Prepared in cooperation with the U.S. Geological Survey,
Dallas L. Peck, Director, under the Cooperative
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ILLINOIS STATE GEOLOGICAL SURVEY
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SYSTEM	SERIES	GROUP	FORMATION	MEMBER and BED	GRAPHIC COLUMN	THICKNESS ft (m)	UNIT DESCRIPTION	DESCRIPTION
QUATERNARY	Holocene		Alluvium, colluvium and talus			0-20(6)	A	**A** Unlithified clay, silt, sand, gravel, and boulders (not examined in detail).
	Pleistocene		Peoria Loess			0-20(6)	B	**B** *Silt* is yellowish brown, light brown, and brownish gray; unit is massive, argillaceous, partly calcareous, and rooted.
			Glasford			0-120? (0-37)?	C	**C** *Diamicton* is a light to medium gray and brownish gray silty clay with intermixed sand and pebbles, angular fragments of Pennsylvanian sandstone, and rounded erratic boulders of igneous rock and dolomite up to 4 feet in diameter. Unit contains lenses of poorly sorted, coarsely stratified sand and gravel, and fragments of wood. Paleosol (Sangamon Soil) occurs locally at top.
			Petersburg Silt			0-10(3)?	D	**D** *Silt* is yellowish brown to orange brown, massive, and contains sandstone fragments.
PENNSYLVANIAN	Desm. / Atokan	Raccoon Creek	Tradewater	upper sandstone unit		0-150 (45); 0-300 (90)	E	**E** Intercalated sandstone, siltstone, and shale. *Sandstone* is a light gray that weathers to brown, predominantly very fine to fine grained lithic arenite with feldspar, mica, and a clay matrix. Unit is locally coarse grained with shale, siderite, and coal clasts; it also contains minor amounts of fine grained quartz arenite. Bedding is thin to massive with large scale planar crossbedding. *Siltstone and shale* are light to dark gray, blocky to fissile, noncalcareous, and planar and ripple laminated. Interval is poorly exposed.
	Atokan			middle shaly unit		40-65 (12-20)	F	**F** Shale, siltstone, and minor sandstone. *Shale* is medium to dark gray, fissile, carbonaceous, and noncalcareous. *Siltstone* is light gray to brown, quartzose, and noncalcareous. *Sandstone* is light gray, very fine grained, shaley to silty, and laminated to thinly bedded. Local thin coal lens occurs near the base. Interval is poorly exposed.
	Morrowan			lower sandstone unit		30-90 (9-27)	G	**G** *Sandstone* is a light gray that weathers to brown, fine to coarse grained, poorly sorted lithic arenite with feldspar, mica, and a clay matrix. Unit is generally thick bedded with large scale planar crossbedding. Quartz granules and shale and siderite clasts occur near the base. Portions are burrowed; marine fossils are present in core. Lower contact is erosional.
				basal shaly unit		30-60 (9-18)	H	**H** Shale, siltstone, sandstone, and local coal. *Shale* is dark gray, fissile, noncalcareous, planar and ripple laminated; trace fossils are abundant. Shale is interlaminated with *siltstone* that is light gray, micaceous, and quartzose. *Sandstone* is a light gray, very fine grained lithic arenite; it occurs as thin interbeds in the shale and siltstone. Discontinuous bright-banded *coal* or carbonaceous shale near the base is approximately equivalent to the Reynoldsburg Coal Bed. Lower contact is gradational and intertonguing.
			Caseyville	Pounds Sandstone Member		0-80 (24); 180-400 (55-122)	I	**I** *Sandstone* is a white to light gray that weathers to gray; it is a very fine to medium grained, well sorted quartz arenite with rare quartz pebbles. Bedding is generally thick to massive; ripple marks, crossbedding, and slumped laminations are common. Lower contact is sharp and probably erosional. Unit thins and becomes discontinuous westward.
				(unnamed)		20-90 (6-27)	J	**J** Shale, siltstone, and sandstone. *Shale* is medium to dark gray, noncalcareous, fissile clay shale and silty shale; some is sideritic. *Siltstone* is light to medium gray, quartzose, laminated, and commonly interlaminated with shale. *Sandstone* is white to light gray, very fine grained quartz arenite that is laminated to thinly bedded. Carbonaceous shale with plant fossils and root casts, and discontinuous thin coal occur near top. Interval is poorly exposed. Lower contact is probably gradational.
				Battery Rock Sandstone Member		0-140 (42)	K	**K** *Sandstone* is white to light gray, very fine to coarse grained quartz arenite. In the east part of the quadrangle, the sandstone contains abundant well rounded quartz pebbles and forms cliffs more than 100 feet high. Planar and trough crossbeds occur in sets 1 to 5 feet thick. Westward, the sandstone becomes finer grained as it thins and pinches out. Lower contact is erosional.
				Wayside Member (Keller ss. lentil; Buck Br. ss. lentil)		30-145 (9-44)	L	**L** Shale, siltstone, sandstone, and thin coal. *Shale* is medium to dark gray (rarely black), noncalcareous, fissile, and generally silty. *Siltstone* is light to medium gray, quartzose, and laminated. *Sandstone* is white to light gray, very fine to fine grained quartz arenite. Unit is dominated by interlaminated and interbedded shale, siltstone, and thin bedded sandstone, which display ripple marks, load casts, tool marks, and slumped bedding. Diverse marine and plant fossils occur near the base of the member in the southeast part of quadrangle. Buck Branch and Keller sandstone lentils are cliff-forming, crossbedded to massive sandstone that is predominantly fine grained, although quartz pebbles occur near the base. Buck Branch sandstone is as thick as 40 feet and Keller sandstone reaches 80 feet. Sandstone lenses near the base are less extensive and thinner than 25 feet. Thin *coal* lenses occur in middle and upper parts of unit. Lower contact is a regional disconformity.
