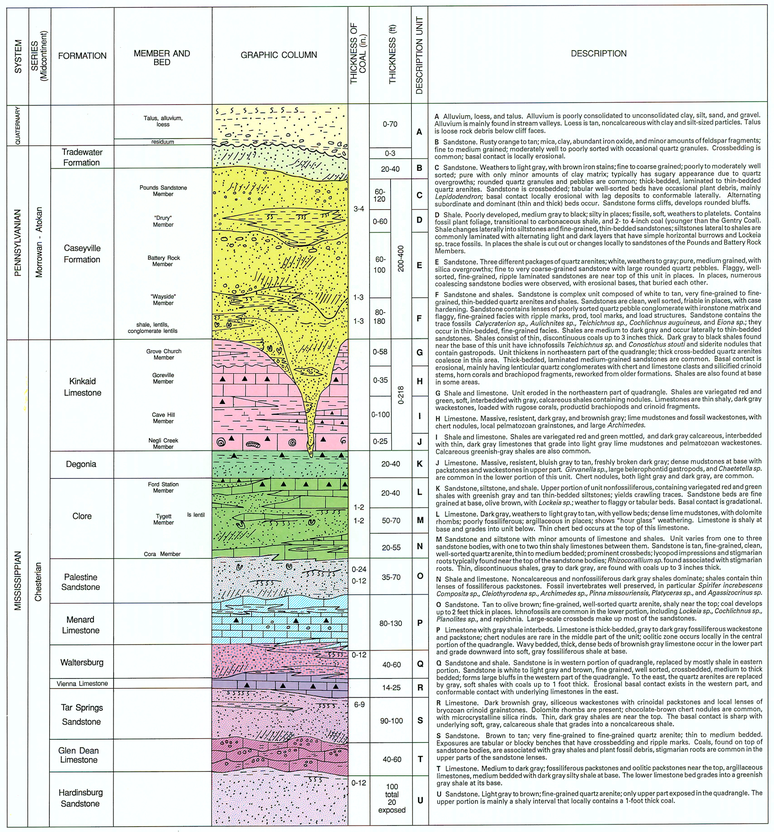
Prepared in cooperation with the U.S. Geological Survey
Dallas L. Peck, Director, under the Cooperative
Geologic Mapping Program (COGEOMAP)



A Alluvium, loess, and talus. Alluvium is poorly consolidated to unconsolidated clay, silt, sand, and gravel. Alluvium is mainly found in stream valleys. Loess is tan, noncalcareous with clay and silt-sized particles. Talus is loose rock debris below cliff faces.

B Sandstone. Rusty orange to tan; mica, clay, abundant iron oxide, and minor amounts of feldspar fragments; fine to medium grained; moderately well to poorly sorted with occasional quartz granules. Crossbedding is common; basal contact is locally erosional.

C Sandstone. Weathers to light gray, with brown iron stains; fine to coarse grained; poorly to moderately well sorted; pure with only minor amounts of clay matrix; typically has sugary appearance due to quartz overgrowths; rounded quartz granules and pebbles are common; thick-bedded, laminated to thin-bedded quartz arenites. Sandstone is crossbedded; tabular well-sorted beds have occasional plant debris, mainly *Lepidodendron*; basal contact locally erosional with lag deposits to conformable laterally. Alternating subordinate and dominant (thin and thick) beds occur. Sandstone forms cliffs, develops rounded bluffs.

D Shale. Poorly developed, medium gray to black; silty in places; fissile, soft, weathers to platelets. Contains fossil plant foliage, transitional to carbonaceous shale, and 2- to 4-inch coal (younger than the Gentry Coal). Shale changes laterally into siltstones and fine-grained, thin-bedded sandstones; siltstones lateral to shales are commonly laminated with alternating light and dark layers that have simple horizontal burrows and Lockeia sp. trace fossils. In places the shale is cut out or changes locally to sandstones of the Pounds and Battery Rock Members.

