THE AREAL GEOLOGY OF SALINE COUNTY.

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The City of Harrisburg is centrally located in Saline County in the midst of a region of unusual attractiveness and great scientific interest. It is a region of unusual topographic contrasts for the Mississippi Valley. The southern part of the County rises abruptly 300 to 500 feet above the region which stretches to the north providing for the beholder on the upland vistas of rolling prairie that are a delight to contemplate. Within the hilly country which extends south into the adjacent county there is an amazing variety of landscape due to the deep dissection of the country into hills and deep, steep-sided coves. It is unfortunate that the region of the hills is relatively so inaccessible, as it is a natural park land, and possesses many areas that might well be preserved as playgrounds for the people of the southern prairie counties of the State. Many sites suitable for artificial lakes and reservoirs exist within the area of the Ozark hills. Such bodies of water within the uplands in addition to providing adequate water supply to the cities of the lowland would add greatly to the scenic beauty of the region and its value as a playground and resort region.

To none more than to the geologist have the natural surroundings of the Harrisburg region a greater interest. There are a number of reasons why this should be so but among them is the relationship which investigation has shown to exist between the surface distribution of rocks and the topographic forms of the land surface. This is the sort of relationship that is generally supposed to exist in any region, but the definiteness of the relationship in Saline County is unusually satisfying and therefore particularly interesting. It is with the belief that an understanding of the geologic factors that have contributed to the development of the features of the landscape and topography will enlarge the pleasure to be derived from their contemplation that this paper has been prepared. With the main purpose of explaining the main topographic features in terms of the surface

distribution of rocks there is associated a desire to point out the nature of the distribution and occurrence of certain other beds of economic or scientific importance such as coal and limestone beds about which naturally some interest exists in the thought of those at all acquainted with this region.

In order to systemmatize our study it will be well first to analyze the topographic features of the county. Saline County has been mapped topographically by the State and National Geological Surveys working in cooperation and is included as part of each of four quadrangles, the Galatia quadrangle on the northwest, the Eldorado quadrangle on the northwest, the Equality quadrangle on the southeast and the Harrisburg quadrangle on the southeast. The topographic map of the County made by combining the necessary portions, of these maps is reproduced in Plate I. As has been suggested in an earlier paragraph and as is clearly shown by the map, Saline County is readily separable into two parts, each of which is in sharp topographic contrast with the other. The line of separation is at the foot of a conspicuous slope which mounts toward an area of rough, hilly country in the south part of the County. It will be noted that the line of separation if drawn on the map would trend approximately east from the west border of the map to a point near Rudimont from which place the trend changes to a direction about 60° to the north, continuing in this direction for about 5 miles. It then changes and again runs nearly due east to the border of the county. This direction is persistent to the east boundary of the State, south of Shawneetown.

One standing at the crest of the rise, the initiation of which we have taken as the boundary between the two topographic divisions of the region, may by turning northward overlook a spreading panorama of magnificent proportions (see Plate II). On a clear day the entire area of the county to the north lies within the range of vision. The panorama that lies in one's view is that of a much lower country whose surface is a series of interrupted waves of apparently diminishing height and frequency extending to the dim background. Be-

tween the nearer ridges can be seen flat stretches of alluvial land which, extending eastward, seem to combine into a featureless plain. This rolling landscape constitutes the southern part of Illinois glacial plains or prairie land. In this region it has not all been glaciated, but so thin is the deposit of glacial drift even where it is

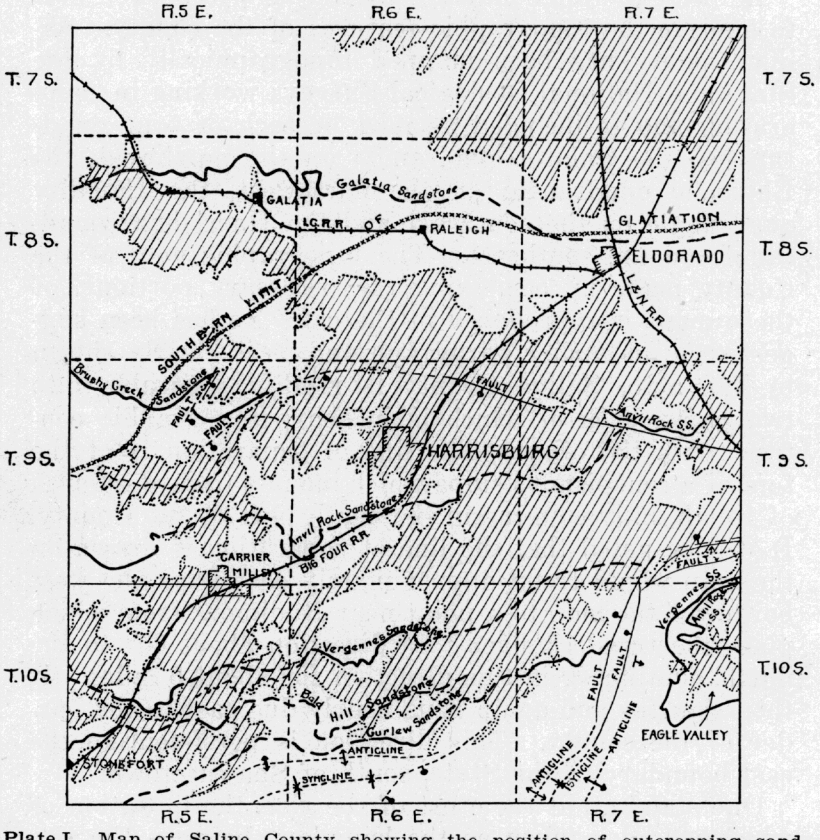

Plate I. Map of Saline County showing the position of outcropping sandstones, important faults and folds, the southern limit of glaciation, and the area underlain by alluvium (shaded area).
(Downthrow side of fault indicated by a dot attached to the line indicating the position of the fault.)
(Structural features shown in T. 10 S., R. 7 E. based on a map by Mr. Charles Butts in Illinois Geological Survey Bulletin No. 47.)

present that it does not greatly modify the bed rock topography. Of much more importance in this respect is the alluvium which effectively conceals any outcrops which may have originally existed below an altitude of 380 feet.

