

# JEFFERSON COUNTY.

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BY W. W. BORDEN.

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This county is located in the southeastern part of the State and is named after Thomas Jefferson. It is bounded on the north by Jennings and Ripley, east by Switzerland, south by the Ohio river and Clarke county, west by Scott and Jennings, and contains 380 square miles. Madison is the county seat, which is pleasantly situated on the Ohio river, contains twelve to fifteen thousand inhabitants, and is the site of extensive manufactures.

I am indebted to Dawson Blackmore, the first child born in Madison, November 4, 1812, who is now living at Indianapolis, for the following history of this city. His father moved from Beaver county, Penn., and settled at Madison, Ind., in 1810. He engaged in manufacturing hats, and bartered with the Indians for furs.

The land on which Madison stands was purchased at the land office in Jeffersonville, Ind., in 1809 by Jonathan Lyons and John Pall, at six dollars and six cents per acre. The first sale of town lots took place February, 1811. The proprietors donated a public square, to be used for the public buildings, but to revert to their heirs if not used for the purpose designated.

In early days Jefferson county included Jennings and Scott counties. Among the first settlers was Mr. Hill, Col. John Vawter, and David Black. When first settled the growth of timber, on the land where Madison is situated,

was very heavy, consisting mainly of large poplar, buckeye, black walnut and gum.

North Madison was at first the nucleus of a Baptist settlement, and had a church called Mt. Gilead.

The topographical features of the county are varied, being gently rolling in the western part, table land in the central part, elevated bluffs on the Ohio river, and lofty hills in the northeastern part of the county. The bluffs on the Ohio river and along all the streams on the eastern border of the county are from three to four hundred feet in height, and give rise to romantic scenery on every hand. Here the streams have cut deep gorges by eroding the Niagara and Clinton formations and the less persistent shales and limestones of the Cincinnati epoch which lie at the base. The more rapid weathering of the underlying soft shaly rocks produced the beautiful water falls of Clifty and other streams. These falls have been cut back from the Ohio to their present position, at least one and one-half to two miles.

The Ohio river flows along the greater part of the southern boundary of the county and is bordered by precipitous bluffs with overhanging cliff rocks and rich alluvial bottoms. The cliff rock is one of the prominent features of the scenery along all of the streams. At some localities it appears as a column standing on a high bluff, and at others the hill sides are strewn with massive blocks, some of which are large enough to support a growth of trees, bushes and vines; or, having descended to the foot of the bluff, to deflect the passing stream from its course.

The most broken portion of the county is in the northeastern part on Indian-kentuck creek and its tributaries. Here the hills are almost exclusively composed of the Cincinnati formation.

The elevated hills afford a good outlook over a landscape of rare beauty. Before disturbed, this region was heavily timbered, and some good size trees still exist along the bluffs. The land in this section is considered the most productive in the county, it is constantly replenished with

plant food by the weathering of the fossiliferous limestone and shales of the substratum and hillsides. Amid the rugged scenery along the water courses, was the favorite abode of the pre-historic races, where they found suitable locations on which to build their stone fortifications, earth-works and burial places. About their long deserted homes are found flint chips, stone spear points, arrow heads, stone battle axes, elaborately wrought drinking cups, and finely finished stone ornaments, some of the latter were probably used as badges of rank, or mementoes of deeds of valor. On every hand are found the remains of a nation proficient in the manufacture of stone implements. Their veneration for the dead caused them to erect memorial stones which remain as monuments of their devotion. From the relics left by these lost races, efforts are made to decipher their history, but the greater part will forever remain blank.

There are a number of prominent bluffs or points along the Ohio river in this county, as "Marble Hill," "Monument Point," and "Plow-handle Point." At "Fair Prospect," a short distance below Hanover, is the residence of Capt. Geo. Logan. He is now ninety-one years of age. He first descended the Ohio in 1801, and settled at Fair Prospect in 1815.

A short distance below Madison is the so called "Devil's Back Bone," an elevated bluff detached from the main range and rises more than two hundred feet above the bed of the river. The space between this and the main bluff was doubtless the river bed in the Champlain era. There are prominent points higher up the river, as at "Cedar Cliff" and at Brooksbury. This county is well watered in the western part where there are abundance of springs flowing from fissures in the limestone. In the central and eastern part, cisterns are much resorted to for a water supply. A number of springs flow from the summit of the Clinton formation on the eastern border of the county and supply water to drinking troughs that are, for the convenience of travelers, placed on the roadside leading down the incline

toward Madison. Along with the very marked topographical feature, and the tottering and falling "Cliff Rock" are to be seen water falls, which, as before stated, form a number of streams in the slowly weathering Clinton rocks. These falls are from a few feet to eighty-five feet or more in height. Near Madison are, first, Cliff Falls, next, Dead Man's Falls, Crow Falls at Hanover, Butler Falls, Chain Mill Falls, Falls number "One and Two," and also Dog Falls on Saluda Creek.

#### STREAMS.

There are a number of streams traversing Jefferson county, all of which, excepting Indian-kentuck creek, and a few smaller creeks, flow from the Ohio river in a west-northwest course and constitute the head waters of Muscatatuck river. The principal streams are: Big creek, which rises in Ripley county, Graham creek, Middle Fork, and South Fork of Big creek, formerly called White river, which rises in Hanover township, Woods' Fork, Stucker's Fork and Smock's branch, which rises near Hanover and receives its principal water supply from "Big Spring," a noted never failing spring on the land of Geo. Millican. The smaller streams of importance are: Harber's creek, Neal's creek, Bear creek and Lewis' creek, which rises in the interior of Jefferson county and flows into Big creek above the mouth of Graham creek. Bordering on Graham creek the land is very broken with sinks and small caves. The timber in this region is very fine consisting principally of beech, white oak, poplar, sugar tree, ash and black walnut. Large grape vines, six inches in diameter, are seen along some parts of these streams, reaching to the tops of the tallest trees. The streams flowing into the Ohio river are Little and Big Saluda, Clifty creek, Bee Camp creek, which are small streams, Indian-kentuck creek, which is a large stream formed by the union of the North Fork and the Brushy Fork and the West Fork, and flows into

the Ohio river at Brooksbury. A remarkable feature of the streams of this county is, that they have as a general thing, cut deep gorges, some of which, especially on the eastern border, have attained the depth of two to three hundred feet. In their beds are found a superabundance of debris derived from the harder parts of the Cincinnati group. On Clifty creek and other streams there is associated with the debris large and small circular masses of *Favistella stellata* (coral). These deep gorges are the result of the streams flowing over strata which are very friable. All the streams flowing west and southwest have their source in the Devonian and Niagara rocks, and have, since they first traced their course, followed the same channel with but little variation. The current is accelerated by following the dip of the strata, and their deep cut beds precludes the formation of extensive bottom lands. Along the streams flowing over quite horizontal strata, or where the banks are a soft material readily yielding to the force of the current, or where the mouth is not much lower than the source, we find broad valleys with fertile alluvial soil.

### GEOLOGICAL FORMATIONS.

The geological formations of this county are embraced in the Quaternary age: Devonian and Upper and Lower Silurian. These several formations are traceable by their outcrops from the western part of the county on Big creek, to the Ohio River on the eastern and southern border. The stratigraphical section is as follows:

#### CONNECTED SECTION OF JEFFERSON COUNTY, INDIANA.

##### *Quaternary System.*

1. Alluvium, Recent.....2 ft. to 10 ft.
2. Champlain .....4 ft. to 18 ft.
3. Glacial or Drift.....0 to trace.

DEVONIAN AGE. *Hamilton Period.*

4. New Albany Black Slate, Genesee  
Epoch of New York..... 0 to 40 ft.
5. Corniferous Period, Corniferous  
Epoch ..... 0 to 18 ft.

## UPPER SILURIAN AGE.

6. *Niagara Period, Niagara Epoch..* 0 to 80 ft.
7. *Clinton Epoch.....* 23 ft.

## LOWER SILURIAN AGE.

8. *Trenton Period, Cincinnati Epoch...* 0 to 300 ft.

The above is a tabulated statement of all the formations occurring in the county, and I will speak of them in their order.

The surface geology of this county comprises: Alluvium, Champlain or terrace and Glacial drift. The recent alluvial is formed along the streams and on the hill sides from the constant weathering of the shales, and the fossil limestones of the Devonian and Cincinnati formations, and is washed down into the narrow valleys bordering the small streams. The broadest valleys and the most elevated hills are in the northeastern part of the county, bordering on Indian-kentuck creek. The soil in this part of the county is very productive. Not only are the bottom lands, where the Cincinnati rocks outcrop, fertile, but the less abrupt hill-sides are cleared and cultivated to their summit.

On either side of Lonesome hollow or Eagle hollow, or on the hill sides along Indian-kentuck creek, or bordering Saluda creek and other small streams on the eastern side of the county, the soil is highly productive. These remarks will apply, with equal force, to the central and western portion of the county where the Devonian and Niagara outcrop. It is evident to all that the limestone lands are at present the best land in the county. These lands are rolling and support a luxurient growth of blue grass, as in the vicinity

of Lancaster and College Hill. They also produce good corn and wheat crops.