E Sandstone. Three different packages of quartz arenites; white, weathers to gray; pure, medium grained, with silica overgrowths; fine to very coarse-grained sandstone with large rounded quartz pebbles. Flaggy, well-sorted, fine-grained, ripple laminated sandstones are near top of this unit in places. In places, numerous coalescing sandstone bodies were observed, with erosional bases, that buried each other.

F Sandstone and shales. Sandstone is complex unit composed of white to tan, very fine-grained to fine-grained, thin-bedded quartz arenites and shales. Sandstones are clean, well sorted, friable in places, with case hardening. Sandstone contains lenses of poorly sorted quartz pebble conglomerate with ironstone matrix and flaggy, fine-grained facies with *ripple marks*, prod, tool marks, and load structures. Sandstone contains the trace fossils *Calycraterion* sp., *Aulichnites* sp., *Teichichnus* sp., *Cochlichnus anguineus*, and *Elona* sp.; they occur in thin-bedded, fine-grained facies. Shales are medium to dark gray and occur laterally to thin-bedded sandstones. Shales consist of thin, discontinuous coals up to 3 inches thick. Dark gray to black shales found near the base of this unit have ichnofossils *Teichichnus* sp. and *Conostichus stouti* and siderite nodules that contain gastropods. Unit thickens in northeastern part of the quadrangle; thick cross-bedded quartz arenites coalesce in this area. Thick-bedded, laminated medium-grained sandstones are common. Basal contact is erosional, mainly having lenticular quartz conglomerates with chert and limestone clasts and silicified crinoid stems, horn corals and brachiopod fragments, reworked from older formations. Shales are also found at base in some areas.

G Shale and limestone. Unit eroded in the northeastern part of quadrangle. Shales are variegated red and green, soft, interbedded with gray, calcareous shales containing nodules. Limestones are thin shaly, dark gray wackestones, loaded with rugose corals, predustid brachiopods and crinoid fragments.

H Limestone. Massive, resistent, dark gray, and brownish gray; lime mudstones and fossil wackestones, with chert nodules, local pelmatozoan grainstones, and large *Archimedes*.

I Shale and limestone. Shales are variegated red and green mottled, and dark gray calcareous, interbedded with thin, dark gray limestones that grade into light gray lime mudstones and pelmatozoan wackestones. Calcareous greenish-gray shales are also common.

J Limestone. Massive, resistent, bluish gray to tan, freshly broken dark gray; dense mudstones at base with packstones and wackestones in upper part. *Girvanella* sp., large belerophontid gastropods, and *Chaetetella* sp. are common in the lower portion of this unit. Chert nodules, both light gray and dark gray, are common.

K Sandstone, siltstone, and shale. Upper portion of unit nonfossiliferous, containing variegated red and green shales with greenish gray and tan thin-bedded siltstones; yields crawling traces. Sandstone beds are fine grained at base, olive brown, with *Lockeia* sp.; weather to flaggy or tabular beds. Basal contact is gradational.

L Limestone. Dark gray, weathers to light gray to tan, with yellow beds; dense lime mudstones, with dolomite rhombs; poorly fossiliferous; argillaceous in places; shows "sour glass" weathering. Limestone is shaly at base and grades into unit below. Thin chert bed occurs at the top of this limestone.

M Sandstone and siltstone with minor amounts of limestone and shales. Unit varies from one to three sandstone bodies, with one to two thin shaly limestones between them. Sandstone is tan, fine-grained, clean, well-sorted quartz arenite, thin to medium bedded; prominent crossbeds; lycopod impressions and stigmarian roots typically found near the top of the sandstone bodies; *Rhizocorallium* sp. found associated with stigmarian roots. Thin, discontinuous shales, gray to dark gray, are found with coals up to 3 inches thick.

