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GEOLOGY OF THE POMONA QUADRANGLE, ILLINOIS

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George A. Desborough

ABSTRACT

The Pomona quadrangle is in extreme southwestern Illinois near the southwestern border of the Illinois Basin. Both Pennsylvanian and Mississippian strata are exposed in the area. The Pennsylvanian strata—Caseyville, Abbott, and Spoon Formations—are composed largely of sandstones and shales, but thin, discontinuous coal and limestone beds also are present. Exposed Mississippian strata include the Clore Formation, Degonia Sandstone, and Kinkaid Limestone of late Chesterian age.

Three ages of faulting are recognized: post-Mississippian—pre-Pennsylvanian, Caseyville, and post-Pennsylvanian. The Pomona Fault is a major structural feature that strikes northwest-southeast and brings Chesterian strata on the southwest side against Caseyville rocks on the northeast side. The Pomona Fault and subordinate faults striking northeast-southwest probably are related to the Rattlesnake Ferry Fault, which is essentially parallel to the Pomona Fault and lies about 4 miles southwest of the quadrangle.

Illinoian glacial deposits mantle essentially all of the quadrangle north of Cedar Creek, and thick loess covers most of the upland throughout the area. Two Wisconsinan terraces have been recognized in the larger valleys.

Coal has been mined on a small scale and ground-water supplies are adequate for most farms. Limestone and sandstone are available for use as building stone, agstone, and road rock.

Pennsylvanian clays and shales and the weathered loess probably could be used for making common tile and structural clay products.

INTRODUCTION

The Pomona quadrangle (pl. 1) is a rectangular area, approximately $8\frac{1}{2}$ miles long and $6\frac{1}{2}$ miles wide, in Jackson County in the southwestern part of Illinois (fig. 1). It is a $7\frac{1}{2}$ -minute quadrangle, the northeast quarter of the 15-minute Alto Pass quadrangle. Strata of Mississippian and Pennsylvanian age are well exposed, and Illinoian till mantles the northern part of the area. Faults of post-Mississippian—pre-Pennsylvanian, Caseyville, and post-Pennsylvanian age are

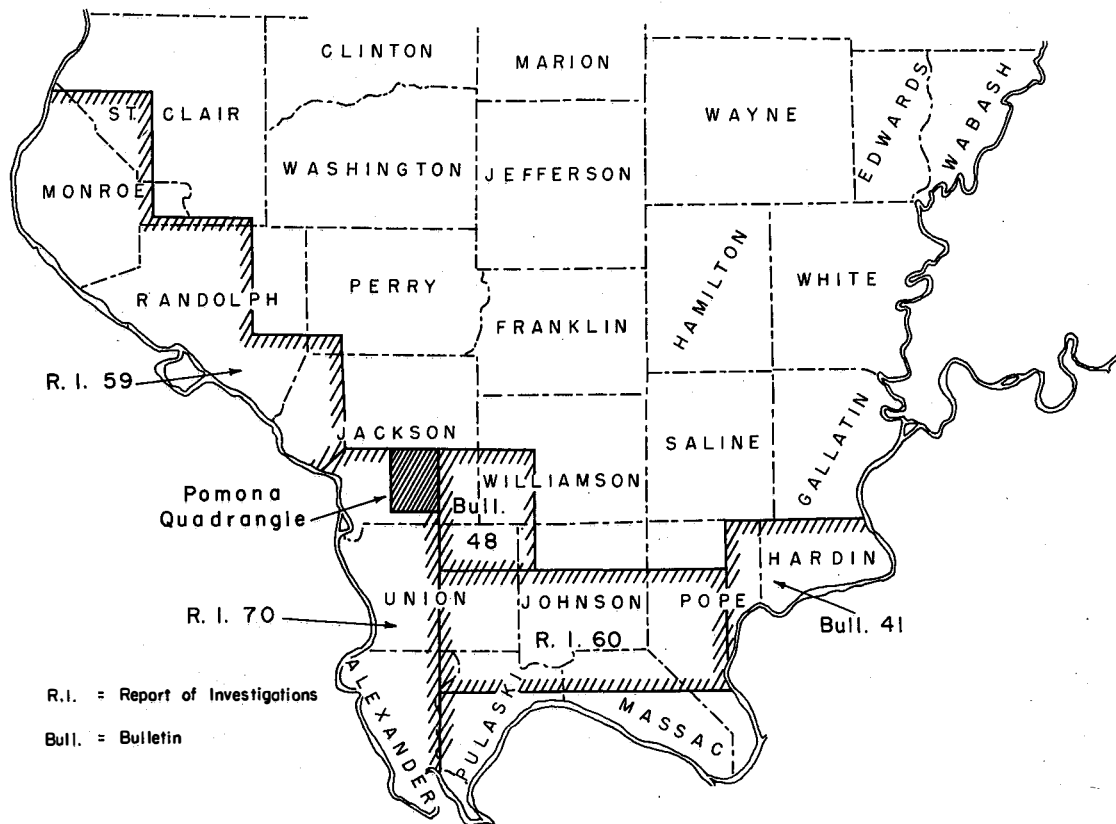


Fig. 1 - Location of the Pomona quadrangle and other areas geologically mapped in southern Illinois.

prominent structural features. Numerous exposures of Pennsylvanian rocks make possible the detailed study of their stratigraphy and sedimentation.

Agriculture is the principal industry of the area. The hilly nature of much of the area does not favor annual tilling, making orchards an important aspect of the agriculture. Some timber is produced, and, although mineral resources have not been important, coal has been mined in small operations in the northwestern part of the area. Ground-water supplies generally are adequate on most farms.

Systematic field work for this report on the Pomona quadrangle was begun in 1957 and ended in the summer of 1960. A more detailed report on the bed-rock geology of the quadrangle submitted as a master's thesis at Southern Illinois University in 1960 was the basis of the present report. Students of Southern Illinois University conducted independent field studies of small areas in the southeastern part of the quadrangle from 1956 until 1959 and have helped to describe the geologic sections. Stanley E. Harris, Jr., chairman of the Geology Department, Southern Illinois University, supervised the study. His help in mapping most of the deposits of Pleistocene age is particularly appreciated.

