STATE OF ARKANSAS
Arkansas Geological Survey
GEORGE C. BRANNER
State Geologist

BULLETIN 4

St. Peter and Older Ordovician Sandstones of Northern Arkansas

By
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With a Section On Their Economic Possibilities
By E. E. Bonewits

LITTLE ROCK

1930

LETTER OF TRANSMITTAL

Arkansas Geological Survey

LITTLE ROCK, ARK., *Aug. 15, 1930.*

HON. HARVEY PARNELL,
Governor, State of Arkansas,
Little Rock, Arkansas.

Sir:

I have the honor to submit herewith the report, "The St. Peter and Older Ordovician Sandstones of Northern Arkansas," by Dr. Albert W. Giles, which contains a section on the economic possibilities of the sandstones by Mr. E. E. Bonewits.

It has long been known that there are in northern Arkansas widespread deposits of relatively soft silica sandstones of high purity. These deposits are exposed over an area of approximately 750 square miles and have a maximum thickness of about 200 feet. Up to the present time information concerning their distribution, geology, physical and chemical characteristics and their economic possibilities has been more or less incomplete. Both in Missouri and Illinois, their quarrying constitutes an industry of some magnitude and especially for this reason it was believed advisable to make a detailed report on the geology and economic possibilities of these sandstones in Arkansas.

Dr. Giles undertook the study of these sandstones in the summer of 1927 with the assistance of Mr. Bryan Parks and Mr. Eugene Brewster. His work constitutes a valuable contribution to the knowledge of these formations in northern Arkansas, particularly the St. Peter sandstone, which has a wide distribution in Missouri, Illinois, Wisconsin, Minnesota, and Iowa. The mapping of a new member of the Everton formation which Dr. Giles has named the Calico Rock sandstone, is important economically and is an addition to the knowledge of the stratigraphy of the north Arkansas region. From a more general geologic standpoint, this report is a contribution to the knowledge of the Ordovician sandstones of central United States.

The addition of a section on the economic possibilities of the sandstones by Mr. E. E. Bonewits is an attempt to stimulate the development of a new industry or industries in Arkansas which would utilize the deposits. His conclusions are important and it is hoped they will attract attention to the industrial possibilities of the region.

Respectfully submitted,

GEORGE C. BRANNER,
State Geologist.

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ABSTRACT

Three sandstones of early middle Ordovician (Buffalo River) age are prominently developed and widely distributed in the Ozark region of northern Arkansas. They are, named from oldest to youngest, Kings River, Calico Rock, and St. Peter sandstones. The Kings River sandstone is the basal member of the Everton formation over a large area in the western and central Ozark region except at places where it is underlain by the Sneeds limestone member of the Everton. The Calico Rock sandstone is conspicuously developed in the central part of the region and lies stratigraphically below the middle of the Everton formation. The St. Peter sandstone overlies the Everton unconformably and is the most widely distributed of the three sandstones extending from northwestern Arkansas to the Mississippi Valley alluvial plain.

The sandstones are normally white or light cream colored, friable, and saccharoidal. Physically they are so similar that it is impossible in hand specimens to distinguish one from the others. The striking physical similarity that they reveal in hand specimens extends also to their larger field relations. On weathering they yield rolling uplands capped with a thin veneer of sandy and infertile soil, through which project here and there picturesque ledges, turrets, and towers, the "hoodoo rocks." They form steep slopes and precipitous bluffs with fluted surfaces on valley sides. Typically the sandstones are massively bedded and laminated. Cross bedding, usually fine, is a conspicuous feature of the sandstones. Ripples, normally of the asymmetric current pattern, are developed in the three sandstones but are most conspicuous in the Calico Rock sandstone. Dips are gentle nearly everywhere; in the western part of the region southward and farther east south-southeastward, away from the central part of the Ozark dome. The sandstones contain no fossils, but their physical features and their association with sediments of undoubted marine origin lead to the conclusion that they are of marine origin.

In size the grains composing the sandstones exhibit a large range. No samples screened left a residue on the 20 mesh sieve, and only about one-fourth of the more than 100 samples had weighable residues on the 28 mesh. The bulk of the sand of all samples found lodgment on the 35, 48 and 100 meshes. All samples had weighable quantities of "fines," grains small enough to pass 100 mesh, and three-fourths of the samples had weighable residues passing the 200 mesh. On the whole the grain size of the St. Peter as well as that of the Calico Rock and Kings River sandstones averages somewhat finer than the grain size of the St. Peter in Missouri and farther north in the Mississippi Valley, indicative of greater attrition resulting from farther transportation from the original source of the sand in the pre-Cambrian mass of northern United States and southern Canada.