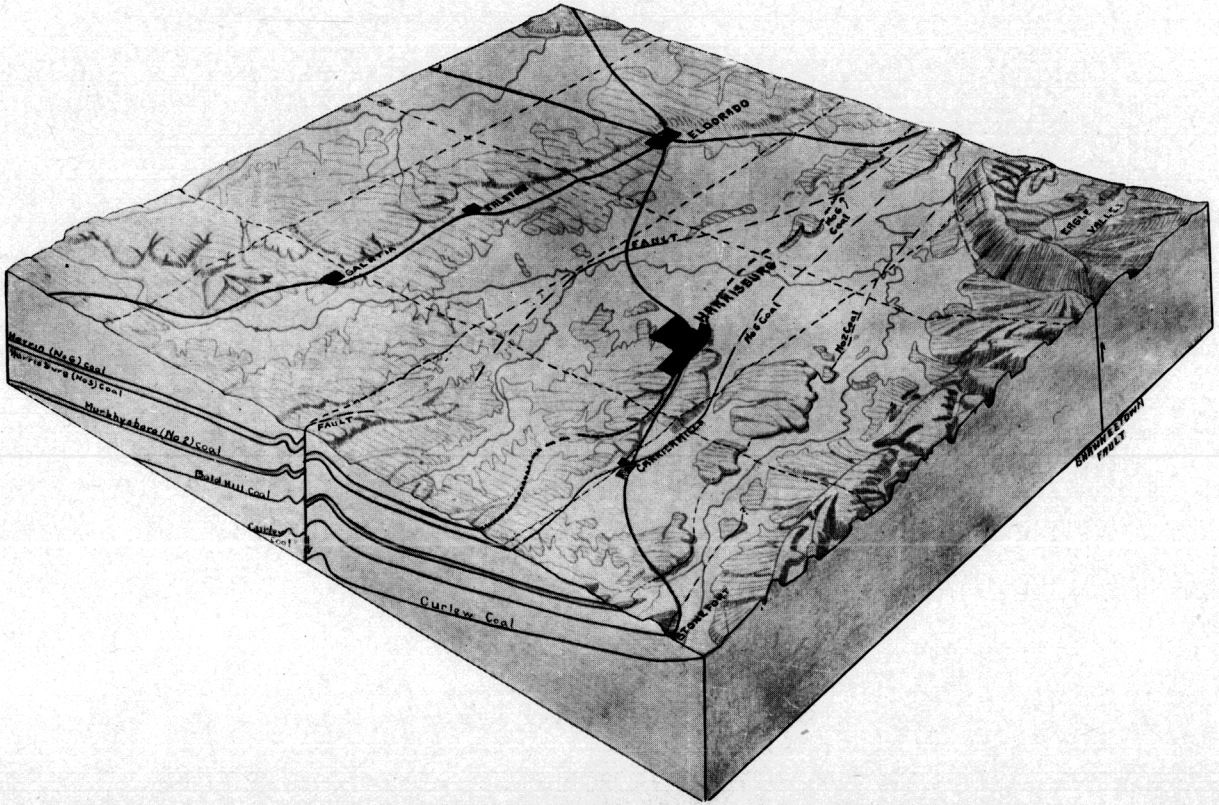

Plate II. Stereogram of Saline County.

About one-third of Saline County consists of a level alluvial plain lying at an altitude below 400 feet. The remainder of the area north of the Ozark ridge consists of hills of low relief and gentle outlines and prairie land rarely rising more than 100 feet above the level of the alluvial plains. These plains are developed in wide expanse in the eastern part of the county between Eldorado, Harrisburg and Equality and finger dendritically into the prairie uplands that occupy most of the eastern part of the county. Above an altitude of 420 feet the stream valleys are relatively narrow and of a size corresponding to the size of the streams that occupy them; below an altitude of 420 the valleys are relatively broad with a breadth that is clearly out of proportion to the width of the streams. These lower broad expanses of alluvial land are regarded as backwater flood deposits and are generally characteristic of the stream valleys of southern Illinois. The alluvial area of backwater origin is the shaded area in the map shown in Plate I.

The importance of this area of level land to the county is tremendous. Under primitive conditions it was wooded and swampy much of the year. Drainage was exceedingly sluggish because the grade of the streams was very low and in dry weather they were sunk in intricately meandering channels that changed position with every flood. Since its value for agriculture has been demonstrated, the land is rapidly being cleared of timber and by an extensive system of drainage ditches is quickly drained each season of its surplus water. The result has been, as it were, the addition of thousands of acres of valuable agricultural land to the area of the county and a shift in maximum land values from the hills to the alluvial valleys.

The hills that rise through the alluvial filling can be seen, by inspection of the map, to have a general east-west alignment. This corresponds to the trend or strike of outcropping strata. Since the strata dip northward it is to be expected that the south slopes of the hills will be somewhat steeper than the northward slopes, and this is almost invariably the case. (See Plate II.) In fact the landscape consists of a series of interrupted cuestas,

each marking the outcrop of a relatively resistant rock layer. The surface deposits overlying the rock above the alluvial plains, whether consisting of glacial drift or of wind borne material, are thin and fail to obscure the relationship of rock outcrop to topography.

In the plains area north of the Ozark Ridge, each cuesta-like escarpment marks the outcrop of a resistant or heavy sandstone layer. The approximate position of these outcrops is shown in Plate I. Five such sandstones can be traced at least partly across the area, two north of Harrisburg and three in the southern part of the county. The valleys that intervene between the ridges trend east and west largely because they occupy the belts of weaker rocks that intervene between the sandstones.