There are two or more extensive terrace lands or bottoms along the Ohio River, Big Bottom above and Loudon Bottom below Madison. These sandy, alluvial soils are among the best lands in the State and the crops are but very slightly affected by either drought or excessive rains. The terrace lands are of the Champlain period and once formed the river bottom. They are made up of sand and gravel beds, with an occasional boulder; they also contain tusks and bones of the Mastodon. There was exhumed, during the past summer, at Wm. Cordery's sand bank, three hundred feet west of the Madison and Indianapolis Railroad track, and twelve feet from the surface, part of a mastodon tusk four to five inches in diameter. It dropped to pieces upon exposure to the atmosphere. This specimen was presented to the State collection by Wm. H. Child of the "West end Drug Store," Madison. The sand pit where it was discovered was marked with ebb and flow lines of stratification.

There is a district from three to four miles in width, called the "Flats," reaching across the county four and one-half miles east of Deputy, and passing immediately west of Hanover and North Madison, and east and south of Dupont, into Jennings county on the north, and Clarke county on the south. The soil is composed of ash-gray siliceous clays of the Champlain period. In some parts of this belt, sand predominates, with occasional boulders. The want of drainage and the compact nature of the soil renders the "Flats" wet and unsuited for cultivation. The growth of timber on these lands is in the main small, consisting of sweet gum, maple and beach, yet in some sections there are good white oak, some poplar and very tall hickories. Since these "Flats" form an extensive district in this county, and are centrally located, it is a matter of very great importance to know how they may be made productive. It has been noticed that similar lands in Scott county, once considered worthless, have been much improved by clearing off the timber and

putting them in grain and clover, especially where the clover has taken deep root. These lands are as productive as any lands in the county, but the "flats" of Jefferson county appear to be even more stubborn and difficult to reclaim. In company with Dr. Harper of Madison, I examined some of this flat land at North Madison, owned by Hon. J. L. Roe, and on which he was putting down tile drains. From what we saw and from the practical tests which have been made, for some years, there can be no doubt but that tile drainage is what this land requires in order to make it as productive as the best land in the county. Lime would be a beneficial after dressing, as it absorbs carbonic acid and renders the soil porous and warm.

The Glacial or Drift epoch, follows the Champlain in the decending order. The material constituting this Age has been derived mostly from the disintegration of rocks that lie beyond the boundaries of the State and brought hither by the agency of ice, which once in the form of glaciers, covered the greater part of the country north of the Ohio river. It is composed of sand, gravel, clay and some small granitic boulders.

A few boulders are found in different parts of the county. In the gravel beds at Madison, they are quite frequent and of large size.

While the Drift is quite pronounced in Jefferson county, it is not general in the counties immediately north and gives evidence that the glaciers had reached their greatest southern limit at this point.

The following notes on Tile Draining on the Flats mentioned above, have been very kindly furnished by Dr. J. L. Roe, of North Madison, Indiana:

"A few years ago I came in possession of some land, which proved in a short time that I was worse off pecuniarily than before, from the fact that the land was so wet and unproductive that it was an expense to keep it. It could not be cultivated, and the only vegetation that flourished upon it were aquatic grasses, etc., so destitute of nourishment that a dozen acres devoted to pasture would not pay



the taxes on a single acre, and it was impossible to dispose of it even at cost. I sought for a mode to get out of the difficulty, and was induced to try the effects of under-draining, and the result has proved beneficial beyond my expectations. Portions of the land first under-drained had water standing on it the year round. A number of practical farmers visited the premises while the work was going on. The sides of the ditches afforded a good opportunity to see the quality of the "soil." They laughed at me for using the term soil; there was no soil there, only white clay. It is a fair sample of Jefferson county "Flats," and if there was any poorer land in the county they did not want to see it. The first season I planted it in corn and cultivated in the usual manner without applying an ounce of fertilizing matter. The yield was an average of 63 bushels and 4 lbs. per acre, and the grain was decided to be the best corn on exhibition at the County Fair. Corn grown upon adjacent ground, all things being equal, save that of under-draining, did not produce 20 bushels per acre. The corn was cut up and taken from the ground and the same field sown in wheat, although most of the wheat in the neighborhood was up a finger length. The yield was not great, the season being a poor one, yet larger than that of the most successful wheat grower in our section whose land is high and rolling.

Last season the same field was in corn; did not measure the crop, but it was thought to be equal to the first crop. I have it in corn again this season with a like prospect. The corn stands even in height and some stalks measure fifteen feet high, and nine feet to the top ear. I see acres of corn daily not shoulder high, though the ground on which it stands was put in cultivation the same time as mine. Those who have examined my ground say they have been misinformed in regard to its character. They were told I had underdrained white flats, whereas it is a black, loose soil and on such land any one can raise from 60 to 70 bushels of corn per acre without trouble. They did not appear to understand how the change had been

brought about. At the same time they all knew that continued washing will whiten or bleach almost anything, and by straining muddy or turbid liquid through a white substance will blacken it. The reason the ground in our flats looks so white, is because it has been rained upon and washed by surface washings for a long period. The clay is so tenacious that but little water can pass through it; but once underdrain it, convert it into a straining cloth, and the many sources from which coloring matter is obtained will soon darken the soil. Rain water, containing coloring matter, is filtered through the ground and comes out of the tile mouths as clear as spring water.

Underdraining is equally beneficial in wet or dry seasons. It is productive of great good by drawing the atmosphere into the ground, as well as carrying away the superabundance of water. So much so that writers on the subject in speaking of little ducts formed by the water in getting down to the tiling, invariably term them air ducts, as the air passes up through them as soon as the water ceases to run; it is just as important to have the atmosphere reach the roots of vegetation for its healthy sustenance, as it is for man to breathe. Fertile soil may be loosened several feet deep, but if covered with a substance impervious to the atmosphere, vegetation cannot grow. In stirring the soil, which all admit is important, we are not directly putting in fertile matter, but making it loose that air may penetrate. By no other process can air be made to enter so deeply, or circulate so freely, as by underdraining, and for this reason lands which are underdrained will not suffer in time of drought like those which have not been.

We all know that the driest atmosphere contains moisture. This is demonstrated by placing a pitcher of ice water in a room where the atmosphere is so dry that it is not pleasant to breathe; in a short time moisture is deposited in sufficient quantity to run down the sides of the pitcher. In like manner when the atmosphere is conducted under ground, where it is always cool, the water is condensed and rises to the roots of the growing crops. Central Park in

New York is, perhaps, the best illustration we have, from the fact that it is more thoroughly underdrained, and to a greater depth, than private individuals are apt to do. It is said in times of protracted drouth, when all the adjacent grounds are parched brown, the lawns in the park display a marvelous freshness.

Rain that falls upon the land belongs to it, and should be made to pass directly through it, for every drop of it contains fertilizing matter washed out of the atmosphere: ammonia, carbonic and nitric acids. By underdraining, the farmer becomes master of his vocation. He is no longer following a game of chance, or risking his capital and toil in having a good season. All opposition to underdraining comes either from those who have never tested it or those who have misapplied it. On the other hand it is unanimous with those who have applied it properly, that it is the most profitable investment they have ever made in the farming pursuit."

#### PALEOZOIC GEOLOGY.

##### *Devonian Age, Hamilton Period.*

New Albany Black Shale, equivalent of the Genesee of New York.

This is the most recent of the stratified rock formations represented in this county, and occurs in detached beds over a large area. It is in heavy beds on the line of Scott and Jennings counties. In the southern part of the county it outcrops on the Lexington, Loudon and Bethlehem road at James Hannah's mill, on the head waters of Fourteen-mile creek. It also outcrops about Deputy on Lewis' creek, and on the head waters of that stream. It shows on Middle Fork, in Lancaster township, at W. S. Gasway's, and on South Fork, and at Smock's Spring (Big Spring) on the land of James Cravens, in Hanover township, within three miles of Hanover, and is traceable in thin beds to Lancaster and one mile beyond in the direction of

Dupont, and in the northwestern part of the county, about Paris, and thence to North Vernon in Jennings county. It is well represented at the crossing of the Madison and Indianapolis Railroad over Graham creek and east of that point. This is doubtless the only point at which it is found on the east side of the above road. The Black Shale maintains the same stratigraphical position throughout, from the Falls of the Ohio River into this county. Its position is immediately above the Hydraulic cement beds of Clarke county, or their equivalent, and when not weathered away, the entire thickness is over one hundred feet. The predominant color of this shale is black, and it is often mistaken for Cannel coal, from a resemblance which it bears to that mineral. It affords but few fossils, owing to the absence of lime, and to its thin laminated structure, which in some cases show ten to twenty or more laminae to the inch. It is quite bituminous, and burns when well lighted without any perceptible diminution of bulk.

In Ohio, where it is 350 feet thick, it is estimated by Dr. J. S. Newberry to contain ten per cent. of combustible matter, and is, therefore, equivalent in carbon to a coal seam 40 feet thick. "It is remarked that the bitumen in this shale is not present in it as oil, as no solvent will separate it, but it will yield a portion of oil by dry distillation.

A section of the rocks which crop out on Big creek one mile west of Deputy, on the land of Dr. Shelden, near Shrewsbury, will show the position of the New Albany Black Shale:

1. Ochreous clay soil with a trace  
of sand, etc., and an occasional  
boulder ..... 10 ft to 20 ft.
2. Black Shale (New Albany)..... 10 ft. to 40 ft.
3. Very shaly, gray limestone, with  
fossil shells..... 8 ft.
4. Hydraulic cement, horizon of  
the cement beds of Clarke  
county ..... 2 ft. to 3 ft.

5. A very dark gray limestone, shaly, with fossils..... 10 ft.
6. Very dark and bituminous shaly limestone, with characteristic fossils of the Corniferous, to the bed of Big creek.....18 ft. to 20 ft.

The land in this locality is very rolling, and the shale in force, but the country becomes more level to the west toward the Scott county line.