Contrary to prevalent conception, the grains of the St. Peter are dominantly angular, and this is true also of the Calico Rock grains. Only 10 per cent of the St. Peter grains and 14 per cent of the Calico Rock grains are rounded or fairly well rounded, the remaining grains being subangular or angular.

Pitting is a prominent feature of the grains both of the Calico Rock and St. Peter sands. It is restricted largely to the coarser sizes. About one grain in three of the St. Peter and one grain in seven of the Calico Rock sand are pitted. Pitting develops at points of contact of adjacent grains and is attributed primarily to secondary enlargement by the addition of silica to the surfaces of the grains not in contact with surfaces of neighboring grains and hence exposed to the precipitating activity of penetrating solutions, and secondarily to chemical attrition at points of contact of neighboring grains.

Secondary enlargement is a marked feature of all samples examined both of St. Peter and Calico Rock sand. The silica precipitated on the surfaces of the grains develops crystal faces, which are clean and smooth and free from fractures, chipping, pitting and frosting. Rhombohedral faces typically terminate the grains, and prism faces are developed about the central parts of the grains. One or both forms may be present. Frequently the central part of the grain is frosted but its ends are terminated with rhombohedral faces. Some grains are completely bounded by crystal faces; other grains are partly bounded, the remaining surface being frosted. In

grains larger than 100 mesh the crystal faces are due chiefly to secondary enlargement. In grains smaller than 100 mesh the crystal faces are in part secondary and in part inherited from the original source of the sand. Many of these grains and those passing 200 mesh are fragments and flakes derived from the attrition of the larger grains. The coherence of the sandstones is attributed primarily to secondary enlargement.

Frosting is a conspicuous feature of the sand grains forming the St. Peter and Calico Rock sandstones. The phenomenon is, however, restricted almost entirely to grains coarser than 100 mesh, particularly to those grains which are oblong, egg-shaped, spindle-shaped, and lens-shaped. The coarser grains with angular outlines are either not frosted or only partly frosted. On an average about 14 per cent of the grains are entirely frosted and 46 per cent partly frosted. The proportion of grains originally frosted was unquestionably very much larger, the marked decrease resulting from subsequent secondary enlargement. The frosting is attributed to the action of the wind in shifting the sand about the beach and the adjacent upland before it was deposited in the invading marine waters.

Chemically the three sandstones are remarkably similar and significantly high in silica, selected samples, unwashed, averaging about 99 per cent silica. Lime and magnesia are either absent or are present in scarcely more than traces. Iron averages under 0.2 and alumina about 0.25. The ignition loss is only 0.25.

The purity, high silica content, cleanness, toughness, and durability of the St. Peter, Calico Rock, and Kings River sands recommend them for utilization in the manufacture of high-grade glass products, for metallurgical and chemical uses, and for uses where high temperatures are encountered, particularly for steel molding purposes, for facing and annealing and for furnace linings. Their toughness, degree of angularity, and durability make the sands very satisfactory for friction and abrasive purposes. The average effective size and uniformity coefficient bring the Arkansas sands well within the range of sands successfully employed for filtration purposes. The sands can also be successfully used in paving and construction where a high grade, fine-textured sand is desirable. And, finally, the sands are adapted to the many minor uses where high silica, clean, and durable sands are employed.

As a resource the Kings River and Calico Rock sandstones are untouched, and the St. Peter is being actively exploited in only one locality. Each of the sandstones over large areas possesses a thickness that is commercially inviting, but, unfortunately, transportation facilities are unavailable in large parts of the region. There are, however, a number of localities near or on railroads, where the sandstones are thick and extensively developed, that are recommended with a view to exploitation. It is apparent that Arkansas has an almost inexhaustible resource of high-grade sand, the exploitation of which should furnish a constant source of income for generations to come.

Note.—For abstract on the economic value of the sandstones see page 159.

THE ST. PETER AND OLDER ORDOVICIAN SANDSTONES IN NORTHERN ARKANSAS

By Albert W. Giles

ACKNOWLEDGMENTS

The writer wishes to express his appreciation of the constant interest Mr. George C. Branner, State geologist, has taken in the progress of the study, and to acknowledge the many helpful suggestions received from Mr. Branner during the course of the field and laboratory work and in the publication of the report. Acknowledgments are gratefully tendered Mr. E. T. McKnight of the United States Geological Survey, who placed the results, so far as available, of his study of the St. Peter sandstone and Everton formation in the Yellville quadrangle at the disposal of the writer. The writer desires also to express his gratitude to Mr. Bryan Parks, who assisted in the field and later made the sieve analyses of the sands; to Mr. Eugene Brewster, who assisted in the field and in the laboratory, particularly in the gravity determinations and in the microscopic study of the sand grains; and to Mr. Forrest Uhl for effective clerical assistance, particularly in making and checking the computations. Acknowledgments are also due Miss Lucille Muse and Miss Blanche Roberts for their efficient service in typing the manuscript.