MISSISSIPPIAN	Chesterian	Pope	Kinkaid Limestone	Grove Church Sh. Mbr.		0-25 (7.6); 110-188 (33.5-57.4)	M	**M** Shale and limestone. *Shale* is gray to greenish and olive gray, soft, blocky to fissile, partly calcareous, and contains marine fossils. *Limestone* is gray to brown, argillaceous, coarse skeletal wackestone to grainstone that occurs as lenses and thin interbeds in shale. Lower contact is disconformable.
				Goreville Ls. Mbr.		0-50 (15)	N	**N** *Limestone* is light to medium gray and brownish gray, largely medium to coarse grained crinoidal packstone and grainstone. Unit is oolitic near the top and medium to thick bedded with argillaceous partings and scattered chert nodules. Lower contact is sharp and probably disconformable.
				Cave Hill Member		83-92 (25.4-28.0)	O	**O** Shale, claystone, and thin limestone layers. At the top is dark gray, well laminated, calcareous *shale* thinly interbedded with dark gray, micritic *limestone*. Below lies variegated greenish gray, brick red, and ochre *claystone* that contains nodules of argillaceous limestone and dolomite. Lower contact is sharp and slightly irregular.
							P	**P** Limestone and shale. *Limestone* is petrologically diverse, dominated by a partly dolomitic lime mudstone to wackestone that is medium to dark gray and weathers to light gray; it contains dark gray vitreous chert nodules. Interbeds of light gray, fine to coarse grained skeletal packstone and grainstone are present. *Shale* is greenish gray, dark gray to black, fissile, well laminated, calcareous clay shale; it occurs as partings, laminae, and interbeds. Lower contact is sharp and planar.
							Q	**Q** *Shale* is greenish to bluish gray and dark gray, calcareous, and fissile; the upper part is silty. Lower contact is sharp and planar to slightly irregular.
				Negli Creek Limestone Member		30-32 (9-9.6)	R	**R** *Limestone* is medium to dark gray, fossiliferous lime mudstone to skeletal wackestone with some fine to coarse grained skeletal packstone and grainstone at the top of the unit. Bedding is nodular; dark gray, wavy, argillaceous partings separate the beds. Fossils are common; large bellerophontid gastropods and *Girvanella* oncoids are diagnostic for the lower portion of the member. Lower contact is sharp and planar.
			Degonia			40-80 (12-24)	S	**S** Shale, siltstone, sandstone, and claystone. The relatively thin unit consists of interbedded *shale* and *siltstone* to very fine *sandstone*. The greenish gray, brownish gray, and olive gray rocks are noncalcareous and laminated to thinly bedded. Variegated greenish gray, yellow, and red *claystone* occurs at the top. The unit thickens near the west edge of the quadrangle, where it is composed largely of light gray, very fine to fine grained, crossbedded quartz arenite. Lower contact is sharp.
			Clore	Ford Station Mbr.		20-45 (6-14); 110-138 (33.5-42.0)	T	**T** Shale and limestone. *Shale* is dark greenish gray, olive gray, and black, weakly to very fissile, calcareous clay shale and silty shale. *Limestone* is light to dark gray and brown, argillaceous lime mudstone and skeletal wackestone. At the base is a massive layer of dolomitic limestone that is 5 to 16 feet thick and weathers to a distinctive grayish orange. Lower contact is sharp.
				Tygett Ss. Member		28-80 (8.4-24)	U	**U** Sandstone, siltstone, shale, and limestone. Outcrops generally consist of two upward-coarsening siliciclastic intervals separated by limestone. The two clastic intervals grade upward from a dark gray clay *shale* and *silty shale* at the base to a fine grained quartz arenite at the top. Both sandstones contain stigmarian root casts at the top. The *limestone* is a dark gray, argillaceous lime mudstone to skeletal wackestone with interbeds of dark gray clay shale. Subsurface data indicate that the limestone bed is locally absent. Lower contact is sharp to rapidly gradational.
				Cora Member		38-75 (11.6-23)	V	**V** Shale, limestone, and siltstone. *Shale* predominates; it is a medium to dark gray and greenish gray, laminated, fissile, calcareous, abundantly fossiliferous clay shale to silty shale. *Limestone* is medium to dark gray, argillaceous lime mudstone with numerous whole fossils. Limestone beds are up to about 4 feet thick. Gray to greenish gray, micaceous, calcareous *siltstone* occurs in the lower part of the unit. Lower contact is not exposed at outcrops; sharp contact shows in core.
			Palestine			40-67 (12-20)	W	**W** Shale, siltstone, and sandstone. *Shale* is medium to dark gray, noncalcareous, fissile, clay shale to silty shale. *Siltstone* is light to medium gray, quartzose, noncalcareous, laminated, and commonly interlaminated with shale. *Sandstone* is a very fine to medium grained, well sorted quartz arenite. Thin to thick beds occur mainly in the lower part of the formation. Thin, shaley coal and rooted claystone occur near the middle of the formation, as shown in core. Lower contact is not exposed at outcrops, but appears sharp and probably disconformable in core.
			Menard Ls.			50+(15+)	X	**X** Limestone and shale. *Limestone* is a medium to dark gray that weathers to light gray, fossiliferous lime mudstone and skeletal wackestone. Medium to thick hummocky beds are separated by shale partings. *Shale* is medium gray and olive gray to black, weakly to very fissile, and partly calcareous and fossiliferous. Shale occurs as laminae and interbeds, and in layers as thick as 15 feet.

