NEW PROVIDENCE,
CLARKE CO., IND., Dec. 1873.

PROF. E. T. COX,

State Geologist of Indiana:

Sir—Agreeable to your letter of March 14, 1873, instructing me to make a Geological Survey of Clarke and Floyd Counties; to make examinations and note localities, and collect specimens of all minerals that are likely to be of commercial value; and obtain information on the manufactures and agricultural resources of the counties named, I submit the following report:

Very Respectfully, your obedient servant,

WM. W. BORDEN.
REPORT

of a

GEOLOGICAL SURVEY

of

CLARKE AND FLOYD COUNTIES,

INDIANA.

BY WM. W. BORDEN.

HISTORY.

The County of Clarke was laid off in the year 1801, at which time the whole number of its inhabitants did not exceed four thousand. The number of voters, who consisted only of freeholders numbered about three hundred and fifty. Until the purchase made by Governor Harrison of the Indians, the grant made by the State of Virginia to Gen. George R. Clarke and other officers and soldiers of the Illinois regiment, consisting of one hundred and fifty thousand (150,000) acres, it was the only tract in the county which belonged to the citizens of the United States, the remainder was owned by the Indians. This county was called Clarke as a tribute of respect to Gen. G. R. Clarke to whom the acquisition of this territory to the United States may be ascribed. Jeffersonville, situated on
the northwest bank of the Ohio river, nearly opposite Louisville, and a little above the commencement of the "great falls," was laid out in the year 1802 and was the first seat of justice of Clarke county. A land office for the disposal of the United States lands, and a post office were established here. Two pilots were appointed by law to conduct boats over the falls. Jeffersonville has grown to be a flourishing city and there are but few, or no better situations on the Ohio. The banks of the river at Jeffersonville are very high, and the current of the river for several miles above washes the northwest shore, and the depth of water is sufficiently great at any season of the year for boats or vessels of any burden, affording at all times an easy landing place and good harbor for boats descending the Ohio river.

BLOOMS EDDY.

This eddy is just below the first rapid. The early settlers availed themselves of this eddy as a landing place, and made portages from this landing to Jeffersonville, the distance not being more than half as great, on the Indiana as on the Kentucky side, and it was supposed that Jeffersonville would eventually become the principal landing place for boats having to unload above the falls. There is also noticed in this early history, that in the vicinity of Jeffersonville, about one mile to the northwest is a Medicinal Spring, supposed to be strongly impregnated with sulphur and iron. It was a place of considerable resort for invalids many years, and the waters were believed to be beneficial in fevers that prevailed in the west. This spring flows from the New Albany Black Slate, and was owned by Mr John Fischly.

The State Prison South is located at Jeffersonville, and also the United States depot, for United States Army supplies. The Ohio Falls Car Works of this city are among the largest in the West and are engaged in the manufacture of a large number of passenger and freight cars. Here
are also extensive ship yards where it is probable that more steamboats are annually built than at any other point on the river. Pork packing is also a business of very great importance to this city, and is extensively carried on.

Besides the above there a number of other manufactures which though less in extent, serve to add materially to the prosperity of this city, which is, as well as the neighboring city of New Albany, very favorably situated for the successful prosecution of all kinds of manufacturing industries.

GEOLOGY.

The counties of Clarke and Floyd are divided by a line extending from the point of union, of Clarke, Washington, Floyd and Harrison counties in a southeasterly direction, to its intersection with Silver Creek, and thence along this stream to its junction with the Ohio riv. r.

They are bounded on the north by Jefferson and Scott counties, on the west by Washington and Harrison, and on the south and east by the Ohio river.

The geological series represented within the above territory probably embraces a greater range of strata than is found in any other portion of the State. Beginning with the upper beds of the Cincinnati Group of the Lower Silurian, as seen in the northeastern part of Clarke County, it includes all the intermediate formations to the Pentremi tal limestone of the Sub-Carboniferous, at Greenville in the western portion of Floyd county.

The rock strata of this district were originally deposited horizontally, but at present are very much elevated in the northeastern border on the Ohio river.

These formations have the appearance of having been built up from the southwest, resting uniformly one upon the other, the lower always reaching farther east, than the formation immediately above, thus presenting to the geologist, on a grand scale, a wide field for investigation. The out-crop of so many different formations in this field is doubtless owing to the Cincinnati uplift, and to the effect of
erosion which has constantly been doing its work in wearing away strata.

As it is generally conceded by geologists that by fossils we may determine the equivalency of strata; as it were, the alphabet of the science; by them, therefore, I propose to identify the number and order of strata.

Water being the principal agent in the deposition of strata, the life of the ancient oceans has been buried in the sand, clay or lime which accumulated at the bottom. It is in this material therefore, subsequently changed to rock and elevated above the seas, that we now find their remains preserved in the condition of fossils.

Reasoning by analogy, from what is transpiring in the lakes, rivers and oceans of the present time, the conclusion is reached that countless myriads of organisms were ground to impalpable powder by the waves, and lost in the constitution of the rocks. Immense numbers of these remains although of frail structure are preserved intact, with their microscopic markings. Life abounded in the ancient Silurian sea which once covered the territory through which a portion of the Ohio river and some of its affluents now flow between corn covered hills. The coral reefs of these ancient oceans are now seen as limestone beds covered with the stems and heads, and long, gracefully waving and delicately fringed arms which belong to forms of a life, so old that the most exalted imagination of the poet and geologist, can have no adequate conception of the lapse of time since they were possessed of life.

THE CINCINNATI GROUP.

The lowest series of rocks exposed in the district composed of Clarke and Floyd counties, are seen in the northeastern part of the former county. The upper strata of the Cincinnati Group here outcrop at the mouth of Begg's Run on the Ohio river on tract No. 77, Illinois Grant, one and a half miles north of Fourteen Mile Creek. Begg's Run is fed by springs at the summit of the bluff some three
hundred feet above the Ohio river. The stream, by constant abrasion has worn a narrow and romantic channel through strata after strata to the river. In this locality the rock is a hard shaly blue limestone, carrying an abundance of characteristic fossils, which are exposed at extreme low water.

The following section was obtained immediately below the entrance of the stream into the river:

<table>
<thead>
<tr>
<th>Description</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Corniferous limestone</td>
<td>12 ft.</td>
</tr>
<tr>
<td>2. Yellow rock—Magnesian limestone</td>
<td>20 ft.</td>
</tr>
<tr>
<td>3. &quot;Grandad&quot; limestone used for building purposes</td>
<td>4 ft.</td>
</tr>
<tr>
<td>4. Gray Crystaline limestone, Niagara</td>
<td>14 ft.</td>
</tr>
<tr>
<td>5. Crinoidal bed containing Caryocerinus, etc.</td>
<td>6 ft.</td>
</tr>
<tr>
<td>6. Magnesian limestone</td>
<td>20 ft.</td>
</tr>
<tr>
<td>7. Blue and Yellow Clay shale</td>
<td>8 ft.</td>
</tr>
<tr>
<td>8. Stratified magnesian limestone</td>
<td>75 ft.</td>
</tr>
<tr>
<td>9. Blue shaly marlite</td>
<td>100 ft.</td>
</tr>
<tr>
<td>10. Dark blue shaly limestone, Cincinnati group</td>
<td>20 ft.</td>
</tr>
<tr>
<td></td>
<td>279 ft.</td>
</tr>
</tbody>
</table>

Low water Ohio river.............................. 0 ft.

The upper part of this section from number six upward correspond with the section at Utica, in Clarke county, where the rocks are quarried for lime and building purposes. The bluffs are here capped with corniferous limestone. The outcrop of the Cincinnati group here first exposed is on Camp creek; fourteen miles farther up the river, it is one hundred and eighty feet above the bed of Camp creek and two hundred and fifty feet above low water in the Ohio river. The elevation of the strata from that point to Marble Hill, six miles distant, and on the line of Jefferson county, will add about fifty feet more to this number. The Magnesian limestone which comprises the bluffs
on the river below the latter point, becomes the surface rock at many places on the bank of Camp creek and is in detached masses fifteen to twenty feet thick, and liable at any time, as their foundations weather away, to be precipitated into the valley below.

The general character of the Madison rocks, which belong to the Cincinnati group (in great force at Cincinnati), (Hudson River, so called, from being found on the Hudson River, N. Y.), as exposed on the bluffs of Camp Creek, are a thin stratified dark blue crystalline limestone, with intermediate layers of a lighter colored coarse grained limestone. At this point this formation carries an abundance of characteristic fossils—mollusca, corals, etc. The Marble Hill, marble stratum is also recognized here by its fossils, although in a disintegrating state.

The streams running into the Ohio at this point are tortuous in their course, and diminutive in size; their fountain heads being only two to three miles from the Ohio river, and they have worn their channel with difficulty through the rocks. The inclination of the strata is to the south-west, carrying the drainage a few miles west of the Ohio river into the head waters of Fourteen Mile creek. The country in the interior, a short distance from the river, is an alluvium flat which soon changes to fine rolling lands. Along the margin of the streams, and on the bluffs, the timber consists of Beech, (fagus), White oak, (Quercus alba), Buckeye, (Æsculus lutea), Poplar, (Populus canadensis), and Black Walnut, (Juglans nigra.) The dip of the strata in this region is to the southwest, at the rate of about twenty two feet to the mile. In places along the banks of the Ohio river, the rocks show in magnificent cliffs, some two or three hundred feet high. From the northeastern corner of the county the river flows along the line of strike in a southerly direction until it reaches a point near Utica, where it is abruptly deflected to the west, and runs nearly with the dip of the strata as far as New Albany where it is again deflected to the south.
At Marble Hill, on the line of Jefferson county, six miles from the mouth of Camp creek, the beds of the Cincinnati formation are well exposed. I obtained the following section in a ravine above the quarry, formerly worked by the Messrs. Dean:

1. Covered space, slope of the hill........... 90 ft.
2. Hard impure cavernous Sandstone, with surface weathered into holes....... 20 ft.
3. Blue shale ..................................... 6 ft.
4. Blueish limestone, magnesian.............. 20 ft.
5. Deep blue marly limestone, with Cincinnati fossils................................. 40 ft.
6. Murchisonia shell marble, Dean's.... 20 ft.
7. Dark gray limestone........................... 40 ft.
8. Fine grained marly limestone with green spots.................................. 20 ft.
9. Blue shaly limestone with Cincinnati fossils.......................................... 75 ft.
10. Space covered with debris.................. 12 ft.

The height of the ridge from low water is.......................................... 373 ft.

For convenience of reference, I introduce the following section of Dean's Quarry, as given by Dr. David D. Owen, formerly State Geologist, in a special report, with his remarks on the same:

1. "Upper Cliff" composed chiefly of magnesian limestone, terminating at their base by the four foot bed, used in the construction of the Court House at Louisville, Kentucky................. 93 ft.
2. Dark gray Madison water lime.......... 13 ft.
3. Thin beds of blue limestone alternating with dark marlite.......................... 40 ft.
4. Dark gray marlite (hard pan)............. 10 ft.
5. Ditto, rather darker colored and more indurated................................. 10 ft.
7. Alternations of blue limestone and marls............................................. 177 ft.

363 ft.

