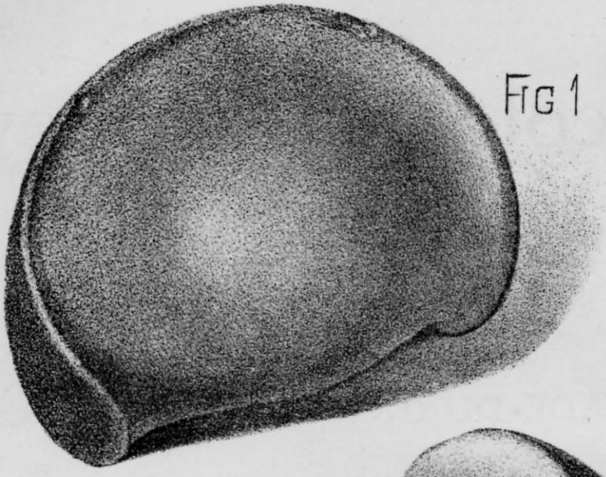


FIG 1

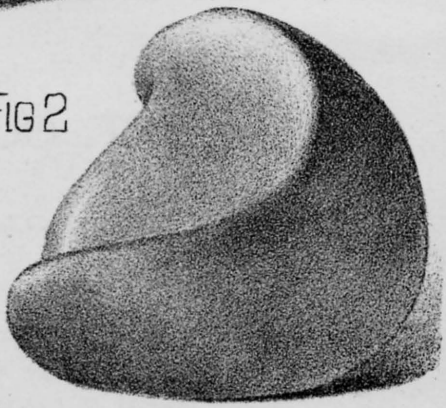


FIG 2

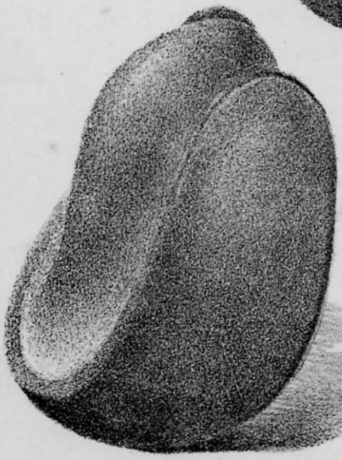


FIG 3

STONE IMPLEMENT

See Page 40

SIXTH ANNUAL REPORT

OF THE

Geological Survey

OF

INDIANA,

MADE DURING THE YEAR 1874,

BY

E. T. COX,

STATE GEOLOGIST;

ASSISTED BY

PROF. JOHN COLLETT, PROF. W. W. BORDEN, AND
DR. G. M. LEVETTE.

INDIANAPOLIS:
SENTINEL COMPANY, PRINTERS.
1875.

OFFICE OF STATE GEOLOGIST,

INDIANAPOLIS, INDIANA,

December 30th, 1874.

To the Hon. President and Members of the

Indiana State Board of Agriculture:

SIRS:—I herewith submit to your honorable body my Sixth Annual Report of progress in the Geological Survey of the State, embracing detailed reports on the counties of Jackson, Brown, Scott and Jefferson, accompanied by maps of the same, also, a report on Morgan county, and special reports on the Kaolin and Iron Ores of Lawrence county; the Artesian Well at Fort Wayne, and descriptions and illustrations of a few of the pre-historic remains found in the State.

Very Respectfully,

E. T. COX,

State Geologist.

GEOLOGICAL REPORT.

The district surveyed in detail, during the year 1874, embraces the counties of Jefferson, Scott, Jackson, Brown and Morgan.

Professors John Collett and W. W. Borden, have been engaged for a part of the year on the field work, and Dr. G. M. Levette has been engaged in the office and chemical laboratory, preparing maps and assisting in making chemical analyses of coal, iron ore, clay and such other minerals as were likely to prove of commercial value to the State. My personal attention has been given to the examination of Jackson county, in addition to the general supervision of the field and office work.

Mr. Borden continued the line of survey, of the previous year, from Clarke into Scott and Jefferson counties. He followed the Clinton, Niagara, Corniferous and New Albany black shale from the western exposure of the beds along the eastern rise of the strata until they were successively replaced by the Hudson River or Cincinnati group of the Lower Silurian period. After passing east of Madison, in Jefferson county, the Cincinnati beds continue in great force to the State line and beyond into the State of Ohio.