A section at Deputy, on Lewis' creek, below Wesley Riley's flour and corn mill, is as follows:

1. Ochreous clay, soil..... 4 ft. to 15 ft.
2. New Albany Black Shale..... 0 ft. to 12 ft.
3. Dark gray limestone, shaly, with fossil shells..... 4 ft.
4. Hydraulic cement stone, with fucoidal markings and some of the characteristic fossils of the Clarke county cement beds, *Atrypa reticularis*, *Spirifer owenii* ..... 2 ft. to 3 ft.
5. Light-colored limestone, (Corniferous) with *Spirifer acuminatus*, *Spirifer gregaria*, *Nucleocrinus*, *Combophyllum sulcatum* and other fossils..... 3 ft. to 5 ft.
6. Limestone, Corniferous, with good fossils, *Zaphrentis gigantea*, *Z. rafenesquii*, *Cyathophyllum rugosum*, *Favosites goldfussi*, *Productus* and other fossils .....18 ft. to 20 ft.
7. Niagara limestone, in thick and thin beds, to Lewis' creek, opposite the Camp grounds... 10 ft.

On the Branch Railway, one mile above Deputy, the strata show a very perceptible dip to the west and southwest. In a section at this point, taken at Hiram Foster's quarry, the Hydraulic limestone does not appear with its characteristic features, yet the Black Shale which rests immediately above it is in place, as will be seen from the following:

1. Ochreous clay soil..... 2 ft to 10 ft.
2. Black shale shows two to three inches in the cut, thickens toward the brow of the hill... 6 ft. to 8 ft.
3. A very compact, dark-gray limestone, in 6 to 8 strata, one foot or more thick with perfect partings, horizon of cement bed, is a good building stone and was used in the construction of the piers of the railroad bridge over Big Creek, and is very suitable for foundations of houses and railroad tracks ..... 12 ft.

No. 3 of the above section represents the place of the Hydraulic limestone, but at this point the rock is a very hard, fine-grained, dark gray limestone, making when burned a pretty good quick lime. It contains well marked impressions of Fucoids, and a few specimens of *Cardiola radians* some of which were with difficulty worked out, the stone being very hard and compact. The changed lithological features of the formations at this locality is doubtless due to the fact that they are formed near the shore line of the Devonian age, in shallow water, and in contact with the Cincinnati group of the Lower Silurian. The Cincinnati formation at Madison, on the Ohio River, being less than twenty miles distant, contains nearly three hundred feet of

strata. In the railroad cut, not three quarters of a mile, north of Foster's quarry, the order is as follows:

- 1st. Soil.
- 2d. Soft, coarse-grained magnesian  
limestone, Dolomite, color  
light brown with *Zaphrentis*  
sp?.....10 ft. to 12 ft.
- Foster's quarry..... 5 ft.
- Railroad track..... 0 ft.

The next member of the Devonian Age, in descending order, is the *Corniferous limestone*, which at this point appears to be rather bare of fossils.

A section of the bluff on Big creek, on the land of Gilbert Wiggans, Graham township, on which the *Mound Builders Fort* is situated, is as follows: Section taken below western wall of old fort:

- 1. Soil.....

#### DEVONIAN.

- 2. New Albany Black Shale..... 0 ft. to 5 ft.
- 3. Very dark gray stratified limestone 12 ft.
- 4. Corniferous limestone.....20 ft.

#### NIAGARA.

- 5. Dark and light gray limestone, variegated.....20 ft.
- 6. Very coarse grained limestone full of  
crinoid stems and fossil shells.....10 ft.
- 7. Magnesian limestone to the bed of creek..10 ft.

From this point north along the railroad and on Graham's creek, the land is quite rolling, with numerous outcrops of Devonian and Niagara limestone. A section in the

northwestern part of Jefferson county and on the line of Jennings county at Old Paris, and below the woollen mill on Neal's creek, presents the following strata:

1. Ochreous clay, soil..... 3 to 14 ft.
  2. Trace of Black shale on the summit of the hills.....
  3. White limestone containg *Conocardium*, *Zaphrentis*, *Spirifer acuminatus* and many other fossils.. 20 ft.
  4. Light brown coarse-grained magnesian (Dolomite) limestone..... 5 ft.
  5. Bedded gray limestone, light and dark shades..... 6 to 8 ft.
  6. Very fine-grained gray limestone (Niagara) in strata of 12 to 20 inches, building stone, makes good lime..... 4 to 6 ft.
- Bed of Neal's creek .....

Good quarries of limestone for building purposes and making lime could be easily worked at this point. The distance to the Paris crossing of the Branch Railroad is from one to two miles. Along Neal's creek and on Graham creek, which is near by, the strata shows a very perceptible dip to the southwest. The Corniferous and Niagara rocks are well exposed along Graham creek to its junction with Big creek above the Mound Builders fort and near the railroad bridge. These rocks are also well exposed as far west as Foster's rocks in Scott county, and along Big creek as far east as Lancaster and beyond, the Niagara maintaining a good thickness to the source of this latter stream in Ripley county on the north.

A section taken immediately above Lancaster Mill, owned by Frank Landon, is as follows:

1. Ochreous clay and soil, with chert  
below ..... 5 to 25 ft.
2. Trace of black shale, (N. A.)..... 0 ft.



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|---------------------------------------|--------|
| 3. Hydraulic limestone, not seen..... | 0 ft.  |
| 4. Corniferous, with fossils.....     | 20 ft. |

#### NIAGARA.

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|--|--------------|
| 5. Shaly limestone.....  | 15 to 20 ft. |
| 6. Fine-grained, light-colored limestone, without cleavage, and containing nodules of very white chert ..... | 5 to 6 ft.   |
| 7. Three-inch strata of variegated chert, chalcedony.....  | 3 in.        |
| 8. Light-gray and fine-grained limestone, irregular bedding, makes a good lime.....                          | 4 ft.        |
| 9. Light-gray limestone in very even flags from 3 to 8 inches thick with rectangular cleavage.....           | 5 ft.        |

All these strata have been tested and found to make good lime. A section at College Hill, below Middle Fork and extending to Dr. McCoy's at the summit of the hill, will show :

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|--|--------------|
| 1. Clay soil with chert.....   | 1 to 6 ft.   |
| 2. Dark-grey limestone, in strata of 12 to 20 inches, used in the construction of the college buildings at this place, appears to be durable and makes good lime. It outcrops near the summit of the hills and has a few fossils <i>Atrypa</i> and <i>Combophylum sulcatum</i> were weathered out..... | 4 to 5 ft.   |
| 3. Corniferous limestone.....  | 18 to 20 ft. |
| 4. Dark, coarse-grained limestone, containing crinoid stems and fossil shells.....   | 10 to 12 ft. |

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|---|-------------|
| 5. Shaly limestone with pink shades<br>obtained from this ledge, <i>Favosites niagarensis</i> ..... | 20 ft.      |
| 6. Fine-grained, light-colored limestone, containing light chert.....                               | 6 ft.       |
| 7. Strata of variegated colored chert..   | 0 ft. 3 in. |
| 8. Limestone to the bed of Middle Fork .....  | 4 ft. 0 in. |

On the northeast side of Middle Fork, on the road to Dupont is seen an outcrop of stratified chert, sixteen to twenty inches, containing a number of good fossils, *Spirifer acuminatus*, with occasional shells, preserved specimens showing the spiral arms. Also, *Tentaculites scalenius*, Meek, and many other fossil forms, but the chert is as brittle as glass, and the fossils are difficult to procure. This chert strata, No. 7, first noticed at Lexington, in Scott county, extends from here north to the Jennings county line, and may be seen on all the hill sides, and along the streams, since it lies very near the surface.

Lancaster and College Hill are situated at the junction of Middle Fork and Big creek. The wearing down of these streams to deep beds gives to this locality a broken and romantic appearance. There are several small caves situated in this vicinity, and some singularly shaped rocks produced by weathering.

There is a fine show of the Corniferous with fossils, and a trace hydraulic limestone at Big Spring, on Smock's branch, in Hanover township. The Devonian strata at this place show a very perceptible dip to the southwest, and the stream is flowing with the dip and from the Ohio river. A section of the outcrop of rocks above the spring shows:

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|---|-------------|
| 1. Ochreous clay soil.....                                    | 4 to 10 ft. |
| 2. New Albany Black Shale, in the<br>summit of the hills..... | 0 to 4 ft.  |

3. A trace of Hydraulic limestone determined by the weathered fossils ..... (?)
4. Very white limestone, with a few fossils, *Combophyllum sulcatum*.. 6 to 8 ft.
5. Corniferous limestone with a magnificent display of fossil corals, equal to the coral beds of the Falls of the Ohio, collected *Cyathophyllum rugosum*, *Favosites fibrosa*, *Zaphrentis gigantea*. There are also imbedded in the rock many other beautiful forms and a large species of *Strematopora*, species undescribed.....
6. Chert bed, color brown, with Corniferous fossils.....12 to 15 in.
7. White limestone in the bed of the stream with imbedded Corniferous fossils..... (?)

Having traced the New Albany Black Shale to its eastern limit, and pointed out the extent of the Corniferous, with its abundant beautiful fossil forms, the next formation in the descending order is the Niagara. A section at the crossing of the Madison and Indianapolis Railroad over Big creek beneath the structure that spans that stream, 150 feet in length and 61 feet from the bed of the stream, is an outcrop as follows :

1. Covered space.....60 to 75 ft.
2. Corniferous limestone..... 2 to 6 ft.
3. Coarse-grained dark disintegrating limestone..... 5 to 8 ft.
4. Disintegrating clay shale, various shades..... 4 to 6 ft.
5. Light magnesian limestone, in two to three layers..... 4 ft.