In order to explain satisfactorily the relationship of the sandstones to one another and the position of their outcrops, it will be necessary to describe briefly the stratigraphic position of the different beds with relation to the general Pennsylvanian succession. Plate III is a diagrammatic generalized representation of the geological succession of the Pennsylvanian rocks in the southern part of Illinois. It will be noted that the System is divided into three formations, the Pottsville at the base, above it the Carbondale formation, a relatively thin formation, and at the top the McLeansboro formation, which, as is the case with the Pottsville, has a thickness of more than 1,000 feet. The outcropping rocks north of the Ozark Ridge are of McLeansboro, Carbondale and upper Pottsville age. Possibly as much as 300 feet of the Pottsville outcrops north of the Ozark Ridge but probably not more than that. The subdivision of the Pennsylvanian into these formations is based upon more or less arbitrary considerations, but the units are convenient, because in most places in the State the three formations are separated by an important bed of coal. Thus Murphysboro (No. 2) coal lies at the base of the Carbondale and marks the top of the Pottsville formation and Herrin (No. 6) coal lies at the top of the Carbondale formation and marks the base of the McLeansboro formation. Harrisburg

(No. 5) coal lies about 100 feet below Herrin (No. 6) coal in this region, and hence is within and part of the Carbondale formation. The Carbondale formation besides containing the Herrin and Harrisburg coals also contains a thin coal between the two thicker coals which has been called the Briar Hill (No. 5½) coal. The Murphysboro (No. 2) coal in this region is in two benches, separated by several feet of shale. The upper bench is sometimes called the Dekoven coal and the lower bench the Davis or "Four-foot" coal. These names are more

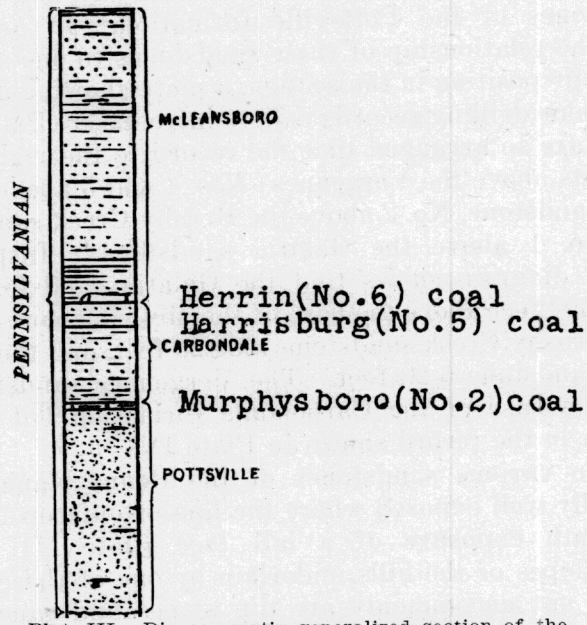

Plate III. Diagrammatic generalized section of the Pennsylvanian system of Southern Illinois.

commonly applied to the coals in Kentucky or in southern Gallatin County in Eagle Valley than in the main portion of the Illinois coal basin. The occurrence of these coals and other coals in the Pottsville formation will be described in greater detail later in the paper. On the map, Plate I, the strip of territory lying between the line marking the position of the Anvil Rock sandstone and the line marking the position of the Vergennes sandstones is underlain by rocks of Carbondale age except

for a narrow strip at the north, immediately adjacent to the position of the Anvil Rock sandstone. North of the outcrop of the Anvil Rock sandstone, the strata are of McLeansboro age. South of the line marking the base of the Vergennes sandstone all strata are of Pottsville age except for a narrow strip adjacent to the line.

The outcropping cuesta-forming sandstones of the plains region consist of the following: the Galatia sandstone, the Brushy Creek and Anvil Rock sandstones of the McLeansboro formation, the Vergennes sandstone of the Carbondale formation, and the Bald Hill and Curlew sandstones of the Pottsville formation. In order to show the relationship of these sandstones to one another and their position in the section, a plate showing a series of graphic drilling records is here introduced (Plate IV). These are so arranged that the record to the right (No. 5) starts above the Vergennes; Nos. 4 and 3 above Anvil Rock sandstone, No. 2 above the Brushy Creek sandstone and No. 1 above the Galatia sandstone. Inspection of this diagram shows that the Galatia sandstone lies about 500 feet above the base of the McLeansboro formation, Brushy Creek sandstone 100-125 feet, and the Anvil Rock sandstone 5-20 feet. The Vergennes sandstone is near the base of the Carbondale formation but is not present in the record shown in Plate IV.

These various sandstones of the Pennsylvanian are generally well exposed where the line of outcrop follows the south exposure of a hill (see Plate II). The north slopes of the hills underlain by one of these sandstones, not uncommonly are dip slopes and sandy soil and occasional outcrops of sandstone will characterize these back slopes. In some instances, however, particularly to the north where the glacial drift is thicker than it is to the south, the north slopes of the hill will be more gently inclined than the country rocks and covered with drift which apparently thickens northward. The sandstones are all much alike, consisting of massive or cross-bedded, micaceous, earthy sandstones which commonly are very poorly cemented, so that the rocks do not commonly weather into cliff-forms. Places where the sandstones are typically exposed will be briefly cited:

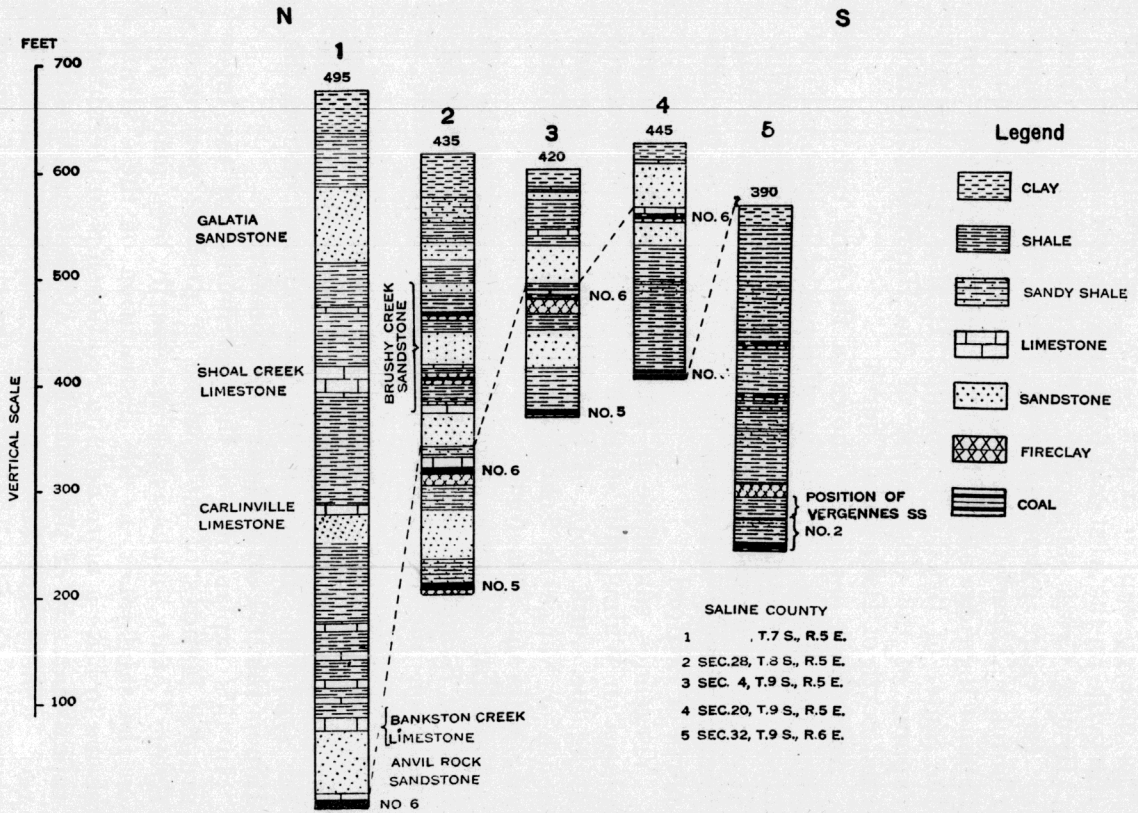

Plate IV. Graphic logs of drill hole sections in Saline County arranged from north to south.

Galatia sandstone: This sandstone outcrops north of Galatia about one-half mile at an altitude of 450 feet. The outcrop can be traced fairly continuously toward Rileyville on the west and for a mile or two eastward.

Brushy Creek sandstone: This rock forms the crest of the ridge extending west from North American Church to Liberty Church and is exposed on the north flank of the ridge along Brushy Creek at Town Hall near the center of Brushy Township. It also forms the hill capping of the ridge north of the Harrisburg-Marion road north of Dallasania Church.

Anvil Rock sandstone shows in the new railroad cut along the Illinois Central cut-off south of Bankston Fork about 4 miles east and one mile north of Carrier Mills. It is also well exposed in the vicinity of Absher in Williamson County and forms the crest of some of the hills north of Ledford.

Vergennes sandstone is found outcropping in many places on Walnut Hill south of Harrisburg, particularly along the south slope of that hill and also on the hill south of Newcastle School about midway between Carrier Mills and Stonefort.

Bald Hill sandstone is found along the crest of the hill north of Stonefort, that is the Stonefort Hill, and is exposed on the low knoll upon which Mitchellville is located.

Curlew sandstone is particularly well developed on the hill south of Macedonia School and is thought to be the sandstone present in the new railroad cut on the Illinois Central cut-off near Old Stonefort.

In this explanation of the distribution of the topographic features of the lowland or prairies portion of Saline County emphasis has necessarily been placed upon the sandstones, as the distribution of these strata seems to have a more definite relationship to the topography than any of the other beds, at least in a positive way. There are, however, other considerations with respect to the areal geology of the region that are of interest aside from the influence or lack of influence upon the topography. The positions of the outcrops of the coal beds are particularly of interest because of their

great economic importance, and to a less degree the positions of the outcrops of the limestones.

The names and stratigraphic positions of the three important coal beds of the Carbondale formation have already been mentioned. The outcrops of the Herrin and Murphysboro coals can be followed with relative ease as each coal lies a short distance below a resistant formation that possesses topographic expression (see Plate II). It is to be expected that in general the outcrops of these coals will be found on the south slope of hills capped by the resistant layers. Hence the outcrop of the Herrin (No. 6) coal can commonly be discovered on the slope southward of the Anvil Rock sandstone cuesta, and the Vergennes sandstone cuesta faces southward over the slope on which outcrop the two beds of the Murphysboro coal, one immediately below the sandstone and the lower or Four-foot seam 25 to 40 feet below. The Harrisburg (No. 5) coal on the other hand is difficult to trace. No natural outcrop of this coal is known in the county unless possibly there is such an outcrop in the hill about a mile west of Equality. The coal, usually capped by a considerable thickness of soft rock and underlain by the same sort of material, offers no resistance to erosion and hence commonly outcrops in the valleys under a covering of alluvium. It is only due to the systemmatic drilling by coal companies along the suspected and approximate position of the outcrop that it has been possible to map the southern limit of this bed.

Murphysboro or No. 2 coal lies in two benches. In Kentucky the upper one is called the Dekoven and the lower one the Davis or 4-foot bed, as has already been stated. In the Harrisburg region both benches have been worked but the lower bench is the more important of the two. One railroad mine near Harrisburg is working this bed and a small wagon mine along the hard road about two miles northeast of Stonefort is operating in the same seam. Other small local mines are found along the south slope of Walnut Hill.

The two outcropping coals below the Murphysboro coal belong in the Pottsville formation. Bald Hill coal

is found outcropping below the crest of Stonefort Hill and has been worked rather extensively at Bald Hill two miles southwest of Stonefort along the Big Four Railroad. The Curlew coal outcrops in the south side of Pond Creek on the flank of the Ridge east and west of Oldtown and has been worked a little in a local way about a mile south of Macedonia church. Neither coal seems to be continuous and it is thought that in places a bed of black shale or slate occupies the position of the upper coal. Furthermore, the interval between the sandstone cap-rock and the coal varies, increasing considerably west of the Saline County line. It is acknowledged that some uncertainty exists as to the relationship of these two coal seams.