N Shale and limestone. Noncalcareous and nonfossiliferous dark gray shales dominate; shales contain thin lenses of fossiliferous packstones. Fossil invertebrates well preserved, in particular *Spirifer increscens Composita* sp., *Cleiothyrodena* sp., *Archimedes* sp., *Pinna missouriensis*, *Platyceras* sp., and *Agassizocrinus* sp.

O Sandstone. Tan to olive brown; fine-grained, well-sorted quartz arenite, shaly near the top; coal develops up to 2 feet thick in places. Ichnofossils are common in the lower portion, including *Lockeia* sp., *Cochlichnus* sp., *Planolites* sp., and repichnia. Large-scale crossbeds make up most of the sandstones.

P Limestone with gray shale interbeds. Limestone is thick-bedded, gray to dark gray fossiliferous wackestone and packstone; chert nodules are rare in the middle part of the unit; oolitic zone occurs locally in the central portion of the quadrangle. Wavy bedded, thick, dense beds of brownish gray limestone occur in the lower part and grade downward into soft, gray fossiliferous shale at base.

Q Sandstone and shale. Sandstone is in western portion of quadrangle, replaced by mostly shale in eastern portion. Sandstone is white to light gray and brown, fine grained, well sorted, crossbedded, medium to thick bedded; forms large bluffs in the western part of the quadrangle. To the east, the quartz arenites are replaced by gray, soft shales with coals up to 1 foot thick. Erosional basal contact exists in the western part, and conformable contact with underlying limestones in the east.

R Limestone. Dark brownish gray, siliceous wackestones with crinoidal packstones and local lenses of bryozoan crinoid grainstones. Dolomite rhombs are present; chocolate-brown chert nodules are common, with microcrystaline silica rinds. Thin, dark gray shales are near the top. The basal contact is sharp with underlying soft, gray, calcareous shale that grades into a noncalcareous shale.

S Sandstone. Brown to tan; very fine-grained to fine-grained quartz arenite; thin to medium bedded. Exposures are tabular or blocky benches that have crossbedding and ripple marks. Coals, found on top of sandstone bodies, are associated with gray shales and plant fossil debris, stigmarian roots are common in the upper parts of the sandstone lenses.

T Limestone. Medium to dark gray; fossiliferous packstones and oolitic packstones near the top, argillaceous limestones, medium bedded with dark gray silty shale at base. The lower limestone bed grades into a greenish gray shale at its base.

U Sandstone. Light gray to brown; fine-grained quartz arenite; only upper part exposed in the quadrangle. The upper portion is mainly a shaly interval that locally contains a 1-foot thick coal.

STRUCTURAL GEOLOGY

The Glendale Quadrangle lies along the southern margin of the Illinois Basin. Paleozoic strata in the quadrangle dip northward into the basin at 1° to 3°. The Dixon Springs Graben, named by Weller and Krey (1939), crosses the southeastern part of the quadrangle. The two bounding fault zones are the Lusk Creek Fault Zone on the northwest side and the Raum Fault Zone on the southeast. The graben contains lower Pennsylvanian rocks that were downdropped 800 to 1,200 feet relative to the surrounding Mississippian rocks of the Chesterian Series.

The Lusk Creek Fault Zone (Weller et al., 1952) consists of two to four northeast-trending subparallel faults and smaller oblique cross-faults in a zone 200 to 1,300 feet wide. Highly shattered and deformed rocks and gouge zones up to 60 feet wide are present in many places (e.g. SE 1/4, NW 1/4, NW 1/4, SE 1/4, Section 9, T13S, R4E). Most of the minor faults parallel to the main fault are normal antithetic faults, but small-scale thrust faults were observed in a roadcut along State Highway 146, 1,400 feet west of the intersection of State Highway 145. The main fault is a high-angle reverse fault that dips to the southeast. This interpretation is supported by borehole and outcrop data, and by a proprietary reflection seismic profile in the adjacent Waltersburg Quadrangle. The seismic profile across the Lusk Creek Fault Zone also shows the master fault steeply dipping to the southeast and becoming listric at depth. Rocks are downthrown on the southeast side of the main fault. Sandstone of the Caseyville Formation occurs on the southeast side, and Chesterian rocks occur on the northwest side of the fault. A narrow fault slice containing St. Louis and Ste. Genevieve Limestones occurs southeast of the main fault north of Dixon Springs. This slice of older rocks is sandwiched between younger rocks of Chesterian and Pennsylvanian age. The Lusk Creek Fault Zone merges with the Rough Creek-Shawneetown Fault System to the northeast (Weller et al., 1952).