COMMERCIAL VALUE OF THE SANDSTONES

Three sandstones of commercial value are found in northern Arkansas. They are, named from the oldest to the youngest, the Kings River, Calico Rock, and St. Peter sandstones. Of the three the St. Peter is by far of greatest economic importance. It is the most widely distributed of the three, it maintains a thickness that makes it commercially attractive over a great area, and it lies contiguous to transportation facilities for long distances. The Calico Rock sandstone in the area of its development is inviting from a commercial standpoint and close to transportation, but its area

of development is restricted. The Kings River sandstone is widely distributed, but in the area where it is sufficiently thick to make it commercially inviting, transportation facilities are not available. The distribution, geologic features, physical and chemical properties, uses, and areas favorable for commercial development of the sandstones are described.

THE ST. PETER SANDSTONE

FIELD WORK

During the summer of 1927 the mapping of the St. Peter sandstone in northern Arkansas was continued after a lapse of several years. The project was inaugurated by the Arkansas Geological Survey and carried out under the auspices of that organization. The field party consisted of the writer and Mr. Bryan Parks and Mr. Eugene Brewster, of the department of geology of the University of Arkansas.

The geographic distribution of the sandstone had previously been mapped in the northwestern part of the State and the results published by the United States Geological Survey.[1] During the summer and fall of 1928 the Yellville quadrangle was remapped by Mr. E. T. McKnight of the United States Geological Survey, the work being carried on in co-operation with the Arkansas Geological Survey. The results, so far as available, of that part of his work pertaining to the St. Peter sandstone are incorporated in this report. The work done in 1927 involved tracing the formation eastward from the eastern limit of the Yellville quadrangle to its disappearance beneath the Mississippi Valley alluvial plain.

NAME, AGE, AND REGIONAL DISTRIBUTION

The term "St. Peter sandstone" was applied by Owen in 1847 to exposures of sandstone along the Minnesota River near St. Paul, Minnesota. This river was formerly known as the St. Peter River.[2] In Arkansas for many years sandstone of the same age was called the "Key sandstone," named for the postoffice of Key, northeast of Fayetteville, in the northwestern part of the State. In northeastern Oklahoma it has been called the "Burgen sandstone." In Missouri the older geologists referred to the St. Peter as the "Saccharoidal sandstone" or "First sandstone." It has also been known locally

[1] Purdue, A. H. and Miser, H. D., Eureka Springs-Harrison Folio, No. 202, Geologic Atlas of the United States, Washington, 1916.
Adams, G. I., Purdue, A. H., and Burchard, E. F., Zinc and Lead Deposits of Northern Arkansas. Prof. Paper No. 24, U. S. Geological Survey, 1904.

[2] Owen, D. D., Senate Executive Document No. 2, 30th Congress, 1st session, p. 169, 1847.

in Missouri as the "Crystal City," "Pacific," and "Cap au Gres" sandstone[3].

The St. Peter sandstone is of early middle Ordovician age. Table 1 shows the general stratigraphic succession of the formations of the Ordovician system in the Ozark region of northern Arkansas.

Table 1.—Ordovician Section of Northern Arkansas

Age	Standard Time Scale		Formation
Upper Ordovician	Richmond		Cason shale Fernvale limestone
Middle Ordovician	Black River		Kimmswick limestone
			Plattin limestone
	Buffalo River (Ulrich)		Jasper limestone Joachim limestone St. Peter sandstone Everton formation
Lower Ordovician	Canadian	Beekmantown	Black Rock limestone Smithville limestone Powell limestone Cotter dolomite Jefferson City dolomite

The St. Peter sandstone is widely distributed in the upper Mississippi Valley region. Much of the formation is buried beneath later formations, but it outcrops locally in the bottoms of valleys, on hill slopes, and on ridge tops. In some localities its outcrop may be traced continuously for scores of miles. Where the sandstone is buried its presence is revealed in drill cores. From much of the Ozark region of extreme northern Arkansas and southern Missouri the sandstone has been removed by erosion.