6. Magnesian limestone, with cherty layers, a poor building stone, as shown by its wear in the bridge piers..... 8 ft.
7. Light gray limestone, in strata of 16 to 20 inches, used in the piers of bridge, more durable than No. 6..... 5 to 6 ft.
8. Very hard gray crystalline limestone to the bed of Big creek..... 6 to 10 ft.

Two miles beyond in the direction of Madison, at the railroad crossing of Middle Fork, in Lancaster township, and beneath the railroad bridge, there is a good exposure of Niagara limestone where the stream has cut the rocks to a great depth. The stone for the piers of the bridge were obtained from this place. The beds are in strata from 20 to 30 inches thick. The stone is easily quarried of any requisite length. The exposure may be followed to Lancaster, four miles below. I was informed by Mr. Robert Williams, a resident here for 60 years, that all the rocks in this section, 60 and 75 feet thick, will make good lime. Some are very good for building purposes, and easy of access for making fences. A short distance below the railroad bridge, on Middle Fork, and on the land of Robert Williams, a short distance from the creek, is an exposure of the dark-colored, coarse-grained bituminous limestone, No. 4, of College Hill section, containing nests of transparent crystals of calc spar that show double refraction. Similar beds, containing calc spar are on the land of R. H. Pilcher, and reported to be a foot thick. This stone also outcrops four miles north of Dupont, on Graham creek. At this place there are nests, of calc spar crystals, a yard in width, and afford some good cabinet specimens.

Another section on Big creek, on the land of Alexander McAllister, exhibits the following strata :

- Ash-colored soil with ochreous shades ..... 2 to 10 ft.
2. Corniferous limestone..... 8 to 10 ft.

## NIAGARA.

3. Disintegrating clay shale, various shades ..... 4 to 6 ft.
4. Dark-gray stratified limestone, with pink shale, containing encrinite stems ..... 2 ft.
5. Light-colored, fine-grained, stratified limestone, with light cherty concretions between the layers.. 2 to 4 ft.
6. Hard, fine-grained, stratified limestone, pink..... 2 to 3 ft.
7. Light-colored encrinital limestone, making good lime ..... 2 to 4 ft.
8. Irregular bedded limestone, dark, with pink shades to the bed of Big creek ..... 8 to 10 ft.

All of the above beds of stone have been burned and make good lime, and all, with the exception of the clay shale, will make a good building stone.

It will be seen from the above sections that limestone is abundant along the streams, and will furnish a cheap and valuable lime for the flat lands that lie adjacent thereto. The labor spent in this direction will prove to be remunerative. A section on Camp creek, a short distance above Dupont, on the land of Mark Tilton and along the streams below, shows:

1. Light colored, sandy clay soil, with ochreous shales below and resting on gravel..... 2 to 10 ft.
2. Very dark coarse grained, bituminous limestone, soft and weathering, containing crinoid stems and other fossils, *Michilina* sp? was especially recognized... 14 in.

3. White and brown chert 6 to 10 inches. It is brittle and breaks into irregular and angular shaped pieces with sharp edges and contains a great many fossils: *Spirifer acuminatus*. The casts especially of these shells are very abundant, *Pteropods* are also represented by *Tentaculites*, but good specimens are hard to get..... 1 ft. 4 in.
4. Dark, bituminous limestone, soft, with *Zaphrentis* and other fossils, also masses of very pure white chert.....10 ft. to 20 ft.
5. Dark blue limestone with lighter shades of shaly magnesian limestone ..... 6 ft.

There are an abundance of good springs issuing from the beds of rocks along this stream, and they also contain a great number of miniature caves.

The water shed in Saluda township, which is two to three miles in width, lies between the head waters of Fourteen Mile creek, and the waters of Saluda creek. The former rises at the base of the New Albany Black Shale, on the western side and flowing southwest and south, empties into the Ohio River in Clarke county. The latter rises on the east side of the divide and flows through a deep gorge and enters the Ohio River to the southeast. A section on the head waters of Saluda creek, at the crossing of the Lexington, Loudon and Bethlehem road at the crossing of Saluda creek, will show as follows:

1. Light colored clays with ochre colored sand at bottom.....10 to 15 ft.
2. Blue and yellow clay shale with chert..... 6 to 8 ft.

3. Very white magnesian limestone... 6 to 10 ft.
4. Dark gray limestone in thin strata  
to the stream..... 8 to 15 ft.

Less than one-half mile below this section, at Dog Falls, on the same stream, and on the land of Daniel P. Monroe, Sec. 2. T. 2, R. 9, and near the junction of the North and South branch we have an increased elevation of forty to fifty feet, with an outcrop that shows a succession of massive and thin bedded limestones. The falls are a succession of three benches, twelve to sixteen feet in high, and are very interesting and add variety to the scenery of this romantic region. Immediately below the falls we find:

1. Massive and thin bedded siliceous  
stone of various shades of color,  
being the most western outcrop  
of the Clinton formation.....18 to 20 ft.
8. Light blue shale..... 3 to 5 ft.
9. Cincinnati formation, (Lower Silurian,) the most western outcrop,  
with an abundance of characteristic fossils. It thickens fast on  
descending the stream towards  
the Ohio River, a few miles  
distant.

It will be seen from the above, that we have the New Albany Black slate on the west, at the head waters of Fourteen Mile creek, and the Niagara, Clinton and Cincinnati (Hudson River) on the east, all within a space of three miles. All the following sections will show a thickening of the Lower Silurian rocks as we approach the eastern part of the county, a continuation of the Niagara to North Madison, and the final absence of the Devonian formation. Dr. J. C. Cornett of Madison, who has given these formations a more minute investigation than any other person, makes the Madison and Indianapolis Railway the eastern boundary of

the Devonian, which boundry this survey has confirmed. The line, however, does not directly follow the railroad, in some places it does not quite reach the road, while at others, it extends a little east of that line. In the bed of Henry P. Lee's branch, Saluda township, is a good display chambered *Cephalopoda orthoceras* firmly imbedded in the Niagara limestone, and a short distance below this, on the stream, are Lee's Falls. The water falls thirty-five feet or more over the Clinton rocks.

There is a good outcrop of the Niagara rocks along the entire length of Big creek, and along the streams in this county, that flow from the Ohio river, showing in some places extensive sections of thick and thin strata, as in the vicinity of the old paper mill, and six miles east of Dupont, at Kirkville, and at Joseph Stephen's sawmill, on Big creek; and it continues along the same stream to Louis Munier, in the direction of Bryantsburg, and still beyond to Ripley county line. The Niagara limestone when burned produces an excellent quality of lime. It is suitable for all ordinary building purposes and well adapted for making stone fences.

The Niagara limestones are seen as far east as the west fork of Indian-kentuck creek, east of Mud Lick, Monroe township, and about Canaan, but at the latter place only the lower members of the series are met with.

The Michigan road, from Madison to Ripley county line, would represent approximately the eastern outcrop of the Niagara formations, yet it shows about the headwaters of the different branches of Indian-kentuck creek, as at Canaan, and in some cases to the east of it. Canaan is situated fifteen miles west of the Ohio river.

The next well-marked and distinct formation is the

#### UPPER SILURIAN.

1—*Niagara period.* 2—*Clinton epoch.*

The Clinton formation, noticed in the survey of 1873,



page 143, as appearing along the Ohio river on the north-east border of Clarke county, is well marked and of considerable thickness in the eastern part of this county on the Ohio river. The Clinton here, as in New York, is in the main a sandstone, and of variable texture; it is very soft in the lower part where it is largely composed of sand and clay; but in other parts very hard and contains concretions of oxide of iron on the surface. The upper part of the formations at some points is a very dark gray limestone.

#### FOSSILS OF THE CLINTON.

W. S. T. Cornett, M. D., of North Madison, who has studied the Clinton beds very closely, says the upper and lower strata of the Clinton are non-fossiliferous. The fossils which characterize this formation are to be found at or near its upper third. They are so compactly cemented in the rock that it is in most instances impossible to isolate them, consequently they have to be studied in fragments. I recognize the following: *Zaphrentis bilateralis*, *Fenestella prisca*, *Atrypa reticularis*, *Ilænus insignis*, *Dalmania*, *Orthis biforata*, *Strophomena rugosa*, *Leptaena serica*, *Rhynchonella neglecta*, *Encrinites* and fragments of *encrinite* stems, many of which are encased in calc spar.

From the above it will appear that the fossils of the Clinton are well marked and quite numerous, extending through a vertical outcrop of 23 feet. Quite a number of well marked fossils, illustrative of this formation, have been presented to the State Cabinet for examination, by W. S. T. Cornett, M. D.

Prof. R. P. Whitfield, of Albany, N. Y., remarks: "We find *Orthis lynx* frequently, although not common, in the Clinton of New York. There is no formation extending over a great territory but may and generally does contain a small percentage of the forms of the lower rocks, where they follow on in an unbroken series, as the Clinton does in your State, following the Cincinnati." I am aware that

there is a difference of opinion as to the thickness of the Clinton in this county, but if we take the fossils for a guide we have evidence sufficient to justify the sections which follow.

The strata are uneven, being in layers from a few inches to several feet thick. The prevailing color of the stone is light yellow, with salmon and pink shades. The face of the stone often presents very nicely marked lines of a yellow or gray cast. This formation is strongly marked by contrast with the Cincinnati rocks below, and the Niagara limestone above.

