

township, the parting runs out nearer the bluffs along the south side of Muddy Fork of Silver Creek. From this point westward it is carried lower and lower in the hills by the general westward dip of the rocks until it passes beneath Blue River.

It will be noticed that the head waters of Muddy Fork of Silver Creek and Blue River overlap by some ten miles, and that the line of parting passes to the south of Muddy Fork of Silver Creek and to the north of Blue River.

The region between these two streams has had its limestone removed by their combined erosion. It is interesting to note that this is the only locality in the Knobstone region where there is such an overlapping of east and west flowing streams.

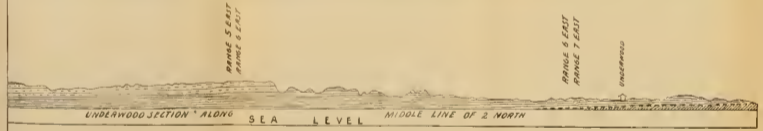
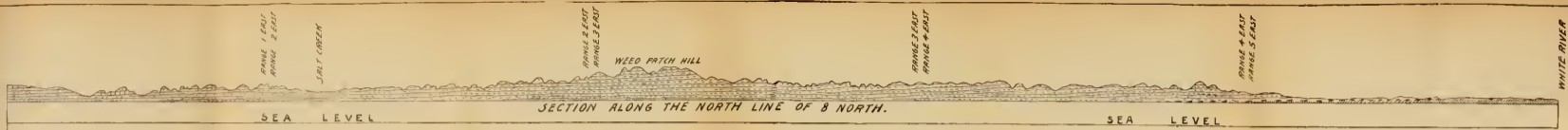
The knobs of this locality are formed by a high plateau sloping gently to the west, with an abrupt slope to the east, and north on the south side of Muddy Fork of Silver Creek, and a steep south slope on the north side. The hills immediately north and south of Blue River are less rugged.

In a general way the lower limit of the group runs in a direction somewhat parallel to that of the upper limit, making a slight westward bend from block 182 to block 192 of the Illinois grant, where it crosses Muddy Fork of Silver Creek and turns to the northeast.

It will be noticed that the lower limit does not make as great a bend to the west as does the upper limit. This is due to the fact that the lower limit is very near to the drainage level of the country. In this region the lower limit of the Knobstone shale is marked by the greenish Rockford Goniatite limestone, which has a thickness of from ten inches to three feet. Immediately below the Goniatite limestone is the Devonian black shale.





FOUR COMPARATIVE CROSS SECTIONS OF THE KNOBSTONE GROUP OF INDIANA. By L. F. BENNETT.

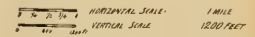
In connection with the geological work of the State University in 1897 several cross sections of the Knobstone group were made in order that its width and the distribution of the rocks forming it might be discovered. It is with four of these comparative cross-sections that this paper deals. The elevations were obtained by means of the aneroid barometer and the locations by placing and inquiry. As the main object



FOUR COMPARATIVE CROSS-SECTIONS
OF THE
KNOBSTONE GROUP
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INDIANA

By
L. F. BENNETT AND OTHERS OF THE
INDIANA UNIVERSITY GEOLOGICAL SURVEY.
1897.

- LEGEND
-  LOWER CARBONIFEROUS LIMESTONE
 -  KNOBSTONE GROUP
 -  GONIATITE LIMESTONE
 -  DEVONIAN BLACK SHALE



was to work out the topography, not so much attention was paid to the geology, but in most places it was worked out with some degree of accuracy.

This formation is made up of sandstones and shales. Above it is the Subcarboniferous limestone; below, the New Albany black shale. In the south the shale predominates; in the north, the sandstone. At the base of the formation is a layer of hard greenish-blue limestone, called the Rockford Goniatile limestone. This layer is very persistent and varies from ten inches to three feet in thickness. In the southern part of the State, north to where it is covered by a glacial clay, the eastern limit of this limestone is but a few feet below the general surface of the country, being covered by soil and clay to the depth of eight to twenty feet.

None of the sandstone is pure. It is mixed with considerable quantities of muddy shale and also contains small quantities of iron, which is shown in the weathered rock. The shale is muddy, easily eroded, and contains large quantities of iron nodules. In most places there is a gradual transition from the shale to the sandstone; just where one leaves off and the other begins it is difficult to tell. This is especially true in the southern part of the State. Farther north there are alternating beds of shale and sandstone, but the beds of shale are much the thinnest.

The formation shows an entirely different topography in the south from that in the north. It makes up the knobs of Floyd, Clark, Scott, Washington and Jackson counties and the hills of Bartholomew, Brown and Morgan counties.

In the south, in Floyd and Clark counties, the knobs present a bold face toward the east; they are steep and vary from 200 to 400 feet in height. East of the knobs the country is comparatively level and farther north outlying hills are found. These outliers in northern Jackson and in Bartholomew counties extend eastward from the main range of hills five or six miles.

In the four cross-sections under discussion the dip of the rock was not determined, but it was measured in other places and found to be 26 feet to the mile to the west.

The southernmost of the four cross-sections was run in township 1 south, range 6 east, a short distance south of St. Joseph, a small town on the J., M. & I. R. R., six miles north of New Albany. The Subcarboniferous limestone is found on the top of the easternmost knob or hill and is 250 feet above the Goniatile limestone to the east. This is about the

narrowest place in the formation. It is two miles wide. Here the sandstone is 90 feet in thickness and the muddy shale over 200 feet. Both the sandstone and shale have been worn away as fast as the limestone has receded. For this reason the hills are steep and the country to the east is low and flat.