PENNSYLVANIAN STRATIGRAPHY

The lower part of the Pennsylvanian System in southern Illinois is a succession of sandstone, siltstone, shale, minor conglomerate, and thin discontinuous coal beds. These strata are difficult to map and interpret because of rapid lateral facies changes, subtle and gradational vertical changes, and an absence of marker beds.

In most of the Lick Creek Quadrangle, two Pennsylvanian formations are recognized, the Caseyville (older) and the Tradewater. The Caseyville is characterized by monomineralic sandstones: quartz arenites commonly containing rounded quartz pebbles and granules. Sandstones of the Tradewater are generally polymineralic lithic arenites containing conspicuous mica, feldspar, rock fragments, clay matrix, and rare quartz granules. The top of the Caseyville Formation is mapped at the highest occurrence of quartz arenite. In the eastern part of the quadrangle, the top of the Caseyville is mapped at the top of the Pounds Sandstone Member. In the central part of the quadrangle, monomineralic sandstones grade upward to polymineralic sandstones and the two types of sandstone intertongue. In the western part of the quadrangle, the combination of a gradational boundary and poor exposures precludes mapping of the contact. In this area, the two formations are undifferentiated and referred to as the Raccoon Creek Group (Greb et al. 1992).

The Caseyville Formation thins westward from as much as 400 feet thick near the eastern edge of the quadrangle to less than 200 feet thick near the western edge. Both the Pounds and Battery Rock Sandstone Members become finer grained as they thin westward and pinch out. The Keller sandstone lentil near the base of the Caseyville is the only Caseyville sandstone differentiated in the western part of the quadrangle. Little is known about the continuity of sandstone units in the Tradewater Formation because of limited exposures and the paucity of subsurface data for the quadrangle.