The Clinton here presents the greatest variety of qualities as regards durability, of any formation encountered in the eastern part of the county. Some parts furnish a durable building stone, and the thin layers found in the upper part of the hills at Madison are used for flagging, while others again are prone to decay, and have no commercial value. The most western, well-marked outcrop of the Clinton rocks is to be seen in Saluda Township, two to three miles from the Ohio river, at the crossing of the Lexington and Bethlehem road, over Saluda creek, where we have:

1. Clay soil.....10 to 20 ft.
2. White shaly limestone, Niagara..... 6 to 8 ft.
3. Gray limestone with Trilobites,  
*Calymene senaria*..... 6 to 8 ft.
4. "Cliff rock," a gray, porous limestone, with shades of yellow, weathering into holes containing crinoid stems, and in some parts pieces of crinoidea. ....13 to 18 ft.
5. Disintegrated blue and yellow clay shale..... 4 to 6 ft.
6. Light brown and yellow sandstone, glistening, clay layers below Clinton.....19 to 22 ft.

7. Blue, shaly limestone, terminating  
in a 4 inch strata of hard, blue  
limestone..... 26 ft.
8. Cincinnati rocks (Lower Silurian)  
with characteristic fossils to the  
bed of Saluda creek.....200 to 300 ft.

The *Favistella stellata* bed does not show in this section, and there are but few specimens of that coral found in this vicinity.

A section at Marble Hill in the southeastern border of the county on the Ohio river, James King's Landing, is as follows :

1. Light ash colored clay soil with  
sand, yellow clay subsoil.....10 to 18 ft.
2. Light colored magnesian limestone  
weathered into holes, "Cliff  
Rock" .....18 to 20 ft.
3. Yellow and blue clay shale, dis-  
integrating..... 6 to 8 ft.
4. Light blue magnesian limestone,  
variegated, sandy in some  
parts, crinoid stems on the  
upper surface .....25 to 30 ft.
5. Dark blue marlite, with alternat-  
ing strata of hard blue lime-  
stone containing Cincinnati  
fossils (Lower Silurian).....75 to 100 ft.
6. *Murchisonia*, shell marble,  
"Dean's quarry, Marble Hill" 20 ft.
7. Very hard blue limestone in thin  
layers, with shale and abund-  
ance of fossils (Cincinnati).....80 to 100 ft.
8. Space covered with debris..... 20 ft.

The hight of the ridge from low water is: 378 ft.

This is a noted locality for fruit farms, an account of which was given in the report of last year.

The Clinton is not as well marked in the above section as at Hanover and other places. The first show of the Clinton rocks is some six or eight miles south of Marble Hill on the Ohio river.

The elevation from Marble Hill to Hanover is not very great, as shown by the following section taken at "Crow's Falls" and above the falls:

1. Ochreous clay terminating in brown chert..... 15 ft.
2. Light brown and gray magnesian limestone containing crystals of calc spar..... 2 to 6 ft.
3. Yellow and blue clay shale..... 4 to 6 ft.
4. White and gray limestone in strata of from 4 to 18 inches, a pretty good building stone—yet has some cherty concretions in the upper part..... 15 to 25 ft.
5. Gray magnesian limestone, with shades of yellow or brown, rather porous, and terminating in thin strata, with clay shale "Cliff Rock."..... 13 to 20 ft.
6. Summit of the Falls—a very hard dark-gray limestone with imperfect fossils..... 6 ft.
7. Light yellow and brown sandstone—glistening, uneven stratification, disintegrating in lower part—Clinton. Makes all the water falls of this region..... 16 to 20 ft.
8. Four to six inches of blue, soft shale, makes a good slate pencil..... 6 in.

9. Dark blue, disintegrating magnesian limestone, making a part of the Falls.....18 to 20 ft.
10. Thin strata of dark blue, hard limestone studded with *Lepæna sericea*, Sow. *Orthis lynx*, Eich. and a number of impressions of parts of *Calymene blumenbachii*, Brongt. *Favistella stellata*, Hall. *Chætetes* and a great variety of other Cincinnati fossils..... 230 ft.

Sections at "Butler's Falls," a short distance west, and at "Chain Mill Falls," show a good outcrop of Clinton rocks.

Section on the "New Pike, College Hill, Hanover :

1. Ochreous clay with chert, below... 6 ft.
2. Stratified chert, white and variegated..... 3 to 5 in.
3. White limestone in strata of 12 to 20 inches, Niagara..... 4 to 6 ft.
4. White and gray magnesian limestone, porous rock, weathered rough, with thin layers below, "Cliff Rock."..... 21 ft.
5. Very hard, gray limestone in strata of 16 inches to 2 feet, good building stone..... 8 to 10 ft.
6. Clinton, shaly bed with layers of sand and clay.....12 to 23 ft.
7. Blue shale, horizon of *Favistella stellata* bed ..... 12 ft.
8. Dark blue limestone alternating with shales and containing characteristic Cincinnati fossils 250 ft.

All the outcrop from College Hill within a short distance of Madison, indicates the same stratigraphical order, with a slight increased elevation of the country and a greater thickness of Niagara limestones.

A section at the Inclined plane of the Jeffersonville, Madison and Indianapolis Railroad, where the plane cuts through the hill for 2,686 yards, with an elevation of 255 feet per mile to the summit of North Madison, shows :

1. Ash-colored clay, terminating in  
ochreous shades..... 5 to 12 ft.

#### NIAGARA.

2. Limestone in strata of varying thickness, called here "white limestone," which in some parts of the outcrop chips badly and does not stand weathering—burned for lime and used for all ordinary purposes .....20 to 40 ft.
3. Contains *Calymene senaria* limestone, weathered dark and rough, yet light colored when broken, with yellow clusters of coarse particles, makes a poor lime, contains an occasional trilobite, crinoid stems, and a few other fossils—"Cliff rock".....13 to 20 ft.
4. Blue and yellow clay shale, disintegrating when exposed..... 6 to 12 ft.

## CLINTON.

5. A very hard, and, in some parts, very soft, disintegrating sandstone, light yellow and salmon color, unevenly bedded, and contains streaks of iron and pockets of calc spar, and some fossils, *Zaphrentis bilateralis* and crinoid stems ..... 23 ft.
6. Fine grained, dark blue marlite, with fucoidal impressions, large and small, circular masses of *Favestella stellata* (coral) and often containing fine crystals of spar..... 10 to 13 ft.
7. Dark blue siliceous fossiliferous limestone in strata of varying thickness, alternating with shale and clay layers, contains imperfect fossils. This member constitutes the principal part of the hills about Madison .....200 to 300 ft.
8. The terrace on which Madison is situated, sand and gravel beds, river deposits, in which are found mastodon remains..... 30 to 75 ft.

Richard Owen, M. D., in his Geological Reconnoissance of 1859, says: "A section in the railroad at Madison, as given beneath, will give, approximately, the thickness and relative position of these rocks:

1. Buff and gray magnesian limestones of Upper Silurian date, nearly.....100 ft.
2. Marls and clays..... 3 ft.

3. Impure, variegated magnesian limestone, some with green and reddish bands ..... 35 ft.
4. Dark marlite, containing *Favistella* and crystallizations of spar..... 27 ft.
5. Fossiliferous limestone, alternating with marl, marlites, and clays of Lower Silurian date, to low water mark, about .....340 ft.

Some of the bands of both No. 3 and 4 of the above section possess hydraulic properties."

The Niagara outcrops in and around North Madison and is extensively used for building purposes.

A section of the various formations as they outcrop on the "Michigan Road," Madison Hill, for which I am indebted to W. T. S. Cornett, M. D.; also, the position of the fossils and the altitudes above low water of the Ohio river:

Strata.	Altitudes above low water.
Railway crossing, North Madison.....	412 ft.
Toll gate on Michigan road.....	417 ft.
Clay soil with chert below 2 to.....	14 ft.

#### UPPER SILURIAN AGE.

##### *Niagara Epoch.*

1. Blue limestone with *Pentamerus oblongus* ..... 403 ft.
2. White Limestone..... 5 ft. 398 ft.
3. Top of Cliff rock on Michigan road, porous and rough by weathering .....13 ft. 387 ft.
4. Base of Cliff rock and found in all positions from the top to the base of the Cliff.... ..... 374 ft.



5. Blue and yellow clay shale, weathering when exposed and undermining the Cliff Rocks..... 5 ft.

## CLINTON EPOCH.

6. Very dark gray and hard limestone in strata of 16 to 22 inches..... Clinton fossils.
7. Light brown sandstone, of various shades, in varying strata from 2 feet to 4 feet 3 in. containing iron in some parts and producing all the water falls on the eastern border.....30 ft. Cincinnati fossils.

LOWER SILURIAN AGE—TRENTON PERIOD. CINCINNATI EPOCH.

- Tetradium fibratum* horizon..... 319 ft.
- Dark blue shale, weathering, fucoid impressions in the upper part, a show of Cincinnati fossils and *Favistella stellata* reef, coral in the lower part, 15 to.....20 ft. 304 ft.

*Tetradium fibratum.*

The Cincinnati formation is in the main a dark blue fossiliferous limestone, in thick and thin strata, with shale and clay layers, containing well preserved fossils, and extending under the river at Madison.

