of pyrite and large colonies of *Fenestlex* sp. and calyxmed trilobites. The lower contact is disconformable.

Q *Limestone* is dark gray lime mudstone in thin, wavy, and 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. Fossils include crinoids, carpoids, echinasteroids, and a few trilobites. The lower contact is gradational.

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

S *Intergrading sandstone and siltstone* are light to medium gray, greenish to brownish gray, argillaceous, and laminated to thinly bedded. They are quartzose and partly calcareous. A few horizontal burrows and repichnia (trails) are present. The base is not exposed in the study area.

STRUCTURAL GEOLOGY

The Mill Creek and McClure Quadrangles lie along the boundary between the Ozark Dome on the west, the Illinois Basin on the northeast, and the Mississippi Embayment on the southeast. The Ozark Dome area has outcrops of Devonian and older strata, which dip eastward at an average rate of less than 1°. Mississippian rocks in the Illinois Basin portion of the study area dip east-northeast at 2° to 3°. The Cache River bottoms, underlain by thick Quaternary alluvium at the southeast corner of the Mill Creek Quadrangle, are at the edge of the Mississippi Embayment. Southeast of the Cache River, Cretaceous and lower Tertiary strata are at the surface. Undifferentiated Cretaceous–Tertiary strata within the Mill Creek Quadrangle occupy a south-trending paleovalley and occur in small downfaulted slices and scattered hilltop outliers. Cretaceous–Tertiary sediments of the Embayment may have originally blanketed the study area.

The Harrison Creek Anticline in the northwestern corner of the Mill Creek Quadrangle is a north-trending, nearly symmetrical fold that extends northward into the Jonesboro Quadrangle. The Upper Ordovician Girardeau Limestone Member of the Maquoketa Formation is exposed at the core of the anticline and flanked by the Silurian Sexton Creek Limestone and Bainbridge Formation and Silurian–Devonian Bailey Limestone. Maximum dips are about 19° on the west flank and 11° on the east flank. The axis of the anticline plunges gently southward in Section 33, T13S, R2W, and is truncated by a northeast-trending, high-angle fault in the north part of Section 4, T14S, R2W. The upper Bailey Limestone and Grassy Knob Chert (Lower Devonian) northwest of the fault are juxtaposed with Grassy Knob Chert on the southeast, downthrown side. Throw of the fault is about 50 to 60 feet.

The Delta Fault in the western part of the Mill Creek Quadrangle was first mapped and named by Weller and Ekblaw (1940). The fault trends S15°E about 4 miles from near the mouth of South Ripple Hollow nearly to Sandy Creek. The Delta Fault is a high-angle, dip-slip normal fault with 100 to 200 feet of throw down to the east. The fault plane, exposed in several places, dips 60° to 80° east and bears vertical slickensides and mullion. A zone of limonite-cemented chert breccia as wide as 12 feet occurs along the fault. In places the Delta Fault divides into several closely spaced subparallel faults that have stepwise displacements down to the east. A number of smaller faults that strike N15°W to N40°W have been mapped a short distance east of the Delta Fault, particularly in Section 21, T14S, R2W. The exposed faults are high-angle and normal.

Innumerable small faults, most too small to show on the geologic map, were observed east of the Harrison Creek Anticline and Delta Fault. Trends of these faults are diverse, but the most common trends are N20°E to N20°W, east to west, and N30°E to N40°E. Northtrending faults are most common in the northern half of the study area, whereas northeast-trending faults are largest and most numerous in the southern half. Linear drainages and scarps such as Sexton Creek, Sandy Creek, Jim Branch, and the Cache River bluff at Tatumville indicate the presence of additional large, unmapped northeast-trending faults or fracture zones.

Nearly all the small faults in the Mill Creek Quadrangle dip steeper than 60°, and many are vertical. Most of these faults have a few inches to about 20 feet of throw, but a few have more than 100 feet of throw. Horizontal slickensides, reversals of dip directions, wrong-way "drag," and positive and negative flower structures (Harding 1985) along many of the faults indicate strike-slip displacement; however, the amount and direction of horizontal offset can rarely be determined. Two west-northwest-trending faults west of Dago Hill in the SW¼, Section 3, T14S, R2W, bear horizontal striations; the "smoothness test" and arrangement of pinnate fractures along the faults are consistent with left lateral displacement. A positive flower structure, or pop-up structure, has been mapped in the NE¼, Section 33, T13S, R2W. In the narrow, west-northwest-trending fault slice, the distinctive red limestone of the Bainbridge Formation has been upthrust into contact with the younger Bailey Limestone and Grassy Knob Chert. A small pull-apart graben filled with megabreccia is exposed along the streambed in You-Be-Damned Hollow in the SW¼ NW¼, Section 35, T13S, R2W. North of this site a series of en echelon north-northeast-trending faults have been mapped. These high-angle faults outline narrow horsts and grabens and locally contain pull-apart breccia like that in You-Be-Damned Hollow. The fault pattern implies left lateral, divergent wrenching.

At least some faulting is post-Cretaceous. Undifferentiated Cretaceous–Tertiary gravel is in fault contact with Paleozoic rocks along Cooper Creek, SW¼ SW¼ NE¼, Section 1, T14S, R2W, and also at the entrance of an abandoned ganister mine northeast of Elco in Section 18, T14S, R1W. The belt of Cretaceous–Tertiary strata in the northeastern Mill Creek Quadrangle is a paleovalley filled with fluvial sediments. The linear trend and parallelism with faulting suggest structural control.

The complexity of faulting, poor exposure, and paucity of marker beds precluded drawing structure contour lines on the geologic map.