In a paper which I read at the Indianapolis meeting of the American Association for the advancement of Science in 1871, attention was called to the fact that the Silurian beds, so well displayed at Cincinnati, were not elevated by a local axis of disturbance, but, that the rocks of this famous district simply partook of the general continental

fluctuations of level. Neither in Indiana nor in the adjoining State of Ohio, especially in the region around Cincinnati, have I been able to discover any evidence of a local disturbance or axis of uplift. On the contrary the strata are almost horizontal for many miles, in a westerly course, from Cincinnati. Strata equivalent to these which occupy the tops of the hills at Cincinnati, and 430 feet above the Ohio river, are seen in Jefferson county, Indiana, at about the same level above the stream.

It is a reasonable interpretation of the geological history of the territory embraced between the eastern slope of the Appalachians and the Silurian of Arkansas, and the States to the northward, that the Silurian continent of North America was represented by a large body of Archean land in the northern regions with the silurian resting upon it in the regions of the lakes. From thence three great belts or peninsulas extended in a south-westerly direction. The eastern belt lay in the regions of the Appalachians and extended south to Georgia and Alabama. The middle formed the Cincinnati belt but did not reach quite so far south. The third and western belt extended into Arkansas. These three parallel prolongations were surrounded by and enclosed deep seas, and their summits have for the most part, ever remained above the water since they were first elevated. The superior strata were now formed by the deposition of mud and sand in the surrounding waters.

At this time there was a large inland sea filling up between Lake Huron and Lake Michigan. This condition of things continued to the close of the sub-carboniferous era when the seas between the Silurian belts and the inland sea of Michigan were nearly filled up and great marshy basins were formed, which together with favorable climatic changes, furnished the conditions suitable for the accumulation of vegetation that served to make the coal seams. During the coal making era the continent commenced to sink, but this movement was interrupted by long periods of rest. During the periods of rest, vegetation accumulated for coal seams and during the periods of depression the influx of

the ocean covered them with mud and sand, which as shale, limestone and sandstone filled up the spaces between the various seams of coal.

At the close of the Carboniferous era, the continent was again subjected to elevating forces and the surrounding seas filled up with superior strata. The coal measures included within the basins formed by the Silurian continent as above defined, have remained above the sea ever since.

The Appalachian uplift, which distorted and folded the coal strata of that region in such a remarkable manner, is of subsequent date and its effects did not extend to the measures in western Pennsylvania, Ohio and Indiana.

From Lake Superior on the north and running southwest to Arkansas along the western Silurian belt, we find a rich mineral district with a wonderful uniformity in the character of its minerals over the whole extent. Copper ores, galena, specular and magnetic iron ores, nickle ore and Tenantite (silver ore). The latter, especially, seen in Arkansas. No less striking in similarity are the minerals seen along the eastern parallel belt. This coincidence seems also to indicate, that the seat of greatest force, operating to produce the elevations and depressions of this part of the continent, lay in the direction of these two mineral belts.

In Indiana, the geological changes that have taken place since the deposition of the coal strata, belong exclusively to the Quaternary period, and are due to the grinding and disintegrating power of glaciers moving over the surface, fluvial and lacustrine waters together with the ever corroding atmosphere. Between the coal measures then and the Quaternary there is not to be found in the State any portion of that immense depth of strata which constitutes the Mesozoic and Tertiary ages. The Glacial, Champlain and Loess deposits are resting immediately upon Paleozoic rocks.

It matters not, so far as its effects are concerned, whether the Glacial era was the result of a change in the precession of the equinoxes or by an immense elevation of the northern regions of the continent; a study of the drift will lead to

the conviction that glaciation extended over the northern part of the continent. The direction of the main glaciers was southwesterly but minor courses made by tributaries which served to swell the main glaciers were as varied as the mountain and valley courses which marked the topography of the period. It is also highly probable as suggested by Newberry that the glaciers gave direction to the present river drainage.