At Madison, *Orthis bifurcata*, and *Orthis occidentalis*, have a vertical range from the base of the hills to the top of the Cincinnati outcrop. *Strophomena alternata* has the same range. *Orthis retrorsa* is said to have the narrowest vertical range of all the Cincinnati fossils, not to exceed three feet. It occurs here opposite the first stone culvert on

the Michigan road. *Strophomena sulcata*, is found on the Michigan road, between the second and third stone culverts.

The Clinton rocks are well exposed above and below Madison, and it is the most persistent formation in this section of the county. It forms projecting cliffs, weathered into natural amphitheatres of great extent, and these afford the wearied teams, that ascend and descend the inclines, to and from the city of Madison, a place to rest in the shades of the overhanging Clinton rocks, and drink from the springs which issue from the rocks at about this elevation, on many of the Madison hills, throughout all seasons of the year. A few miles above Madison, the Clinton becomes the surface rock, as at Cedar Cliff. On Indian-kentuck creek, it is found only here and there on the highest points.

The next, and lowest formation, exposed in Jefferson county, is of the *Lower Silurian Age, Trenton Period, Cincinnati Epoch*, equivalent of Hudson River of New York and Nashville, Tenn.

The outcrop of the rocks of the Cincinnati epoch are of wide extent, occurring in Canada and in New York, and from Lake Erie to Tennessee. This formation is composed of shales in New York and Canada, but in the west the strata consists of limestone alternating with shales that were once beds of sand, mud, clay, or shells, deposited at the bottom of the Lower Silurian sea which teemed with life, as is attested by their fossil forms mingled in the composition of the rocks, or appearing on their surface. Immense quantities of fossils are found in the soft shale and clay layers without having the most minute line, or peculiar form of the Molluscs, Radiates, or Articulates.

Passing north of Madison the county is very broken, and a number of ridges, as Pleasant Ridge and Rice's Ridge, are composed almost exclusively of Cincinnati rocks. These ridges extend in the direction of the Ohio river. About Brooksbury, in Milton township, and near the mouth of Indian-kentuck creek, the outcrop is almost exclusively Lower Silurian rocks. The same outcrop continues along

this stream to Manville. A short distance above Manville, at Pleasant R. Vernon's, there are several quite compact strata in the bed of the creek, containing very peculiar markings. Specimens of this stone have been sent to the State collection. From Manville north and west, along the West, Middle and Brushy Forks of Indian-kentuck, the Cincinnati outcrop continues in full force, with the same general order of shales and shell limestones, and an abundance of fossils of that period, to near the head waters of these streams.

A section on the West Fork of Indian-kentuck creek, a short distance east of Mud Lick, in the direction of Canaan, and on the land of Reuben Daily, is as follows:

1. Clay terminating in ochre shades<sup>^</sup>  
and chert..... 3 to 15 ft.
2. White and gray limestone (Niagara) .....50 to 75 ft.
3. Clinton not found..... 00 ft.
4. *Favistella stellata* bed, fine specimens .....10 to 12 ft.
5. Fossil limestone and shale, Lower Silurian Age..... 225 ft.

A section on the head waters of all these streams, branches of Indian-kentuck creek, would show about the same result.

At present the channel of the Ohio river at Madison is deep, affording a good landing for boats of heavy burdens at all seasons of the year. The city has extensive water works, and the supply of water is ample for any emergency. The supply, the greater part of the year, is from reservoirs along the railroad cut, which are filled direct from springs issuing from the outcropping rocks and when this supply fails the larger reservoir at the head of Main cross street is drawn upon. This reservoir is supplied by water of ordinary purity, pumped from the river above the city. Water from the hydrants is used without stint in

watering the lawns, sidewalks and streets, and it is refreshing to visit the city after a walk, or drive on a hot day over dusty roads.

Madison has the credit of projecting and building the first railroad in the State, and one of the first roads of the kind in the West. The charter was granted in 1835 or 1836, with John Woodburn as President. The cars were running as far as Columbus in 1845, and finished to Indianapolis in the fall of 1847. The "Michigan road," with its terminus at Madison and Lake Michigan, was projected in 1823 to 1826 and its completion was a work of great importance at that time.

Madison was at one time extensively engaged in the pork trade, but is at present employing her capital in manufactures. One of the most important is the manufacture of pure refined pearl starch, by Messrs. R. Johnson & Son, and John Clements, who have extensive factories. The factory of Johnson & Son consumes several hundred bushels of corn per day, and employs ninety hands. Large quantities of starch are shipped East in barrels to the calico-print works and for laundry purposes. This starch is also sold in boxes in all the markets of the country, and finds its way to Europe.

Pure water for washing all impurities from the starch is obtained by sinking deep wells in the sand and gravel beds mentioned as occurring at Madison. John Clements manufactures about the same quantity and quality of starch as the above company. The factories have, from the residue of the corn, two grades of starch feed, which is extensively used by the farmers in this part of the county. One grade of the feed is gluten, the tenacious substance which is left after washing out the starch, the other feed is the water from the washing of the starch.

Cobb, Sterling & Co. are doing all kinds of foundry work; also, M. E. Ceena, Walsh & Co.

## PORK PACKING.

Powell & Imblard, E. A. Fitch & Co., C. Friedersdoff, Meuser & Co., are engaged in this branch of business.

## COOPERS.

Wyman & Gibson are manufacturing from 50,000 to 100,000 coal oil barrels, and other tight barrels, per year. William Staff & Co. are manufacturing slack barrels.

## FLOUR MILLS.

Stapp & Trow, City Mills; W. W. Page and C. L. Gordon.

## SADDLE-TREE MANUFACTORY.

There are several large establishments engaged in the manufacture of saddle trees at Madison.

## SCHOOLS.

This county is well supplied with graded schools and a university at Hanover. This university is under the patronage of the Presbyterians and is well endowed. The Alumni date back to 1834.

The college library contains some 6,000 well-selected volumes, many of which are rare works. The cabinet of Natural History, although not large, is a very interesting collection, containing some specimens which it will be difficult to duplicate. The cabinet is at present in charge of Prof. John M. Coulter and bids fair to increase in interest.

## HANOVER COLLEGE.

The college is situated in the edge of the village of Hanover, and stands on an elevated bluff of the Ohio river, five miles below Madison. The Ohio river and the railway

from Madison, places Hanover within twenty-four hours of all the principal points in Indiana, Kentucky, Ohio and Illinois. Turnpikes from Madison to Hanover, render the college easy of access at all seasons of the year.

The scenery, in beauty, extent, variety and accessibility is not surpassed in the neighboring States, if indeed, it is equaled, in the whole valley of the Mississippi. The locality is extremely rich in a geological point of view. The variety of surface configuration within a mile of the college, and for many miles around, furnishes unrivalled facilities for practical instruction in every department of civil engineering. There is *no more healthful* place in the whole country. No malarious streams or marshes poison the clear bracing atmosphere of the hills and produce that physical debility and mental depression so unfavorable to study. Innumerable waterfalls, deep ravines and wild gorges, shadowy hillsides, quiet glens and rolling plateaus, with the "beautiful river," invite students and visitors to the most healthful and delightful modes of exercise. Every cultivated mind knows the great educational value of fine scenery. The absence of saloons and other evil resorts reduces temptation to the very minimum. It will therefore be seen that few colleges are equal in natural and local advantages to Hanover.

#### AGRICULTURE.

Agriculture is the principle wealth of the county. The soil presents very many natural advantages in some sections, and skillful farming is remunerative, but in other sections drainage and the application of fertilizers is required. We would, as stated, propose drainage for the "flats," and the introduction of blue grass, or other grasses, and especially clover. The essential mineral ingredients are doubtless in sufficient quantities in the soil as a base, but the potash and phosphates taken up by the crops as food must be returned to the soil, or the land will be impoverished to the amount abstracted from it. It is a fact patent to all farmers, that

ashes is a good fertilizer, and its stimulating effect on the crops is soon apparent.

The county agricultural fair which meets annually, at North Madison, it is thought, will stimulate to improved farming, and the culutre of graded stock. The anniversary jubilee of the Farmers' Club, held at Swan's grove, S. T. Swan, President, B. F. Schull, M. D., Secretary, is calculated to foster social intercourse, and by interchange of sentiment, can not fail to result in good.

#### CLAY.

A good clay for brick is found in nearly all parts of the county. A good tile clay is found at North Madison, on the land of J. R. Roe, M. D., and is used by him in making tiles. There is also, found on the same land a species of fire clay used at the founderies at Madison. Tile clay also occurs on the land of James Lee, Loudon Bottom.

#### WATER POWER.

Water power afforded by the numerous streams in this county was extensively used in former days, as shown by the remains of mill sites.

#### ROAD MATERIALS.

This county has quite a number of gravel roads, the material being siliceous gravel, obtained from along the streams, and the chert bed which traverses this county. Black slate is used for mending roads in the western part of the county, and answers remarkably well. Limestone of the Upper and Lower Silurian is in great supply for macadamizing.

No ores of the metals are found in any quantity in this county. Pyrites of iron occurs in nodules in the Black slate in the western part of the county, and if in sufficient quantity, could be utilized in the manufacture of sulphuric acid.

## MINERAL SPRINGS.

Mineral springs are not very abundant in this county, yet there is a show of salt water at various points. A salt well was sunk in 1835 to the depth of sixty feet or more, on the middle fork of Indian-kentuck creek, a short distance above Manville, by Rev. Joseph Hawkins. The water from this well afforded some salt.

## STONE.

It will be seen from the foregoing notes that there is an abundant outcrop of white and gray limestone, Niagara age, along the various streams traversing this county, suited to the manufacture of the best grades of lime, and for all ordinary building purposes. In some localities these stones are admirably adapted for making fences, being of the requisite thickness, and easy of access.

