DESCRIPTION OF THE FAYETTEVILLE QUADRANGLE

By George L. Adams and E. O. Ulrich.

INTRODUCTION.

Topography of Ozark Region.

General features.—Briefly defined, the Ozark region embraces the southern half of Missouri, a very small corner of southeastern Kansas, the northeastern part of Indian Territory, and the northern part of Arkansas. On its borders are the cities of St. Louis, Jefferson, Marshall, Nodaway, and Joplin in Missouri; Galena in Kansas; Waynesville in Indian Territory, Fort Smith and Batesville in Arkansas, and Poplar Bluff in southeastern Missouri. The streams which are the outlets of this region are the White, Current, and Red Rivers. The southern part of the region is the Ozark Plateau. The Boston Mountains consist of two divisions: the Boston Mountains and the Ozark Plateau. The Boston Mountains occupy the eastern part of Indian Territory, Fort Smith and Batesville in Arkansas, and a part of southeastern Kansas. The Ozark Plateau lies between the Boston Mountains and the Arkansas Valley, the region is an elevation of the Ozark Mountains. A lower elevation is maintained, since the dip of the surface is not maintained, since the dip of the surface is not maintained, since the dip of the surface is not maintained, since the dip of the surface is not maintained, since the dip of the surface is not maintained, since the dip of the surface is not maintained, since the dip of the surface is not maintained, since the dip of the surface is not maintained, since the dip of the surface is not maintained, since the dip of the surface is not maintained, since the dip of the surface is not maintained.
the Mississippian limestones and constitute a deeply dissected highland. They rise above the structural plain of contrast with the rocks of the Springfield upland, structural plain are principally limestones with member, which usually underlies the shale. There are, however, apparently wanting in a large part of the remain­ ing portion of the region. There are, however, limestones, at which horizon springs also issue. They mostly are formed by solution and (breaking down of the limestones, constituting the northern edge of the Boston Mountains. Elkhorn Mountain, in the northern edge of the BTC area and dolomite crystals are found. The floor is developed on the surface of the columnar section sheet.

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streams have eroded the higher formations, uncovering Ordovician rocks, and to these facts the exposures are due. The exposures are found on White River and on Illinois River.

**Yellville Formation.**

This formation, of which only the upper part is exposed in the Fayetteville quadrangle, consists of magnesium limestone and dolomite, in which nearly bedded layers varying in thickness from a few inches to several feet. These layers exhibit various in composition, and more in physical character. The beds containing much lime and have a soft gray color. The more siliceous varieties are of a dark, brownish color, and very tenacious. Those containing numerous small, rounded grains of quartz, exhibit some variation in thickness, frequently occurring. Traced laterally in one direction, the grains in such a layer may become so abundant as to constitute a conglomeratic sandstone, while in the opposite direction they may soon fail entirely. As a rule these quartz grains are associated with oolite. These quartz grains are generally present. Because of its white and sugary appearance, and since it nearly always rests under the later deposits occupying the Mississippi valley, the formation has been recognized it retains very well, though it frequently weathered with an even surface and have a soft gray color. The beds containing much lime and little silica are usually white, its surface is often brown, from a quarter to several inches in diameter. Locally this basal limestone contains a considerable amount of iron pyrite in certain localities, and this weathers to a bluish black color. The usual absence in this region of at least the lower members of the Kinderhook group suggests an occasional and probably always inconspicuous unconformity also at the top of the shale.

**Carbonton Beds.**

The lowest formation of Carboniferous age is a small group of beds called the Carbonton. These beds consist of a few inches thick and are surrounded by a few inches of green shale. The upper part of the Carbonton is often changed, and the formation is usually covered with a few inches of green shale. The upper part of the Carbonton is often changed, and the formation is usually covered with a few inches of green shale. The upper part of the Carbonton is often changed, and the formation is usually covered with a few inches of green shale. The upper part of the Carbonton is often changed, and the formation is usually covered with a few inches of green shale. The upper part of the Carbonton is often changed, and the formation is usually covered with a few inches of green shale. The upper part of the Carbonton is often changed, and the formation is usually covered with a few inches of green shale. 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ous. It has many diverse colors, such as black, green, and dull, and the more siliceous varieties are of a compact texture, being easily frac­
tured, dentured into small angular fragments. The chart, which is frequently fusiform, occurs as concretions in the limestone strata, as lenses or beds. There is much efflorescence distributed through certain of the limestones and, on removal of the line by solution the rock has a porous texture. The term "cotton rock" is used locally to design­
icate this variety. As its disintegration progresses such a rock will crumble into a white, chalky bed, such as may be seen in the entrails of some Gravetian. A "Tripoli" rock, so called, which is quarried and used for veneer, is obtained from similar silicious beds from which the line has been removed by solution, thus rendering the rock porous. To be of commercial value the rock must be free from flat concretions or nodules, which would prevent its being cut and dressed easily.