The Champlain or terrace formations composed of gravel, sand and clay, mostly the debris of crystalline rocks, form the shores of the retreating and diminishing glaciers. After the melting of the glaciers there was left upon the Champlain shores, strips of fresh water ponds or lakes in which sediment accumulated, that constitutes the Loess or Bluff formation. The Loess is usually rich in fossil shells belonging to the fresh water species, so that there can be no doubt of the source of its origin. The fossil mollusca of the Loess belong to the aquatic, amphibious and pulmonifera tribes, all of which have living representatives in this State with one single exception. *Helicina occulta*, Say, which has not been found, I believe, north of the Ohio river, but is abundant in the southern states and I have found it in Arkansas and along the southern border of Kentucky. They are such species as live in marshy places and in stagnant water. The following list comprises the fossils found in the Loess in Posey county, Indiana, on the Cut-off river (an arm of the Wabash) bluffs, near the town of New Harmony: *Macrocyclis concava*, Say; *Zonites indentatus*, Say; *Patula perspectiva*, Say; *Helix lineata*, Say; *H. labrynthica*, Say; *H. hirsuta*, Say; *H. monodon*, Rack.; *H. monodon*, var. *fraterna*, Say; *Punctum minutissimum*, Lea; *Succinea elongata*, Say; *Pupa armifera*, Say; *Helicina occulta*, Say; *Cyclostoma lapidaria*, Say; and one or two other species of aquatic, univalve mollusca, not identified.

The Loess is always found near the present main water courses and capping the highest river bluffs. In Posey county it is 165 feet above the Wabash river and at

Merom, in Sullivan county, the elevation is 170 feet in Perry county, on the Ohio river, it is about 200 feet.

The Champlain deposit, which underlies the Loess, has never, so far as my knowledge goes, furnished fossils of any kind, which is evidence that it is not of fluviatile origin, but the result of currents of water that flowed from the melting glaciers with such force as to preclude the existence of fauna.

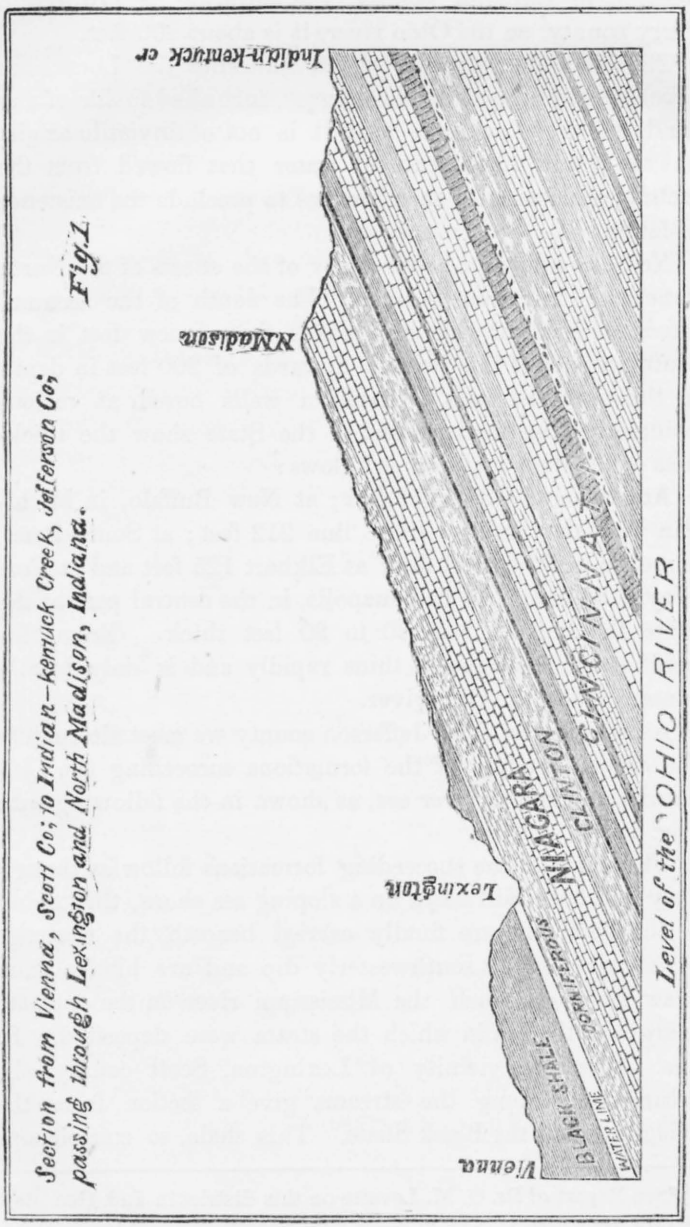
No State affords a better study of the effects of the North American drift than Indiana. The depth of the accumulated material of this era ranges from a few feet in the southern part of the State to upwards of 200 feet in depth in the northern part. Artesian wells bored at various points over the northern end of the State show the thickness of the drift material as follows:

At Michigan City* 172 feet; at New Buffalo, in Michigan near the Indiana State line 212 feet; at South Bend, three wells, 92 to 103 feet; at Elkhart 125 feet and at Fort Wayne 88 feet. At Indianapolis, in the central part of the State, the drift is from 80 to 90 feet thick. From this point south the deposit thins rapidly and is only locally present along the Ohio river.