A TABLE OF ALTITUDES AT MADISON, INDIANA, ON  
MICHIGAN ROAD.

1. Outcrop of Favistella-Reef on Michigan road, above low water mark of Ohio river..... 304 ft.
2. Hard blue limestone strata, thin, alternating with thicker of the Madison water lime of Owen's banded limestone, and called by Dr. Cornett non-fossiliferous rock..... 351 ft.
3. On Michigan road there is overlying the non-fossiliferous rock a strata ten inches in thickness, bearing fossils of the Hudson Period. Also, below the same bed a thin strata of the same fossils.
4. Gales' culvert on Michigan road.....357 ft.



5. Second stone steps in front of C. C.  
Cornett's gate..... 369 ft.
6. Base of cliff rock on Michigan road.... 374 ft.
7. Top of cliff rock..... 387 ft.
8. Top of white limestone on Michigan  
road ..... 398 ft.
9. Toll-gate on Michigan road..... 417 ft.
10. Top of rock in ravine between North  
Madison and Mill Run..... 403 ft.
11. Railroad crossing at North Madison... 412 ft.
12. Pike beyond North Madison..... 426 ft.
13. Water trough on Hanover hill, Han-  
over road..... 281 ft.
14. In front of brick house on top of Han-  
over hill..... 372 ft.
15. On Kent road, Morgan raid battle-  
field..... 353 ft.
16. On second step of Hanover College.... 316 ft.

## ELEVATION AT OTHER POINTS ABOVE MADISON.

- High water mark at Madison above low  
water..... 46 ft.
- Sidewalk in front of Catholic church..... 77 ft.
- Sanxy road, in front of Mrs. Rupert's..... 188 ft.
- Sharp turn, on same road..... 246 ft.
- Quarry, on same road..... 341 ft.
- On same road, in front of H. C. Sanxy's  
residence ..... 406 ft.
- On Michigan road, front of Judge Malin's,  
which is the highest plateau in the  
immediate vicinity of Madison, and quite  
as high as any land on the Kentucky  
side of the river..... 472 ft.
- Mr. Hervert's house, back of Milton Ky.,  
opposite Madison..... 391 ft.

## Levels of water works at Madison :

Top of shut off in supply pipe.....	38 ft.
Top of dry well .....	47 ft.
Top of valves of pump above low water ...	21 $\frac{1}{10}$ ft.
Top of plug corner of Ohio and Ferry street .....	45 ft,
Top of plug corner of Ferry street and Lawrenceburg road.....	92 $\frac{1}{2}$ ft.
Top of plug corner of Ferry and Second street .....	89 $\frac{1}{2}$ ft.
Top of reservoir.....	210 $\frac{1}{2}$ ft.
Top of reservoir above Lawrenceburg road and Ferry street.....	94 ft.

Messrs. Humphries & Abbot, in "Hydraulics of the Mississippi River," give the Ohio (low water,) at Cincinnati, 432 feet above the sea. Prof. Richard Owen (Report of Indiana Geology 1859-60,) gives the Ohio river at Madison, (high water,) as 450 feet. Louisville, above the falls of Ohio river, 377 feet above the sea.

## FRUIT.

This county is well suited to fruit growing. Peaches do well on the Ohio river bluffs, and have been successfully grown in large quantities about Marble Hill for some years. John Carver, George Davis, Argus Dean, and William Dean, have about three hundred acres in peaches in this locality. Some of these orchards were noticed in the report of Clarke county last year. Large quantities of the fruit is put up in cans and finds ready sale at the hotels at Cincinnati and Louisville. Argus Dean put up the present season five hundred dozen cans of peaches and 1,000 bushels of apples.

The western and central parts of Jefferson county along the streams are better suited to the growing of apples, which were a success the past season, and the land flowed with cider.

## GRAPES.

Dr. G. Lewis has cultivated the Ives seedling on the "Flats," near Dupont, for several years with good success. The land has had nothing more than surface drainage, and the vines are free from blight and the grapes are not effected by the rot. The crop of wild grapes on the "Flats" this season was very great. The varieties were the large blue and the small winter grape. Wild grapes flourish on these flat lands, and the crop of grapes is very remarkable both in regard of quality and quantity, a single vine yielding several bushels. Does the grapevine in its natural state adapt itself to the soil? or is there some property in the soil suitable to the development of the grape? The instances are rare where a grower of grapes would think of planting a vineyard in these cold soils.

## BEE CULTURE.

Attention has been given to bee culture by various persons in this county. The most extensive apiary noticed was that of P. R. Vernon, near Manville, on Indian-kentuck creek. The building is exclusively for bees, and is insulated at the corners so as to prevent the ingress of any insect. With this arrangement the working of the bees can be noticed, and directed, the ingress of the moth can be detected and successfully noticed and checked. We have not space for a detailed statement, but from what we saw with reference to the arrangement, and from the extensive knowledge which Mr. Vernon has acquired, of the habits of *Apis mellifica*, their culture is here a success in every particular, yielding one hundred or more pounds per hive, during the season, of beautiful white honey. Dan, P. Monroe, of Saluda township, is also extensively engaged in bee culture.

## FARM CROPS

Are principally corn, oats and wheat. On the "flat land" grass for hay is extensively cultivated. Of the large growers are John Reid, in the southern part of the county, and A. W. Jessup, Samuel Baker and others, near Mud Lick. In the eastern part of the county, above Madison, barley and onion sets are extensively grown. The latter crop for a few years past has proved remunerative.

## CONCLUSION.

In conclusion, I desire to return my thanks for the uniform courtesy extended to me by the citizens of Jefferson county, and they are especially due to Capt. D. P. Monroe, Wm. Stacy, Edward Lyon, Stephen Mills, of Saluda township; Capt. Nugent, W. S. Robertson, Sisney Conner, Geo. Grafton and S. Shrewsberry, M. D., of Deputy; Frank Landon, Wm. S. Gasaway, T. H. Rector, Dr. McCoy, Lancaster; and to the County Commissioners, C. K. Lard, Robert Walker and James Officer, Rev. John E. McCoy, Dr. G. Lewis, Ben. Thorn, Gideon Moncrief, Wm. Moncrief, B. B. Williams, Rob. Williams, Ed. O'Neal, Benj. Hughes, Wm. Griffin, J. C. Rawlings, Alex. McCallister, of Deputy; Joseph Stephens, Kirkville; Louis Manier, Munroe township; Robert Daily, J. H. Lockall and Ed. Millegan, Canaan; John King, P. M., Mud Lick; John Follick, Bryantsburg; P. R. Vernon, Mr. Jackman, County Surveyor, Manville; Aljia Wright, James Hill, Thos. L. McKay, A. N. Gale, of Brooksbury; Fred Harper, E. Harper, W. T. S. Cornett, M. D., M. C. Garber, Madison Courier, John G. Sering, Rufus Gale, Auditor, Wm. H. Child, C. C. Cornett, M. A. Gavitt, of Madison; Rev. S. H. Thompson, L.L.D., Prof. F. L. Morse, Prof. J. M. Coulter, W. A. Cravens, W. T. Reuking, of Hanover; J. R. Roe, M. D., Rev. Wm. Monroe, of North Madison.

TO W. W. BORDEN, Esq.,

Assistant Geologist, Geological Survey of Indiana :

DEAR SIR:—In examining the fossils sent to me from the Black Slate formations of southern Indiana and adjacent portions of Kentucky, I find them to consist of the following species :

*Lingula melia* (?) Hall, from Lebanon, Ky.

*Lingula spatula*, Hall, from Lebanon, Ky.

*Discina minuta* (?) Hall, from Lebanon, Ky.

*Discina* (*Trematis*?) *truncata*, Hall, from Lebanon, Ky.

*Chonetes lepida*, Hall, from Lexington, Scott county, Ind.

*Leiorhynchus limitaris*, Vanux. from Lexington, Scott county, Ind.

*Leiorhynchus quadricosta*, Hall, from, Lexington, Scott county, Ind.

*Cardiopsis*, sp.? from Lexington, Scott county, Ind.

*Tentaculites fissurella*, Hall, from Lexington, Scott county, Ind.

In making these identifications I would note the following facts in regard to the several forms :

LINGULA MELIA (?) Hall, Pal. N. Y., Vol. 4, p. 14, plate 1, fig. 3. The individuals referred to this species are somewhat variable in form, the larger ones being more truncate in front than the originals of the species, while the smaller specimens are beautifully oval in outline. The identification is not quite satisfactory, there being no particular or salient feature by which to distinguish it from many other species of the genus.

LINGULA SPATULATA, Hall, Pal. N. Y., Vol. 4, p. 13, plate 1, fig. 1. The only specimen of this species now remaining in my possession is quite satisfactory in its characters, and I have no hesitation in saying that it is specifically identical with the shells from New York

localities. I have seen other examples from Indiana localities, the identification of which, was equally satisfactory.

*DISCINA (TREMATIS?) TRUNCATA*, Hall, Pal. N. Y., Vol. 4, p. 23, plate 1, fig. 15. The specimens of this species are quite numerous, the surfaces of shale being thickly covered with separated valves, showing the features of both the slit and entire valves. They are of characteristic form and size as compared with those from New York, and their peculiarities easily recognized. I can detect no feature wherein they differ from the typical forms of the species.

*DISCINA MINUTA?* Hall, Pal. N. Y., Vol. 4, p. 16, plate 1, fig. 16. Of this species I find only a single lower valve upon the block with *D. (Trematis?) truncata*. So far as can be determined from the specimen, it does not differ from the New York specimens, still from a single valve of so minute a form, it is not safe, perhaps, to say positively that it is identical.