The limestones of the Boone formation are often free from silicious matter and occur both as thin and as massive beds. They are commonly crystalline and usually have a light-gray color on weathered surfaces. The sandstones are often stained with dark matter, and where struck give off a flat color. Usually the limestones are fus­
iform, and there are some beds which contain numerous crinoidal stems. The rock breaks with a conchoidal fracture and is very tenacious. The more even beds furnish curves and the purer varieties are burned for lime.

BATESVILLE SANDSTONE.
The Boone formation is succeeded by rocks which are more, or less, impure sandstones. In certain localities there are sandstones and limestones inter­stratified with sandstones. The sandstone beds are yellowish and generally are rather more prominent than the limestones. The more argillaceous ones have a greyish-green color. The outcrops occur in small areas scattered over the northern part of the quadrangle and are composed of sandstones which have been left by erosion. The bed of stratified sandstone is the most prominent in the outcrops, and the base of the bed has been eroded and removed. It is a light-gray or brown color on weathered surfaces. The rock is not persistent throughout the formation as definite beds. The rocks are of a greenish-gray color and have been quar­ried for flagstones.

The small patches in which sandstones and silt­stones occur are found over the area of the widely distributed Boone formation have been referred to the Bateville from their relation to the underly­ing rocks. One of these is west of Bentonville, which has a maximum thickness of 25 feet, con­taining flaggy layers and some impure interstratified limestones. The rocks are of a greenish-gray color and have been quar­ried for flagstones.

Along the base of Collins, Greersville, and the Yellville Quadrangle, the Bateville from their relation to the underly­ing rocks.

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by the uneven upper surface of the Yellville limestone and by the abrupt variations in thickness, or the total absence of the beds, in certain localities, of the Sylamore sandstone. Where present this Devonian sandstone is the first deposit following the Yellville limestone, and its stratigraphic relations to the latter show clearly that it served to fill considerable hollows in the limestone, and thereby to change the way for the more evenly spread Devonian shale. There is no record preserved within the quadrangle of the sudden submergence in the Silurian period, nor in the earlier parts of the Devonian period, and it is probable that the Oriskany rocks during that time formed the surface of a great land area in the Ozark region and were washed away under atmospheric agencies.

Toward the close of the Devonian period the sea gradually encroached upon the land, and a bed of sand, probably derived by erosion from the land, was deposited. These beds are now known as the Chattanooga shale and the Sylamore sandstone member.

The Carboniferous period began with a comparatively brief, and perhaps local, regression of the sea. This is indicated by the general absence of deposits representing the earlier stages of the Kingshook group. However, before the close of the Kingshook period, the land near the sea was again submerged. In consequence of this advance, and the descending of the sea occasioned thereby, the distance to the shore increased and the sedimentation changed from mud to limy deposit. The condition of the surface upon which the pre-Carboniferous formations form what is known as the Boone formation. The beds first laid down were nearly pure lime and now constitute the St. Joe limestone member. After this there was an accumulation of silt, which gave rise to the clays of the upper part of the Boone formation.

After the deposition of the Boone formation the sea retreated once more. This retreat is indicated by the restriction of the next following deposit, the Missouri shale, to the eastern part of the area and the occurrence of the Porcelain sandstone in the western part of the quadrangle, and it is probable, however, that this sandstone marks merely the later position of the shore. The formation of this shale, which in places is accentuated into low domes and synclines, is partially preserved at the present time and can be traced with certainty, is in late Tertiary time. Land reappeared in the eastern part of the quadrangle, and the condition of the surface upon which the succeeding formations rested was not unlike that found in the area above described, and is perhaps a continuation of it.

The evidence of the fossils the Pitkin formation is the highest of the Mississippian series. Prior to the formation of the succeeding beds in the Silurian period, the beach of the sea retreated and was elevated by the restriction of the next following deposit, a sandstone that is the Batesville sandstone, which rests on the limestone. The axis of this sandstone abuts against the Fayetteville shale, which is the lowest of the Silurian rocks. This sandstone marks that the rocks have a gently undulating structure. The axis of the succeeding beds becomes more nearly horizontal and is the only stable layer that is exposed in the quadrangle. This is the Pulaski limestone, which is the highest of the Silurian rocks and contains an admixture of sandstone and shale. This sandstone affords the best datum for studying the broader structure. An example may be seen in the railroad cut near Price Mountain, where the limestone is exposed. There is a fault which has a dip of 45° E., which is in evidence near Chambers Spring, where a remnant of the Fayetteville shale occurs. The limestone is in evidence near Price Mountain, where a fault which is on the same strike with the other fault has an angular relationship of 90°. The maximum displacement is 200 feet in the same direction. In connection with this fault there is an area of down faulting which is nearer this quadrangle than was the corresponding area near the mouth of the Arkansas river. This fault appears to extend to the northeast far beyond this quadrangle.

In the northeast part of the quadrangle there is, locally, evidence of folding and displacement, but the structure can not be traced very far owing to the surface covering of clay. At certain places the Batesville sandstone is exposed and its near absence in other parts of the quadrangle is due to the action of the Willow wind, which has removed the greater part if not the whole of the Silurian rocks in the quadrangle. Moreover, the structure can not be traced very far owing to the surface covering of clay. At certain places the Batesville sandstone is exposed and its near absence in other parts of the quadrangle is due to the action of the Willow wind, which has removed the greater part if not the whole of the Silurian rocks in the quadrangle. Moreover, the structure can not be traced very far owing to the surface covering of clay.