The northern boundary of the St. Peter sandstone extends through southern Minnesota and Wisconsin into northern Michigan. Its eastern limit is indefinitely known because of its burial beneath later formations, but in general it extends through eastern Michigan and Indiana into eastern Kentucky and Tennessee. Its southern boundary is generally considered as located in southern Tennessee, central Arkansas and central Oklahoma but it may extend beneath Gulf Coastal Plain sediments far south of this limit. Its

[3] Dake, C. L., The Sand and Gravel Resources of Missouri. Missouri Geol. Survey Vol. XV, 2d series, p. 105, 1918.

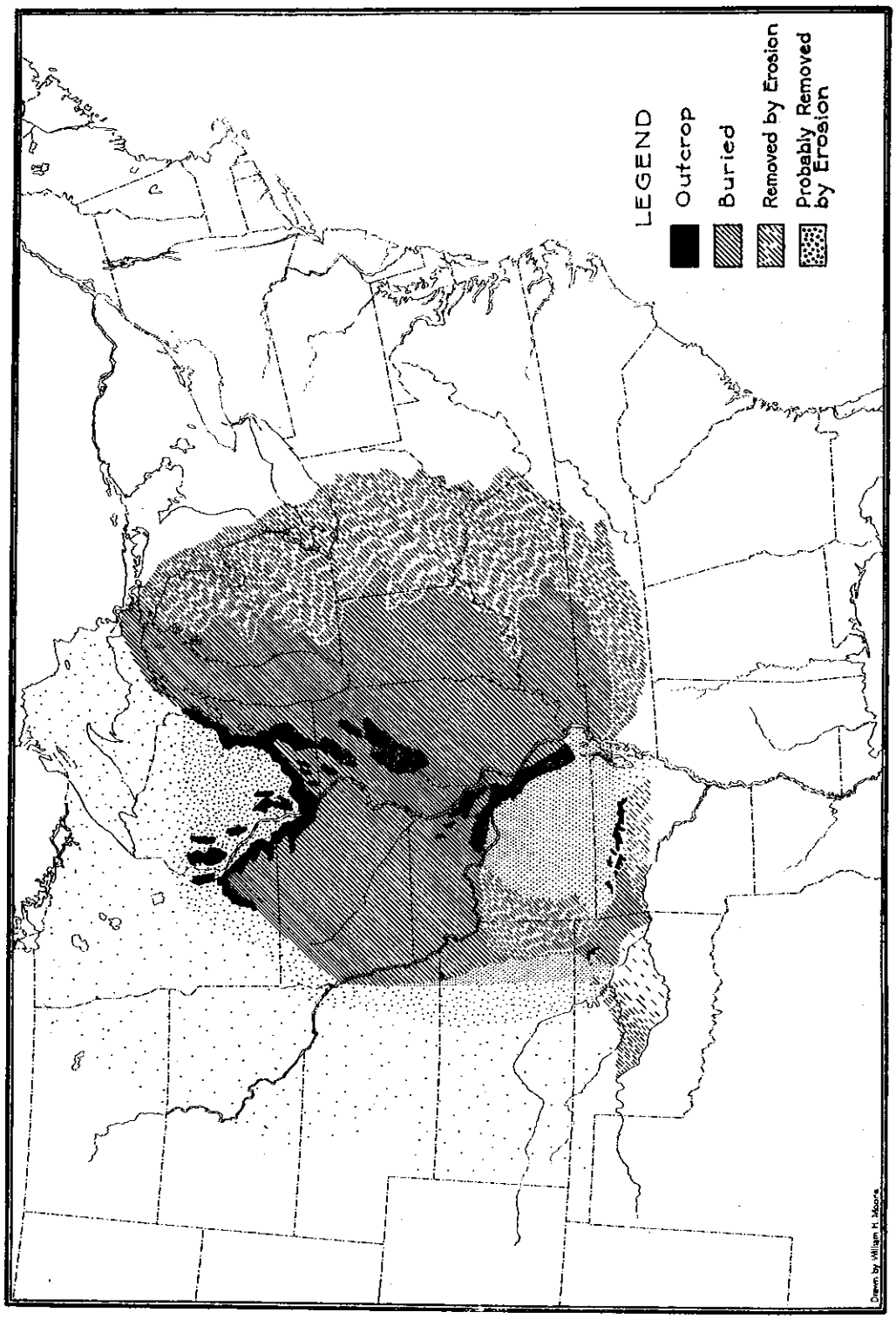


FIGURE 1.—Map showing distribution of the St. Peter sandstone in the United States.
From C. L. Dake, University of Missouri School of Mines and Metallurgy Bull. Tech. Ser., Vol. 6, No. 1, August, 1921. Arkansas surface distribution according to A. W. Giles.

western boundary extends northward from central Oklahoma through western Missouri and Iowa into Minnesota. It is believed to have extended formerly much farther westward into the Great Plains region and northward to the Canadian boundary, having been removed from these regions by erosion. Figure 1, originally prepared by Dake, shows the general distribution of the St. Peter sandstone.[4]