Lower Pennsylvanian strata, as subdivided in Lamar (1925), Kosanke et al. (1960), and this study, are summarized in a chart to the far right.

STRUCTURAL GEOLOGY

The Lick Creek Quadrangle is on the southwest margin of the Illinois Basin. The structure of the quadrangle is characterized by a simple north-northeast homoclinal dip towards the basin center. The average dip decreases from about 100 feet per mile (approximately 1°) in the southwestern part of the quadrangle to about 80 feet per mile in the northeastern part. The strike changes from approximately N45°W in the southwest, to around N67°W in the northeast sector of the area.

The only mapped fault in the quadrangle is a small thrust fault exposed in an abandoned sandstone quarry southeast of Interstate 57 (I-57) in the NE¼ SW¼ NW¼, Sec. 25, T11S, R1E. The fault strikes N60°W, dips about 25° to the southeast, and displaces strata of the Wayside Member of the Caseyville Formation. A thick bedded sandstone is thrust over interbedded shale and sandstone. Throw is about 10 feet and net displacement is about 24 feet. This fault may be related to the Ste. Genevieve Fault Zone, a northwest-trending, high angle reverse fault about 13 miles to the west.

Several small faults (not shown) that probably were contemporaneous with deposition and/or compaction of sediments are exposed in the roadcut along I-57 in the NW¼ NW¼, Sec. 19, T11S, R2E. Displacements are less than 3 feet.

Joints are common in the western part of the quadrangle; they are widely spaced and poorly developed in the eastern part. Trends of joints vary, but due north and east-northeast orientations are prevalent in most exposures.

ECONOMIC GEOLOGY

The principal geologic resource in the Lick Creek Quadrangle is limestone for construction and agriculture. Sandstone was quarried for construction. The potential for developing fluorspar, base metals, sand and gravel, or coal from this area is limited. Nine unsuccessful exploration wells for shallow petroleum deposits have been drilled. Deeper petroleum prospects remain untested.

The Kinkaid Limestone is the best prospect for economic development in the Lick Creek Quadrangle because its thick limestone beds may be suitable for use in agriculture and for production of road aggregate as well as construction aggregate for portland cement concrete and bituminous road pavement (Lamar 1959). The Negli Creek, Cave Hill, and Goreville Limestone Members of the Kinkaid comprise a predominantly limestone interval of about 160 feet thick. Scattered chert nodules throughout the formation and thin shale intervals at the top and base of the Cave Hill probably are not deleterious to commercial development. The Cave Hill has been quarried in the center of the S½ NE¼ SE¼, Sec. 21, T11S, R1E, near the center of the E½ NE¼, Sec. 29, T11S, R1E, and at several sites in the NW¼ SE¼, Sec. 20, T11S, R1E. A small amount of Goreville limestone was quarried in the NW¼ SW¼ NW¼, Sec. 25, T11S, R1E. The Kinkaid is quarried just southeast of the quadrangle, and potential exists for quarry development along its outcrop belt.

Sandstone from the basal part of the Caseyville Formation has been quarried near the center of the W½ NW¼, Sec. 25, T11S, R1E, presumably for foundation and culvert construction or road ballast. Although sandstone is abundant in the Raccoon Creek Group, the economic potential is slight because of lack of demand for this material.

Resources of coal are negligible in the quadrangle. Coal beds in the Raccoon Creek Group are too thin, less than 1 foot thick, and discontinuous to map.

Nine oil and gas exploration wells have been drilled in the quadrangle. The deepest test was the C.A. Houston No. 1 well, which was drilled in the SE¼ NE¼ NE¼, Sec. T10S, R2E, to a depth of 2,109 feet. All of these wells were drilled to the middle Mississippian Ste. Genevieve Limestone, except for the Walker No. 1 well, which was drilled to the upper Mississippian Cypress Sandstone. Only the Mary Throgmorton No. 1 well, in the NE¼ SE¼ NW¼, Sec. 29, T10S, R2E, had an oil show from 1,980 to 1,981 feet deep in the Ste. Genevieve Limestone. Chances of finding shallow petroleum deposits are slim. Geologic mapping did not reveal any structural closures near the surface. Reservoir characteristics and structure of pre-middle Mississippian strata are unknown within the quadrangle. All of the wells were plugged and abandoned.