The Raum Fault Zone (Baxter et al., 1967; Nelson, in prep.) is represented in this quadrangle by two subparallel high-angle faults 2 to 2 1/2 miles southeast of the Lusk Creek Fault Zone. A minor fault north of Highway 146 juxtaposes sandstone of the Caseyville on the southeast with the Kinkaid Limestone on the northwest. This fault dies out to the southwest beneath the alluvium of Root Lick Branch. The main, high-angle, normal fault of this zone was projected under the alluvium across the southeastern corner of the quadrangle. Stratigraphic evidence from the Reevesville and Brownfield Quadrangles, and direct observations of the fault trend in the Waltersburg Quadrangle, indicate that this fault runs beneath the surficial alluvium of Root Lick Branch Creek. A seismic profile indicates that the Raum Fault Zone dips to the northwest and intersects the Lusk Creek Fault Zone at depth.

A south- to southwest-trending fault occurs in the northwestern corner of the Glendale Quadrangle. This fault splits in the northeastern corner of Section 11, T12S, R4E. The Kinkaid Limestone is juxtaposed with sandstone of the Wayside Member indicating a throw of about 60 feet down to the west on the western fault. The eastern fault displaces sandstone of the Wayside against Battery Rock Sandstone Member. Both faults die out to the south.

Five small anticlines occur in the quadrangle. Two of these occur within the Lusk Creek Fault Zone. The other three occur in flat-lying strata of the Clore Formation. The latter three anticlines are 3 to 50 feet wide. The axes of four out of five of the anticlines roughly parallel the trend of the Dixon Springs Graben. The fifth anticline, well exposed in a railroad cut at Robbs, strikes perpendicularly to the graben. These anticlines all are sharp upward buckles, having steeply dipping limbs and sharp crests in the form of an inverted "V". They are believed to reflect minor adjustments, in incompetent, shaly strata, in response to compressional stresses induced by reverse displacement along the Lusk Creek Fault Zone.

ECONOMIC GEOLOGY

Coal has been mined for local use by property owners, but there has been no commercial mining in this quadrangle. Two discontinuous coal beds (or seams) occur within the lower Pennsylvanian rocks. The lower of the two is found in the Wayside Sandstone Member and ranges from 2 to 4 inches thick. This coal has a rooted underclay in places; elsewhere it consists of rafted coal stringers. The coal in the Wayside was found in four outcrops and in one coal-test borehole (Gd-1), in Sections 11 and 12, T12S, R4E, and Sections 9 and 15 of T12S, R5E. The upper coal occurs in the Drury Member of the Caseyville Formation, in a similar stratigraphic position as the Gentry Coal Bed in Hardin County, to the east. However, spores found in the coal in the Drury in the Glendale Quadrangle indicate it is slightly younger than the Gentry Coal Bed (Russel A. Peppers, personal communication). Coal in the Drury was found in the NW 1/4, NE 1/4 , NW 1/4 of Section 10, and SW 1/4 of Section 5, T12S, R5E. It is 3 to 5 inches thick and forms one to three stringers with intervening shale benches.