The Carboniferous period is divided into two great epochs, the Mississippian and the Pennsylvanian, containing the Coal Measures. The Mississippian period is another great era of marine deposition, and is characterized by the deposit of sandstones, shales, coal, and other similar sedimentary rocks. The Pennsylvanian period is remarkable for the deposition of coal during a period of great subsidence of the land. The Ordovician rocks during that time were elevated and the coarser sandstones were deposited on the land. The next period, the Silurian, was characterized by the deposition of sandstones and shales, with the predominance of the sandstone in the central part of the quadrangle. The next period, the Mississippian, was characterized by the deposition of sandstones, shales, and coal. The next period, the Pennsylvanian, was characterized by the deposition of sandstones, shales, and coal. The next period, the Carboniferous, was characterized by the deposition of sandstones, shales, and coal. The next period, the Permian, was characterized by the deposition of sandstones, shales, and coal.

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fields which are constantly enriched and renewed by the overflow from the hills. Where the Chattanooga and Fayetteville shales enter the soil would be poor and thin if it were not for the addition of material which has been transported from neighboring hills.

In the area of the sandstones of the Morrow formation the soil is usually a light, sandy loam. The presence of the limestone ledges where they form heavy ledges modifies this character considerably, since the washing of the surface water distributes over a considerable belt the soil resulting from the decay of these limestones. In decomposing, the shales, which are interstratified, receive such an admixture of sand from the higher slopes that they do not form a distinct class of soils. The areas of alluvial soil are the richest farming lands, but they are of limited extent, since none of the streams have extensive flood plains. This class of soil is found principally along White and Illinois rivers.

Clay and shales.—Briickklays have been operated to supply the local trade, their production has never been large, owing to the facility with which they may be worked.

In the southern part of the quadrangle shales are available which could be utilized in making brick and tile, but the cost of operating is too great considering the present local demand and the condition of the general market.

Building stone.—The St. Joe limestone is an even-bedded stone which is well adapted for walls and heavy masonry. Its occurrence at Sulphur Springs is favorable for quarrying, and it is there conveniently near the railroad, so that it can be shipped. It has been used to a limited extent and quarries are already open. This limestone has also been quarried on Little Sugar Creek, where it forms a conspicuous ledge. At many places there are quarries in other beds of the Boone limestone to supply the local demand. Sandstone is also commonly employed in building, since it is soft and therefore easily dressed and quarried. There is an abundance of it in the southern part of the quadrangle, and in some of the smaller areas of the Batesville formation in the northern part it has been quarried for building blocks and for flagstones because of the facility with which it can be worked.

Lime.—Small limekilns have been operated at many places wherever there has been a demand for the product. Half a mile south of Johnson there is a kiln which is situated on the railway at a point that is convenient for quarrying and shipping. The stone which is used at this place is obtained from the more massive upper beds of the Boone formation, which are here free from chert. Another kiln is in operation at a point about 1.5 miles south of Sulphur Springs. This is conveniently situated and the product of the kiln is sold to be of excellent quality. The stone used is limestone of Kinderhook age that here forms the basal part of the St. Joe member of the Boone formation.

Coal.—The coal which is mined in secs. 20 and 21, T. 37 N., R. 20 W., in the vicinity of Luminous bank, is a hard, lustreous, bituminous coal. The bed is only 14 inches thick, and its thinness prevents its being worked on any large scale, but considerable coal is supplied to the local trade. Mines are also operated near the summit of Robinson Mountain, where the same formation occurs, and the coal there is of a similar character and thickness. There is little prospect that beds of commercial importance will be developed within the quadrangle.

Prospects, drill holes, and shafts.—Considerable money has been spent in drilling wells with the hope of finding oil or gas, and a number of shafts have been sunk in prospecting for lead and zinc. The records of the drill holes conform with the general section of the rocks as exposed within the quadrangle, and where the holes reach a considerable depth they penetrate the magnesian limestones of the Ordovician rocks. Oil or gas has, however, not been found. In probing through the Chattanooga shale, which is usually about 50 feet thick, the cuttings of the drill commonly give off a pungent odor, and this has been an encouragement to the prospector. The Chattanooga shale is, however, not known to be oil-bearing, and the rocks above and below cannot be expected to contain either oil or gas.

The Boone limestone, which is so widely distributed over the quadrangle, is the formation which contains the lead and zinc deposits of southwestern Missouri, and the finding of small quantities of lead and zinc has induced many people to prospect with the hope of finding larger bodies of ore. Thus far no one has met with success. Usually the prospects have not been located with respect to fault lines or fissures. Judging from results obtained in neighboring mineralized regions, it may be worth while to prospect some of the localities in the quadrangle in which the rocks have been disturbed. The conditions which brought about the deposit of lead and zinc in southwestern Missouri do not, however, seem to have prevailed in this quadrangle.

February, 1905.