"The greater part of the beds composing the Marble Hill quarry consist of an immense accumulation of spiral marine univalves, belonging to the fossil genus *murchisonia*, and chiefly to the species *belicineta* intermixed with some *bicineta*. These shells are seldom perfect, more frequently broken, the fragments being cemented with calc spar, with occasionally a small percentage of protoxide of iron. An analysis of two specimens from the most important member of this section, the "conchitic marble" marked number six, was made by Dr. Owen and found to contain:

<table>
<thead>
<tr>
<th></th>
<th>No. 2a</th>
<th>No. 2b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture</td>
<td>0.001 grammes</td>
<td>0.001</td>
</tr>
<tr>
<td>Lime</td>
<td>0.460</td>
<td>0.505</td>
</tr>
<tr>
<td>Magnesia</td>
<td>0.050</td>
<td>0.018</td>
</tr>
<tr>
<td>Protoxide of Iron</td>
<td>0.0328</td>
<td>0.015</td>
</tr>
<tr>
<td>Alumina</td>
<td>0.0052</td>
<td>0.010</td>
</tr>
<tr>
<td>Insoluble earthy matter</td>
<td>0.002</td>
<td>0.020</td>
</tr>
<tr>
<td>Carbonic Acid</td>
<td>0.434</td>
<td>0.426</td>
</tr>
<tr>
<td>Phosphoric Acid</td>
<td>0.006</td>
<td>0.005</td>
</tr>
<tr>
<td>Manganese</td>
<td>a trace</td>
<td>a trace</td>
</tr>
<tr>
<td>Loss and Alkalies</td>
<td>0.010</td>
<td>a trace</td>
</tr>
</tbody>
</table>

|                | 1.000          | 1.000          |
The constituents appear to be combined in the rock as follows:

<table>
<thead>
<tr>
<th></th>
<th>No. 2a</th>
<th>No. 2b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbonate of Lime</td>
<td>81.6</td>
<td>89.68</td>
</tr>
<tr>
<td>Carbonate of Magnesia</td>
<td>10.5</td>
<td>3.80</td>
</tr>
<tr>
<td>Carb. of the protoxide of Iron</td>
<td>5.28</td>
<td>2.30</td>
</tr>
<tr>
<td>Phosphate of Lime</td>
<td>0.90</td>
<td>0.85</td>
</tr>
<tr>
<td>Alumina</td>
<td>0.52</td>
<td>1.00</td>
</tr>
<tr>
<td>Insoluble Earthy matter</td>
<td>0.20</td>
<td>2.00</td>
</tr>
<tr>
<td>Moisture</td>
<td>0.10</td>
<td>0.10</td>
</tr>
<tr>
<td>Manganese</td>
<td>a trace</td>
<td>a trace</td>
</tr>
<tr>
<td>Loss and Alkalies</td>
<td>0.90</td>
<td>0.21</td>
</tr>
<tr>
<td></td>
<td>100.00</td>
<td>100.00</td>
</tr>
</tbody>
</table>

The strata from which the above analysis was obtained, was extensively quarried by the Messrs. Dean in 1853. Many thousand yards of the stone, was cut by an extensive steam mill erected for the purpose, and distributed over the country. It entered into the construction of many public and private buildings, but proved on exposure to the weather to be unsuitabl for the purpose, and has long ceased to be employed as a building material. The quarry and mill was abandoned more than fifteen years ago, but the ground in the neighborhood on the occasion of my visit was covered with large quantities of cut stone, in a weathered condition. The lines of light yellow in the interstices, and between the shells, being composed of a salt of iron which is oxidised on exposure, destroys the value of the stone. Time with its agents, moisture, atmosphere, freezing and thawing, are the best tests of the durability of building stone.

Although this stone has not proven to be durable for outdoor work It is well adapted for inside ornamentation, and may be worked into mantels, table tops and other useful articles.

It takes a good polish, and is quite handsome, being filled with fossil spiral shells, which appear in fine contrast with its dark ground.
CLINTON GROUP OR EPOCH.

Immediately overlying the rocks of the Cincinnati formation, I have occasionally found a gray and yellow stratified sandstone, which I am inclined to refer, from its lithological characteristics, to the "Clinton Group" of the Ohio and New York geologists. It varies greatly, sometimes being hard at other times soft and easily worked. The thickness averages twenty feet.

It occurs at the summit of the ridge at Camp Creek; and continues to Marble Hill.

NIAGARA EPOCH.

The rocks belonging to this epoch, are so called from their appearance in great force at Niagara Falls. It is conspicuously displayed in Clarke county, along the line of the Ohio river, and occasionally occurs in the neighborhood of Charlestown, the county seat. The lowest outcrop of the Niagara is seen at extreme low water on the Falls of the Ohio, near the whirlpool on the Indiana side.

A characteristic fossil *Halysites escharoides*, or chain coral is here occasionally obtained. These rocks extend in a north-easterly direction to Utica on the Ohio river, seven miles above, where they are quarried for the manufacture of lime. The following section was obtained at Speed's quarry:

1. Corniferous limestone .................... 12 ft.
2. Yellow rock, impure limestone ............ 20 ft.
4. Gray crystalline limestone, burned for lime ................................. 14 ft.
5. Upper bed Crinoidal limestone .......... 2 ft.
6. Crinoidal bed containing Caryocrinus ornatus, etc, etc ....................... 4 ft.
7. Gray limestone ............................ 8 ft.
8. Magnesian limestone .................... 5 ft.

Total: 96 ft.
The "Yellow Rock," here forming the top of the Niagara appears to be a magnesian limestone and is well exposed in the quarry. At the head of Begg's Run it is weathered into large irregular shaped masses, presenting on the bluffs a columnar and castelated appearance which, in some instances, resemble the ruins of an ancient temple. One well poised block, six feet in diameter is termed "the head of the corner."

The limestone No. 2, 3 and 4, of the Utica quarry were used in the construction of the Ohio river bridge at Louisville. This bridge is one of the finest structures of the kind in the United States, and was built at a cost of over two millions of dollars.

We submit the following communication from the Louisville Bridge and Iron Company.

LOUISVILLE, Ky., November 25, 1873.

WILLIAM W. BORDEN, Esq.,

Assistant Geologist, Indiana:

Dear Sir—Yours of 25th. inst is at hand. We made no detailed experiments of the crushing strength of the Utica stone which is used in the Ohio river Bridge, having been perfectly satisfied from its character, appearance, and chemical composition that there was no doubt of its being able to do all that would be required of it in this respect. We compared its ability to withstand the action of frost, with that of five or six other stones with which we were acquainted, by the method given in Millans Civil Engineering, page eleven, and found it perfectly satisfactory. We did not allow the ledges with blue seams to be used in the face work. Regretting that I am unable to give you more definite information I am,

Yours Respectfully,

I. W. VAUGLEAN, Vice President.
The gray crystalline limestone, number four of this section, contains immense numbers of corals, characteristic of the Niagara limestone of the New York geologists, among which the beautiful chain coral, Halysites escharoides, is quite conspicuous. I also collected specimens of *Eridophyllum rugosum*, *Favosites niagarensis*, *Cladopora multiforma*, *C. reticulata*, and others of allied structure and beauty. It presents wherever exposed on the river a good face for quarrying. There is usually but little stripping required. The stone is easy of access, and convenient to the river for transportation; and is extensively used for building purposes. Some members of it are sufficiently firm and durable to answer the purpose of heavy masonry.

The lime burned from this bed and sold under the name of the Utica lime has acquired by long use a high reputation and where known is used in preference to all other brands.

J. Speed Esq., has erected at Utica two of pages patent kilns, each producing one hundred and twenty barrels of lime per day. At Robinson's landing, a few miles above Utica, Mr. Jacob Robinson burns of the same stone ten thousand barrels per year. The fuel employed is wood and requires four cords to burn one kiln. The Utica Lime Co., use a mixture of wood and coal, and have two kilns, each producing ninety barrels of well burned lime per day. The Louisville Cement and Lime Co., and the Utica Lime Co., and Mr. J. Robinson burn one hundred and twenty five thousand barrels of lime per year employing in the business a large number of hands.

The upper bed in the above section is shaly and unstable for building purposes, yet when burned produces a good article of lime, which is highly esteemed for the purpose of purifying coal gas. Mr. Jonas Howard uses the same layer of stone in the manufacture of lime at the falls of the Ohio. The crinoidal bed of the Niagara is worked with the other members at the Utica quarry and in it are found many beautiful fossils of interest to the geologist. The remains of crinoids are abundant, yet perfect specimens are rare. Perhaps the most notable
species is *Caryocrinus ornatus*, as this crinoid is here frequently obtained in a state of perfect preservation. The beds numbered seven and eight in the preceding section contain several species of Orthoceritites; and a number of corals with large cells resembling the genus Acervularia. The Niagara limestone is again seen a short distance above Utica at Charlestown landing. This is one of the oldest landings on the river. It was selected by the early settlers as being free from any danger, which might occur upon landing their arks near the "great falls" of which they had heard much but knew little. The out-crop at Charlestown landing is on the lands of Capt. S. C. Rucker and J. K. Sharp, Esq. Here are several extensive quarries, and the stone has been extensively worked for building purposes, and for making lime. At Sharp's quarry, below the landing, the following section was obtained:

1. Corniferous limestone .................. 2–3 ft.
2. Yellow rock, magnesian, used for building .......... 10–20 ft.
4. Gray crystalline limestone, used for lime ........................................ 14 ft.
5. Gray limestone .......................... 8 ft.
6. Blue and yellow clay ..................... 5 ft.
7. Magnesian limestone ..................... 18 ft.
10. Covered space to the river .......... 53 ft.

170 ft.

All the strata below No. 1 in the above column belong to the Niagara.

A section at Charlestown Landing would show a greater elevation of the strata on the river, and the elevation gradually increases as you go to the Mound Builder's Fort, one mile above, and to the mouth of Camp Creek, and Marble
Hill, in the edge of Jefferson county. There is an outcrop of the stratum marked No. 4, in the above section, on the south west side of Fourteen Mile Creek, near the summit of the hill, and on the road from Charlestown to the Mound Builders' Fort, in tract No. 76, Illinois grant. The fossils characteristic of this rock can here be collected without difficulty, as they are weathered out and lie scattered over the surface. Another exposure may be seen north-west of Charlestown, at "Nine Penny" branch, opposite "Tunnel Mill," on the road to New Washington. A section of the rocks show:

1. Covered space above......................... 20 ft.
2. Crinoidal limestone, blue.................. 3 ft.
3. Cement rock............................... Devonian 12 ft.
4. Corniferous limestone...................... 22 ft.
5. Magnesian limestone with corals, and
crinoidal stems................................ 24 ft.
6. Dark gray crystalline limestone........... 22 ft.
7. Light drab magnesian limestone, weathering into irregular shaped holes...... 20 ft.
8. Blue and yellow clay........................ 6 ft. 6 in.
9. Pinkish and gray magnesian limestone 6 ft. 6 in.
10. Stratified "marble," with green and
blue spots..................................... 4-6 ft.
11. Hard, shaly magnesian limestone........ 10 ft.
   Branch........................................ 0

The bed of Fourteen Mile creek, near this point, follows the base of the bluffs in the shape of a horse shoe. Samuel Works, the first proprietor of the mill, who located here over forty years ago, drove a four by six foot tunnel 315 feet in length through the narrow part of this ridge, and tapped the waters of the creek above. Motive power was thus obtained sufficient to drive three sets of burrs. This mill
in early days was the only grist mill in the county, and proved a great accommodation to the first settlers. It will stand as a monument of the perseverance and well-directed energy of its original owner. The mill is now owned and run by Wm. M. Green.