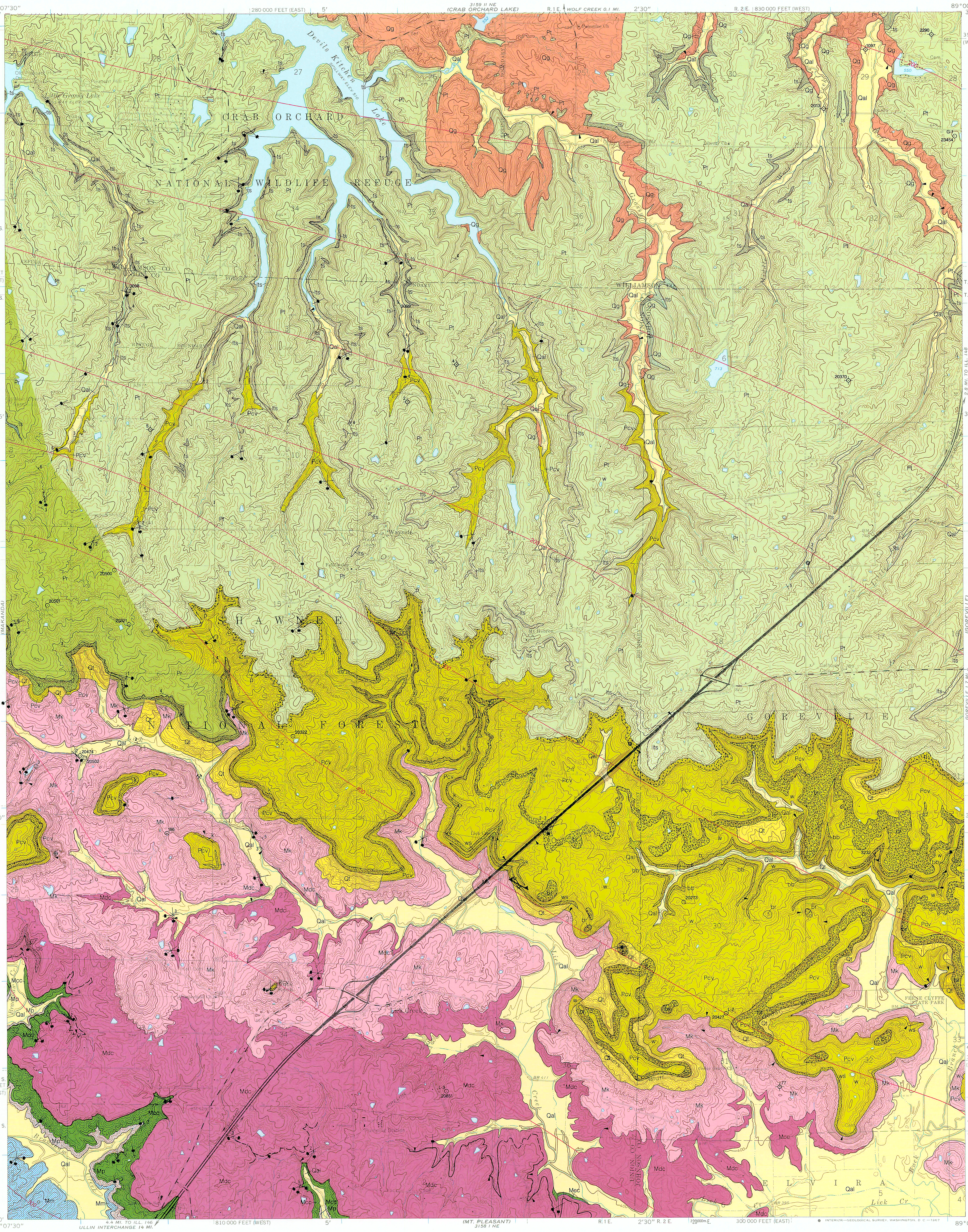
REFERENCES

Greb, S.F., D.A. Williams, and A.D. Williamson, 1992, Geology and Stratigraphy of the Western Kentucky Coal Field: Kentucky Geological Survey, Bulletin 2, Series XI, 77 p.

Kosanke, R.M., J.A. Simon, H.R. Wanless, and H.B. Willman, 1960, Classification of the Pennsylvanian Strata of Illinois: Illinois State Geological Survey, Report of Investigations 214, 84 p.

Lamar, J.E., 1925, Geology and Mineral Resources of the Carbondale Quadrangle: Illinois State Geological Survey, Bulletin 48, 172 p.