DISTRIBUTION IN NORTHERN ARKANSAS

The accompanying map (Pl. I, in pocket) shows the general distribution of the St. Peter sandstone in northern Arkansas. It occurs in Madison, Carroll, Newton, Boone, Searcy, Marion, Baxter, Stone, Izard, Sharp, and Independence counties, and has been reported in Lawrence County.[5]

The St. Peter sandstone does not crop out in the extreme northwestern part of Arkansas. Its most westerly known outcrop is on War Eagle Creek, northeast of Hindsville, in Madison County. The sandstone crops out also near the heads of the tributaries of Kings River south and southeast of Rockhouse, in the northeastern part of Madison County and in adjacent Carroll County. Farther east, in the Harrison quadrangle, the formation is present as inliers, its discontinuous outcrops occurring in the lower parts of the valleys of the larger streams. In the western part of the Harrison quadrangle, in Carroll County northwest of Osage, the formation is present as a long, continuous outcrop on Osage Creek. East of Harrison, in Boone County, the sandstone outcrops along Hussar and Crooked creeks and underlies a large area at Bellefonte. In the southern part of the quadrangle, in northern Newton County, the formation is again found as long, continuous outcrops in the lower parts of the valleys of Buffalo Fork and White River and their larger tributaries.[6]

Numerous outliers of St. Peter sandstone are also present farther north, both in the Eureka Springs and Harrison quadrangles, these erosional remnants indicating the former widespread extent of the formation in this region. The formation disappears entirely about the middle of the quadrangles, but it probably originally extended over the entire Eureka Springs-Harrison region to unknown limits beyond this region, but during the long interval of later Ordovician, Silurian, and Devonian erosion the formation was largely re-

[4] Dake, C. L., The Problem of the St. Peter Sandstone. Bulletin Missouri School of Mines, Vol. 6, No. 1, Plate III, 1921.
[5] Eureka Springs-Harrison Folio, p. 7.
[6] Eureka Springs-Harrison Folio, p. 7 and maps.

moved, except in small protected areas, so that in general in this region the Sylamore sandstone, St. Joe limestone, and the higher Boone limestone succeed unconformably the Everton and other formations older than the St. Peter.[1]

The St. Peter sandstone is widely distributed in the south-central and southern parts of the Yellville region, forming continuous outcrops along Buffalo River and its tributaries in southern Marion, northern Searcy, and northeastern Newton counties.

The outcrop of the St. Peter sandstone in the Mountain Home quadrangle is limited essentially to the region south of White River in northern Stone and southern Baxter counties. Its outcrop is continuous in the escarpment south of the river, and it has been traced up the valleys of Big Creek and other tributaries that flow into Buffalo River from the south and southeast. In southwestern Izard County, northeast of White River, the sandstone is conspicuous near the tops of the highest hills, such as Turkey Knob, Pilot Knob, Twin Knobs, Devils Knob, and other residuals. East of the Mountain Home quadrangle, in central Izard County, the formation is represented only on the highest peaks and ridges, the massive saccharoidal sandstone seen north of Melbourne and elsewhere belonging to a lower horizon.

The formation is well developed in the northern part of the Mountain View quadrangle. An outcrop several miles long floors the valley of Roasting Ear Creek, in northern Stone County. It caps the bluffs on both sides of White River and extends up all the tributaries of that river in northeastern Stone and southern Izard counties. Farther east in the Batesville quadrangle, along White River, the sandstone descends to water level, and its outcrop has been traced on the north side of the river to the vicinity of Guion, in southern Izard County. It is absent south of the river in this quadrangle, the steep southward dip carrying it beneath the bluffs on that side of the river. The sandstone forms broad outcrops in southern Sharp and northern Independence counties, in the northern part of the Batesville quadrangle.

The area east of the Batesville quadrangle has not been surveyed topographically, but the sandstone was traced southeastward for several miles, finally disappearing beneath the gravels and sands of the Mississippi Valley alluvial plain east of Walnut Grove, in Independence County. In this direc-

[1] Eureka Springs-Harrison Folio, pp. 7 and 18.

tion the outcrop of the formation gradually diminishes in width, becoming less than one-half mile wide at the eastern termination of its outcrop. The lack of adequate base maps, together with the wooded and rugged nature of the country, prevented an accurate determination of the boundaries of the formation both north and east of the Batesville quadrangle. The problem is further complicated by the presence of a similar sandstone below the St. Peter and separated from it by a narrow and irregular vertical interval, which in places apparently absent.