The corniferous limestone, immediately overlying the beds of the Niagara formation, constitutes, in the southwestern part of Clarke county, the Falls of the Ohio. The beds have here a thickness of twenty-two feet, and extend across the river in a southerly direction, forming a series of rapids, on a direct line, of one mile and a half. The following notes are from the office of Major General Godfrey Weitzel, United States engineer in charge of the improvements of Louisville Canal. They were furnished by Phil. I. Schopp, Assistant Engineer. The distance from the upper dam to head of Portland wharf, taken in a direct line, is seventeen thousand feet. Length of Canal around the Falls is nearly two miles. Lift of locks in the Canal, twenty-two feet. Greatest depth of water at the head of the Falls is at the Kentucky shore, where it is thirty feet. The length of the Falls proper is two and one-quarter miles, and the fall in this distance is twenty-six and one quarter feet. Sand Island is at the foot of the Falls, opposite the mouth of Silver Creek. Above this is Rock Island. Then Goose Island, the largest of all, and Corn Island, now almost washed away. Opposite Jeffersonville is Willow Island, or Tow-head.

The length of the great railroad bridge which crosses the Ohio at the Falls is, from tower to tower, one mile.

The main body of the water at the Falls passes through the Indian chute on the Indiana side, and has a descent from twenty-six to twenty-eight feet. The river here flows over the outcropping edges of the strata and along the dip, which is almost west. These strata belong to the Corniferous and Niagara series. A section of the rocks at the Whirlpool exhibits the following:
1. Soil and clay.
2. Spirifer gregaria bed............. 3 ft.
3. Crinoidal bed, nucleocrinus...... 3 ft. \{ Corniferous. \\
5. Black coral bed....................12 ft.
6. Gray crystaline limestone with 
   Halysites escharoides.......... 3 ft. \} Niagara.
   25 ft.

The corniferous limestone in New York contains disseminated masses of hornstone, or impure flint, and hence the name corniferous from the latin *cornu*, a horn. The general color of this limestone here, as in New York, is a dark gray, but disseminated between the layers more or less bitumen is found, which gives to the surface in such places a darker appearance; hence, called by the quarry-men, black rock.

The locality of the Falls has long been known as the collectors Paradise. The rocks are the coral reefs of the Paleozoic ocean and they contain myriads of fossil forms which exhibit the exquisite workmanship of the Creator. The corals are in the greatest profusion, many being of an immense size, and delicate texture. The species are numerous. I obtained specimens of Favosites turbinatum, F. Troostii, F. fibrosa, F. maximus, F. Goldfussi, Cyathophyllum corniculum, C. Halli C rugosum, Amplexus Yandelli, Zaphrentes gigantea, Z. Rafinesquii, with many others.

Crinoids are rare, although the lamented Maj. Sidney S. Lyon after a search of twenty years at the Falls, accumulated a magnificent collection, which are of great interest to the scientific world.

The vast water power of the Falls should be utilized, and perhaps the day is not far distant when this power will be brought into requisition.

Messrs. Smith & Milton have a large merchant mill on the Indiana shore, below the Great Railroad Bridge—
driven by a turbine wheel. This is the largest mill about the Falls and is capable of grinding five hundred barrels of flour per day, and with the recent additions of building and machinery will have a capacity to manufacture eight hundred barrels per day of the best merchantable flour in the country.

The dip of the corniferous limestone being about twenty one feet to the mile, it disappears beneath the Hydraulic limestone at Beaches mill below the Falls. At Fourteen Mile Creek, twelve to fifteen miles above the falls it attains an elevation of two hundred and fifty feet, and caps the bluffs almost the entire length of the creek, affording a fine field for the amateur collector of fossils, and a good stone for the manufacture of lime, and the building of fences.

In the neighborhood of Charlestown, it is well exposed on the head waters of Pleasant Run, but disappears one mile below, in the bed of the stream where it is replaced by the Niagara. At Skaws mill, and the Black Diamond Cement mill at Silver Creek it is seen beneath the Hydraulic limestone. On the Sinking Fork of that stream it outcrops in various places.

I have repeatedly found this formation to contain small caves; some of them one half to one mile and a half in length; with an abundance of stalactites, and some evidence of cave life. I have no doubt if the floors of these caves were dug into, that the remains of extinct animals might be obtained, with perhaps relics of the "mound builders."

The most important rock, in an economical point of view, in the district composed of Floyd and Clarke counties is:

**THE HYDRAULIC LIMESTONE.**

The lithological, stratigraphical and palæontological, characteristics of this stone should be well understood by the inhabitants of the latter counties, where its outcrop may be seen in the banks of almost every stream. Its horizon is immediately above the corniferous limestone and below a forty two, to forty eight inch bed of crinoidal limestone which is over-laid, by the New Albany Black Slate. It frequently occurs as the surface rock.
The color is usually a light drab, but sometimes it is of a much darker shade. The top layers of the Hydraulic stone is marked at various points by a dendritic crystalization of magnesia or lime. The upper beds contain cherty or hornstone concretions, with spicula of sponges and desmids.

The characteristic fossils of the Hydraulic or cement limestone are, Atrypa reticularis, Spirifer Owenii, S. euritine, S. barucosa, Hydrophyllum orbignyi. The stone is without cleavage and breaks with a conchoidal fracture. The average thickness of the strata is about twelve feet, and the bed is divided according to its hydraulic properties into quick, medium and slow setting. The quick setting variety is well marked in J. Speed’s quarry on Silver Creek by a seven foot stratum, which diminishes in the time required to set, towards the bottom. The medium stone is from two to three feet thick and imperfectly parted from the slow setting stone, forming the lower part of the quarry. The lines of demarcation between the separate beds, although well marked, in some cases, are rather assumed lines of division.

On the lines where the Corniferous or Niagara are the surface rocks, the cement is wanting, that is, it has been worn away by erosion. The beds follow the line of Silver Creek from the Falls to the junction of the west fork, bearing east on the line of Pleasant Run, thence west of Charlestown with a more easterly belt following the Vernon Branch of the O. & M. R. R., as at Watson, and terminating northeast of Charlestown on A. Barnett’s land, but appearing again at a few points north of Fourteen Mile Creek on the same line, as at J. McMillan’s. The most western belt follows the line of Sinking Fork, cropping out on that stream, and to the west of it, as at J. Davis’ Tract 169, Illinois Grant. West of this it disappears below the New Albany Black Slate. The most workable beds are on Tract No. 169, and No. 150, lands of Dr. Taggart; No. 132, lands of Collins McCoy deceased; and cement mill tract No. 130, Illinois Grant; and on Pleasant Run, and a narrow belt east of Charlestown, thence to the Falls. The cement rock
appears on the head waters of Fourteen Mile Creek, and disappears beneath the New Albany Black Slate two miles north of G. W. Mathews', Tract No. 152, Illinois Grant. Also, at A. M. Tucker's, Tract No. 153, Illinois Grant. The cement reaches far in the direction of Wm. Kirkpatrick's, formerly the residence of Ex-Governor Jennings.

I have traced the outcrop of this formation on fifty sections of the Illinois Grant, each containing five hundred acres, making twenty-five thousand acres of exposed workable beds. This estimate does not include twenty thousand acres more which may be reached by means of shafts and tunnels. There is but a small portion of the county in which the hydraulic limestone may not be found. Indeed, it is in quantity practically inexhaustable, and on account of its value for the manufacture of cement, will always be a source of profitable industry.

There are at the present time six firms in the county engaged in the manufacture of hydraulic cement.

The stone was first employed for this purpose at Verey's (now Beach's) mill, at Clarksville, on the Falls of the Ohio. The strata containing it, outcrops in the river bank beneath the mill, and the hydraulic stone is here fourteen feet six inches thick, as will be seen by the following section:

```
1. New Albany black slate............. 5 in.
2. Crinoidal limestone.................. 4 ft. 2 in.
3. Dark, impure limestone, containing concretions of hornstone, with spicula of sponges............. 11 in.  
   Hydraulic limestone.
4. Upper cement bed... 4 ft. 1 in.
5. Middle cement bed... 6 ft. 14 ft. 6 in.
6. Lower cement bed... 3 ft. 6 in.
Corniferous limestone................. 6 ft.
```

25.1
The dividing line between the corniferous and hydraulic is not distinctly marked. The beds in the quarry are separated by lines of fracture, making occasional floors. The stone increases in hydraulic properties from below upwards, and is designated by the manufacturers as slow, medium and quick setting. It has no distinct lines of cleavage, and breaks with a conchoidal fracture. The extreme upper beds contain concretions of hornstone, with spicula of sponges. The overlying crinoidal bed is persistent and contains a good many fossils, which are difficult to obtain in good condition. It cleaves well, but is hard to work.

It is used in constructing the outer wall of the kilns in which the cement stone is burnt. The mill located here is one of the oldest engaged in the manufacture of cement, and has acquired a widespread reputation. Three kilns are employed in calcining the cement stone, preparatory to grinding. And the two sets of burrs at this mill are sufficient to grind fifty thousand barrels of cement per annum. The proprietor, Wm. F. Beach, Esq., employs a large number of men in quarrying, burning, grinding and shipping cement. On account of its being convenient to the river, boats may be loaded direct from the mill. A tunnel, with lateral branches, has recently been driven one hundred feet into the bed of hydraulic lime stone, and the quality and thickness of the layers prove to be continuous.

The hydraulic limestone originally extended in one unbroken stratum across the river, but has been eroded, and now only a small portion of the original mass remains on Rock Island, near the center of the stream. Here there is a good exposure, and the rock is extensively quarried at Rock Island, which is below Goose Island. The cement rock may be traced at a low stage of water to the Kentucky shore. On the latter side of the river is the old Tarviscon Mill, originally built for grist purposes, but now employed by the Louisville Cement Company for grinding cement. About one mile above this is the new cement mill of D. Belknap & Co. The hydraulic limestone used at both of these mills is obtained from the bank of the river close by.
On the Indiana side of the river in Clarke county, six miles from Jeffersonville, on the line of the Jeffersonville, Madison and Indianapolis Railroad, on the bank of Silver Creek, is the cement mill of Hohn & Co. The hydraulic limestone outcrops in the bank of the creek and presents the same characteristics as at the Falls. This mill has four kilns and two run of stones. A short distance further down the creek near the railroad bridge, on Tract No. 48, Illinois Grant, is the Black Diamond Cement Mill of Dexter, Belknap & Co. This mill has sufficient capacity to manufacture seventy-five thousand barrels of cement per annum. It contains two sets of burrs and three kilns, and furnishes employment to thirty men. The fuel used is Pittsburg coal. The sales of the Company amount to thirty thousand barrels of cement per year, and is shipped in bulk, sacks and barrels, to all parts of the country. The hydraulic limestone used is obtained from the bank of Silver Creek beneath the mill. A section measured here exhibits:

1. Alluvium........................................ 4 ft.
2. Dark col’d hydr’lic limestone, 6 to 8 ft. 13 ft.
3. Hard, dark colored cement stone, 7 ft. 6 ft.