This is not quite a typical section for this region, because limestone is seldom found on the hill farthest to the east. It is usually found a mile or more west of the eastern face of the knobs.

The next section to the north, the Underwood section, was run along the middle line of township 2 north. It begins on the west side of the Illinois grant and runs west $13\frac{1}{4}$ miles. On the east are found low hills called the Guinea knobs, none of which are over 150 feet above the surrounding country, and most are much lower. On the tops of some glacial gravel is found, on others clay, due to the decomposition of muddy shale. Fifty feet above the Goniatite limestone there is a layer of muddy shale containing iron nodules, and higher up there are layers of blue shale, much bluer than is the usual color.

For four and a half miles west of the Guinea knobs the country is generally level; then the outliers of the western knobs are reached. They are made up entirely of shale and clay, except the last hill to the west, which contains sandstone at the top. The country continues rough for three miles and only one valley of any consequence is crossed; it is the valley of the Big Ox Fork. The last ascent is 250 feet where sandstone 190 feet in thickness is found. Typical of this formation, the sandstone at some depths is much muddier than at others; and in this hill, at the top, the sandstone is much muddier than about 100 feet down, where for a few feet it is comparatively pure, then it gradually grows muddier until it grades into a sandy shale, and still farther down into a nearly pure shale.

For the next two miles the country is nearly level; it then becomes more broken until the limestone is reached, four and one-half miles west of the first sandstone hill. Just beneath the limestone there is a layer of blue shale; below this is the sandstone.

The next section, the Scottsburgh section, was run along the middle line of township 3 north. It begins in the vicinity of Scottsburgh and continues westward $13\frac{1}{2}$ miles. It is comparatively level for 10 miles, the country being covered with alluvium and glacial and residual clays. The first hill of any consequence is capped with muddy sandstone, the second by the Subcarboniferous limestone.

A comparison of this section with the Underwood section shows a considerable difference. In the latter there is but little level country; the Guinea knobs are on the east; the outliers of the western knobs are four and a half miles to the west, and it is several miles farther before the limestone is reached. In the Scottsburgh section there are no outliers, and limestone is found on the second hill. The knobs make a great bend to the west in running through township 2 north and township 3 north, hence the difference in the two sections.

The Weed Patch Hill section was run along the north line of township 8 north. It is 30 miles long. It begins at the White River, two miles south of Columbus, runs across Brown County over Weed Patch Hill and ends in Monroe County.

For two miles and one-half the country is level and is covered to a depth of 30 feet or more with alluvium. The next four miles is rolling, the first two miles of which is covered with glacial clay, the latter with residual clay. A well section in the first hill shows the Goniatite limestone to be 40 feet above the surface; this is its eastern limit.

The higher hills begin six and one-half miles west of White River. The first hill rises almost abruptly 150 feet and is almost entirely made up of muddy sandstone. Throughout the rest of the section the hills are steep and high. In many places it is but 300 or 400 yards from one hill to the next, and the hollow between is 150 feet deep and sometimes deeper. Shale is found in the deepest hollows for the first six miles. Farther on no shale is found except in thin layers at various heights in the sandstone. This is one peculiarity of the rock in this section. The sandstone greatly predominates; in fact, it is $22\frac{1}{2}$ miles wide, and through it there are these thin beds of muddy shale. All gradations between the nearly pure sandstone and shale are found and in several places the sandstone is nearly blue.

Weed Patch Hill was made 1,135 feet high by the barometer; the correct height is 1,147 feet. Sandstone is found all the way to the top. It is much higher than any of the hills on either side.

Seven miles farther west Salt Creek valley is crossed; it is one-half mile wide. Still farther west, a mile and a half east of the west end of the section, there is a layer of fossiliferous limestone. It is found at the base of the hill in the sandstone, and is 15 feet thick and is made up almost entirely of crinoid stems. One-fourth of a mile farther west, at the base of the next hill, there is a fifteen-foot layer of blue shale.

It would naturally be supposed that the watershed is at the highest point, namely, at Weed Patch Hill, but this is not the case. It is about two miles west of the eastern face of the hills. Most of the streams crossed east of Weed Patch Hill flow to the southeast and empty into Salt Creek several miles below the place where it is crossed by this section. The location of the watershed, perhaps, gives a clue as to the position of the rocks that once covered this region, which is now an excellent example of a completely dissected plateau.

This last section is typical of the Knobstone north of White River. The limestone has pushed farther to the west, leaving a wide area covered by the Knobstone, most of which is the muddy sandstone. The sections south of White River are also typical for that region. The St. Joseph section has very little sandstone exposed and the shale greatly predominates.

A glance at the map will explain why it is there are so many hills in the north in the Knobstone group; it is because of the thickness and wide distribution of the sandstone.

NOTES ON INDIANA GEOLOGY. BY J. A. PRICE.

In connection with the field work in geology at Indiana University during the last season the distribution of a strip of limestone, usually surrounded by outcrops of the Knobstone group and lying east of the main mass of the Lower carboniferous limestone of Indiana, was in part outlined. It is with this unconformity that this paper deals.

In the Report of the State Geologist for 1896, page 391, a strip of limestone commencing at Limestone Hill, eight miles southeast of Bloomington, and extending east of south through Heltonville to and probably beyond Fort Ritner, Lawrence county, is referred to.

Without attempting to solve the conditions under which this limestone was laid down, it is desired to touch upon the extent and relative position of this limestone strip and the Knobstone north and south of the points referred to in the report.

In sections 26, 27, 34 and 35, township 4 north, 2 east, Washington County, between Twin Creek, which flows north through sections 35, 36 and 25, and the East Fork of White River, which flows south through