The limestones outcropping in the lowland area are, next to the coals, of greatest interest. Five limestones have been recognized. The uppermost, stratigraphically, of the outcropping limestones is found in the northern part of the county in Longbranch Township (NW. ¼, SE. ¼, sec. 33, T. 7 S., R. 6 E.) About eight feet of limestone are exposed but htere is said to be about 15 feet present, in two benches. It is a fairly pure, sparely fossiliferous limestone, probably suitable for lime or for agricultural uses. This limestone lies north of the outcrop of the Galatia sandstone and hence lies above it stratigraphically. Underneath the limestone there is said to be eighteen inches of coal. The limestone is 550-575 feet above the base of the McLeansboro formation and is thought to be the same as that outcropping on the bank of the Wabash valley at New Haven and is called from that occurrence, the New Haven limestone (see Plate IV). This limestone is regarded by Worthen[1] as marking the boundary between the Upper and Lower Pennsylvanian of Illinois. The reference is, however, not clear, since the Carlinville and Shoal Creek limestones are erroneously correlated with the New Haven by Worthen, and these actually would occur, if present, about 200 feet and more lower in the section.

[1] Geological Survey of Illinois, Vol. VII, p. 3, 1883.

Another thin limestone is found a short interval below the Galatia sandstone in a ravine about 1 mile northeast of the town of Galatia. This limestone lies at an altitude of about 440 feet and the base of the McLeansboro formation at this place is about at sea level. This is an impure rather argillaceous or clayey limestone. It is lenticular in occurrence and in the Galatia region its place is commonly taken by a conglomerate which is exposed in numerous places in the ravines draining the hills north of Galatia. In its place of typical occurrence the limestone is said to be underlain by a bed of coal of workable thickness, but not much faith is put in this report. This limestone lies about midway of the usual interval between the New Haven and Shoal Creek limestones.

So far as has been discovered by the writer, there are no outcrops of limestone in the county that can be correlated with either the Carlinville or the Shoal Creek limestone. Some of the drill holes, however, are thought to have penetrated limestone beds at the proper position of these beds. (See Plate IV.)

Between the limestone outcropping near Galatia, last described, and the next outcropping limestone which I have chosen to call the Bankston Fork limestone, there is a stratigraphic interval of about 400 feet. The Bankston Fork limestone lies about 40 feet above Herrin (No. 6) coal and hence is exposed not far north of the line of outcrop of that coal. One of the best exposures is along the south side of the valley of Bankston Creek just east of the county line (Sec. 19, T. 9 S., R. 4 E.) The same limestone is exposed in several places in the vicinity of Ledford at an altitude of about 450 feet. The limestone is discontinuous in distribution possibly because locally displaced by the Anvil Rock sandstone. The stratigraphic relation of these two strata is not very certain in the mind of the writer.

It should be stated here that fragments of the Bankston Fork limestone may be found along the County line about two to two and a half miles north of the Marion-Harrisburg hard road. It is probable that the fragments exposed at this place mark the trace of an important

fault line, to be described later, extending westward into Williamson County from this position.

About 30 feet stratigraphically below the Bankston Fork limestone is the limestone cap rock of Herrin No. 6 coal, which I shall call the Herrin limestone since it is so commonly associated with the Herrin coal. This is the most commonly exposed limestone in the area. The frequency of exposure is due largely to artificial excavation at places where the coal has been mined or quarried. It is doubtful whether natural exposures of the limestone are much more common than natural exposures of other limestone since the deep weathering to which the rocks of the region have been subjected has resulted in the disintegration and solution of most of the limestones near the outcrop. It is only where streams or other agencies have kept disintegration products removed that fresh limestone is generally exposed in southern Illinois.

The character of the Bankston Fork and the Herrin limestones may be briefly considered. The former is a fairly pure, slightly brownish or pinkish, hard dense limestone that commonly breaks with a fracture somewhat conchoidal in appearance. The Herrin limestone on the other hand is an impure, earthy, dark gray dirty-looking limestone that breaks with a splintery fracture. Where exposed along streams, the rock spalls off in angular fragments showing little structure. Both limestones are fossiliferous and it is particularly noteworthy that both carry the fusulinid forms of foraminifera, the upper limestone rather more abundantly than the lower. The forms in each limestone are relatively short and thick and are thought to be the same species of the genus Girtyina. The limestone has also recently been shown by Mr. L. G. Henbest, my field assistant, to carry other forms of foraminifera besides Fusulinidae.

No limestones belonging to the Carbondale formation are known to outcrop and drilling shows that in this region this formation is practically barren of this kind of strata. Therefore, the remaining limestones to be described belong in the Pottsville formation. There are two of these limestones. The uppermost, which needs

but brief mention, is the Bald Hill limestone which lies between the Bald Hill coal and the Bald Hill sandstone. It is exposed in the railroad cut east of Stonefort as a discontinuous layer a few inches in thickness but is more typically developed at Bald Hill about 2 miles southeast of Stonefort on the north side of the Big Four railroad. One hundred feet or more below the Bald Hill sandstone, stratigraphically, is the Curlew limestone, which underlies the Curlew sandstone and overlies the Curlew coal. In Saline County this limestone seems to have a restricted distribution in the eastern part of the county. It is found along several stream channels on the hill south of Macedonia School; there are several occurrences mapped by Butts (Equality quadrangle) near the foot of Cave Hill and it is also found on the southwest slopes of the Eagle Valley depression. This is a fairly pure fine-grained flinty limestone. Particular interest attaches to it because the fossil fauna which it carries is particularly rich in Fusulinidae. These in general are small and are thought to be distinctly different from those occurring in the Herrin and Bankston Fork limestones. The occurrence of flint in the limestone is also of interest as such occurrence is unusual in the Pennsylvanian limestones of Illinois.

It will be well before completing the description of the areal geology of the lowland portion of Saline County to point out one or two other features of the geology that are observable by inspection of the surface. First, there is the distribution of glacial drift. The approximate position of the southern limit of glaciation is indicated on the map. (Plate I.) This line is based largely on the result of work by Dr. Paul MacClintock during the past summer. It will be noted that the line marks no distinguishing topographic differences between glaciated and unglaciated country. It is traceable only by careful observation of the character of the material overlying the rock and underlying the surface loess. It is only in the northern part of the county that drift attains a considerable thickness. For instance, a portion of the ridge north of Galatia and Equality is composed of till of considerable thickness and the topography in places sug-

gests that of a moraine. In the main, however, this is a rock ridge underlain by the Galatia sandstone.