The four foot bed of crinoidal limestone usually capping the hydraulic, being absent at this quarry, the only stripping required is the removal of the earth. The stone as a general thing is considerably harder and of a darker color than at other exposures, but the quality of the cement manufactured is equal to the best brands. About eight miles from Jeffersonville, near the J., M. & I Railroad, is D. Belknap & Co’s Fall City Mill. The hydraulic limestone here attains a thickness of thirteen feet, with no overlying crinoidal limestone. The quarry is very extensive and furnishes all the limestone the mill is capable of grinding. The burrs are of the best quality and four and one half feet in diameter. The fuel employed in the four kilns used for calcining the stone is bituminous nut coal.
At Petersburg, near the crossing of the J., M. & I. Railroad over Muddy Fork of Silver Creek, and at Watson on the Vernon branch of the O. & M. Railroad, Messrs. J. Speed & Co., have two of the largest mills engaged in the manufacture of cement. The one at Petersburg has the capacity to produce one hundred thousand barrels per annum, and employs about sixty men. There are four sets of French burrs, four feet and one-half in diameter. The kilns are eight in number, built of the crinoidal limestone, which overlies the hydraulic, and lined with fire brick brought from Pomeroy, Ohio. They are each capable of producing from fifty to one hundred and twenty-five barrels of cement per day. During six days of last August, six kilns at this mill made two thousand three hundred and ninety-five barrels of cement. A section at the quarry adjoining showed:

1. Soil..............................................4 to 6 ft.

The companies manufacturing cement on both sides of the Ohio river, in Indiana and Kentucky, have formed a copartnership under the name of the Union Cement Association, and have appointed Philip Speed, Esq., Agent, with an office at No. 113 Main street, Louisville. To this Association all the mills make returns and are apportioned a certain amount of cement to manufacture, so as not to glut the market. From data obtained at the Secretary's office, we tabulate the following statistics:
# Cement Made in Clarke County During the Year 1871

<table>
<thead>
<tr>
<th>List of Firms</th>
<th>Brands</th>
<th>Locality</th>
<th>Annual Capacity of Mills, Barrels</th>
<th>Annual Sales, Barrels</th>
</tr>
</thead>
<tbody>
<tr>
<td>W. F. Beach</td>
<td>Red Brand</td>
<td>Clarkesville, Clarke Co., Ind...</td>
<td>50 000</td>
<td>22 350</td>
</tr>
<tr>
<td>W. S. Hohn &amp; Co.</td>
<td>Silver Creek</td>
<td>Cementville, Clarke Co., Ind...</td>
<td>75 000</td>
<td>35 245</td>
</tr>
<tr>
<td>Dexter, Belknap &amp; Co.</td>
<td>Black Diamond</td>
<td>Cementville, Clarke Co., Ind...</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D. Belknap &amp; Co.</td>
<td>Falls City</td>
<td>Seiversburg, Clarke Co., Ind...</td>
<td>300 000</td>
<td>137 471</td>
</tr>
<tr>
<td>D. Belknap &amp; Co.</td>
<td>Crescent City</td>
<td>Louisville, Kentucky...</td>
<td></td>
<td></td>
</tr>
<tr>
<td>J. Speed &amp; Co.</td>
<td>Louisville Cement Co.</td>
<td>Shippingsport, Kentucky...</td>
<td></td>
<td></td>
</tr>
<tr>
<td>J. Speed &amp; Co.</td>
<td>Louisville Cement Co.</td>
<td>Watson, Clarke Co., Ind...</td>
<td>400 000</td>
<td>166 100</td>
</tr>
<tr>
<td>J. Speed &amp; Co.</td>
<td>Louisville Cement Co.</td>
<td>Petersburg, Clarke Co., Ind...</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The month of December sales not included in the above.

Total: 391 166
The many uses to which cement is put in Europe, has impressed Prof. E. T. Cox, the Indiana Commissioner to Vienna, with its importance. There it is extensively used for laying pavements, in ornamenting buildings, making statuary, etc. He is of the opinion that the Indiana cement, commonly called Louisville cement, may be profitably used for similar purposes in this country. Occasionally in calcining the cement the rock is over-burned, making what is called a cinder; and it is here suggested that this "cinder," ground in connection with the other stone, will improve the quality of the cement. The manufacture of cement opens an interesting and wide field for investigation.

Various grades of cement are already manufactured, and there can be no doubt but new combinations of stone may be formed in Clarke county that will equal in value the Portland or Roman cement of Europe.

**CRINOIDAL LIMESTONE.**

This stone immediately overlies the hydraulic, and is seen at almost every locality where the latter outcrops, or is quarried for cement. It is a hard, gray, crystalline limestone, containing a great many fossils, principally crinoids, and also pentramites of the carboniferous type, intermediate between P. florealis (Godenii) and P. pyriformis, (Say). The fossils of this limestone have been carefully studied and described by the late Major Sidney S. Lyon. Collectors in the neighborhood of the Falls have also enriched their cabinets with the fossils from this rock.

The collection of James Knapp, M. D., of Louisville, is undoubtedly the most complete in these fossils, and his collection of corals, made at the Falls, is the most extensive in the country.

A very nice collection of Falls fossils is also in the possession of Samuel L. S. Smith, M. D., of New Albany, to whom I am indebted for characteristic fossils and valuable information. The crinoidal limestone seldom attains a greater thickness than five feet. It is a poor stone for the manufacture of lime, but serves a useful purpose in the
erection of kilns for calcining cement, and is a reliable guide for denoting the position of the hydraulic.

The New Albany black slate is referred by the Ohio geologists to the Devonian, and the equivalent of the Genesee slate of New York. Prof. R. P. Whitfield, of Albany, N. Y., the able assistant of Prof. James Hall, remarks, that this slate has been referred to the Devonian on stratigraphical grounds alone. It is possible, therefore, that it is not correctly placed, as fossils are the only reliable means of determining its horizon. From this it may be inferred that the place of these shales is not satisfactorily settled.

The black slate is largely exposed at New Albany, and on that account I propose to designate it in this report as the New Albany black slate. It is usually of a jet black color, and occurs in thick beds, but after being exposed to the weather it exhibits a thin, laminated cleavage, and it assumes a pink, drab or mottled color. It contains sulphuret of iron in concretionary forms, and also in needle shaped crystals and cubes, familiarly known as "fools gold," or "sulphur balls."

Wells have been sunk at various points in this formation for mineral oil or petroleum, but without reaching it in any quantity. It contains a small percent. of bitumen and burns quite readily when thrown into a hot fire, so long as the inflammable matter lasts. The bituminous character of the black slate has misled a great many persons, and caused them to expend large sums of money in searching in it for coal. The black slate is very presistant over a large extent of territory. It lies at the base of the range of hills known as the "knobs," and has been traced from the outcrop in Clarke and Floyd counties, Indiana, through Kentucky in a semi-circle to Portsmouth, Ohio. At one time it rested uniformly over Clarke and Floyd counties.

At the foot of the knobs near New Albany, according to the borings made by Dr. Clapp, the thickness of the black slate is one hundred and four feet, and from thence it may be traced in patches through the cement region to Rockford, in Jackson county, Indiana. It was struck at a depth of
twelve hundred feet in the artesian well at Terre Haute, and it outcrops on the Wabash river at Delphi, Carroll county, Indiana. But in many places it has been cut through and entirely removed by weathering, and glacial action, so as to leave exposed the underlying encrinital limestone. The valleys of deundation have a general direction—north-west and south-east. The Vernon branch of the O. & M. Railroad passes over the black slate south of Charlestown, and cuts it at several points below and above Lexington, in Scott county. On the west of Charlestown there is an outlier of the formation seventy to seventy-five feet in thickness. The Jeffersonville, Madison & Indianapolis Railroad passes over the black slate until it reaches White river at Rockford, Jackson Co., Ind. At Memphis and Henryville, on the line of this road, the black slate is largely exposed, and may be seen in the beds of the streams and extending some distance up the surrounding hill sides. Numerous, so-called, copperas banks are met with in this formation. One of these localities on Silver Creek, three miles from the mouth, is mentioned in the "Navigator's Guide," an old work published at Pittsburgh in 1813, as furnishing "copperas as good as any brought to this country."

A noted copperas bank is found on Miller's Fork of Silver Creek, below Henryville.

The "black slate" has no economical value whatever at present. A few years ago it was thought it would make a good roofing material, ground and mixed with coal tar and spread on felt. A mill was erected at New Albany by Dr. Samuel Reid & Co. for the purpose of its manufacture, and large quantities of slate was ground and shipped to all parts of the country. It answered the purpose for which it was intended very well for a time, but ultimately it cracked by exposure to the weather, and was at last discarded as worthless. In my examination of the black slate I have invariably found a ferruginous limestone capping it, varying from ten to thirty inches in thickness. This limestone is very persistant and marks the top of the black slate over a large district in Indiana and Kentucky. It has a
fetid odor when struck, and breaks with an uneven fracture. It is compact and durable and has been used in several sections for masonry, as at Memphis and Henryville, where it outcrops to a large extent. I have recently seen it four feet in thickness on the Knoxville Branch Railroad, in Kentucky, and it attains a thickness of thirty inches in Falling Run, below New Albany. At Blue Lick Post Office, in Clarke county, on the land of Thomas McDeitz, Jr., in the bed of a branch of Silver Creek, is the best exposure of this stone I have seen. So far I have not been able to detect any characteristic fossils in this stone beyond a few crinoidal stems. But I have no doubt the age of the black slate will be ultimately determined by the discovery of fossils in this formation, which from its position, is the equivalent of the goniatite limestone of Rockford, Indiana.

The knob measures of the Kentucky, or the siliceous group of the Tennessee geological reports, extend over the western part of the district composed of Clarke and Floyd counties, and constitute the broken range called "Silver Hills" by the first settlers. These hills, or knobs, extend from a point on the Ohio river below New Albany to the northern line of Clarke county. At the latter locality the range is called the Guinea Hills. The knobs, as their names imply, rise abruptly from the black slate to a height of four or five hundred feet above the general level of the country. The margin of the outcrop of the knob formation is very irregular, especially on that portion west of Henryville, outliers being seen some distance from the main body. One of these, called the "Round Top" is near the fruit farm of J. F. Willey, Esq., another at Piney Point, south of Obadiah Nowland's, Buzzard Roost Point to the east, and also Crow's Nest Point to the west of Nowland's. The horse shoe range of knobs, entirely disconnected from the main body, are about one mile in extent, and on land owned by John Richardson. The prolongation of the knobs north-east of Henryville comprise several benches of table land. Where the base of the knobs cover a considerable area the top is usually flat, especially if the harder members of the formation represent
CLARKE AND FLOYD COUNTIES.

their summits. The rocks forming the knobs are arranged as follows:

NEW PROVIDENCE SHALE.

This shale lies at the base of the knobs and immediately above the ferruginous limestone referred to above, and has a thickness from eighty to one hundred and twenty feet. As you follow the line of the knobs to the north-west it becomes thinner, until at the Guinea Hills it is only fifty to sixty feet. It is a fine greenish colored marly shale, that pulverizes when dry without difficulty. It contains a great variety of fossils identical with those obtained at Button Mold knobs even miles south of Louisville, in Kentucky.

I have collected at several points from this shale: Spirifer Kentuckensis; two species of Chonetes, Orthis michelini, O. penelope, and an undetermined Orthis, a trilobite of the genus Phillipsia, and several species of crinoids belonging to the genus Cyathocrinus, Platycrinus, Synbathocrinus, Actinocrinus, and Forbesioerinus.

The corals are well represented by a number of Bryozoans. The shale is fissured in places and the cracks are usually filled with transparent sulphate of lime, or gypsum.