As we go west from Jefferson county we meet alternately the cropping edges of the formations succeeding the Cincinnati or Hudson river era, as shown in the following cut: Fig. 1.

The strata of the succeeding formations follow as though they had been laid down on a sloping sea shore, thickening to the west and are finally carried beneath the drainage level by the slight southwesterly dip and are hidden from view until we reach the Mississippi river on the opposite margin of the sea in which the strata were deposited. In the immediate vicinity of Lexington, Scott county, the escarpments along the streams give a section from the Niagara up to the Black Shale. This shale, so conspicuous

*See Report of Dr. G. M. Levette on this district in Ind. Geo. Rep. —1873, page 430.



Section from Vienna, Scott Co; to Indiana-kentuck Creek, Jefferson Co; passing through Lexington and North Madison, Indiana. Fig. 1

at New Albany just below the falls of the Ohio, has been variously classed as the equivalent of the Genesee and Portage shale of the New York Reports. Dr. Newberry, in the Ohio Rep. refers it to the Portage and not to the Genesee as misquoted in my last report.

Previous to this year we have not been able to find any fossils in the Black Shale except some small species of *Lingula* and *Discina* which are so closely allied to carboniferous species that it was not considered prudent to rely upon them for the identification of the age of the strata. At Rockford, Jackson county, where these *Brachiopods* are found in the Black Shale in great abuudance, we find it overlaid by the hard greenish marl-shale containing the *Goniatites* and other fossils usually referred to the subcarboniferous era. This shale is found resting upon the Black Shale throughout southern Indiana and western or middle Kentucky.

During the present year (1874) Mr. Borden has had the good fortune to find in the Black Shale at Lexington, Scott county, a large number of well preserved fossils which were sent to Prof. R. P. Whitfield and referred by him to the following species: *Leiorhynchus quadricostata,* Hall; *Chonetes lepida,* Hall; *Tentaculites fissurella,* Hall, and a fragment of a large species of *Cardiola* allied to *Cardiola radians. Leiorhynchus quadricostata,* he says, is in New York, only found in the Genesee shale and the *Tentaculites* is found as well in the Marcellus and Hamilton. The *Chonetes* belong to the Hamilton but is possibly found in the Genesee also, while the *Cordiola* is recognized as a Devonian fossil in general, several species occurring in the Upper Helderberg and Hamilton, including both the black slates in New York.

If, then, we are to rely upon a few known species of fossils for the identity of equivalent strata, we can with propriety refer the New Albany Black Shale to the Genesee, and the Goniatite shale, which rests upon it, to the Kinderhook group of Illinois. This leaves then a hiatus in the formations of Indiana that is occupied in Ohio by the Waverly

group, consisting mainly of shales and heavy bedded sandstone.

The beds of earthy carbonate of iron mentioned in the last Report as being found in great abundance in Clarke and Floyd counties, and especially in the vicinity of Henryville, on the J., M. & I. R. R., are proved to extend into Scott county. I am more and more convinced of the great value of these iron-stone beds, as an accurate knowledge of their extent is acquired. Though lean in iron they contain a large per cent. of manganese and will make an excellent quality of mill and foundry iron. Mr. Stewart, who lives at Henryville and owns large tracts of land containing this iron-stone, has made a careful examination of the beds and finds that there are as many as thirteen distinct seams or bands, ranging from three inches to one foot or more in thickness, in a vertical space of twenty feet. The analyses of various bands of the Henryville ore, was given in the last Report and it will be seen from the following analysis, that the ore is of about the same quality in Scott county:

Scott county ore; earthy carbonate, color, gray.

Combined water	15.00
Silicic acid	14.00
Protoxide of iron	38.56
Sesquioxide of iron	3.01
Oxide of manganese	4.50
Carbonate of lime	2.02
Carbonate of magnesia	.85
Sulphur	.05
Phosphoric acid	.50
Carbonic acid and loss	21.51
	100.00

Total per cent of iron 32.20.

Mr. Stewart says he will contract, at $1.75 to $2.00 per gross ton, to deliver on the cars at Henryville, from 100 to 200 tons of this ore per day, for a period of five or ten years.