The second feature of special interest concerns the structural irregularities that affect the rocks of the lowland area. Here and there surface evidence of structural irregularities are found. These surface evidences are, howevre, less numerous than the actual occurrence of irregularities, as shown by mine workings and drilling. In the main these irregularities do not effect definite responses in the topography but the effect after all may be greater than is commonly suspected.

It is known from mine workings and drilling that a zone of fracture crosses the county beginning at Equality and extending in a direction slightly north of west. A fault with a throw which locally amounts to 160 feet passes between mines No. 1 and No. 12 of the O'Gara Coal Company about two miles northeast of Harrisburg. This fault cannot be followed on the surface as the fault trace is buried beneath the alluvium. This is thought to be the same fault which causes the duplication of the Anvil Rock escarpment at Big Ridge and to the north along the Cottage Grove ridge, the fault running between the two hills, as mapped by Butts.[1]

West of Harrisburg irregularities in structure are probably in part responsible for the lack of definite alignment of the Brushy Creek sandstone escarpment. This escarpment near the west line of the county is in duplicate. The southern escarpment extends east-northeast as the ridge north of the State road at Dallasania Church. The southern escarpment is that upon which North American Church is located, 1½ miles north of Dallasania. This ridge can be followed eastward to the vicinity of Bankston Fork Curch, but about ½ mile west of that location it is interrupted by another fault. East of this fault the sandstone again comes in at a slightly lower altitude and forms a ridge with a trend slightly northwest. Again faulting supposedly interrupts the continuity of the outcrop but the sandstone again shows on a small knoll 2 miles northwest of Harrisburg. It

[1] Butts, Charles, Geology and Mineral Resources of the Equality-Shawneetown Area, Illinois State Geological Survey, Bull. 47, 1925.

should be stated that the identity of the sandstone occurring at these various places is determined by the fact that it lies about 200 feet above Harrisburg (No. 5) coal, the altitude of which is determined by numerous drill holes.

There are few locations in the belt of faulting where the fault traces can be observed. These occurrences are all in the hilly region west of Harrisburg. The most noteworthy instance is in the vicinity of Bankston Fork Church (NW. ¼, SW. ¼, sec. 10, T. 9 S., R. 5 E.) The fault brings Bankston Fork limestone to the surface on the east side, against what is thought to be the Brushy Creek sandstone on the west, the throw, therefore, being 50 to 60 feet or more. Trace of what is possibly the same fault is to be seen about 1 mile northeast in a cut bank along Brushy Creek in the SE. ¼, NE. ¼, sec. 3, T. 9 S., R. 5 E.

The most notable example of the surface exposure of a fault trace in the coal basin of southern Illinois, excluding the highland area to the south, begins at the county line ¼ mile southwest of Liberty Church and extends N. 72° W. in Williamson County. Along this fault line within 100 feet of the county line boulders of Bankston Fork limestone have been found, as has been previously noted. The Illinois Central cut-off right-of-way crosses the fault line and the cut necessary to bring the track to grade should disclose exceedingly interesting structural relationship. Farther west in Williamson County, the fault trace is readily followed on the surface.

The Harrisburg region is known to be crossed by dikes of igneous rocks. One is at least 300 feet in width where it cuts the coal in a mine but most of them are less than 50 feet in width. The occurrence of ten or more such dikes are known in the mines in the region, but so far none has been located at the surface probably because of the deep weathering to which surface exposures have been subjected. It is not improbable that a surface occurrence will eventually be discovered.

The portion of the Harrisburg region thus far described is part of the Prairies Province and geologically part of the Illinois coal basin. The remaining and south-

ern portion of the region is physiographically a portion of the Ozark Province and lies outside of the coal basin proper, since the rocks do not partake of the regional northward dip of the rocks in the southern portion of the coal basin.

The rocks of the Ozark region of Saline County and the northern part of Pope County belong to the Pottsville formation of the Pennsylvanian System, except for a small area of Mississippian on Cave Hill, another near Horton Hill and the Carbondale and McLeansboro rocks found in the isolated basin of Eagle Valley south of Cave Hill.

Geologically, that is both physiographically and structurally, the region is separable into two parts; one portion lies east and south of the Shawneetown Anticline and Fault and the other portion lies west of this structural feature. The eastern portion includes the high range of Cave Hill and Eagle Valley to the south, and the western portion the lower hills south and southwest of Harrisburg extending to the county line and beyond. Without much doubt the most interesting portion of the county, geologically, is the Cave Hill-Eagle Valley region. The geology of this region has been mapped and studied by Mr. Charles Butts of the U. S. Geological Survey, and a report on this potion of Saline County and adjoining portions of Gallatin County is shortly to be published by the State Geological Survey in cooperation with which bureau the geological work was done. In view of the fact that this report is shortly to appear, this portion of the county will be described very briefly.

Cave Hill ridge and Eagle Valley are a structural unit bounded on the east and north by a fault or zone of faults of considerable magnitude. (Plate V.) The fault is vertical or normal with the rocks upthrown on the south and east sides. The position of the limiting fault on the north is not definitely established because the fault trace lies buried beneath the alluvium of the lowland, but on the west the trace of the fault can be followed three or four miles along the flank of Cave Hill southward, eventually becoming a fold or zone of folding rather than a fault. The effect of the faulting has