As many as six to ten bands of carbonate of iron have been found in this formation in a vertical space of about twenty feet. The lower band is usually on a level with the drainage of the country. These bands will average from four to six inches in thickness, and are separated from each other by from two to four feet of soft shale. They have a great persistency, and may be seen cropping out along the side of all the ravines. Attention was called to the importance of these ores in the second and third Reports on the Geology of Indiana. The following analysis of a portion of what appears to be the average of these ore bands found on the farm of John Stewart, Esq., north of Henryville, as taken from a paper published by the State Geologist, will serve to show their commercial value. The mass of the ore is of a bluish gray color, enclosed in a coating of red oxide
of iron one-eighth to one-fourth of an inch thick. This coating is very rich in iron, but was entirely excluded from the portion analyzed, so that the yield of the entire mass will be a little better than here reported. The net results are given in parts of 100:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture dried at 212°</td>
<td>0.500</td>
</tr>
<tr>
<td>Insoluble silicates</td>
<td>16.400</td>
</tr>
<tr>
<td>Carbonate of iron</td>
<td>49.720</td>
</tr>
<tr>
<td>Peroxide of Iron</td>
<td>2.171</td>
</tr>
<tr>
<td>Manganese</td>
<td>2.500</td>
</tr>
<tr>
<td>Alumina</td>
<td>1.500</td>
</tr>
<tr>
<td>Carbonate of magnesia</td>
<td>14.000</td>
</tr>
<tr>
<td>Carbonate of lime</td>
<td>10.000</td>
</tr>
<tr>
<td>Sulphuric acid</td>
<td>0.686</td>
</tr>
<tr>
<td>Phosphoric acid</td>
<td>0.779</td>
</tr>
<tr>
<td>Loss and undetermined</td>
<td>1.744</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100.000</strong></td>
</tr>
</tbody>
</table>

By roasting, this ore will lose thirty per cent. of volatile matter, which will increase the iron to thirty-five per cent., and the manganese to 3.571. A portion of the sulphuric acid would be eliminated, but the phosphorus will be increased to about .485, which is rather large. However, it is not improbable that a portion of the latter highly injurious ingredient may be taken out along with silica in the slag, and owing to the large per centum of manganese, if not a spiegeleisen, at least, a valuable Bessemer pig may be made from these ores. Owing to their leanness these ores should be roasted before being shipped to the furnaces.

Thomas Montgomery has on his land, Tract No. 274, Illinois Grant, three and a half miles from Henryville, a good exposure of iron ore, as shown in the following section:

1. Greenish blue shale       2 ft.  0 in.
2. Band iron ore, with interme-diate kidney ore       0 ft.  5 in.
3. Greenish blue shale       4 ft.  0 in.
4. Band iron ore             0 ft.  5 in.
5. Greenish blue shale ....................... 4 ft. 6 in.
6. Band iron ore .................................. 0 ft. 6 in.
7. Greenish blue shale ....................... 3 ft. 0 in.
8. Band iron ore with kidney ore ........ 0 ft. 8 in.
9. Greenish blue shale ....................... 2 ft. 0 in.
10. Band iron ore ................................ 0 ft. 8 in.
11. Greenish shale ................................. 1 ft. 6 in.
12. Band iron ore with grains .......... 0 ft. 5 in.
13. Shales ........................................... 3 ft. 0 in.
14. Ferruginous limestone, with crinoidal stems ...... 2 ft. 6 in.
15. New Albany black slate ............... 6 ft. 0 in.

31 ft. 6 in.

The ore in this bank was examined forty years ago by an iron master from Pennsylvania—James Works. He pronounced it good, and made preparation to erect a furnace, but the project was finally abandoned.

The ore crops out in almost every ravine in this region—everywhere of the same general character, and contains about the same quantity of iron. Another deposit of iron ore of considerable extent is seen on the land of Allen Barnett, near Broom Hill, on the New Albany & Chicago Railroad. Some of this ore has rather a peculiar structure, and is made up entirely of an aggregation of coarse particles of hydrated brown oxide. It is what is usually denominated kidney ore, and is scattered profusely over the surface. The whole country at the base of the knobs, where the New Providence shale outcrops, is rich in iron ore. It accumulates in the ravines and valleys by the washing down of the formation which contained it, and is generally easy of access.

The Jeffersonville, Madison & Indianapolis, and the Louisville, New Albany and Chicago, and also the Vernon branch of the Ohio & Mississippi Railroad, are about ten miles apart in Clarke county, and they all pass through the district containing these ore seams, and afford a ready means of shipment to the blast furnaces now in operation in this
State. But I should like to see one or more furnaces built expressly to smelt this ore, and either of the following cities would prove a suitable location, viz: Jeffersonville, New Albany or Indianapolis; the question of cheap fuel being of chief importance in the selection of the locality.

It is probable that the New Providence shale, on account of its mineral constituents, and being highly fossiliferous, will make a good fertilizer. I have instituted practical experiments to determine its value, and forwarded specimens to the State Geologist for analysis.

A great number of mineral springs flow from the fissures previously mentioned as occurring in this formation, the waters of which possess decided medicinal virtues. One of the most noted of these springs is situated on the land of Sampson King, Tract 234, Illinois Grant. The water has been analyzed by the State Geologist and found to contain the following:

<table>
<thead>
<tr>
<th>Component</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alumina and oxide of iron</td>
<td>2.001 grains.</td>
</tr>
<tr>
<td>Sulphate of lime</td>
<td>71.806 grains.</td>
</tr>
<tr>
<td>Sulphate of magnesia</td>
<td>429.660 grains.</td>
</tr>
<tr>
<td>Chloride of Sodium</td>
<td>286.090 grains.</td>
</tr>
<tr>
<td>Sulphate of sodium and potash</td>
<td>204.400 grains.</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>993.957</td>
</tr>
</tbody>
</table>

This mineral has a similar composition to that from which the celebrated Crab Orchard salts of Kentucky are manufactured, and its use has produced good results in certain diseases where a simple alterative or cathartic was required. It is in good demand, and has been shipped to the cities about the Falls, and to other parts of the State. Another spring, of equal medicinal properties, is on the farm of John Stewart, north of Henryville. Augustus Reid, in Munroe township; [and Parady]Payne, a short distance from Blue Lick Post Office, have springs, the waters of which also produce the same medicinal properties. Mr. Hosea, near by, and Esq. King, of Carr township, have mineral springs of similar water. This medicinal water, as predicted by
Prof. E. T. Cox, has been found at New Providence by deepening the well at Mr. T. S. Carters' stave factory, and no doubt will be found over the entire region of the shale. The New Providence shale is well exposed below New Albany at the base of the knobs. In this locality, as well as along the Corydon Plank Road, it attains its full thickness. Trestle No. 6 of the Air-line Railroad, rests upon its summit, and Trestle No. 1 is at its base; and the thickness is here more than one hundred feet. About the usual quantity of kidney ore is found also in it at this locality, but the stratified ore does not occur here as it does on the extension of this horizon into Clarke county. This shale at the base of Caney Knob, below New Albany, is capped by a thin stratum of ferruginous sandstone, while in the northwestern part of Clarke county it is covered by a thin fossiliferous limestone, composed of an aggregation of crinoidal stems. Specimens of the stone, ground and polished, exhibit a fine variegated surface. Above this hard band of shale is a bluish, friable micaceous shale, which I recognize to be the true knob shale. It ranges in thickness from one hundred and twenty to one hundred and sixty feet, and extends half way or more up the sides of the knobs, and in many cases where they are conical, it forms the summit.

In other places it is frequently capped with massive sandstone, or beds of impure limestones, containing crinoidal stems. In these shales are found fossil worm tracks, tcocoids and concretions of iron ore of large size, and often containing brachiopods.

The massive knob sandstone, where capping these shales, is from fifty to eighty feet thick, in beds of various thickness. The upper part is composed of ferruginous layers ten to fifteen inches thick, and contain ripple marks on the underside. It hardens on exposure. This stone is used about New Providence for door steps, and many other purposes. A section of the knobs at Jarus Fordyce's, Esq., on the Greenville road, exhibits the following succession, commencing at the top:
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GEOLOGICAL REPORT.

1. Hydraulic limestone of Floyd county, with fossils............. 5 to 10 ft.
2. First knob limestone, with chert beds................................ 20 to 65 ft.
3. Ferruginous sandstone, used at New Providence............... 3 to 4 ft.
5. Knob shale........................................ 100 to 160 ft.

314 ft.

The first limestone of the Knobs No. 2 of this section has a gray color, with crystalline structure, and contains in some parts concretions of chert. It has a thickness of twenty feet at this point, but thickens toward the southwest, and finally reaches sixty-five feet. This is the stone so extensively quarried near Mooresville, in Floyd county, for building purposes about New Albany.

I have obtained from some members of this formation, especially at the Bryozoa bed, on Daniel Coates' land, near the sand bank, *Productus tenuicostatus* P. *punctatus*, P. *vitalis*, and a great variety of spirifers, and terebratula, with numerous Bryozoans. The sandstone, No. 4, of the above section is highly fossiliferous and contains *Spirifer*, *Syringothyris textilis*, *Orthis umbraculum*, *Streptorthynchus*, *Keokuk*, *Orthis Keokuk*, *Spirifer propinquus*, S. *cuspidatus*, *Hemiphronites crenistriata*, *Productus reticulatus*, and a conularia.

Immediately above this fossiliferous limestone are found a number of thin layers of bituminous shale, containing an occasional coal plant fossil. The impure limestone, capping these formations resembles the Devonian hydraulic limestone of the cement region. I have no doubt if properly tested it will be found to answer the same purpose of that stone. It underlies the white sand, which is mined for the Star Glass Works, of New Albany, Floyd county, Indiana, at
the top of the knobs, near the intersection of Washington, Clark, Floyd, and Harrison counties. From this point to Greenville, in the western part of Floyd county, the following section is exposed:

1. Soil, red ferruginous clay........ 22 ft.
2. Pentramital limestone with Archimedes...................... 15 to 25 ft.
3. Blue limestone with intercalated shales.................... 50 to 60 ft.
4. Carboniferous hydraulic limestone, with fossils........... 5 to 10 ft.

117 ft.

The shales of this section are of a bluish color and may be seen in the ravines and banks of the water courses underlying the pentramital limestone.

The members composing the knob series do not retain the same character throughout the district. They are not as uniform in composition as the formations below them, and they vary greatly in thickness and color, and are thicker at the western than at the eastern outcrop. A section from Spurgeon Hill, near Harristown, Washington county, to low water mark of the Ohio river at New Albany, will show all the Knob formations with their minute divisions from the upper pentramital limestone to the black slate:

1. Red ferruginous clay.............. 20 to 30 ft.
2. Light gray shaly limestone, with Bryozoa, Pentramites, etc........ 5 ft.
3. First chert beds, with geodes containing quartz crystals....... 3 ft.
4. Dark gray crystalline limestone with pentramites and crinoids, and a mass of fossils in some parts............................. 25 ft.
5. Light drab, soft magnesian limestone (hydraulic) ............... 6 to 8 ft.
6. Blue shaly crystalline limestone, with shades of brown, full of fragments of crinoids.............. 15 ft.
7. Blue aluminous shale.................. 16 ft.
10. First limestone top of the knobs 20 to 65 ft.
11. Knob grit stone, with thin slabs in the upper part............. 20 ft.
12. Knob sandstone, with spirifer, Syringathyris textilis, and Strep-torhynclus koekuk (Orthus)........ 40 ft.
13. Knob shale, with concretions of iron stone........................ 100 to 120 ft.
14. Crinoidal limestone, with fragments of crinoids.................. 2 ft.
15. New Providence shale, with iron ore, and fossils in some parts................................. 120 ft.
16. Ferruginous limestone, with crinoidal stems...................... 3 ft.
17 New Albany black slate.............. 60 ft.

It usually contains several thin beds of fossiliferous limestone containing lithostrotion mamillare. The pentremital limestone has a thickness of twenty-five to fifty feet, in the neighborhood of Greenville, where it outcrops near the summit of the hills.

This limestone contains many fossils, as Pentramites, florealis, P. sulcatus, P. konickana, and a species of Archimides. The soil immediately covering the limestone is tough, tenacious clay, colored with the oxide of iron. The following section is seen at Greenville, Floyd county:

1. Soil and clay.............................. 4 to 10 ft.
2. Light drab fine grained limestone, St. Louis.......................... 60 ft.
3. Pentramital limestone................. 20 to 50 ft.
4. Shaly limestone with fossils......... 30 ft.
5. *Very dark* stratified limestone
with fucoid impressions in the
upper parts............................ 15 to 50 ft.
6. Light colored stratified limestone,
with fossils............................ 25 ft.
7. Light drab shale with *Bryozoa*
and shells, at Alexander Hedden’s
branch ......................... 20 ft.