Coals are also found in Chesterian strata in the quadrangle, within the Tygett Sandstone Member of the Clore Formation, and in the Palestine, Waltersburg, and Tar Springs Sandstones. These coals consistently occur just above Chesterian sandstones. Coal in the Tar Springs is exposed in the railroad cut of Illinois Central in Section 12, T13S, R4E, and is 6 inches thick. Coal in the Waltersburg is up to 12 inches thick and has been mined for local use south of Lake Glendale, near the center of Section 9, T12S, R5E. Coal in the Palestine crops out in the SW 1/4, SW 1/4 of Section 23, T12S, R4E, and is 1 inch thick. In borehole Gd-2, 19 inches of coal with high sulfur and shale contents was recovered in the Palestine. Coal in the Tygett crops out in Sections 19, 22, 23, and 28 of T12S, R5E, and ranges from 1 to 3 inches thick.

In summary, the prospects for commercial coal mining in the Glendale Quadrangle are remote.

Fluorspar and barite prospecting was described by Bradbury (1959) and Tippie (1944) from the eastern half of Section 9, T13S, R5E, of the Glendale Quadrangle, within the Lusk Creek Fault Zone. Only traces of fluorite and barite have been found in prospect pits and in inclined diamond drill holes in Section 9. Some of the boreholes encountered the Ste. Genevieve and St. Louis Limestones near the surface (Tippie, 1944). The Ste. Genevieve Limestone is the principal host formation of fluorspar-barite mineralization throughout the Fluorspar District. Although only traces of fluorite and barite have been found in prospect pits and drill holes in Section 9, T13S, R5E, Bradbury (1959) stated that drilling other areas along the Lusk Creek Fault Zone southwest to northeast of this prospect might reveal fluorspar and barite deposits of considerably greater extent.

Limestone in the Goreville Limestone Member of the Kinkaid Limestone was quarried at the Millstone Bluff quarry (NW 1/4, NW 1/4, Section 20, T12S, R5E). A smaller quarry on the southwestern toe of Johnson Ridge (SE 1/4, NE 1/4, Section 23, T12S, R4E) produced limestone from the Negli Creek Limestone Member of the Kinkaid. Both quarries are abandoned. The Goreville and Negli Creek are both dense, resistant, cherty limestones that were probably used for aggregate and roadstone.

The Menard Limestone would be a good carbonate rock for road aggregate. It contains dense limestone beds and has a thickness that ranges from 80 to 130 feet in this quadrangle. Good exposures and easy access to this formation are found south and east of Flatwoods, Illinois, along the Menard/Palestine cuesta.

The Vienna Limestone would make a tough aggregate for skid-resistent asphalt, because of its siliceous nature.

The closest oil and gas production is about 12 miles north of the Glendale Quadrangle near Mitchellsville. The oil in the Mitchellsville area is produced from sandstones of the Degonia, Waltersburg, and Cypress Formations (Chesterian). No oil has been produced from this quadrangle. Four of the 57 known boreholes were tests for oil and gas, but no shows of oil were reported. The deepest test in the study area was the Robbs Resettlement well No. 2, located in the NW 1/4, SE 1/4, NW 1/4, Section 33, T12S, R5E. This well reached a depth of 680 feet in the Haney Limestone Member (Chesterian). No wells have reached the Cypress, Aux Vases, and Ste. Genevieve outside the fault zone. The oil possibilities of this quadrangle have not been satisfactorily tested.

Structural plays along the west side of the Lusk Creek Fault Zone have not been tested. The main reason that exploration has been hampered in this area is because of hydrothermal activity and loss of porosity due to recrystallization along this fault zone. However, surface exposures near the faults show that mineralization and recrystallization are restricted to localized areas a few feet from respective faults. Porosity increases short distances away from the faults.