Lamar, J.E., 1959, Limestone Resources of Extreme Southern Illinois: Illinois State Geological Survey, Report of Investigations 211, 81 p.



Base from U.S. Geological Survey, 1966. 10,000-foot grids based on Illinois coordinate system, east and west zones

NOTE: A detailed report on the geology of the quadrangle will be published in the Illinois State Geological Survey Bulletin Series, entitled "Geology of the Lick Creek Quadrangle, Johnson, Union, and Williamson Counties, Illinois," by W. John Nelson and C. Pius Weibel

UTM GRID AND 1966 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL

QUADRANGLE LOCATION

Cartography by Williams and Heintz Map Corp.

Geology mapped from 1987 to 1989

GEOLOGIC MAP OF THE LICK CREEK QUADRANGLE JOHNSON, UNION, AND WILLIAMSON COUNTIES, ILLINOIS

C. PIUS WEIBEL AND W. JOHN NELSON

1993

EXPLANATION

QUATERNARY — Pleistocene and Holocene

- Qt — Talus, includes colluvium
- Qal — Alluvial deposits
- Qg — Glacial deposits

Unconformity

PENNSYLVANIAN — Morrowan - Desmoinesian

Pr — Raccoon Creek Group

Pt — Tradewater Formation
- ts, *Tradewater sandstone lentil(s)*
- lts, *lower Tradewater sandstone lentil*

Pcv — Caseyville Formation
- p, *Pounds Sandstone Member*
- cs, *unnamed Caseyville sandstone lentil*
- br, *Battery Rock Sandstone Member*
- w, *Wayside Member*
- k, *Keller sandstone lentil*
- bb, *Buck Branch sandstone lentil*
- ws, *unnamed Wayside sandstone lentil(s)*

Unconformity

MISSISSIPPIAN — Chesterian

- Mk — Kinkaid Limestone
- Mdc — Degonia Formation and Ford Station, Tygett Members of Clore Formation undifferentiated; ds, *sandstone lentil in Degonia*; l, *limestone in Tygett Member*
- Mcc — Cora Member of Clore Formation
- Mp — Palestine Sandstone
- Mm — Menard Limestone

LINE SYMBOLS: Dashed where inferred

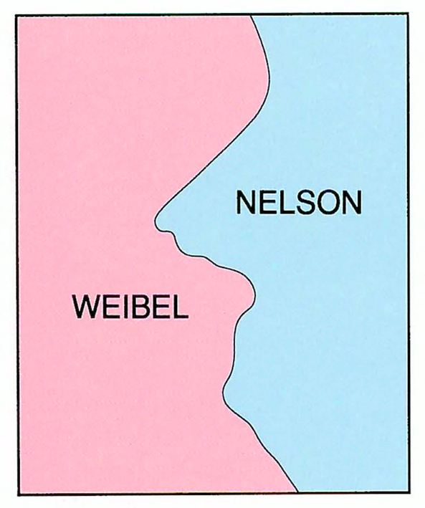
- Contact
- Reverse fault: triangle on upthrown side
- 200 — Structure contour on base of Kinkaid Limestone; contour interval 100 feet

SYMBOLS

- Strike and dip of bedding; number indicates degree of dip
- Horizontal bedding
- Joints
- 3098 — Coal exposure, with ISGS coal maceration and palynological analysis number
- Outcrop of special note, shown where contact, map unit, or fault was well exposed at time of mapping

DRILL HOLES FROM WHICH SUBSURFACE DATA WERE OBTAINED

- L-2 20427 — ISGS cored test hole, with ISGS county number
- 186 — Mineral/water well, with ISGS county number
- 3232 — Oil test hole, with ISGS county number



Index map showing areas geologically surveyed by authors

Pennsylvanian lithostratigraphic nomenclature used on the Lick Creek Quadrangle

Lamar, 1925		Kosanke et al., 1960		This Map	
Pottsville Formation	Makanda sandstone member	Spoon Formation (part)		Tradewater Formation	
		Abbott Formation			
	Drury shale and sandstone member				
	Lick Creek sandstone member	Caseyville Formation	Pounds Sandstone Member	Caseyville Formation	Pounds Sandstone Member
			Drury Shale Member		(unnamed)
			Battery Rock Sandstone Member		Battery Rock Sandstone Member
	Wayside sandstone and shale member		Wayside Sandstone Member		Wayside Member