One of the most interesting as well as valuable discoveries made during the year, is a large bed of White Porcelain Clay in the Carboniferous rocks of Lawrence county. Pockets of porcelain clay in the carboniferous strata of Pope county, Illinois, have long been known to the public under the name of Golconda Clay, and owing to its excellent quality for the manufacture of fine grades of porcelain it was eagerly sought for by the queensware potters. The Golconda clay is only found in small beds resting on the sub-carboniferous limestone and these pockets are so scattered and difficult to find that, the mining of the clay could not be profitably carried on. Such is not the case in Lawrence county; the bed is here stratified with the rocks and may be traced over a very large area of land, and is from five to six feet thick. On an average about one-third of this thickness is pure white and the remainder is more or less stained with iron and manganese. Beneath the stratum of clay there is a deposit of brown hematite ore from a mere trace to five feet thick; being very irregular and formed in pockets which often encroach upon and diminish the thickness of the seam of clay. The principal body of clay is on section 21, town 4, range 3. This property has been purchased by Dr. J. Gardner of Bedford, Lawrence county, who has associated with him Messrs. Tempest, Brockman and Co., the pioneer potters of Cincinnati. This firm have given the clay a thorough practical test and find that it makes a beautiful white ware equal to the best English iron-stone china. Mr. Tempest, the senior member of the firm who has had a very extended experience in the manufacture of porcelain, feels assured that the discovery of this clay will prove to be the most valuable aid to the advancement of the porcelain manufacture in America that has yet been made.

A mine has been opened and several hundred tons of clay have already been taken out and shipped to the pottery at Cincinnati The following section shows the position of the clay and iron ore and associated strata:

SECTION OF THE PORCELAIN CLAY MINE.

3 Ft.	Soil and Subsoil.
100 "	Coal Measure conglomerate.
6 "	PORCELAIN CLAY—replacing Limestone.
4 "	Iron Ore.
4 "	Marly and Siliceous Shale.
50 "	Chester Sandstone.
17 "	Archimedes Limestone.
10 "	Marly Shale.
40 "	Chester Sandstone.
6 "	Limestone. 1 to 3 inches of Coal.
150 "	St. Louis Limestone—to low water mark in White River.
387 "	Total.

It will be seen from the above section that the clay lies immediately beneath the Millstone grit or pebbly conglomerate of the coal measures and here occupies the place of a bed of Archimedes limestone which is seen in *situ* about two miles southeast of the mine. The overlying sandstone is very ferruginous and the base, where exposed to the weather, has decomposed and covered the clay in places to a depth of eight or ten feet with ferruginous sand and pebbles. There is a constant oozing of water from this sandstone which has, no doubt, played an important part in the chemistry of the clay and hematite deposit, for, though similar in its chemical composition to kaolin, this clay differs physically and owes its origin to an entirely distinct set of causes and effects. While the former is derived from the decomposition of the feldspar of feldspathic rocks, such as granite, porphyry, etc., the porcelain clay of Lawrence county has resulted from the decomposition, by chemical waters, of a bed of limestone and the mutual interchange of molecules in the solution, brought about by chemical precipitation and affinity. Where cavities existed in the limestone at the base of the strata there the chalybeate water found the oxygen to change the carbonate into sesquioxide of iron which finally filled up the cavity. In places, you can trace the passage of the ferruginous water along irregular joints in the clay bed, by the iron-stained path which it has left, to the brown hematite ore which lies in a mass at the bottom. The largest beds of hydrated sesquioxide of iron, both in Europe and America, are found at the base of the Millstone grit and filling up cavities in the cavernous sub-carboniferous limestone.

Owing to the mode of its formation and other features, to be mentioned beyond, I have thought proper to give to this porcelain clay the name of *Indianaite*.

It has associated with it in places a transparent emerald green mineral which I at first took to be a new species of mineral containing in addition to alumina and silica, some glucina. Subsequently Dr. Gardner found a large mass of this mineral in the midst of the clay bed and I sent

some good specimens to J. Lawrence Smith M. D., Louisville, Ky., who has very kindly taken part in the analysis both of this and the porcelain clay. The matter soluble in carbonate of ammonia proved to be alumina and the mineral *Alophane*. According to Dr. Smith's and my own analysis the composition may be stated as follows:

Water	40 per cent.
Silica	20 per cent.
Alumina	40 per cent.

It also contains less than one per cent. of lime, magnesia and alkalies.

A regular gradation from *Indianaite* to *Alophane* may be traced in single masses.