Several good quarries are worked in this vicinity; one
near the camp ground. It is owned by Joseph Fetz. The
stone is No. 5 of the above section, and is in layers from
fifteen to thirty-six inches thick. It is a good building
stone, and is used for repairing stone roads. There are two
other quarries of limestone on the summit of the hill near
the toll gate on the turnpike. One of these is worked by
Morris Morris, Esq., of Greenville, and the other is owned
by Dr. R. Smith, of the same place. The stone of these
quarries is the true St. Louis limestone.

On the old New Providence road to New Albany, south
east of Scottsville, below Aken’s mill, on Big Indian Creek,
the following section is seen in Aken’s hill:

1. Ochreous clay......................... 5 to 10 ft.
2. Stratified chert beds (well ex-
posed in this region).................. 12 ft.
3. Layers of stratified sandstone,
alternating with shale................. 200 ft.
4. Massive sandstone with concre-
tions of iron, and *Syringathyrys
textilis* in the upper part........... 50 ft.
   Bed of Indian Creek............... 0 ft.

Near the top of the hill towards Mooresville, beds of from
ten to twelve feet of very soft, bright colored ochreous sand-
stone are exposed, portions of which is a good mineral paint.
Buck Creek, a branch of Indian Creek, at Mooresville, near
the summit of the knobs on the Vincennes pike, is elevated one hundred feet or more above New Albany. A section on the Vincennes pike, in the knobs east of Mooresville, is as follows:

1. Ochreous clay .......................... 4 to 6 ft.
2. Stratified sandstone with flag stone 12 ft.
3. Dark, crystalline limestone, gray with shades of brown, containing a mass of crinoidal stems and other fossils; used for building stone, curbing, etc................. 4 to 8 ft.
5. Knob shale (greenish marly) ....... 102 ft.
6. New Providence shale, containing large masses of argillaceous iron ore, and carbonate of iron.......... 126 ft.
7. Greenish limestone band, top of New Albany black slate at Falling Run.......................... 2 to 3 ft.

The elevation of the country where this section is taken corresponds with that of the survey of the Vincennes turnpike made by Mr. Owen P. Owen. Through the kindness of Wm. F. Reid, assistant engineer on the New Albany and St. Louis Air Line Railroad, I obtained the following elevations:

The Corydon Plank Road, at the point where it is immediately above the eastern portal of the Railroad Tunnel, is four hundred and fifty seven feet above the mitre sill at the Louisville and Portland Canal. The elevation of the summit on which Edwardsville stands, at the point where the tunnel line crosses, is five hundred and seventy one feet, which is the highest point on the knobs, and is distant from State street, New Albany, five and one half miles. The
elevation of the head waters of Little Indian Creek, at a point near the western portal of the tunnel, is four hundred and twenty-nine feet. All the elevations about the Falls are taken from the same base line, viz: the mitre sill at the Louisville and Portland Canal. A section at Edwardsville, on the Corydon Plank Road, is as follows:

1. Covered space above.................. 40 ft.
2. Gray limestone, used for making roads and paving streets, contains *Forbesiocrinus Worthenii*.............. 30 ft.
3. Imperfect stratified crystalline gray limestone, with shades of brown, containing fossils........... 25 ft.
5. Stratified sandstone and shale..... 220 ft.
6. New Providence shale and iron stone........................................ 126 ft.
7. Greenish limestone.................. 2 to 3 ft.

The thickness of the New Albany black slate, at New Albany, from data derived from borings made by Dr. Clapp, is.................... 104 ft.

I have enumerated in the foregoing remarks, the lithological, stratigraphical and palaeontological characteristics of the rocks included in the district composed of the counties of Clarke and Floyd: comprising formations from the Lower Silurian to the Sub-Carboniferous. A section from the western line of Floyd county, to the eastern part of Clarke county on the Ohio river, will show these formations well developed, in the following order:
1. Soil and Clay .......................... 20 to 40 ft.
2. Knob limestone—Keokuk Group........ 80 ft.
3. Knob Sandstone, Kinderhook Group... 344 ft.
5. New Albany black slate
6. Crinoidal limestone—Hamilton Group... 140 ft.
7. Hydraulic limestone
9. Utica limestone—Niagara Group...... 52 ft.
10. Magnesian limestone—Clinton Group... 30 ft.
11. Madison limestone—Cincinnati Group 207 ft.

The minute divisions of the groups, in the above section are not always accurately defined, and are not everywhere present. They thin out, in some localities, to a knife-edge. Especially is this the latter the case in the neighborhood of the Falls, where the characteristic fossils of the Niagara, Corniferous and Hamilton formations may be obtained within a verticle space of a few feet.

That the underlying, or outcropping rocks, in a very great measure, determine the nature of the soil, is plainly seen in Floyd and Clarke counties, where there are extensive outcrops of so many different formations, and each giving rise to a characteristic soil. In the northeastern part of the county of Clark are the rich but narrow bottoms of Camp Creek, leading to the large and very fertile “Bethlehem Bottom” on the Ohio river. These soils were enriched in ages past, and are destined to be for all time to come by the weathering of the fossil coral and shell beds of the Cincinnati Group, which rocks in this region are from one hundred to two hundred feet thick, and capped by magnesian limestone beds one hundred feet thick. These lands will ever remain productive, as they are continually enriched by the disintegration of the rocks above. The soil is a dark loam, partaking of the shade of the limestones. Camp Creek and Fourteen Mile creek are noted localities for Buckeye trees, many of which measure from three to four
feet in diameter, and attain a height of fifty feet or more to the first limbs.

The summits of the river hills are from three hundred to three hundred and fifty feet above the streams. These hills are considered among the best fruit lands of the west. The fact is accounted for by some on the theory that the atmosphere is here tempered by fogs, and the radiation of heat from the river. It is known that a tub of water placed in a cellar, will maintain therein an evener temperature of the atmosphere. Water contains 140° of latent heat, which is required to retain the fluid in a liquid state, and this heat must be given off before the freezing point is reached. The 140° of heat is distributed by radiation to the atmosphere, and maintains an even temperature. Should the water be frozen, the heat of liquifaction in the water below the ice is a constant supply of caloric, influencing the ice to melt, or escaping in the form of vapors, called fogs, which rise to the summit of the hills, laden with heat, to descend as rain or snow after parting with its eloric by radiation. An additional explanation of the cause of the freedom from frosts, and the fruitfulness of the high lands, including the knobs, is the well known fact that the warmer strata of atmosphere is at the summit of the hills, while the colder descends into the valleys.

A few miles back from the head waters of Camp Creek the lands are wet, the soil is light-colored clay that holds water. The growth of timber is beech (Fagus ferruginea) and white oak (Quercus alba). In the vicinity of New Washington, the soil is a light clay and sand, and has a better drainage than the lands last mentioned. The line of drift reaches but a few miles south of the road from New Washington to Knabbs' station, on the Vernon branch of the Ohio and Mississippi Railroad, at the line of Scott county. An occasional boulder is seen as far south as the Charlestown and Henryville road. But an abundance of large bowlders are found in the ravines at the "Guinea Knobs," southwest of Knabbs, and six miles northeast of Henryville. The land about New Washington is well
adapted for growing grass and wheat, and in some localities excellent corn. It was in this region I noticed the best average prospect of wheat in the county, seeding with the drill having been extensively adopted. This region is well timbered with white oak, \textit{(Quercus alba)} beech \textit{(Fagus ferruginea)} and in some localities most excellent poplar \textit{(Populus angulata)}. The latter timber is more abundant to the south where the land becomes rolling, and the limestones begin to show. From the mouth of Fourteen Mile Creek, reaching as far down the river as Utica, and the Sinking Fork of Silver Creek, the land is rolling, and especially on the river, very much broken. The predominating rocks are corniferous and cement limestones, the base of a limestone soil; the bluegrass region of the county. Charlestown is situated immediately on the summit of the corniferous limestone, from which flows abundant, never-failing springs of cool water. The drainage of the country is excellent. A very interesting cave is found on Mr. Bentley's farm, east of Charlestown, and another cave on tract No. 116, Illinois Grant, designated "Thomas Crew's" cave by Prof. E. T. Cox, on his recent visit to that place. "In this cave several small eyeless crustacean and centipedes were caught; also crawfish, with eyes. We also captured a small red and a small black beetle. A number of fragments of small bones of quadrupeds were picked up, and it is believed that an interesting osteological collection might be made by digging up the bottom of the rooms. Eyeless fish have been found in this cave by Mr. Thomas Crew." The easy weathering limestones render the soil of this region not only well adapted to bluegrass but likewise better suited to a variety of crops than that of any other portion of the county. Some of the farms in the neighborhood of Charlestown have been under cultivation for over seventy years, and excepting fields, where rotation of crops have been disregarded, their productiveness has not been perceptibly impaired. This soil is also well adapted to clover, and in some localities, especially on the river, fruits of all kinds are
grown in great perfection. The scenery here is very attractive. It is varied by undulating uplands and hills, through which flow small streams to the Ohio river, which lies to the south. In the distance the silver gray line of the "Silver Hills" (knobs) is easily traced in an unbroken chain from New Albany to New Providence. The two boldest peaks at Bennetsville, known as the "Hay Stack knobs," stand prominent in the view. A few miles west of this, and skirting the New Providence valley, are several outlying peaks (knobs) known as the "Hound's Leap," "Borden's Pine Knob" and the "Huckleberry Knob." The scenery in the knob region, near the boundary of Floyd, Clarke and Scott counties is grand and beautiful. The principal range is elevated four or five hundred feet above the level of the valleys, and is broken into numerous peaks, or knobs.

The bold escarpments, at the head of the valleys, form magnificent look-outs, from which a birds-eye view of the surrounding landscape may be obtained in all its beauty. The scenery viewed from the "Knobs" west of New Albany, is grand, "giving a most magnificent view of New Albany, Louisville, Jeffersonville, the Falls of the Ohio, the great Ohio river bridge at the Falls, and the far distant hills that loom up in grandeur along Salt river, in Kentucky." The "Knobs" are a favorite resort for the citizens about the Falls, also for strangers visiting these cities, as the hills afford a good birds-eye view of the surroundings. The view from Flower's Gap and the Round Top, on the farm of Col. Fletcher Willey, and north in the direction of Henryville, is one of very great interest. From the summit of Round Top a view of the surrounding landscape may be obtained in all its variety, the high lands of Kentucky are again seen appearing like a cloud sinking behind the distant horizon. The Ohio is assuredly entitled to the name originally given to it by the French—"La Belle Riviere" and from points above noted is seen meandering like a silver stream through the valley to the southwest. The view gives a succession of hill and dale, woodland and
cultivated fields, streams and rocks, most magnificently blended in a panoramic picture of which the eye does not weary.