ALTERED ROCKS

Lithologies of all Paleozoic units are altered in a large portion of the study area. The area of altered strata covers the Mill Creek Quadrangle (except the northeast and northwest corners) and part of the southeastern McClure Quadrangle. The altered strata continue northward into the Jonesboro Quadrangle and southward into the Tamms Quadrangle.

In this area, all the rocks are leached of carbonate minerals and silicified. The Grassy Knob Chert and Clear Creek Formation are altered to chert and microcrystalline silica (tripoli) with some clay partings. The Grand Tower Limestone is dissolved, leaving a residuum of clay and chert. The basal Dutch Creek Sandstone Member is brecciated. The St. Laurent Formation is altered to punky, cherty, laminated low-density rock that contains no calcite or dolomite. The altered Springville Shale is a multihued chertlike material called "calico rock"; and the formerly siliceous limestone of the Fort Payne Formation is a bedded chert and ganister (granular silica). Alteration extends at least 400 feet below the surface, the depth of the deepest drill holes in the area.

The rocks are thoroughly faulted and fractured throughout the area of altered strata, as described in the preceding section on structural geology. By contrast, unaltered rocks contain few faults and are only moderately jointed. Geophysical data indicate a large body of dense magnetic rock, probably a mafic pluton, beneath the altered strata. In several parts of the study area, densely silicified rocks of the Clear Creek and Grassy Knob Formations occur along faults. The Grassy Knob is extensively silicified along the northern part of the Delta Fault and other faults in Sections 5 and 8, T14S, R2W; whereas ledge-forming cherts of the Clear Creek follow northeast-trending faults in the NW¼, Section 14, in the same township. Horizontally burrowed layers in both the Grassy Knob and Clear Creek Formations were especially susceptible to alteration; they are heavily silicified well away from mapped faults.

The relationship of alteration to igneous activity suggests hydrothermal activity (Berg and Masters 1994). Intense fracturing provided pathways for hydrothermal fluids. Weathering processes also may have played a role in altering rocks near the surface.

ECONOMIC GEOLOGY

Microcrystalline silica (tripoli) is the principal economic mineral product of the Mill Creek–McClure area. More than 200 tripoli mines, mostly small room-and-pillar drift mines, have operated in the study area in the last 100 years or so. One underground and two surface mines are active, and silica processing plants are in operation at Elco and Tamms (Berg and Masters 1994).

Tripoli occurs in altered Clear Creek Formation and Grassy Knob Chert, and to a lesser extent, in the Bailey Limestone. Four factors led to the formation of tripoli: (1) original biogenic silica in the form of sponge spicules, abundant in the host rocks; (2) abundant detrital quartz silt in the host rocks; (3) hydrothermal leaching and concentration of silica; and (4) near-surface weathering in the past (probably a miner factor). Tripoli is used for polishing compounds, abrasives, and extenders or fillers in paints and plastics. Iron-oxide-stained tripoli is used as an ingredient in portland cement.

Dense, hard chert from the study area has been used for skid-resistant pavement and road gravel, and for making refractory bricks. Ganister derived from silicification of the Fort Payne Formation was formerly mined for use in the manufacture of refractory bricks (Lamar 1953).

No oil or gas production has been achieved in or near the study area. The Humble Oil Company's Pickel No. 1 well, drilled in 1967 to a total depth of 8,492 feet, was dry and abandoned. This hole was drilled near the structural apex of the Harrison Creek Anticline. The oldest formation penetrated was the basal Cambrian Mt. Simon (Lamotte) Sandstone. No shows of oil or gas were reported.

The hydrothermal theory of alteration in this area suggests the possibility of metallic ore deposits in the subsurface. Local residents tell of pioneer lead mining in the vicinity of the Delta Fault, but their reports cannot be confirmed. Concentrations of limonite, goethite, and manganese oxides occur near the Delta Fault and other faults in the study area. These minerals suggest that metallic ores may be present at depth. Unusually high concentrations of metals occur in cuttings from the Humble Pickel No.1 oil test hole. Results of the analysis of cuttings from 29 wells distributed throughout Illinois (Erickson et al. 1987) indicated that samples from the Pickel well had the highest values of silver, arsenic, and lead; the second highest molybdenum value; and the third highest copper value. The silver value for the Pickel well was six times greater than that for any other well (Erickson et al. 1987).

REFERENCES

Berg, R. B., and J. M. Masters, 1994, Geology of Microcrystalline Silica (Tripoli) Deposits, Southernmost Illinois: Illinois State Geological Survey, Circular 555, 96 p.

Erickson, R. L., M. S. Erickson, B. Chazin, J. W. Baxter, J. M. Masters, and J. J. Eidel, 1987, Subsurface Geochemical Investigation in Western and Southern Illinois: A Pilot Study: Illinois State Geological Survey, Illinois Mineral Notes 98, 45 p.

Harding, T. P., 1985, Seismic characteristics and identification of negative flower structures, positive flower structures, and positive structural inversion: American Association of Petroleum Geologists Bulletin, v. 69, no. 4, p. 582–600.

Lamar, J. E., 1953, Siliceous Materials of Extreme Southern Illinois—Silica, Novaculite, Ganister, Calico Rock, and Chert Gravels: Illinois State Geological Survey, Report of Investigations 166, 39 p.

Weller, J. M., and G. E. Ekblaw, 1940, Preliminary Geologic Map of Parts of the Alto Pass, Jonesboro and Thebes Quadrangles: Illinois State Geological Survey, Report of Investigations 70, 26 p. with map, scale 1:62,500.