There are at least three well marked varieties of Indianaite, all having very nearly the same chemical composition.

a. Snow white, massive when first mined but slakes and falls into powder after having been exposed to the air for some time, meager feel, powder white and without apparent grit when tested between the teeth, though it exhibits fine polishing properties.

b. Massive, white or purplish brown, cuts smooth like dry putty, powder creamy-white, unctuous feel.

c. In concretionary masses or slabs, pea-green, fades on exposure to light and becomes white, some of the concretionary masses are wrinkled and cracked on the surface, cuts smooth, powder snow white, unctuous feel.

These varities all have about the same specific gravity which ranges from 2.3 to 2.55; hardness 2.5.

Though some parts of this bed of clay are too much stained with iron to be used for making fine porcelain, it is throughout free from undecomposed rock and gives no sensation or grit when tested between the teeth.

A main drift has been run into the seam for a distance of

more than one hundred feet and rooms driven on either side for twenty or thirty feet without finding the least evidence that would indicate its giving out; indeed Dr. Gardener, who superintends the mining informs me that the seam thickens as he proceeds under the ridge and there is less of it stained with iron.

In connection with the analysis of the Indianaite, in the subjoined table are the analyses of some of the most valuable clays, of Europe and other localities in America, used in the manufacture of porcelain.

From an inspection of the above table of analyses it may be seen that the Lawrence county clay takes rank with the best and has the advantage, at the mine, of being free from particles of decomposed rock and sand, or of containing uncombined silica. The importance of the discovery of this clay can hardly be overestimated, since it places within our reach the means of becoming independent of Europe for fine grades of chinaware.

The most extensively worked kaolin beds, at present, in this country, are situated in New Jersey; the most noted being in the vicinity of Woodbridge, Perth Amboy and South Amboy, Middlesex county. They have long been noted for their good qualities and adaptation to the manufacture of porcelain. Only the purest and whitest portions of the beds are employed for porcelain manufacture; the common being used for making fire brick, common store ware, sizing paper, etc. According to the statistics furnished by the Geological Report of New Jersey, the price of clay varies from $1.50 to $13.00 per ton, according to the quality, the average value being placed at $3.50. The number of tons annually mined is estimated to be two hundred and sixty-five thousand, which gives an aggregate of $927,500.00 for the amount of sales.

"There are twelve potteries in Trenton, N. J., employing about one thousand men and one thousand women and boys and turn out $1,500,000.00 of ware annually. The ware is of the common white earthen and iron-stone and its quality is said to be equal to the best English ware of these grades."

TABLE OF ANALYSES OF PORCELAIN AND FIRE CLAYS.

	Silica.	Alumina.	Oxide of Iron.	Manganese.	Lime.	Magnesia.	Potash.	Potash and Soda.	Zirconium.	Water.
Lawrence County, Ind., Var. A	45.90	40.34			trace.					13.26
" " " " B	47.05	37.14	trace.	.03	.03					15.55
" " " " C	47.13	36.76	trace.	trace.	.04					15.13
Golconda, Ill	42.28	43.05			trace.	trace.				14.66
Ballclay, Mo	65.69	24.87	2.54							6.60
Near South Amboy, N. J.	43.20	49.71	0.74				0.37		1.40	14.25
Near Trenton, N. J.	45.30	37.10	1.30		0.17	0.22	1.30		1.40	13.40
Chinese Kaolin, (washed)	50.50	33.70	1.80			0.80		1.9		11.12
St. Yrieix, France, "	48.37	34.95	1.26					2.4		12.62
Cornwall, England	46.32	39.74	0.27		0.36	0.44				12.67
Stourbridge Fire-Clay, England	64.10	23.15	1.85			0.95				10.00
Pipe Clay, England	53.66	32.00	1.35		0.40					12.08
Brick Clay, "	49.44	34.26	7.74		1.48	5.14				1.94

The table gives the analysis of the clay used in China and at the celebrated Government Pottery at Sevres near Paris; the Cornish porcelain clay; the celebrated Stourbridge fire-clay and English brick-clay; the New Jersey porcelain clay; the Golconda, Ill., porcelain clay and the ball-clay of Missouri.

It occupies the same geological position as the Golconda clay, its origin is due to the same chemical agencies and its working properties are alike favorable for the manufacture of fine grades of porcelain ware.

The Missouri ball-clay is used at a number of American potteries in making the body of the ware, and the analysis is interesting for comparison with other clays used in the ceramic art. It is mined by Mr. J. W. Reed, eight miles west of DeSoto, Missouri.