In the preceding paragraphs the outcrop of the sandstone is sketched in a general way, but the distribution of the sandstone is much more general and extensive than the tracing of its outcrop indicates. The sandstone undoubtedly persists as a continuous formation underlying the ridges between its outcrops on the valley slopes that bound the ridges. Hence the sandstone is present, though buried by later formations, in large areas in northern Arkansas. Its northward extent is terminated by older formations that appear in extreme northern Arkansas. It was originally present in this region but has been removed during the prolonged period of erosion which this region has experienced. Eastward the sandstone probably continues beneath the Mississippi River alluvial plain, and southward it continues beneath the Boston Mountains and Arkansas Valley and for an unknown distance beneath the Coastal Plain of southern Arkansas and northern Louisiana. Westward the sandstone thins and may be absent locally, but it continues far into eastern and central Oklahoma, where it is called the Burgen or the Wilcox sandstone.

THICKNESS

The St. Peter sandstone in Arkansas is very variable in thickness even within short distances. Its thickness reaches a maximum of 200 feet. The sandstone is buried in extreme northwestern Arkansas but appears south of Eureka Springs and thickens eastward, reaching its maximum thickness, 125 to 200 feet, in the Mountain View, Mountain Home, and Batesville region.

On Kings River, in eastern Madison and southern Carroll counties, the thickness of the formation ranges from 10 to 70 feet. In eastern Carroll County, on Osage Creek, its thickness is generally 30 feet but reaches 100 feet northwest of

Osage postoffice. On Crooked and Hussar creeks, east of Harrison, in central Boone County, the formation is 10 to 20 feet thick. It is only 15 feet thick near Yardelle, in northern Newton County, but farther west, on Buffalo Fork, it is thicker, reaching a maximum of 150 feet south of Compton.[8]

The St. Peter sandstone is well developed and widespread in the southern part of the Yellville quadrangle, in northern Searcy and southern Marion counties, but the study of this region, which is in progress at the present time, has not yet reached the stage where precise measurements are available. The thickness of the formation is probably not materially different from its thickness farther west, in the vicinity of Jasper, and farther east, in northern Stone County, where it varies in thickness from about 50 to 150 feet and averages about 75 feet.

In Warner Mountain, in southeastern Marion County, the St. Peter sandstone is 50 feet thick. Farther east, in Stair Mountain opposite Buffalo City, the thickness is the same. This thickness persists in Matney Knob, in southern Baxter County. In Sugar Loaf Mountain, in southwestern Izard County, the sandstone is 126 feet thick. It thins northeastward to 90 feet in Pilot Knob and maintains about this thickness in the neighboring Turkey Knob and Twin Knobs, northeast of White River, in western Izard County. On Roasting Ear Creek, in northern Stone County, and on Big Creek and other tributaries of Buffalo River, in eastern Searcy and Marion counties and southern Baxter County, the formation is 65 to 85 feet thick.

The formation is considerably thicker in the vicinity of Sylamore and eastward to Guion, in southern Izard and northeastern Stone counties. Thus, west of Boswell, on the opposite side of White River, the sandstone is 150 feet thick, and its thickness is the same across from Mt. Olive. Southwest of Perrins Ferry it is 125 feet in thickness and about the same thickness on Livingston and Sylamore creeks. Northwest of Sylamore, on the river, its thickness is 135 feet. In Rocky Bayou and at Guion the sandstone is 150 feet thick. The formation thins northward from the river, having a thickness of 100 feet on Lyons and Twin creeks and 115 feet east of Candlestick Knob. At the heads of these creeks it is generally 50 to 75 feet thick.

[8] Eureka Springs-Harrison Folio, p. 7.

BLUFF OF ST. PETER SANDSTONE THREE QUARTERS OF A MILE NORTHWEST OF WILLIAMSON, IN IZARD COUNTY

Farther east in the Batesville region, in northern Independence County, its thickness is great but variable. According to Miser it is 200 feet thick on the west slope of Pine Mountain, at least 75 feet thick 1½ miles west-northwest of Williamson, 125 feet thick in the vicinity of Cushman as shown by the log of the well at the Southern mine, and 120 feet thick near Sandtown.[9]

The variability in the thickness of the St. Peter sandstone is attributable to uneven deposition, post-depositional differential settling, the unevenness of the eroded floor upon which the sand was spread out in an advancing sea, and the erosion that has in places stripped off its stratigraphic cover and removed partly or entirely the underlying sandstone.