A part of the land in Utica Township has not only the wash of the corniferous and Niagara limestone of this region upon it, but is in good part a river terrace, composed of altered drift, sand and gravel, with numerous aboriginal kitchen heaps. In the gravel or altered drift of this region are found mastodon remains and recent wood at as great a depth as thirty feet, which seems to indicate the situation of an old river or lake bed. Some of these deposits belong to the Champlain epoch, and these ancient waters must have washed the high lands about Charlestown, as on several occasions in sinking wells in the court house yard and other elevated positions at that town, pine or cedar wood has been exhumed. Some years since Mr. McWilliams, Col. Fletcher Willey and J. Coons obtained in a sand bank on tract No. 55, Illinois grant, the skeleton of a mastodon, **(M. giganteus)**. A part of the bones were sent to the old Louisville museum, the remainder are in the possession of Mr. J. Coons, who proposes to forward them to the State cabinet. A tusk six feet in length, which was taken out at the time, crumbled to pieces soon after being exposed to the air. Mastodon remains have frequently been found in the bank of the river at New Albany, in the same geological position. Utica Township is a noted market garden locality, which supplies Louisville and the cities about the falls with a large quantity of garden products—melons, sweet potatoes, Irish potatoes, and a great variety of fruits. This soil is also favorable to the growth of corn and grass. Wheat does well, and ripens early.

On the lands immediately west of Jeffersonville the New Albany black slate cuts off the limestone. The soil is an ash-colored clay, except where mixed with decomposed slate, which gives to it a darker color and adds to its fertility. The drainage is imperfect on the flat land but good where it is rolling; with proper tillage this soil is very productive. Mr. Samuel Patterson, of Jeffersonville, has improved his
land by under drainage with tiles. The slate lands in Clarke county are disconnected, appearing on one farm and absent on the next, or even present and wanting on portions of the same farm. The slate lands, when in large bodies give rise to beech and white oak flats, and are inclined to be wet, and necessarily difficult to drain. West of tract 169, Illinois Grant, the New Albany black slate appears in great force and continues unbroken in the direction of Memphis, where the north branch of Silver Creek, as at Eben Combs' mill, cuts through it to the depth of eighty-five feet. The land in the region of Memphis is well timbered, and the bottom lands produce good crops of corn and grass. The high lands here are clay, and give a generous return for all the fertilizers which may be put on them.

South and west of Memphis is the Blue Lick region. These soils are derived for the most part from the formation designated as the New Providence shale. This is a soft, light colored arenaceous clay-stone, containing some sulphate and carbonate of lime and magnesia. It is well exposed at Thos. McDeitz's, and on tract No. 219, Illinois Grant, on Blue Lick branch, Cany Fork, Cane Run, at the base of the knobs, at Allen Taylor's Esq., the foot of Round Top, at Sampson King's and at Wm. Stone's. At many of these localities this shale is rich in fragments of crinoidal stems and fossil shells, and several species of very delicate Bryozoa. The thin sections of crinoidal stems are disks, with a hole in the center, and resemble button-molds. These fossils are found in great abundance on the surface where the shale has been cut through by small streams and such places are commonly called "Button-mold Washes." This formation also follows the North Fork, and Miller's Fork of Silver Creek, north and west of Henryville. The best White Sulpher Spring, known in Clarke county, is near the North Fork of Silver Creek, on the land of J. A. Boyer, tract No. 241, Illinois Grant, one and a half miles east of Henryville. This village is situated forty feet below the summit of the New Albany black slate. The soil of this region, as far as the base of the knobs, is clay,
belonging to the altered drift and alluvium in the creek bottoms. In the bottoms of Silver Creek the soil is very productive. Persimmon trees abound on the clay lands, which is light colored in the valleys, but changes to deep ochre shades as you approach the knobs. The altered drift is here characterized by containing a number of thin markings of black sand, which are seen in the cuts after a washing rain.

The mineral water mentioned under the head of New Providence shale, issues from this shale at the base of the knobs. Almost all the water at this horizon is impregnated more or less with mineral salts, derived from the overlying New Providence shale. Water, entirely free from medicinal proprieties, is the exception, and pure water for culinary purposes is difficult to obtain, and can only be had by sinking shallow wells in the sand and gravel along the water courses. A very good quality of this mineral water is found on the land of Mr. Parady Payne, west of Blue Lick Post Office, tract No. 266, Illinois Grant. Another medicinal spring, containing similar properties to that at Mr. Payne’s, is found on Mr. Hosea’s land, south of the springs in Monroe township. On the lands of Augustus Reid and Sampson King are to be found springs of the same mineral water, and on the lands of Wm. Stone and Washington P. Butts, in Carr township, also west of Henryville on the land of Mr. John Stewart. On tract No. 266 Illinois Grant, the New Providence shale is eroded to the depth of sixty to seventy feet, and is entirely wanting at various points three miles east.

THE NEW PROVIDENCE VALLEY.

This beautiful valley, at the base of the tall, cone-shaped knobs, which were called “silver hills” by the early pioneers, lies in graceful curves which extend from hill to hill. This valley is about eight miles long, and one to two miles wide. In this valley may be recognized two distinct deposits. The older layers belonging to the Champlain epoch, originally gave the valley an elevation twenty
to twenty-five feet above the present level. The more recent deposit is from the shifting of the streams, and washings from the hill sides. A section of the older deposits would be as follows.

From the surface:

1. Alluvium soil.
2. Ochreous beds of many colors.
3. Fine grained sand, suited for colored glass.
4. Coarse gravel and sand, with fragments of fossils and limestone.

The bed of Silver Creek in this valley was at one time on a higher level than at present, and has shifted its course and cut down the clays of the valley to its present position. The weathering of the knob shales and sandstones, has furnished pebbles which have been born down by the floods from the hills, and, filling the bed of the creek, has altered its course from time to time. The spurs at the foot of the knobs, called “points,” indicate the former level of the valley, and the course of the lateral washings. The shifting of the creek has thus created a rich surface loam, enriched by the decaying leaves and other vegetable matter from the hill sides, with a deep sub-soil of gravel. This soil is well suited to the growth of all the staple farm products, and the growing crops are not materially affected by drought. Apples do well, and strawberries grow to great perfection, as well as all other small fruits. The water in the streams and shallow wells of the valley is noted for its softness. It does not decompose soap, and is as much used as rain water for laundry purposes.

The forest growth of the valley comprises, the Red Mulberry (Morus rubra); the White Mulberry (Morus alba); the Pawpaw (Anona triloba); the Persimmon (Diospyros virginiana); Sugar Maple (Acer saccharinum); Sugar Tree (Acer nigrum). Among the original growth of timber of the valley, Walnut (Juglans nigra), and Chestnut of the hills (Castanea americana), were very abundant, and the nutting time of the year was a real harvest season. But
on account of the waste of the timber the chestnut crop is now small. We hope the time is not far distant when the ruthless hand will not lay waste the noble forests as formerly. There are also found, Shell bark Hickory \((Carya alba C sulcata)\); White and Blue Ash \((Fraxinus americana F quadrangulata)\); Beech \((Fagus ferruginea)\); Prickly Ash \((Zanthoxylum americanum)\); Wild Cherry \((Prunus virginiana)\); Elm \((Ulmus fulva)\); Sassafras \((Sassafras officinale)\); Sycamore \((Platanus occidentales)\), and many other species.

The timber of the hills consists of Chestnut Oak \((Quercus monticola)\); White Oak \((Quercus alba)\); Red Oak \((Quercus rubra)\); Black Oak \((Q tinctoria)\); Post Oak \((Q obtusiloba)\); Pine \((Pinus mitis)\); Black Hickory \((Carya amara)\); White Hickory \((C alba)\); Dogwood \((Cornus florida)\); Poplar \((Populus grandidentata)\); Water Maple \((Acer rubrum)\); Gum \((Nyssa sylvatica)\), and Sumach \((Rhus aromatic)\).

FRUIT.

The line of the knobs, and river bluffs, are famed as the best fruit growing region of southern Indiana or the West, as shown by the success of the orchards situated on the elevated lands below New Albany, and from thence to Moorsville, Scottsville, New Providence, and as far north as Salem in Washington county, and the walnut ridge west of Salem. This includes the southern and western knobs. The northern range above Henryville, going towards Vienna in Scott county, and the river bluffs from Utica to Marble Hill in Jefferson county, are all favorably situated for fruit growing, especially peaches, for the tender buds are not liable to be injured by spring frosts which are confined to the valleys below, and seldom reach as high up the hillsides as the orchards.

Extensive orchards are planted on the hills above Henryville. Col. Fletcher Willey and Gabriel Poindexter, fruit growers, have large peach orchards, and have shipped great quantities of fruit to Indianapolis, Lafayette and other markets. And the business of peach growing is
becoming one of the most profitable branches of farming in this part of the State. The peach orchards of Col. Willey and Poindexter at "Chestnut Flats," have from 15,000 to 20,000 peach trees. Messrs. Dean and Davis on the Ohio river below Marble Hill, near Otto, Clarke county, have peach orchards which number over 100,000 trees. Immediately below New Albany, Edward Mann Esq., secretary of the New Albany Ohio Falls Iron Works, Charles W. Cottom Esq., Dr. P. T. Green, W. Fawcett, D. H. Cadwalader, have also large peach orchards. Owing to a good exposure afforded by the knobs, the peaches here grown have a fine color, and no doubt a better flavor than fruit grown in the valleys.

GLASS SAND.

Lying in very compact beds at the summit of the knobs, and near the intersection of Clarke, Floyd, Washington and Harrison counties, is a fine grained white sand used in the manufacture of plate glass, at New Albany, by Mr. W. C. DePauw & Co. This formation is of very great economical value, and is designed to play an important part, and to add materially to the wealth of the portion of the district under investigation. Its geological position is immediately above the sub-corniferous hydraulic limestone, as already indicated in previous sections. I have traced these beds of sand in isolated patches, from a point south of Spurgeon Hill in Washington county, in a southeasterly direction, to the present workable beds. The width of the sand formation increases as the summit of the hills become broader and more level. I have no doubt the white sand on the Ohio river hills below New Albany, in Harrison county, is a part of the New Providence beds, and that this formation marks the shore line of an ancient beach which extended northeastwardly in the direction of the Ohio valley. The sand beds are very uniform in thickness and quality. The quarry of the Star Glass Works at the summit of the Knobs, three and a half
or four miles distant from New Providence, and 350 to 400 feet above the Louisville, New Albany & Chicago Railway, has been extensively worked.

Through the kindness of Mr. John McKinley, Superintendent, and Jonathan Miller, I have obtained the following section of the beds at this quarry:

1. Soil, stiff clay loam........................2 to 4 feet.
2. Yellow sand, colored by the overly­
ing clay.................................1 to 2 feet.
3. White sand, used for glass manu­
  facture.................................16 feet.
4. Fragments of chert, with Bryozoa..... 6 in.
5. Hydraulic limestone, at bottom
  of the cut............................. 4 feet.

The surface of the ground above the quarry is heavily timbered with white oak. The stripping is continued until the third bed of the section is reached, where the sand is mined by blasting, in the same manner as pursued in quarrying hard rock. After being thus loosened it is easily removed with a shovel.

The sand used at the New Albany Star Plate Glass Works Co., Mr. W. C. DePauw, President, when required for the manufacture of plate glass, is washed in an oscillating trough to free it from a small amount of impurities. Ten or more men are employed in quarrying and washing the sand, and they can prepare it ready for shipping as fast as twenty-five wagons can haul it four miles to the station at New Providence. The larger quantity is shipped to the Star Glass Works at New Albany, but some shipments are made to Louisville and Cincinnati. A bushel of sand weighs one hundred pounds or more before washing, and ninety pounds afterwards. One dollar to one dollar and twenty-five cents is paid per ton for hauling to the railway, and the washing costs $1.25 per ton. Freight to New Albany, $8 per car load of ten tons. Total cost, $3.25 per ton, at the depot at New Albany, exclusive of royalty. Shipped to
New Albany, the current year, two hundred and fifty-two car loads. Also, several car loads to Louisville and Cincinnati.