*CHONETES LEPIDA*, Hall, Pal. N. Y., Vol. 4, p. 132, plate 22, fig. 12. Of this very marked and easily recognized species there are many individuals scattered over the surfaces of the slates from Lexington, Ind. They are somewhat smaller in size than those from the soft Moscow shales of New York localities, but resemble exactly those from the harder and more slaty layers from Ludlowville and Ogden's Ferry, Cayuga Lake, N. Y.

*LEIORHYNCHUS LIMITARIS* (Vanuxem sp.) Hall, Pal. N. Y. Vol. 4, p. 356, plate 56, fig. 21. Only a few individuals in the collection can with certainty be referred to this species. They are flattened on the surfaces of the shale and resemble very closely those so common in the Marcellus shale of New York.

*LEIORHYNCHUS QUADRICOSTATA* Hall Pal. N. Y. Vol.

4, p. 357, plate 56, fig. 44-49. The specimens of this species appear to be somewhat numerous in the harder and more calcareous layers of strata at Lexington, Ind. They are as well preserved as is usually the case in the New York localities, and present more nearly the natural convexity of the shell, owing to the more compact nature of the matrix. The specimens present the same degree of variation noticed among those from the original localities, being in some cases smooth on the sides, and in others showing several incipient *plicae*.

CARDIOPSIS sp? This shell is represented in the collections sent by only three fragments, parts of two individuals. The features presented are similar to those possessed by a species known from the Portage group of New York, (*C. robusta*). The radii may have been a little finer, or intermediate between that one and those of the *C. radians*. *Pterinea radians*, Conrad, from the Hamilton group of New York.

TENTACULITES FISSURELLA Hall Geol. Rept. 4th Dist. N. Y. p. 180 and 222. This species is found entirely covering surfaces of the slates from Lexington, Ind., in the same manner as it does in the Black slates of New York. The specimens are minute and require several hundred individuals to cover a square inch of surface as thickly as they do. The species is recognized both in the Marcellus shale and Genessee slates in New York, as well as in the intervening shales of the Hamilton group apparently often forming nearly the entire bulk of layers several inches in thickness.

Judging from the evidence furnished by the above mentioned species, I would not hesitate to say that the slates from which they were derived are in part at least equivalent to those known as the Genessee slates of New York. It is altogether probable that they represent both of the Black slates of New York as well as the intervening shales of the Hamilton group; or, in other words, that they represent an

equivalent in time to that of the entire Hamilton epoch as represented in New York, and perhaps even some of the overlying beds.

Taking only the species that can be positively identified with those of New York, we have the *Discina* (*Trematis*?) *truncata*, *Lingula spatulata* and *Leiorhynchus quadricosta*, Hall, that are known only in the Genesee slates. *Chonetes lepida*, Hall, commences in the Marcellus shale and continues all through the group, occurring also in the Chemung group above. *Leiorhynchus limitaris* is known only from the Marcellus shale, and *Tentaculites fissurella* passes entirely through the Hamilton group so that we have:

<i>Lingula spatula</i> , <i>Discina</i>	} peculiar to the Genesee slate.
[ <i>Trematis</i> ,] <i>truncata</i> , <i>Lei-</i>	
<i>orhynchus quadricosta</i> .	

*Leiorhynchus limitaris*, peculiar to the Marcellus shales.

<i>Chonetes lepida</i> , <i>Tentaculites</i>	} Common to the entire Hamilton group.
<i>fissurella</i> .	

Leaving the weight of evidence in favor of the upper member of the Hamilton epoch.

Yours very truly,

R. P. WHITFIELD.

ALBANY, N. Y., February 4, 1875.

LIST OF FOSSILS FOUND IN JEFFERSON COUNTY, INDIANA,  
BY W. J. S. CORNETT, M. D.

## LOWER SILURIAN AT MADISON.

### TRILOBITES.

*Asaphus gigas*, *Calymene senaria*, *Dalmanites earleyi*,  
*Phacops gallicecephalus*.



## ORTHIS.

*Orthis*, varieties: *lynæ*, *acutilirata*, *prolongata*, *laticostata*, *dentata*, *madisonensis* provisionally, and another which may be a variety or the young of some species.

*Orthis occidentalis*, *O. sinuata*, *O. retrorsa*, *O. subquadrata*, *O. emacerata*, *O. emacerata*, var. *multisecta*, *O. fissicosta*, *O. insculpta*, *O. ella*.

*Atrypa cuspidata*.

*Strophomena alternata* and varieties *nasuta* and *fracta*.

*S. nutans*, *S. planconvexa*, *S. planumbona*, *S. plicata*, *S. filitexta*, *S. sulcata*, *S. rhomboidalis*.

*Rhynchonella capax*, *R. dentata*.

*Zygospira modesta*, *Z. headii*.

*Ambonychia radiata*, *A. amygdaloidea*, *A. alata*, *A. carinata*, and several varieties of *Ambonychia* not identified.

*Avicula insueta*, *A. demissa*.

*Modiolopsis modiolaris*.

*Leptæna sericea*, *L. transversalis*?

*Streptelasma corniculum*, *S. parvulum*.

*Cyrtoceras lamellatum*.

## UNIVALVES.

*Murchisonia bicincta*, *M. bellacincta*.

*Cyclonema bilix*, *Cyclora minuta*.

*Pleurotomaria tropidophora*.

*Cyrtolites ornatus*.

*Orthoceras junceum*, *O. bilineatum*, *O. spinale*.

*Ormoceras tenuifilum*.

*Chætetes tuberculata*, *C. mammulatus*, *C. lycoperdon*, *C. ponderosa*, *C. ponderosa*, var. *gracilis*.

*Monticulipora dalei*.

*Stenopora fibrosa*, *Stellipora antheloides*.

*Tetradium fibratum*.

*Favistella stellata*.

*Tentaculites flexuosa*.

## PARASITIC CORALS.

*Stenopora petropolitana.*

*Aulopora arachnoidea.*

*Ortonia minuta.*

*Protorea vetusta.*

## ENCRINURUS.

*Heterocrinus subcrassus.*

*Graptolithus mucronatus.*

## PLANTÆ.

*Butrothephis gracilis, B. succulosus.*

UPPER SILURIAN FOSSILS FOUND AT  
MADISON.

## CLINTON ROCK.

*Zaphrentis bilateralis.*

*Fenestella prisca.*

*Cyclonema cancellata.*

*Atrypa reticularis.*

*Ilænus insignis.*

*Dalmanites*, two or three varieties.

*Cariocrinus ornatus,*

*Orthis bifurcata,*

*Strophomena rugosa,*

*Leptaena sericea,*

*Rhynchonella neglecta,*

*Orthoceras*, several varieties,

*Stromatopora concentrica,*

*Hadrophyllum orbigny?*

*Platystoma niagarensis,*

*Chaetetes*, several varieties undetermined.

## FOSSILS IN THE CLIFF ROCK.

*Orthoceratites*,  
*Trilobites*, four varieties,  
*Spirifers*,  
*Encrinites*,  
*Strophomena rugosa*,  
*Hadrophyllum orbignyii*.

FOSSILS FROM THE WHITE LIMESTONE WHICH OVERLIES  
THE CLIFF ROCK.

*Calymene blumenbachii*,  
*Dalmania limularis*,  
*Orthoceratites*,  
*Fenestella*,  
*Spirifer*, several varieties,  
*Columnaria inequalis*.

## FOSSILS FROM THE UPPER NIAGARA.

*Pentamerus oblongus*,  
*Spirifer*,  
*Halysite*?  
*Hadrophyllum orbignyii*,  
*Fenestella*,  
*Favosites niagarensis*.

## DEVONIAN FOSSILS

Found at and near North Madison, and from thence to the west line of the county :

*Spirifer arenosus*, *S. acuminata*, *S. mucronatus*, *S. gregarius*.

*Conocardium trigonale*, *C. ohioense*,  
*Nucleocrinus vermeuillii*,  
*Platyceras attenuatum*,  
*Platyceras*, undetermined,

*Rensselaeria ovoideus*,  
*Fenestella*,  
*Philipsastrea vermeuillii*,  
*Pentamerus aratus*,  
*Spirifer varicosta*,  
*Strophodonta hemispherica*,  
*Xenophora antiqua*,  
*Ptylodictia gilbertii*,  
*Hadrophyllum orbignyii*,  
*Dalmanites ohioensis*,  
*Proetus planimarginatum*,  
*Favosites polymorphia*, *F. ramosa*, *F. fibrosa*, *F. troostii*,  
*F. goldfussii*, *F. gothlandica*, *F. maxime*,  
*Zaphrentis gigantea*, *Z. prolifera*, *Z. coniculum*, *Z. rafinesquii*,  
*Cyathophyllum rugosum*, *C. expansum*, *C. cespitosum*, *C. elongatum* (provisional), *C. parvulum* (provisional),  
*Syringapora tabulata*, *S. tubi-poroides*,  
*Amplexus yandellii*,  
*Stromatopora concentrica*,  
*Stromatopora*, several varieties,  
*Emmonsia hemispherica*, *E. cylindrica*.

Dawson suggests that the supposed impressions of *fucoids* in the Silurian rocks are erroneous, and that they were made by *Trilobites* rooting in the mud. I am not prepared to accept this explanation of the *fucoidal* impressions occurring, at this locality, a short distance above the *Favestella* outcrop.