TOPOGRAPHIC EXPRESSION

The outcrop of the St. Peter sandstone is typically a precipitous slope (see Pl. II), the height of the bluffs in places representing the full thickness of the sandstone and in others including beds of overlying and underlying formations. These bluffs are conspicuous features along Buffalo Fork of White River north and northwest of Jasper, and on the south side of White River from Buffalo City eastward to Sylamore. The vertical faces of the bluffs are fluted in many places, and the upper edges of the sandstone at the top of bluffs are more or less rounded. Streams descending the escarpments have carved narrow, V-shaped steep gorges. (See Pl. III.) The base of the sandstone is marked in many places by springs. The water seeps downward through the sandstone and then flows along the contact of the porous sandstone and impervious underlying limestone to places of exit.

Where the sandstone underlies considerable areas it yields a thin, porous soil that is readily gullied to form a gently rolling surface. Above this undulating surface rise isolated knobs, ledges, pinnacles, towers, and turrets, some of them fantastically carved and known locally as "hoodoo rocks." They are of sufficiently frequent occurrence to be a diagnostic feature of St. Peter outcrops, but unfortunately the Calico Rock and Kings River sandstones, in the underlying Everton formation, display similar features, so that discrimination between the outcrops of these formations must in places be made by other means.

[9] Miser, H. D., Deposits of Manganese Ore in the Batesville District, Arkansas. Bulletin 734, U. S. Geological Survey, p. 17, 1922.

STRATIGRAPHIC RELATIONS

In the Ozark region of northern Arkansas the St. Peter sandstone normally overlies the Everton limestone and is succeeded upward by the Joachim limestone. The sandstone is separated from the Everton by an unconformity, but the Joachim rests with apparent conformity upon the upper surface of the sandstone.

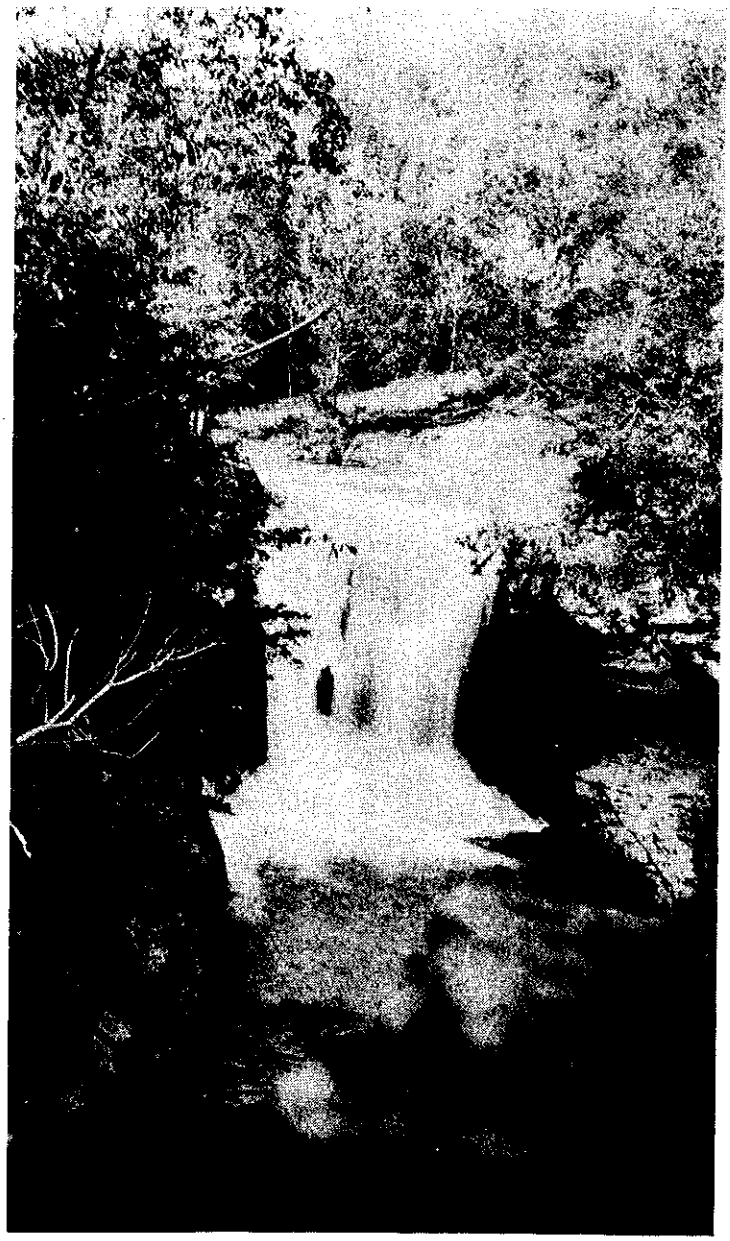
During the interval preceding the deposition of the St. Peter sands the upper surface of the Everton was profoundly eroded and locally the formation was entirely removed, together with underlying beds. As a result the base of the St. Peter in places rests upon the upper layers of the Everton, again upon the middle or basal layers of that formation, and in places upon older formations below the Everton. Thus, at the mouth of Piney Creek, in the Eureka Springs quadrangle, the sandstone rests upon the Kings River member in the lower part of the Everton formation. In a small area on Osage Creek, in the western part of the Harrison quadrangle, central Carroll County, pre-St. Peter erosion completely removed the Everton, so that the sandstone rests upon the Powell limestone.[10]