"The geological position of these deposits of clay is in the Cretacious formation and they constitute the lowest member in New Jersey. They are found in a belt of country which stretches across the State from northeast to southwest; its northeast end being in Staten Island and Raritan bay, and its south-west end in Gloucester county. On its northeast edge it joins the red sand-stone from Woodbridge to near Trenton, where for five or six miles it borders on the gneiss rock and from there to near its south-western end it follows along or near the Delaware river. Its southern end descends beneath the clay marshes, *i. e.*, the clay containing green sand marl. White clay, sufficiently pure to make fire brick and some varieties of pottery, is found throughout the whole length of this belt; but the finest quality of clay has been almost entirely got from the eastern end of the belt, comprising that part which lies in the break or opening between the trap ridge which extends along the west bank of the Hudson River and across a part of Staten Island, and that ridge of trap which begins about six miles west of Raritan and, under the name of Rock Hill, extends on for for many miles to the south-west." *

*Geological Report of New Jersey, by Geo. H. Cook.

On account of the interest which the Lawrence county clay must attract I have, for the sake of comparison, also selected from the Geological Report of New Jersey, 1874, page 47, a table of analyses of the clays used for fire brick and pottery together with the analysis of the famous Stourbridge clay and the German clay from Coblentz on the Rhine.

	No. 1. Woodbridge, N. J.	No. 2. Woodbridge, N. J.	No. 3. Woodbridge, N. J.	No. 4. Stourbridge.	No. 5. Coblentz.
Alumina	27.13	40.14	39.94	28.11	16.33
Silicic acid, combined	30.22	41.67	42.22	29.67	17.99
Silicic acid, free	1.10	1.21	1.22	1.11	1.10
Silica, quartz sand	29.00	.50	.71	27.73	55.30
Peroxide of iron	1.26	.51	.41	1.91	1.19
Magnesia	.08	.....	.....	.37	.29
Potash	trace.	.41	.47	.44	.66
Titanic acid	1.93	1.42	1.63	1.06	1.25
Water, combined	9.63	13.59	13.44	10.36	5.84
Totals	100.35	99.45	100.04	100.76	99.95

No. 4 is the English clay from Stourbridge, and No. 5 is the Coblentz. No. 1 is the New Jersey clay from the pits of William B. Dixon of Woodbridge, and has a fine reputation for making fire brick and glass pots. The analysis shows that it has about the same composition as the Stourbridge and Coblentz. Nos. 2 and 4 contain less uncombined silica and are used for fire-brick and pottery.

For purity of composition and clear white color the Lawrence county clay is not excelled, if equaled, by the kaolins of Europe or this country, and it must rapidly come into use. All that is wanting now in order to make the fine transparent china, similar to the Berlin, Sevres, Dresden and Austrian, is the skill to know how to use it.

The iron ore which underlies the bed of clay in Lawrence county, and found also in many places where there is no white clay above it, has been somewhat extensively mined by the Southern Indiana Coal & Iron Co. during the last two years. It contains only .75 to 2. per cent. of silicia and has 55. to 60. per cent. of iron and 3. to 5. per cent. of sesquioxide of manganese. It smelts easily, requires but little fuel and flux and makes an excellent quality of pig iron. Four specimens, from as many different localities, show the following composition:

No. 1. Analysis of hydrated brown oxide of iron from section 21, T. 4. R. 2, southwest corner of Lawrence county. Ore bed two feet thick overlaid by five feet of white clay (kaolin); the ore is used in the Shoals blast furnace.

Hygroscopic water	3.000
Combined water	8.500
Insoluble silicates	3.000
Sesquioxide of iron	79.000
Sesquioxide of manganese	2.000
Alumina	2.000
Magnesia carbonate	.426
Lime carbonate	.528
Phosphoric acid	.338
Sulphur	trace
	98.792

Iron 55.3. Phosphorus .139.

No. 2. Analysis of hydrated brown oxide of iron, locality, same as No. 1.

Hygroscopic water	1.75
Combined water	8.50
Insoluble silicates	3.50
Sesquioxide of iron	80.00
Sesquioxide of manganese	2.00

Alumina	2.00
Magnesia carbonate	.43
Lime carbonate	2.00
Phosphorus	.14
Sulphur	none
	100.32

Iron 56.

No. 3. Analysis of hydrated brown oxide of iron from land of Geo. Whitaker, sec. 28, T. 5. R. 2, the ore is brownish red, fine grained and free from chert, and used in the Shoals blast furnace.