PHYSIOGRAPHY

The Pomona quadrangle includes parts of two physiographic divisions in two physiographic provinces (Leighton et al., 1948). The northeastern part of the quadrangle, the Mount Vernon Hill Country that is part of the Till Plains Section in the Central Lowland Province, is characterized by topography with low relief and relatively broad, alluviated valleys that are tributaries of the Big Muddy River.

The northwestern and southern parts of the quadrangle are part of the Shawnee Hills Section of the Interior Low Plateaus Province and, for the most part, are strongly dissected. Deep, steep-sloped valleys are prominent in the northwestern part of the quadrangle.

The highest elevation in the Pomona quadrangle is 722 feet above mean sea level in the extreme southwestern part of the quadrangle, sec. 29, T. 10 S., R. 2 W. The lowest elevation is about 340 feet along the Big Muddy River at the northern border of the quadrangle. The maximum relief in the area, therefore, is about 380 feet. The greatest local relief, in the vicinity of Pomona where the crest of a hill rises about 320 feet above the valley floor of Cave Creek, results from thick, resistant sandstones that form bluffs and cliffs. In sharp contrast, there is much less dissection in the northeast quarter of the quadrangle where the uplands are joined to the valley floors by gentle slopes.

STRATIGRAPHY

Strata below the Mississippian System in the Pomona quadrangle have not been penetrated by drilling, but outlying test wells and outcrops in southwestern Illinois and southeastern Missouri indicate that all the older Paleozoic systems are represented. No strata older than the Kimmswick Limestone are exposed in southwestern Illinois, but most of the older formations underlying the Pomona quadrangle are exposed a few miles west of the quadrangle on the flank of the Ozark Dome in Missouri.

The stratigraphic column for the Pomona quadrangle is shown in figures 2 and 3. The strata exposed in the Pomona quadrangle (fig. 4) are described below.

MISSISSIPPIAN SYSTEM


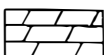
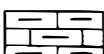
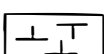
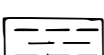
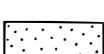
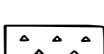
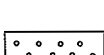
Chesterian Series

The oldest stratigraphic unit exposed in the Pomona quadrangle is the Chesterian Clore Formation. The Clore Formation, Degonia Sandstone, and Kincaid Limestone are poorly exposed and restricted to the southwestern part of the quadrangle (pl. 1). Pre-Pennsylvanian faulting and erosion resulted in the removal of Chesterian formations as old as the Palestine Formation. Near Pomona an oil test that started in the Menard Formation was near and only slightly below a cliff of the basal sandstone of the Pennsylvanian. Chesterian strata above the Menard had been removed by erosion before deposition of the sandstone.

Clore Formation

The Clore Formation consists of shale, siltstone, sandstone, and limestone. It is about 80 feet thick and about 60 percent of it is shale that is in part

KEY
to Figures 2 and 3
PATTERNS and SYMBOLS

-  Limestone
-  Dolomite
-  Shaly limestone
-  Calcareous shale
-  Shale
-  Sandstone
-  Chert
-  Oolite

Geologic columns prepared by
D.H. Swonn and Elwood Atherton

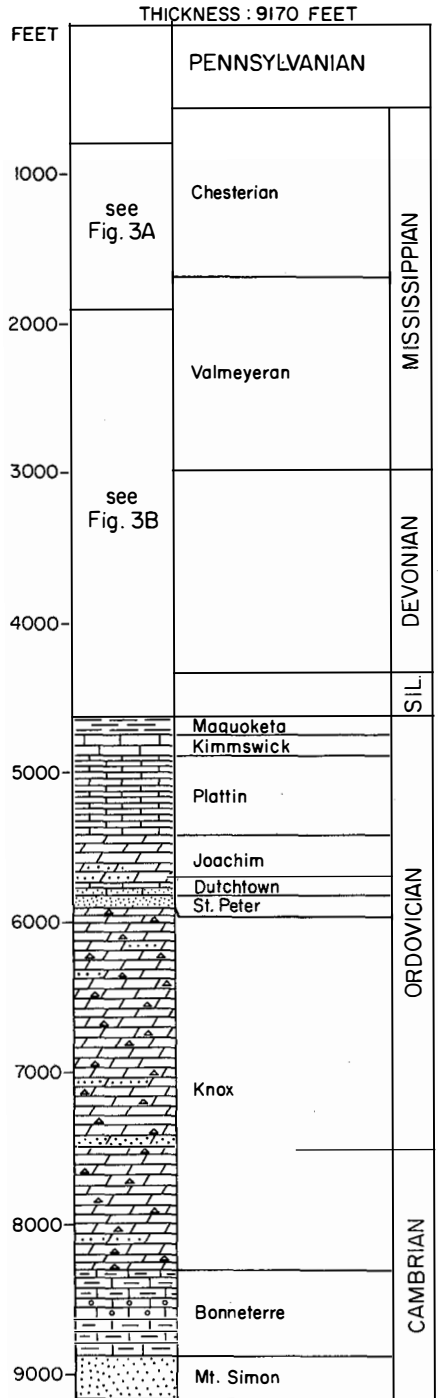


Fig. 2 - Sequence of strata underlying the Pomona quadrangle.