In the Yellville region the formation underlying the St. Peter everywhere is mapped as the "Yellville formation," a term including the Cotter, Powell and Everton formations.[11] The upper surface of the "Yellville" was much eroded before the deposition of the St. Peter sands, so that the contact of the St. Peter sandstone with the underlying formations is very irregular. In Stone and Baxter counties and farther east the St. Peter rests upon the Everton formation, which was submaturely dissected previous to St. Peter deposition, so that in places the St. Peter rests upon layers in the upper part of this formation, and again upon layers in the middle or lower part of the formation. Locally, as near Melbourne, the sandstone rests upon the Calico Rock sandstone, the upper Everton having been entirely removed before the St. Peter sands were deposited.

The Joachim limestone generally overlies the St. Peter sandstone in the eastern part of the Ozark region, but west of Newton County the Joachim is not known. In this region, including Madison, Carroll and Boone counties, the St. Peter is overlain unconformably by the Sylamore member of the

[10] Eureka Springs-Harrison Folio, p. 7.

[11] Adams, G. I., Purdue, A. H., and Burchard, E. F., Zinc and Lead Deposits of Northern Arkansas. Prof. Paper No. 24, U. S. Geological Survey, Plates IV and V, 1904.



MARBLE CITY FALLS, NEAR WILLCOCKSON, IN NORTHERN NEWTON COUNTY, ONE OF THE LARGEST WATERFALLS IN THE ST. PETER SANDSTONE

Chattanooga, by the Chattanooga shale itself, by the St. Joe member of the Boone limestone, or by higher beds of the Boone. On War Eagle Creek, in Madison County, and farther north, on Kings River, the St. Peter is overlain by the Sylamore sandstone. This relationship continues into central Carroll County. East of Harrison and at Bellefonte the Sylamore is again present, overlying the St. Peter. In the southern part of the Harrison region, in northern Newton County, the Joachim normally succeeds the St. Peter.

In the Yellville region the St. Peter is overlain in places by the Joachim limestone, and in other localities by formations younger than the Joachim. Here, as elsewhere in Arkansas, the Joachim succeeds the St. Peter conformably. Where the Joachim is absent younger formations succeed the St. Peter unconformably, locally with angular discordance. Thus, according to McKnight, on the east side of Cabin Creek the Joachim rests upon the St. Peter. Parks reports the presence of Plattin limestone in the Rush district immediately above the St. Peter sandstone.[12] In other localities the St. Joe limestone or the Sylamore sandstone lies above the St. Peter.

East of the Yellville region, on White River, Buffalo River, and Sylamore and Livingston creeks, the St. Peter is overlain by the Joachim limestone. In the Batesville area, as mapped by Miser, the Joachim also everywhere succeeds the St. Peter sandstone.[13]

CORRELATION

In Table 2 an attempt has been made to correlate the St. Peter and adjacent formations with their generally accepted stratigraphic equivalents in neighboring states. The St. Peter of Arkansas is the equivalent, of course, of the St. Peter of Missouri, Illinois, Iowa, Minnesota and other Mississippi Valley states. In northeastern Oklahoma the St. Peter has been called the Burgen sandstone, but that name has now been abandoned, since Ulrich considers the Burgen the equivalent of the St. Peter.[14] Mrs. Edson has recently prepared a correlation table of the Ordovician formations of Oklahoma and concludes that the Wilcox sandstone is the equivalent of the Burgen and St. Peter sandstones.[15] No equivalent of the St. Peter

[12] Personal communications.

[13] Miser, H. D., Deposits of Manganese Ore in the Batesville District, Arkansas. Bulletin 734, U. S. Geological Survey, 1922.

[14] Ulrich, E. O., Boulders in the "Caney" Shale. Bulletin 45, Oklahoma Geological Survey, 1927.

[15] Edson, Fanny C., Ordovician Correlations in Oklahoma. Bulletin Am. Assoc. Petroleum Geologists, Vol. XI, No. 9, pp. 967-975, 1927.