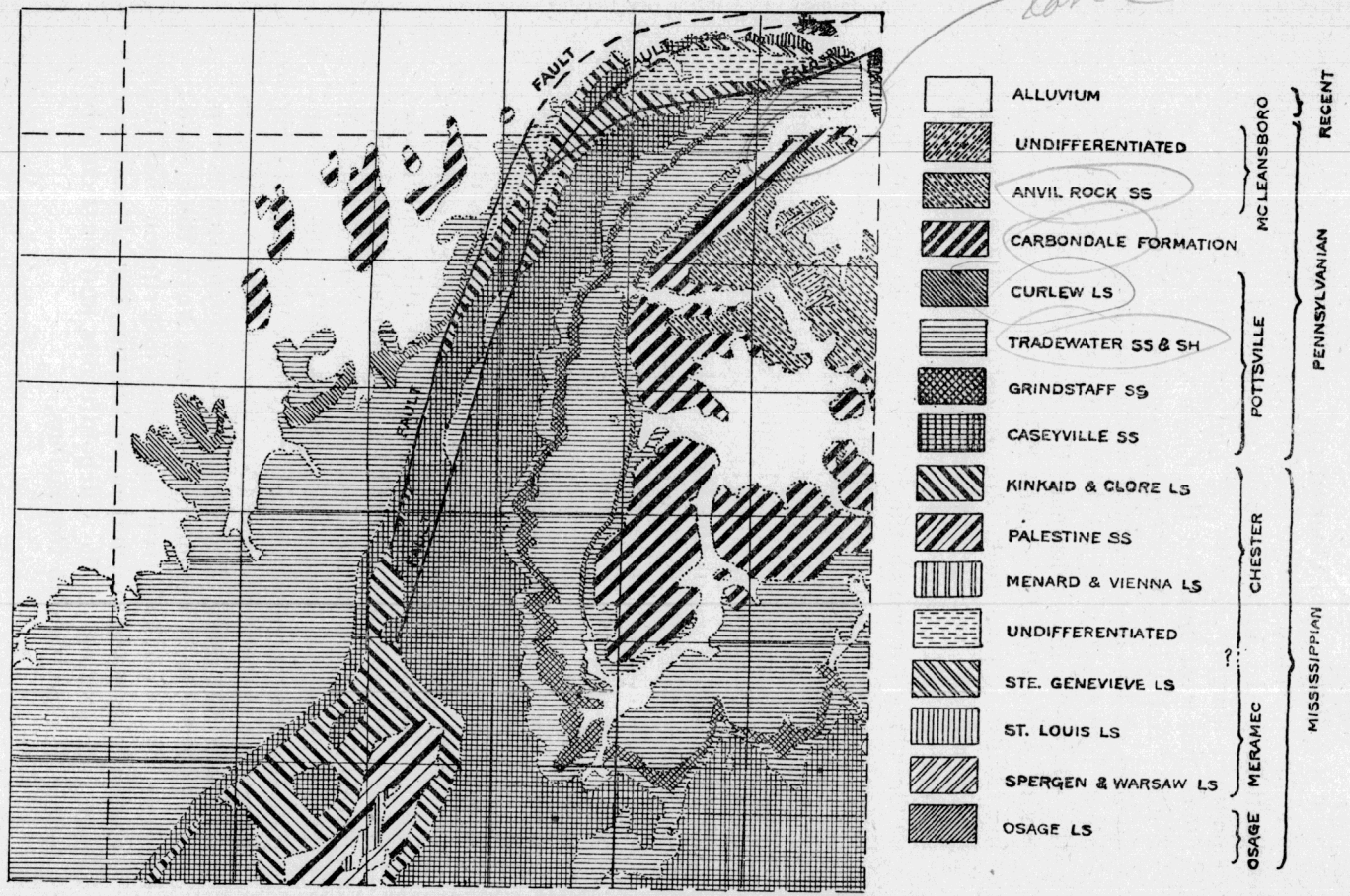

Plate V. Areal geology of the southeast portion of Saline County adapted from a map by Charles Butts. (All of T. 10 S., R. T. E. and part of each of three adjacent townships.)

been a rotation of a block of the earth's crust in such a way as to expose the edges of the block along the curved fault line. In addition to being uplifted, the rocks are inclined sharply southward and eastward to form the north and west flanks of the Eagle Valley syncline to the south. According to maps prepared by Mr. Butts the amount of the displacement along the fault amounts to about 1,400 feet of upper Pottsville strata lying against the Chattanooga shale near the foot of Cave Hill at a small knoll called Horseshoe Hill. Because of the faulting, Mississippian rocks are exposed on the north and east flanks of Cave Hill through the entire Mississippian section.

The Cave for which the hill is named is in the Clore limestone, the uppermost limestone of the Chester Series just beneath massive Caseyville conglomerate.

From the base of the Caseyville conglomerate passing over the hill and down into Eagle Valley a complete succession of Pennsylvanian rocks is exposed up to the Anvil Rock sandstone of the McLeansboro formation. According to Mr. Butts, these formations consist of the Caseyville conglomerate at the base, 340-400 feet thick, consisting of three conglomeratic sandstones separated by thin bedded non-conglomeratic sandstones and shales. Above the Caseyville sandstone is the Tradewater formation near the base of which is the Grindstaff sandstone member and near the top of which is the Curlew limestone and sandstone. The Tradewater formation has a thickness of about 600 feet. Within the Tradewater formation are several lenticular coals, particularly the Willis coal in the lower 200 feet of the formation. The Tradewater formation is succeeded by the Carbondale formation containing Murphysboro (No. 2), Harrisburg (No. 5) and Herrin (No. 6) coal with a thickness of about 300 feet. The McLeansboro formation is represented by beds extending up to the Anvil Rock sandstone. It is obvious from this brief description that the region possesses unusual opportunities for obtaining a complete section of the Carboniferous and particularly of the Pennsylvanian formations.

As has already been mentioned the Shawneetown fault zone which marks the base of Cave Hill does not continue far south into the Hills, but its extension is marked by a series of parallel folds called the Shawneetown anticline, Potato Hill syncline, and Horton Hill anticline. Along this folded zone in the extreme southern part of the county, upper Mississippian rocks are also exposed.

West of Cave Hill and the Shawneetown fault the Saline County portion of the Ozark region, which includes only the northern edge of the highlands, is marked by an abrupt and fairly even escarpment at a much lower altitude than Cave Hill. This escarpment rises to a maximum elevation of about 660 feet, whereas the altitude of Cave Hill is about 900 feet. The surface continues to rise southward largely in response to the geological structure so that along the Delwood McCormick ridge in northern Pope County an altitude of 800 feet is reached in a number of places, but nowhere does the altitude ascend to that of Cave Hill.