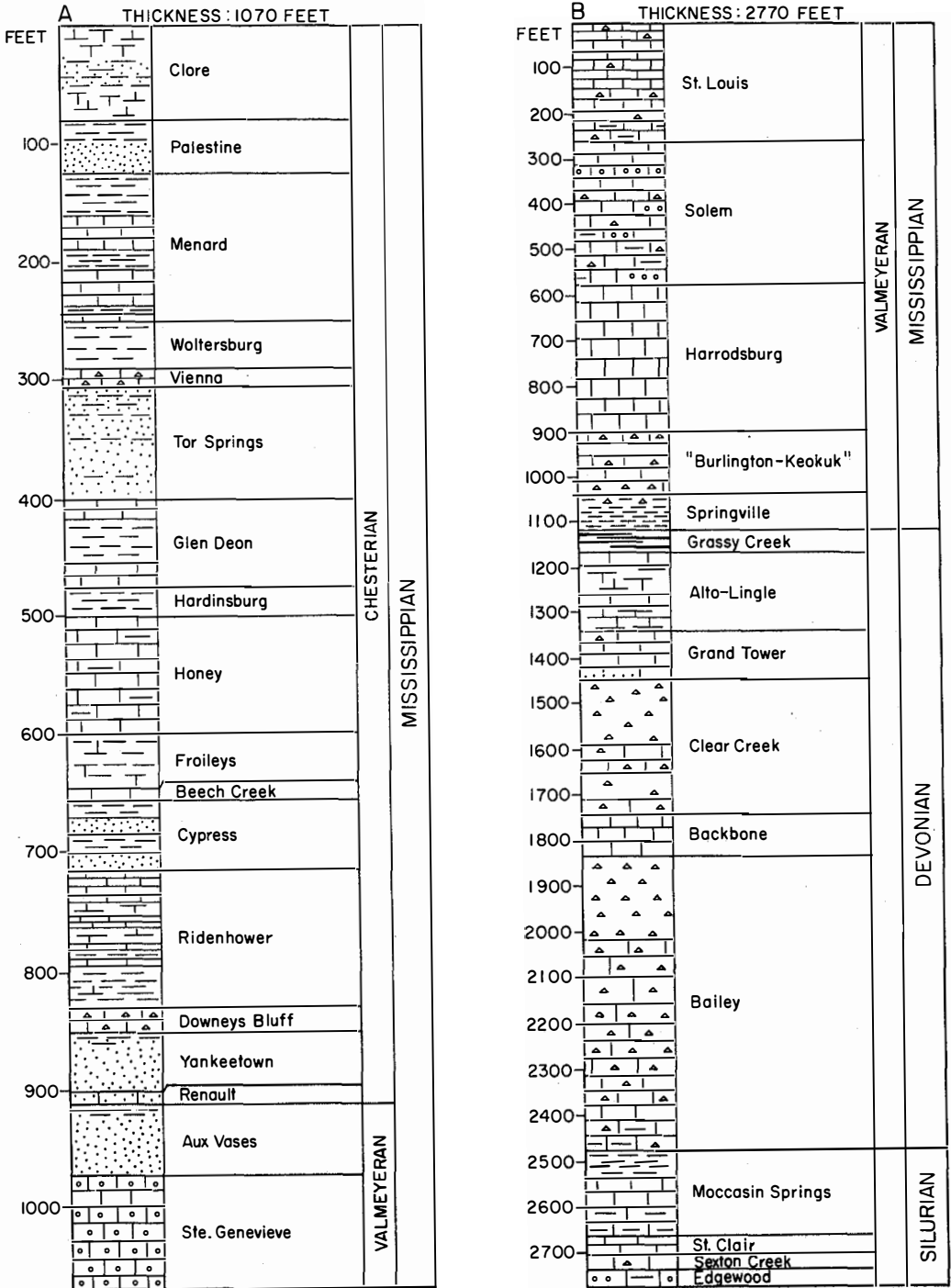


Fig. 3 - Sequence of strata from (A) Ste. Genevieve to Clore Formations and from (B) Edgewood to St. Louis Formations.

calcareous, fossiliferous, and locally carbonaceous. Poorly preserved fossils are present in some of the shales and in thin limestone beds. Limestone units in the Clore may be 10 feet thick but generally are less than 2 feet thick. The limestone is commonly dense, massive, and dark gray; no chert was found in it. Siltstone and lenses of very fine sandstone are common in the Clore in this region, but because of the poor exposures none were observed in this quadrangle. The contact of the Clore with the overlying Degonia Sandstone is exposed in the SW $\frac{1}{4}$ SE $\frac{1}{4}$ and center sec. 19, T. 10 S., R. 2 W., and is believed to be an unconformity. An excellent exposure of the Degonia Sandstone overlying the olive-green shales of the upper part of the Clore is found in the NW $\frac{1}{4}$ sec. 29, T. 10 S., R. 2 W. (Cobden quadrangle). Limestone and shale in the Clore are exposed in the streams below the bluff of Degonia Sandstone in the W $\frac{1}{2}$ sec. 19, T. 10 S., R. 2 W.

SYSTEM	GROUP	F.M.	COLUMN	FEET
PENNSYLVANIAN	Kewanee	Spoon	Vergennes Sandstone Member	50-70
			Murphysboro Coal Member	
	McCormick	Caseyville	Abbot	90-140
			Pounds Sandstone Member	60-110
			Drury Shale Member	45-100
			Battery Rock Sandstone Member	60-110
			Wayside Sandstone Member	10-60
MISSISSIPPIAN	Chesterian Series		Kinkaid Limestone	0-60
			Degonia Sandstone	60-90
			Clore Formation	70-80

Fig. 4 - Strata exposed in the Pomona quadrangle.

Degonia Sandstone

The Degonia is chiefly sandstone but locally contains beds of shale. The total maximum thickness is 90 feet, about half of which is thin-bedded sandstone and sandy shale. The sandstone forms prominent bluffs 40 feet high. Excellent exposures occur in secs. 17, 18, 19, 20, 29, and 30, T. 10 S., R. 2 W. The sandstone is fine to very fine, clean, well sorted, and has conspicuous cross-bedding and ripple marks. In places the sandstone is calcareous. It varies laterally from massive to thin-bedded and generally is shaly in its upper part. Thin, carbonaceous shale lenses are present locally. The Degonia is overlain conformably by the Kinkaid Limestone except where the Kinkaid has been removed by pre-Pennsylvanian erosion.