Weight of sand per barrel, 330 pounds.
Washed and delivered on the railway at New Providence, in barrels, per barrel, $1.00.
Delivered in Louisville, per barrel, $1.40.
Number of barrels per car, 65.

An outcrop of the sand occurs on the land of Michael Brock; another on the land of R. G. Scott and Mr. Jonathan Miller, all in the same neighborhood.

The shipment of sand and cement in barrels has necessitated the establishment of numerous cooper shops through the counties comprised in this district. Some of these shops are operated by steam and are on a large scale, manufacturing an immense number of barrels yearly. Mr. T. S. Carter, at New Providence, cuts on an average 500,000 staves per annum, and manufactures about ten thousand barrels. Thomas Akins, on Turkey run, J. Heaston and John Combs, at Memphis, Mr. Brookbank, at Jeffersonville, J. H. Cruzen, on the line of Scott county, and a stave factory or two at Greenville, Floyd county, and various other factories for cutting staves and shops for making barrels, are turning out a great amount of work. It is estimated that 300,000 barrels per annum are made in this district, which, at 50 cents per barrel, yields a revenue of $150,000.

The clays of Floyd and Clarke counties furnish the very best material for making brick, many thousands of which are manufactured every year in the neighborhood of New Albany and Jeffersonville. I have no doubt if returns were at hand from all the yards a very large capital would be found employed in this business.

The following imperfect returns will serve to convey some idea of the extent of this branch of manufacture in the latter city:

Mr. James H. Keigwin & Co. manufactured, in 1873, 6,000,000; Mr. Jas. Burk, 2,000,000; A. J. Howard & Co., 2,000,000.
The material employed is a clean, tough alluvial clay, containing sufficient iron to give the bricks a fine red color. Formerly Louisville was largely supplied with brick from these yards. Another important branch of industry is the manufacture of salt glazed pottery, commonly called stone ware. An establishment of this kind at New Albany, owned by Mr. Keller, turns out an immense quantity of ware.

Mr. George Uncer, at Port Fulton, manufactured during the past year 1,800 gallons of crocks and jugs per week. The material used is an alluvial blue clay obtained from the low lands in the vicinity. The same clay is also used in the manufacture of drain tiles, a branch which is yet in its infancy in this section. James Burk, of Jeffersonville, made during the summer of 1873, 50,000 feet, for which he finds a ready sale in the neighborhood of his kilns. The lands of Clarke and Floyd counties are well watered by never failing springs and numerous small branches, that rise in the Knobs, and flow into the creeks which empty into the Ohio river. Though the creeks are numerous there are very few of a large size. The principal streams of Floyd county are Falling run, Middle creek, Knob creek, Big and Little Indian creek, and Buck creek.

The streams of Clarke county are Silver creek with its numerous branches, which flow across the country and forms a part of the boundary line between it and Floyd, before reaching the Ohio river. There are, also, Wolf run creek, Miller's fork, and Cany fork, and Cane run, and Blue lick, tributaries of the North fork of Silver creek. The Dry fork, and South fork, Persimmon run, Indian camp run, Turkey run, and Knob run, are tributaries of the West fork of Silver creek.

Fourteen Mile creek empties into the Ohio river fourteen miles above Louisville. Owen creek, and Camp creek are below Bethlehem. There are a number of small streams in various parts of Clarke county that it is not thought necessary to mention. At the mouth of Fourteen Mile creek on the Ohio river is a very large Mound Builder's Stone Fort.
As it was visited by Prof. E. T. Cox during the fall, he will give an account of it accompanied with a map.

The region in the vicinity of the Falls of the Ohio river contains a great many ancient Indian burial places. Almost every elevation of the low lands or peaks of the Knobs show some evidence of having been occupied by a pre-historic people. There are several large mounds which have attracted much attention on account of the relics found in their neighborhood. One of these, located on the farm of Mr. W. T. Aydelotte, six miles below New Albany, is formed of an immense number of common river shells. It is situated in the river bottom, a short distance from the stream, and covers a large space. It is about fifteen or twenty feet high, and has an oval or elliptical form. Several years ago Mr. Aydelotte had occasion to build a new house, and located it upon this mound above high water mark. In excavating the cellar, the shells were met within a foot below the surface, and are continuous to the bottom of the cellar. A quantity of human bones, including fragments of a skull, with the bones of animals, and quite a number of bone implements, were exhumed by the laborers and are preserved in the museum of the New Albany Society of Natural History. Subsequently, several stone axes, manufactured of Syenite and granite were found by farther excavation and have been also added to the collection at New Albany. The river bank from Mr. W. T. Aydelotte’s farm to New Albany affords a fine field for the collection of Indian relics. Arrow heads are common, and frequently immense stone axes weighing ten or fifteen pounds are washed out of the bank during a freshet. Near Galena there is a small mound, where arrow heads have been found. The most extensive field for pre-historic research is at Clarkesville below the Falls, where there is an ancient burial ground on the river bank. During high water, large masses of the bank are undermined and topple into the river exposing the skeletons, which lie about two feet below the surface. At this place I have frequently found human bones protruding from the bank. The skeletons are
enclosed by pieces of slate placed on edge. They are buried in a sitting posture and are covered with shells, and fragments of pottery. Stone pestles and stone axes, a few years ago, were quite common and in the course of an afternoon a good collector might find a large number; together with a variety of arrow heads and other relics. Of the pottery found, one piece probably represented an owl, and was evidently used for drinking purposes. There is an opening at the back of the head and in the beak. Fragments of pottery are occasionally found which have ears that probably served for the attachment of the bail. Some pieces are marked as if moulded in a plaited basket. Implements of bone, including fish hooks, have also been found by careful search. Several years ago a copper spear point was picked up by a fisherman but unfortunately it has been lost. The ground in the immediate vicinity is covered with fragments of boulders that appear to have been broken by the action of fire when used for heating water. Frequently, fragments of bone are met with that have been cracked for the marrow which they contained. This burial ground extends along the river bank for three quarters of a mile to William Beach's cement mill, at the foot of the Falls of the Ohio. During the past summer in excavating the foundation for a new building at this place a stone pestle and axe, and a long stone implement similar to a rolling pin and a large quantity of shells were thrown out. These fine specimens were presented to Professor E. T. Cox for the State museum by Mr. W. F. Beach. The margin of the streams appear to have been the favorite camping ground of this wonderful race, and upon nearly every rise of ground in the neighborhood are found unique relics illustrating their habits and modes of living. The New Albany Society of Natural History, although a recent institution, has been energetic in collecting these specimens of the ancient arts, and they have the most complete archaeological museum in the valley of the Ohio. This collection comprises a quantity of flint implements ranging from the rude arrow head point to the finely executed flesh scraper, and a
variety of stone axes and pestles of many shapes, and elaborate workmanship. The bone implements and needles of the collection comprise a variety of forms, while the display of pottery is also quite varied in design.

CLARKSVILLE.

A small village situated at the foot of the Falls, opposite Shippingsport, in Kentucky, was laid out as early as the year 1813, by order of the Virginia Legislature; and attached to the grant made to the officers and soldiers of the Illinois regiment; from which time, may be reckoned the first settlement of this county. Soon after its establishment it contained a number of inhabitants who were encouraged to settle, under promise of donations of lots by the trustees; and notwithstanding the imminent danger and great inconvenience to which they were subjected, some of them continued to reside there to the end of the Indian war, and in a great measure, contributed to the safety of the inhabitants of Kentucky. Copperas banks were observed by the early settlers, in the bank of Silver creek, about two miles from its mouth. These copperas banks are frequently met with on the banks of Silver creek and Miller’s fork, resulting from the pyrites of iron in the black slate.

It gives me pleasure to acknowledge here, the assistance I have received at different times from citizens of the counties reported on, while engaged in the prosecution of the duties assigned to me.

I am especially indebted to Samuel L. S. Smith, M. D. formerly of New Albany, for assistance and information.

I am also under obligations for favors, to Col. Horace Scott, General Superintendent J. M. & I., R. R.; Hon. A. N. Crystie, Vice President of the O. & M. Ry; and Robert H. Campbell Esq., General Freight Agent of the latter road; E. S. Crosier, M. D., Louisville; James G. Caldwell Jr.; and Felix Lewis, of Jeffersonville; Wm. F. Beach Esq., of Clarksville; Maxwell Little; G. W. Smith City Engineer; John Sloan, M. D.; George Cannon, New
Albany; E. B. Gurney Esq.; Rev. John F. Willey; J. L. Carr; John Richardson; Judge A. Lovering; John Stewart; Augustus Reid; Allen Taylor; H. H. Ferguson, M. D.; and M. E. Wisner, M. D. of Henryville; Esquire Weir; Wm. Combs; Eben Combs; and others of Memphis. Also, Thomas McDeitz; Sampson King; and Parady Payne, of Blue Lick; W. Briton, M. D., New Washington; Geo. Briton, of Bethlehem; Messrs. Argus Dean, Wm. Dean & Wm. Stacy, of Otto; also, James Beggs; A. J. Hay, M. D.; J. Robinson; Allen Barnett; D. S. Coons, County Treasurer; Chas. McCaw; J. Ingram, County Clerk; G. W. Mathews; J. K. Sharp; and Capt. S. C. Rucker, of Charlestown; Joseph Pierce; Jairus Fordyce; Daniel Coats; Michael Brock; A. Q. Standiford; J. D. Hurn; Wm. Stone; John McKinley; Charles Robertson, of New Providence; Capt. Marion Smith, and Mr. Morris Morris, of Greenville. And many other citizens of Clarke and Floyd Counties.

We are under obligations to Mr. C. W. Cottom, of New Albany, for the following notes:

HISTORY OF NEW ALBANY.

"New Albany is the county seat of Floyd county; was laid out in 1813, by Joel Abner and Nathaniel Scribner. The land was purchased by the Scribner brothers of John Paul, who entered it at the Government Land Office, in Vincennes. The lots were disposed of at public auction, on the first Tuesday and Wednesday of November, 1813, and there was a stipulation in the advertisement of the sale, that "one-fourth part each payment upon the lots sold, shall be paid into the hands of Trustees, (to be chosen by the purchasers), until such payments shall amount to five thousand dollars; the interest of which was to be applied to the use of schools in the town, forever." With this fund, the Scribner High School, of New Albany, was founded, and has flourished, up to the present time, through the period of fifty-nine years, and is now one among the most efficiently
managed and prosperous high schools in Indiana. The city is noted for the number and success of its manufactures. The Woolen and Cotton Mills Company, Mr. James Haines, President, and J. F. Gebhart, Superintendent, are doing a large business. The aggregate business in wool and woolen fabrics, and cotton and cotton fabrics, during the year 1873, reaches the sum of $1,034,000.

The most extensive glass works of the kind in the United States are located at New Albany. The works are organized under the name of the Star Glass Company. The Plate Glass Works have a capacity for the production of 1,000 feet per day of the finest quality of polished plates, 92 by 180 inches in size. I have been informed that the polishing department is to be largely increased during the coming season. These extensive works have a capital of over $550,000 employed in the manufacture of glass. Silver plated glass mirrors were first made in this city during the year 1872. There are, in New Albany, some of the most extensive foundries and machine shops in Indiana. The machine shops of the Louisville, New Albany and Chicago Rail Way. The shops of D. C. Hill & Co., and Johnson & Webster, have a large capital invested. There are also stove foundries, brass foundries, Tanneries, forge works, planing mill, by J. B. Friend, Flouring mills, by R. P. Main, J. F. Leyden & Co., and City Mill, by Peter Mann.

There are two immense rolling mills at New Albany, the Ohio Falls Rolling Mill, and the New Albany Rolling Mill, of J. Bragden & Co."