The topography of the northern part of the Ozark region consists of the terminal ridge, mentioned above, at the north, which is of greater height than a narrow belt that lies south of the ridge. Streams break through the ridge in narrow straight sided canyons but farther south the valleys are much broader and more open and tend to have east and west courses. In this valley belt the surface altitude rarely exceeds 550 feet. In the south side of the valley belt there is another escarpment where the surface reaches an altitude of about 800 feet, or nearly 200 feet above the altitude of the first ridge. This second ridge lies in Pope County and forms the watershed between the drainage to the Ohio to the south and that to the Ohio by the way of Saline River.

The topography shows a definite response to the structure. The outer ridge is anticlinal in character and the front slope is generally the dip slope of a resistant sandstone layer, the surface of which roughly determines the topography of the hill. The crest of the hill is usually the crest of the anticline but the dip to the south is usually more gentle than that to the north but still con-

siderable. In the valley tract south of the ridge the strata are fairly horizontal for a distance of a mile or so and then rise sharply, varying from 15 to 45 degrees toward the south. The south ridge constitutes a monoclinal structure.

The accompanying map (Plate VI) represents the pattern of outcrops in a small area of about 13 square miles adjacent to the area shown in Plate V. Eight different strata are mapped, a refinement in mapping that it may be impossible to extend over the entire Ozark Pennsylvanian area. The lowest rocks exposed are those outcropping along streams that flow northward from the second ridge in northern Pope County in the trough of the syncline. The material consists of dark gray shale and is thought to represent part of the Caseyville formation of the Equality-Shawneetown area. Correlation of the Pottsville of the Harrisburg region with that of the Equality quadrangle has not yet been attempted except in a general way and any correlations suggested in this paper must be regarded as highly speculative and subject to radical correction. Difficulties in correlation are in the main restricted to the portion of the section below the Curlew limestone. In the area shown in Plate VI, I have recognized three massive sandstone members, none conglomeratic. Two of these possibly belong to the Tradewater formation and one to the Caseyville.

Although the general structural features of the outer part of the Ozark upland west of the Shawneetown fault consist in the main of two parallel folds as described, there exists considerable irregularity in these main structural features due to faulting. The position of some of the more important faults is shown on Plate VI. It seems quite probable that faults exist in greater frequency than is shown, particularly along the initial anticline. The excavation by the Illinois Central at Old Stonefort, for instance, shows that the uplift along the initial ridge is, at this place at least, accomplished in part by a series of steep faults; and the frequency of occurrence of sandstone boulders with slickensided surfaces indicates that fracturing by some differential movement characterized

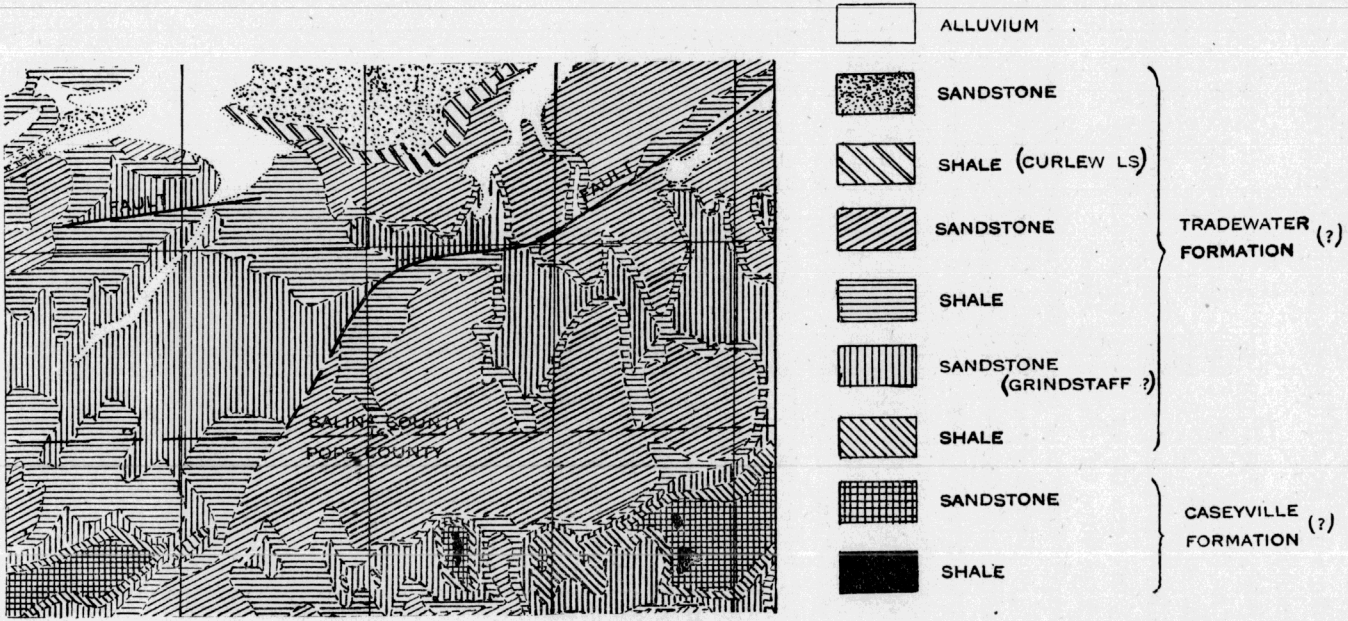

Plate VI. Areal Geology of the southeast portion of the Harrisburg quadrangle in the southern part of Saline and northern part of Pope County.

the movement by which elevation of the region was accomplished.

Evidences of faulting can be found at various places along the Winkleman Fault, particularly, which crosses the NW. ¼ sec. 34, T. 10 S., R. 6 E. These consist in particular duplication of strata, in drag folds, and slickenside surfaces along the projected line of faulting and actual exposure of the fault trace.

The preceding is a brief description of those features of the areal geology of Saline County having most obvious relationship to the topography. There are added a few paragraphs describing the occurrence and distribution of the coals and limestones outcropping in the area north of the Ozark hills. In limiting the description to the facts of areal geology, many other interesting facts concerning the geology of the region have necessarily not been considered. These relate to the physiography, stratigraphy, correlation, paleontology, sedimentary and structural geology, etc., of the region. The problems in these various fields have scarcely been realized to say nothing of having been solved. This portion of southern Illinois will no doubt attract the attention of geologists for many years before geological relationships are fully understood.