Kinkaid Limestone

Pre-Pennsylvanian erosion has removed most, locally all, of the Kinkaid Formation in this quadrangle, but where present it is as much as 60 feet thick. Typically, the lower 20 or 30 feet of the Kinkaid is a massive limestone that crops out conspicuously. The upper part of the Kinkaid is composed of beds of fossiliferous limestone and calcareous, gray or olive-green shale.

The best exposure of the Kinkaid in the quadrangle is in the NW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 30, T. 10 S., R. 2 W., where about 30 feet of sublithographic to crystalline, crinoidal limestone is exposed. Here olive-green shale is present above the limestone and in the lower part of the exposure. Fossils are abundant, and gray to

buff chert beds are present in the limestone. Another exposure of limestone thought to be Kinkaid is present in the SW $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 21, T. 10 S., R. 2 W., just east of the fault that strikes northeast (pl. 1). Here the Wayside Sandstone of Pennsylvanian age lies unconformably on the massive limestone of the Kinkaid. The best exposure of the Kinkaid in the vicinity of Pomona is in the NE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 28, T. 10 S., R. 2 W. (Cobden quadrangle). There almost 50 feet of limestone and shale is exposed in an abandoned quarry and is overlain unconformably by the Wayside Sandstone. The limestone is very dense, massive, and fossiliferous, and contains beds of buff chert as much as 3 inches thick. Blocks of the Wayside Sandstone have fallen into solution cavities developed on the upper surface of the Kinkaid, indicating that the limestone suffered solution during post-Wayside time. The Kinkaid is only 14 feet thick in a water well in the NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 30, T. 10 S., R. 2 W., but about a mile to the west it is 60 feet thick and a mile to the north it is apparently absent. A few small exposures of Kinkaid are found in secs. 17 and 18, T. 10 S., R. 2 W.

Mississippian-Pennsylvanian Unconformity

The Mississippian strata of the Pomona area are separated from Pennsylvanian strata by a prominent unconformity. Mapping of the unconformity is difficult in this area because of post-Mississippian—pre-Pennsylvanian faulting (Ekblaw, 1925; Weller and Ekblaw, 1940; Desborough, 1957), pre-Pennsylvanian erosion, and post-Pennsylvanian faulting.

West of the fault that strikes northeast through Pomona, an oil test well in the SE $\frac{1}{4}$ SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 21, T. 10 S., R. 2 W., encountered the Menard Formation immediately below the valley alluvium. Nearby, massive sandstone of the Caseyville Formation forms a prominent bluff on either side of the well, indicating that the Menard Formation is there overlain by flat-lying basal Pennsylvanian strata. Less than 2000 feet to the southeast in the NE $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 28, T. 10 S., R. 2 W., on the east side of the fault, Degonia Sandstone is exposed, indicating that the Chesterian strata on the east side are downthrown. The relationship of the Caseyville strata on either side of the fault, however, indicates the west side also is downthrown. The same relationship is evident along this fault in the Cobden quadrangle (Desborough, 1957, fig. 3). It appears that the Mississippian strata were faulted and the relief produced by the faulting was reduced by erosion prior to basal Pennsylvanian sedimentation. Detailed descriptions of similar relationships between the Mississippian and Pennsylvanian have been presented in other reports (Desborough, 1960).

Locally, the Pennsylvanian rocks may rest on Kinkaid, Degonia, Clore, Palestine, or Menard Formations. The lateral persistence and slight variation in thickness of the Wayside Sandstone suggests that the relief of the pre-Pennsylvanian surface was low (Desborough, 1960, fig. 3).

PENNSYLVANIAN SYSTEM

Pennsylvanian sediments underlie all of the quadrangle, except for the extreme southwestern part where the Chesterian rocks are exposed. Excellent exposures of Pennsylvanian rocks are numerous in the south half of the quadrangle where the massive sandstones form large bluffs. The Pennsylvanian strata are approximately 600 feet thick and include the Caseyville, Abbott, and Spoon Formations.

McCormick Group

The McCormick Group (Kosanke et al., 1960, p. 28) includes most of the Pennsylvanian strata that are well exposed in the quadrangle. This group, dominantly sandstone, is about 500 feet thick and consists of the Caseyville and Abbott Formations.

Caseyville Formation

The Caseyville Formation (Owen, 1856, p. 48; Kosanke et al., 1960, p. 28) includes strata above the basal Pennsylvanian unconformity and below the top of the Pounds Sandstone Member. It is 350 to 420 feet thick, more than half of it sandstone. Unlike the underlying Chesterian sandstones, the Caseyville sandstones contain quartz and chert pebbles.

The sandstones are largely quartz sand, but in places minor amounts of mica are present. Sorting, as a rule, is good, but locally some beds are poorly sorted with grains ranging in size from fine sand to granules. Fine to very fine sandstone and siltstone lenses occur in the intervals between the thick, massive sandstones. Carbonaceous, sandy, and silty shale and black fissile shale are common, and thin beds of coal, underclay, impure limestone, and shale-pebble or quartz-pebble conglomerates are locally present. Plant impressions are common in the sandstones and shales, and, at one locality, poorly preserved marine fossils have been found in the impure limestone in the Drury Shale Member.

Four members—the Wayside Sandstone (at the base), Battery Rock Sandstone, Drury Shale, and Pounds Sandstone—have been differentiated in the Caseyville Formation in this area.

Wayside Sandstone Member.—The Wayside Sandstone Member (Lamar, 1925, p. 84-85), the basal member of the Caseyville, consists principally of thin-bedded sandstone and shale, although lenses of massive sandstone up to 10 feet thick are present. Studies of adjacent areas indicate the Wayside is widespread east of the quadrangle and correlates approximately with the Lusk Shale Member in southeastern Illinois (Kosanke et al., 1960).