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ILLINOIS STATE GEOLOGICAL SURVEY
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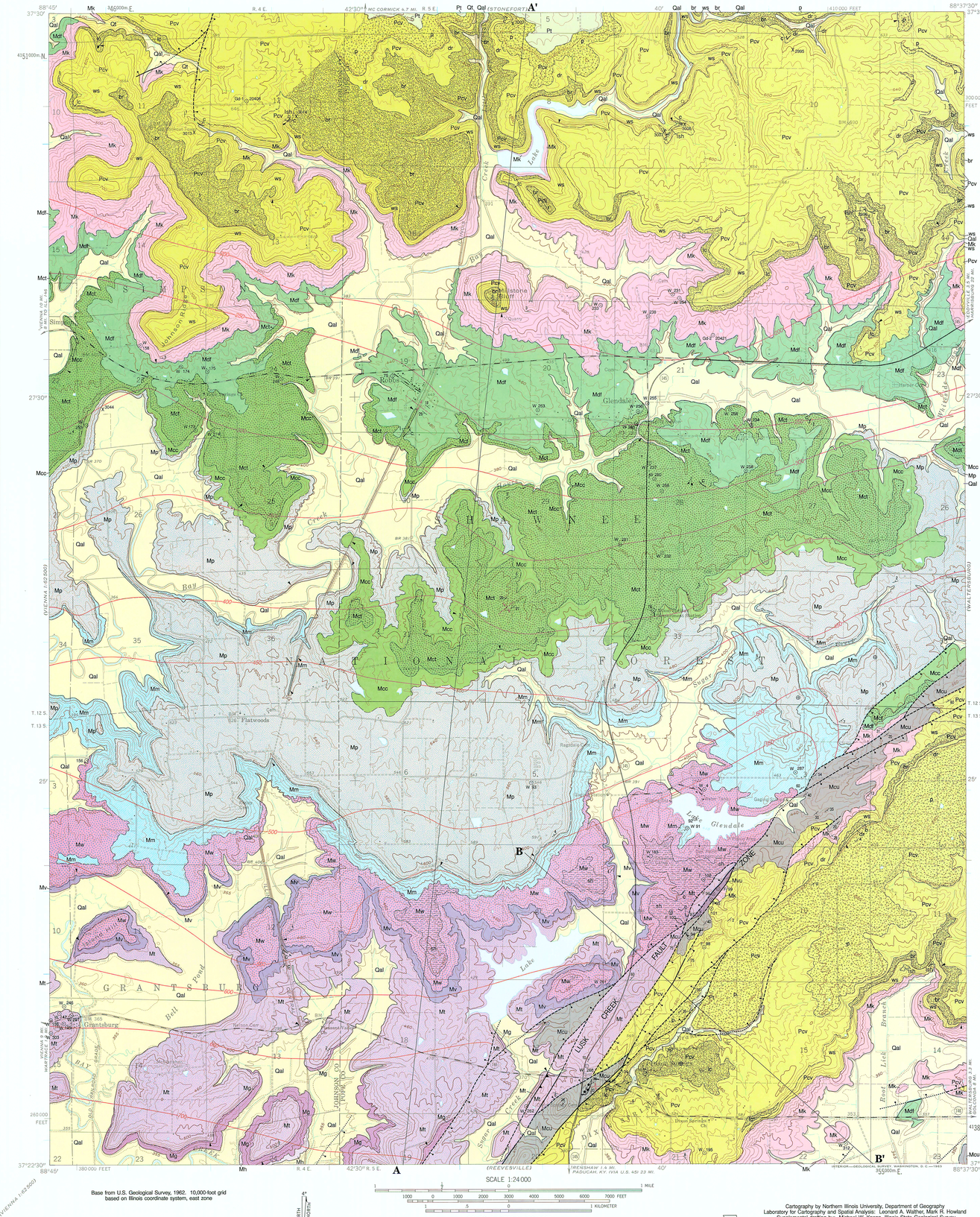
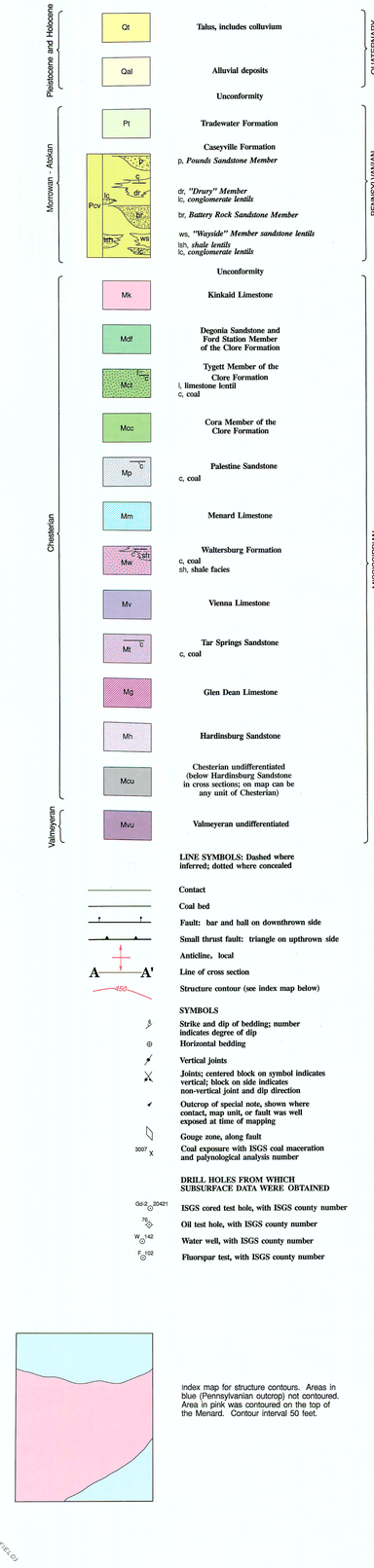
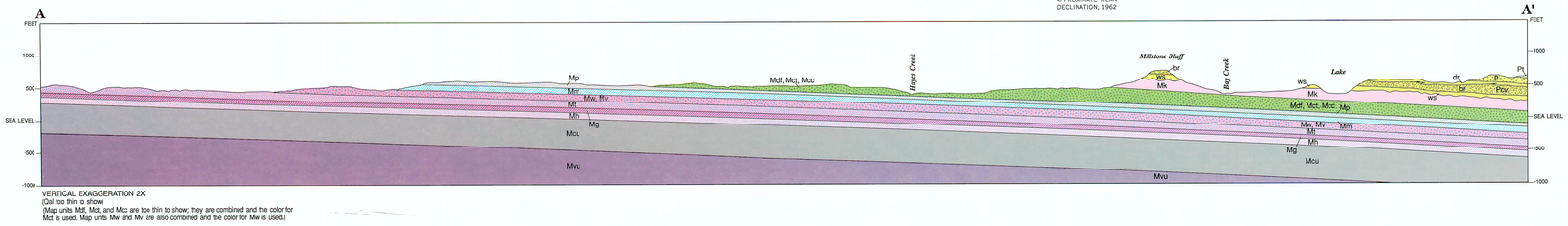
Geologic Map of the
GLENDALE QUADRANGLE, ILLINOIS
IGQ-9

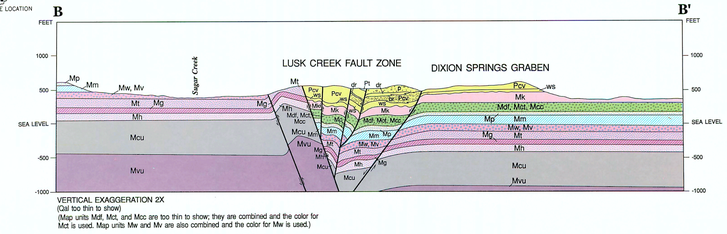


EXPLANATION



index map for structure contours. Areas in blue (Pennsylvanian outcrop) not contoured. Area in pink was contoured on the top of the Menard. Contour interval 50 feet.





GEOLOGIC MAP OF THE GLENDALE QUADRANGLE JOHNSON AND POPE COUNTIES, ILLINOIS

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