The Wayside Sandstone is 10 to 60 feet thick, but because of its weak resistance to erosion it is seldom well exposed. The best exposures, 40 to 60 feet high, are near Pomona, but excellent exposures also are found in the SW $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 21, T. 10 S., R. 2 W., where thin-bedded, ripple-marked sandstone and shale rest on a Chesterian limestone.

Sole markings are more common in the Wayside than in other Pennsylvanian sandstones. Cross-bedding and plant casts are common, but the cross-bedded units generally are thin. The lenses of massive sandstone generally contain quartz pebbles and granules. In a water well drilled on the hill west of Pomona, in the NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 30, T. 10 S., R. 2 W., the Wayside consists of 54 feet of sandy shale, shale, and minor amounts of sandstone overlying the Kinkaid Limestone. In oil test wells drilled just north of the Pomona quadrangle, the Wayside is principally shale.

The Wayside is overlain unconformably by the Battery Rock Sandstone Member. The contact is exposed in the first roadcut east of Pomona in the SE $\frac{1}{4}$ SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 28, T. 10 S., R. 2 W.

Battery Rock Sandstone Member.—The Battery Rock Sandstone Member is the first persistent bluff-forming sandstone above the Mississippian-Pennsylvanian unconformity (Cox, 1875, p. 204). Lamar, in his report on the adjacent

Carbondale quadrangle to the east (1925, p. 85-91), called this the Lick Creek Sandstone. The Battery Rock Sandstone is well exposed along the east side of Cave Creek, where it forms bluffs 40 to 90 feet high. Good exposures also are found along Big Branch in sec. 15, T. 10 S., R. 2 W. Its thickness probably varies from 60 to 110 feet in the quadrangle. At Saltpeter Cave in the NW $\frac{1}{4}$ sec. 15, T. 10 S., R. 2 W., it forms a bluff 90 feet high, and near Pomona in the SW $\frac{1}{4}$ sec. 21, T. 10 S., R. 2 W., there is a bluff 50 feet high.

The Battery Rock is a massive sandstone generally medium to coarse in grain size and commonly containing quartz and chert pebbles. Quartz pebbles as much as one inch in diameter and chert pebbles 1 $\frac{1}{2}$ inches in diameter have been observed, but small pebbles and large granules are more common. Abundant chert pebbles, probably derived from Mississippian and Devonian formations exposed west and northwest of the quadrangle along the northeast flank of the Ozark Dome in Missouri, occur along the base of the bluff in the SW $\frac{1}{4}$ sec. 21, T. 10 S., R. 2 W. Cross-bedding and ripple marks also are prominent features of the Battery Rock Sandstone.

Drury Shale Member.—The Drury Shale (Lamar, 1925, p. 91-95) is perhaps the most variable member of the Caseyville. It is dominantly shale and argillaceous sandstone but contains lenses of sandstone as much as 15 feet thick. The Drury ranges from 45 feet thick in the southwestern part to 100 feet thick in the southeastern part of the quadrangle, a variation probably related to erosion before the overlying Pounds Sandstone was deposited. Excellent exposures of the Drury Shale are found in the NE $\frac{1}{4}$ NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 24, the E $\frac{1}{2}$ NW $\frac{1}{4}$ sec. 14, and the E $\frac{1}{2}$ SW $\frac{1}{4}$ sec. 10, T. 10 S., R. 2 W.

Interbedded shale and sandstone and carbonaceous gray to black shale beds are common in the Drury. Thin coaly layers or coal beds and impure limestone containing marine fossils have been observed, and shale-pebble conglomerates occur at several localities. Ripple marks and cross-bedding are common features. Lateral variability of lithologic character generally prohibits correlation of individual lithologic units within the member. In the roadcut along Illinois State Highway 127 in the W $\frac{1}{2}$ sec. 10, T. 10 S., R. 2 W., about 9 feet of the upper part of the Drury Member underlies the Pounds Sandstone Member. Within this short interval the Drury consists of underclay, coal (6 inches thick), siltstone, black shale, claystone, and conglomeratic sandstone. Limestone nodules of the fresh-water type in 2-inch beds occur in the shale in the SW $\frac{1}{2}$ sec. 10, T. 10 S., R. 2 W.

Impure ferruginous marine limestone occurs in the upper part of the Drury Member at one locality along the stream in the SW $\frac{1}{4}$ SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 4 and the NW $\frac{1}{4}$ NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 9, T. 10 S., R. 2 W. At this locality poorly preserved bryozoan, brachiopod, and crinoid remains are found in a thin, sandy, ferruginous limestone that locally contains laminae of coal and sandstone. The limestone may be equivalent to the Sellers Limestone Member that occurs above the Battery Rock Sandstone in extreme southeastern Illinois (Wanless, 1939, p. 36, 101). The Gentry Coal Member also is recognized in this interval in southeastern Illinois but cannot definitely be correlated with a coal bed in the Drury.

The Pounds Sandstone lies with angular unconformity on inclined, thin-bedded sandstone of the Drury Member in the NW $\frac{1}{4}$ NE $\frac{1}{4}$ SE $\frac{1}{4}$ and the SW $\frac{1}{4}$ SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 4, T. 10 S., R. 2 W. Along Bear Creek in the NE $\frac{1}{4}$ SW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 7, T. 10 S., R. 2 W., 20 feet of conglomerate, mainly sandstone and shale pebbles but containing large sandstone boulders, is overlain by massive beds of the Pounds Sandstone. These relations probably result from post-Drury-pre-Pounds faulting.

Pounds Sandstone Member.—The Pounds Sandstone (Weller, 1940, p. 38) includes the strata formerly considered the lower part of the Makanda Sandstone, which was described by Lamar (1925, p. 96) in his report on the Carbondale quadrangle east of the Pomona quadrangle. The Pounds is the second thick, persistent, massive sandstone above the Mississippian-Pennsylvanian unconformity. It is well exposed in the south half of the quadrangle where it forms prominent bluffs, commonly 100 feet high. It varies from 80 to approximately 140 feet thick. About 125 feet of massive sandstone is exposed in one continuous outcrop in the NW $\frac{1}{4}$ NW $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 13, T. 10 S., R. 2 W.

The Pounds is a medium- to coarse-grained, cross-bedded sandstone that contains quartz pebbles and a minor amount of chert pebbles. It is slightly micaceous. Cross-bedding indicates a southerly transport direction in this area. Ripple marks are common and desiccation marks abundant in the exposure in the lower part of the roadcut of State Highway 127 in sec. 10, T. 10 S., R. 2 W. The Pounds lithologically is not readily distinguishable from the Battery Rock, but generally it contains more mica and matrix.

The top of the Pounds Sandstone is difficult to delineate where the sandstone is overlain by massive conglomeratic sandstone of the Abbott Formation. The contact is well exposed in the S $\frac{1}{2}$ NE $\frac{1}{4}$ sec. 4, T. 10 S., R. 2 W. Westward, where exposures are not as good, the Pounds and sandstones of the Abbott can be confused because of their local similarities. However, the massive sandstones of the Abbott are more ferruginous, and contain more mica, matrix, shale pebbles, and ironstone concretions than the Pounds. Probably the best means of differentiating these sandstones is by the presence of crinoid columnals or fragments of other marine fossils that occur in the lower part of the Abbott. Marine fossils or marine fossil fragments have not been noted in the Pounds Sandstone. Unlike the sandstones in areas to the east, the Abbott sandstones of the Pomona quadrangle in places contain abundant quartz pebbles or large granules (Desborough, 1959b). The Abbott, therefore, cannot be distinguished from the Caseyville on the basis of quartz pebbles. The quartz pebbles in the Abbott sandstones of the study area probably were derived from erosion of the underlying Pounds Sandstone.

Abbott Formation

The Abbott Formation (Kosanke et al., 1960, p. 30) extends upward from the top of the Pounds Sandstone to the top of the Murray Bluff Sandstone. As the Murray Bluff Sandstone has not been recognized in the Pomona quadrangle, the top of the Abbott Formation in this area is at the base of the Murphysboro Coal Member, which is the position of the Murray Bluff Sandstone where it is present. Lamar (1925, p. 95-100) called the Abbott strata, in the Carbondale quadrangle, the upper part of the Makanda Sandstone. He noted (1925, p. 98) that the thickness of these strata ranged from 120 to 160 feet, which agrees well with thicknesses in the Pomona quadrangle.

About 50 feet of the Abbott strata lying directly above the Pounds Sandstone is well exposed in an area less than one mile east of the Pomona quadrangle in the NE $\frac{1}{4}$ sec. 8, T. 10 S., R. 1 W. In that section the lower 30 feet of the Abbott consists of dark gray shale and rests on the Pounds Sandstone. The upper 20 to 30 feet of the Abbott is composed of ferruginous, micaceous, massive, and thin-bedded sandstone that contains lenses of limestone and carbonaceous shale. Quartz pebbles and granules and marine fossils are abundant in the upper 30 feet.

Fossiliferous beds in this part of the Abbott Formation were called the Boskydell Marine Zone by Wanless (1939, p. 13 and 34), and the usefulness of the zone as a stratigraphic marker was described by Desborough (1959b). Because this zone is not considered a rock-stratigraphic unit, the name has been dropped (Kosanke et al., 1960, p. 31). The marine fossils and ferruginous nature of beds in this interval are the principal characteristics that distinguish it from the Pounds Sandstone where there is no shale separating the more massive sandstones. Ferruginous sandstone with marine fossils and quartz pebbles is as much as 50 feet thick and is exposed in the NE $\frac{1}{4}$ SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 18, along Rocky Branch in the NW $\frac{1}{4}$ sec. 7, T. 10 S., R. 1 W.; the NE $\frac{1}{4}$ sec. 4 and NE $\frac{1}{4}$ sec. 6, T. 10 S., R. 2 W.; the SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 31, T. 9 S., R. 1 W.; SE $\frac{1}{4}$ sec. 8, the NW $\frac{1}{4}$ sec. 17, and the SW $\frac{1}{4}$ sec. 26, T. 9 S., R. 2 W. Crinoid columnals, brachiopods, trilobite fragments, or solitary corals have been found at all of these localities. The crinoid columnals generally are very small, and a careful search is required to find them.

Shale and thin, discontinuous coal lenses occur in the Abbott Formation, but the zone with marine fossils is the only unit within the Abbott that appears to be traceable across the quadrangle. This zone apparently lies unconformably on the shaly strata of the lower part of the Abbott and locally rests on the Pounds Sandstone.

The approximate top of the Abbott Formation is difficult to delineate because the Murphysboro Coal Member (near the base of the Spoon Formation) is locally absent. No exposures of the Murphysboro Coal were recognized definitely in this quadrangle.

Local unconformities occur at the top, base, and within the Abbott Formation. These probably are related to the position of the area on the west, or updip, side of the DuQuoin Monocline. There is strong regional evidence that this monocline first developed during the time of Abbott sedimentation, because the Abbott is the oldest Pennsylvanian formation that is greatly thinned west of the monocline. The uplift of the west side of the monocline also exposed the upper surface of the Pounds Sandstone to erosion, and this accounts for the abundance of quartz pebbles in the Abbott Formation west of the monocline compared to their paucity on the east side.

Kewanee Group

The Kewanee Group (Kosanke et al., 1960, p. 31), which consists of the Spoon and Carbondale Formations, is represented in the Pomona quadrangle by only about the lower 50 feet of the Spoon Formation.

Spoon Formation

In the Pomona quadrangle, the Spoon Formation (Kosanke et al., 1960, p. 32) includes the Murphysboro Coal and overlying strata in a small area in the extreme northern part of the quadrangle. The type locality, SE $\frac{1}{4}$ sec. 9, T. 9 S., R. 2 W., of the Murphysboro Coal is less than a mile beyond the northern edge of the quadrangle. The coal, which has been mined at Murphysboro, varies in thickness from 36 to 72 inches; much of it has been mined out. Smith (1958, pl. 1) projected the line of outcrop of the Murphysboro Coal southward into the Pomona quadrangle for a distance of 2 miles, but the coal is covered by glacial deposits and loess and no outcrops were found.

The Vergennes Sandstone Member (Shaw and Savage, 1912, p. 52) is the youngest of the Pennsylvanian strata in the Pomona quadrangle. It is 20 to 40 feet above the Murphysboro Coal and is separated from the coal largely by shale. An exposure of massive sandstone along the stream in the NE $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 16, T. 9 S., R. 2 W., in the Pomona quadrangle resembles the Vergennes Sandstone in the highway roadcut in the SE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 9, T. 9 S., R. 2 W., in the Murphysboro quadrangle. The Vergennes Sandstone is micaceous and medium-grained and contains more matrix than the lower Pennsylvanian sandstones of this area. It is not laterally persistent in the vicinity of Murphysboro; it may be 30 feet thick at one locality and absent a short distance away.

QUATERNARY SYSTEM

Pleistocene Series

In the Pomona quadrangle there is no evidence of Pleistocene glaciation earlier than the Illinoian stage. A broad ice sheet advancing from the northeast in Illinoian time covered essentially all of the quadrangle north of Cedar Creek. The Illinoian glacier reached farther south than any other Pleistocene continental glacier, its southernmost limit extending a few miles south and east of the Pomona quadrangle.

There is no end moraine in the Pomona quadrangle, indicating that the glacier probably melted back after only a short stand. Till containing small logs is found in the bed of Bear Creek in the NW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 7, T. 10 S., R. 2 W., and fresh till is present in the stream bed in the NE $\frac{1}{4}$ NW $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 30, T. 9 S., R. 2 W. The presence of the glacial drift in some of the deeper valleys indicates that the area was dissected almost as deeply before the Illinoian glaciation as it is at present.

The glacial till deposited by the melting ice was thin, and during the Sangamon Interglacial Stage it was completely eroded from parts of the area. Consequently, the loess deposits, which are the surface material of almost the entire quadrangle, rest directly on the bedrock not only in the unglaciated area south of Cedar Creek but in much of the glaciated area to the north.

The loess deposits consist of silt blown from the bottomland of the Mississippi Valley when it was being aggraded by the outwash of the Wisconsin glaciers. The loess is as much as 50 feet thick in and near the Mississippi River bluffs, but it thins eastward and generally is only 10 to 20 feet thick throughout the Pomona quadrangle. Colluvium, consisting largely of loess concentrated by slump and slope wash, occurs along the lower slopes of the valley walls and in some places probably is more than 25 feet thick.

The loess deposits consist of two easily distinguished units. The Roxana Silt at the base is dark brown and generally noncalcareous. It can be seen in many roadcuts directly overlying the bedrock. The overlying Peoria Loess is buff, much lighter in color than the Roxana, generally calcareous in the lower part, and in places contains snail shells. Since the loess was deposited, the carbonates have been dissolved from the upper 10 to 15 feet, and this part is darker than the calcareous loess but generally still lighter in color than the Roxana.

The exposure of loess in the Mississippi River bluffs south of the Pomona quadrangle at Gale (Frye and Willman, 1960, p. 13) probably is typical of the thicker deposits in the western part of the Pomona quadrangle. Fossils from the locality were listed by Leonard and Frye (1960, p. 11).

Two Wisconsinan terraces are found along Cedar Creek in secs. 17 and 18, T. 10 S., R. 2 W. The higher and older terrace differs from the lower terrace in having a mantle of loess.

Recent alluvium along the major valleys consists largely of silt, but in places it contains poorly sorted sand and gravel washed from tributary valleys that are actively eroding the bedrock.

STRUCTURAL GEOLOGY

The Pomona quadrangle is near the southwestern edge of the Illinois Basin, and the regional dip averages less than one degree to the northeast. Faults are present but are not as numerous as in adjacent areas to the south and southwest. The faulting in the Pomona quadrangle is believed to be associated with movements along the Rattlesnake Ferry Fault.

Two major periods of faulting, post-Chester—pre-Pennsylvanian and post-Pennsylvanian (Ekblaw, 1925; Weller and Ekblaw, 1940; Desborough, 1957), have been recognized in this region. Post-Pennsylvanian movement occurred along post-Mississippian—pre-Pennsylvanian fault planes (Desborough, 1957, 1959a). In places relative movement along the same fault plane during the two periods of faulting may have been in opposite directions (Desborough, 1957, 1959a), which suggests that the regional stress orientation for the two periods may have been different. There is local evidence of minor faulting during Caseyville time.

Two major fault trends are apparent in the quadrangle, one essentially northeast-southwest, the other northwest-southeast. The post-Pennsylvanian displacement along the faults striking northeast-southwest generally is less than 100 feet. All but one of the faults in the area are evidently high-angle, normal faults. Steep dips are uncommon in the strata adjacent to the fault because of the relatively competent nature of the massive sandstones. Tension joints generally are abundant near most of the faults and are parallel to them. The fault planes rarely are observed.

The relatively large fault prominent near Pomona, called the Pomona Fault, extends into parts of the Cobden and Gorham quadrangles. It strikes about N. 50° W., and the north side is downthrown. No Mississippian rocks are exposed north of the fault in the Alto Pass 15-minute quadrangle. The Pomona Fault and the Rattlesnake Ferry Fault bound a complexly faulted area in which upper Mississippian and lower Caseyville rocks are exposed. Several faults occur south of the Rattlesnake Ferry Fault and north of the Pomona Fault, but they are not as numerous as in the area between these two major northwest-striking faults.

The maximum stratigraphic displacement along the Pomona Fault is about 200 feet in the S $\frac{1}{2}$ sec. 17 and the NE $\frac{1}{4}$ sec. 20, T. 10 S., R. 2 W., where the Drury Shale on the north side of the fault lies adjacent to the Degonia Sandstone on the south side. Numerous small faults along the stream in the S $\frac{1}{2}$ sec. 17, T. 10 S., R. 2 W., have complex structural and stratigraphic relations.

Another fault striking N. 15° E. through the town of Pomona in sec. 28 and the S $\frac{1}{2}$ sec. 21, T. 10 S., R. 2 W., brings Wayside Sandstone against Battery Rock Sandstone. The Wayside dips westward in the roadcut just east of Pomona. The fault extends southward into sec. 28 in the Cobden quadrangle (Desborough, 1957, fig. 2). Pre-Pennsylvanian movement caused the east side of the fault to be downthrown. Degonia Sandstone and Kinkaid Limestone are present on the east side of the fault, but an oil test well west of the fault at Pomona started in the

Menard Formation. Apparently the Degonia Sandstone and Kinkaid Limestone were protected from pre-Pennsylvanian erosion, whereas on the west or upthrown side, all of the strata above the Menard Formation was removed. The Caseyville is downthrown on the west side, indicating that post-Pennsylvanian movement was in the opposite direction. The structural and stratigraphic relations along the faults of post-Mississippian—pre-Pennsylvanian age and those of post-Pennsylvanian age have been described elsewhere (Desborough, 1960).

Minor faulting of Caseyville age has been recognized in the Pomona quadrangle. Stratigraphic and structural relations in the $S\frac{1}{2}$ sec. 4, T. 10 S., R. 2 W., and the $SE\frac{1}{2}$ sec. 33, T. 9 S., R. 2 W., indicate that deformation occurred after Drury deposition and before Pounds sedimentation. The deformation is shown by massive and thin-bedded sandstone that dips 20 to 40 degrees southeast and is overlain by unjointed, horizontal Pounds Sandstone. The angular relationship, apparently continuous for about a mile along the strike of the dipping beds (N. 55° E.), is well exposed in the $NW\frac{1}{4} NE\frac{1}{4} SE\frac{1}{4}$ sec. 4, T. 10 S., R. 2 W. Slip planes and joints dip 60 degrees northwest and lie in planes almost normal to the bedding plane of the dipping sandstone. The structure, therefore, probably is not normal faulting because the drag effect along normal faults tends to align the bedding planes on either side of the fault subparallel to the slip or fault plane.

The structure of the deformed sandstone in the $N\frac{1}{2} SE\frac{1}{4}$ sec. 4, T. 10 S., R. 2 W., indicates thrusting with the north side upthrown. In the $SW\frac{1}{4} SW\frac{1}{4} SW\frac{1}{4}$ sec. 4, T. 10 S., R. 2 W., several small thrust faults involve Drury sandstones and shales, and the small drag folds and displacements along slip planes indicate that the northwest side is upthrown. Just north of the angular unconformity and thrust fault in sec. 4, southeastward-dipping sandstone beds in the Drury are exposed in the stream in the $NW\frac{1}{4} SE\frac{1}{4} SE\frac{1}{4}$ sec. 33, T. 9 S., R. 2 W. These beds strike N. 45° to 50° E. and locally dip 22 degrees southeast, conforming with the pre-Pounds beds in the $S\frac{1}{2}$ sec. 4, T. 10 S., R. 2 W.

A small fault strikes about N. 45° E. in the $E\frac{1}{2} SW\frac{1}{4}$ sec. 20, T. 9 S., R. 2 W. The adjacent strata have well developed joints parallel to the fault. The north side appears to be downthrown, but the amount of displacement is not known.

MINERAL RESOURCES

Development of the mineral resources of the Pomona quadrangle has not been extensive. The area contains deposits of limestone and sandstone suitable for building purposes, but because of the small population of the Pomona region and the greater availability of such materials in adjacent areas these resources have been used only locally.

The only outcrops of limestone in the Pomona quadrangle occur at a few localities in the southwestern corner where thin limestone beds of the Clore Formation and somewhat thicker limestone beds of the Kinkaid Formation are found. The limestone beds in the Clore are not known to be of commercial importance, but some outcrops of the Kinkaid expose as much as 30 feet of limestone. A chemical analysis of a sample taken from 29 feet of limestone exposed in an abandoned quarry a short distance south of Pomona and just outside the quadrangle limits follows (J. E. Lamar, personal communication, 1961).

SiO ₂	3.48 %	Na ₂ O	.03 %
Al ₂ O ₃	.73	K ₂ O	.16
Fe ₂ O ₃	.67	CO ₂	41.47
MgO	1.06	Loss on ignition	41.60
CaO	52.17		

Agricultural limestone and road rock probably could be produced from the Kinkaid.

Some of the sandstones of the Pennsylvanian System have been the source of small amounts of stone for local building. The sandstone deposits of the quadrangle are capable of supplying additional quantities of such materials. Judging from the nature of the Pennsylvanian sandstones elsewhere in extreme southern Illinois (Biggs and Lamar, 1955), some of the sandstones, if disaggregated and suitably processed, might be sources of sands for industrial use.

No extensive deposits of gravel were noted in the quadrangle but some small alluvial deposits of sandy gravel were noted in the beds of streams.

The Murphysboro Coal underlies a small area in the northwestern part of the quadrangle, but much of it has been mined (Smith, 1958). Other Pennsylvanian coals are too thin and discontinuous to mine.

An oil test well drilled near Pomona was unproductive.

Ground water adequate for individual farms and homes generally is found at shallow depths, particularly in alluvial fills in the valleys. Several farms obtain water from Pennsylvanian sandstones (Pryor, 1956).

The Pennsylvanian clays and shales and the weathered loess probably would be suitable for the manufacture of common tile and structural clay products if a market should arise.

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