Loss by ignition, water	13.000
Insoluble silicates	.900
Sesquioxide of iron	84.890
Manganese	none
Alumina	trace
Magnesia	none
Phosphoric acid	.145
Lime carbonate	1.000
Loss	.065
	100.000

Iron 59.42.

No. 4. Analysis of hydrated brown oxide of iron, locality same as No. 3.

Loss by ignition, water	13.000
Insoluble silicates	1.200
Sesquioxide of iron	83.200
Manganese	none
Alumina	trace
Magnesia	none
Lime carbonate	2.000
Phosphoric acid	.150
Sulphur	trace
Loss	.450
	100.000

Iron 58.24

The manufacture of porcelain in the United States has, in the last few years, grown very rapidly in importance and with an abundance of suitable porcelain clay there can be no good reason why the ceramic art should not reach a very high degree of perfection in America, since we are, probably, the best customers for fine ware, due to an almost universal and liberal distribution of wealth among the populace. Notwithstanding the progress made in the production of ware in this country the importation last year amounted to about $6,000,000. Surely, a demand so far beyond our present means of supply should steadily lead to the building of additional potteries, especially in the west where the market is constantly on the increase, and to efforts for the production of the finer grades of chinaware. Though the consumption of the latter is not equal to that of the common ware, still it is very great and at present has to be met entirely by importation from Europe. Potters are earnestly requested to test the properties of Lawrence county porcelain clay for this purpose and there is no doubt but the effort will be attended with success.

ANTIQUITIES.

In order to aid in throwing as much light as possible upon the mystery which surrounds the pre-historic races who once occupied the Mississippi valley, attention has been directed to collecting stone and other relics and to the mapping of tumuli and walled or fortified sites of villages which alone remain, so far as yet known, to mark the progress of their arts and as evidence of their civilization. Only a small portion of the State has, so far, been examined in this respect, yet the results accomplished are in the highest degree gratifying; while uncollated information points to still richer fields before us. Though it may not prove possible by this research and study of archæological history to fully satisfy ethnologists of an unbroken chronology that connects the mound-builders with the existing races of red men, yet it is to be hoped that much may be done to establish the geological era which marks the first appearance of man upon the earth.

Opinions that are founded upon mere superstition must yield to well authenticated facts, for people who have the independence to think for themselves, can not fail to see by the light already before us, that it will not satisfy the inquiring mind to circumscribe anthropological history within the narrow limits of six thousand years. Indeed, ten times that number of cycles of time will not suffice to account for the changes which have taken place in the physical features of this planet, nor for the extinction of species of animals that were contemporaneous with man; and for

the subsequent introduction of new forms of organic life. It is not at all improbable that the existence of man dates back, at least, to the time when dry land occupied most of the area now covered by the Pacific Ocean and connected China with America. Nor is it dificult to trace a close resemblance both in national and physiological organization between the inhabitants of India, China and Japan and the Toltec and Aztec races of America. Each have the same general features, color of skin, and long, coarse, straight, black hair, with the same habits of seclusion from outside interference in their domestic arrangements.

The walled enclosures of the Aztecs, Toltecs and prehistoric men of this country have their counterpart in the great Chinese Wall which was made to enclose an entire nation and shut off all intercourse with strangers.

In the Indiana Geological Report, 1873, an account is given of a remarkable pre-historic stone wall enclosure, situated on the Ohio river at the mouth of Fourteen-mile creek in Clarke county. Since the publication of that account Mr. W. W. Borden has, while prosecuting the geological survey in that portion of the State, fell in with a number of remarkable antiquities not before noticed, and to which he called my attention. Being favored last fall by a visit from Prof. F. W. Putnam, Editor of the American Naturalist and Director of the Peabody Museum, a scientist who, in connection with other important studies is probably giving more attention, at this time, to archæology than any one else in America. It was thought advisable to take advantage of the occasion by availing myself of his valuable aid to make an examination of these new discoveries. Prof. Putnam was on his way to join Prof. Shaler's corps in the geological survey of Kentucky and the localities to be examined were not far out of his road.

In the natural advantages of the location and in the execution of the bold plans conceived by the engineers of a primitive people, this fortification surpasses any antiquity of the kind which has yet been found in the State. The

walls which fill up the spaces unprotected by mural escarpments, around this enclosure, are generally ten feet high from the outer base, but at a natural weak point, on the north-west part, the gap was closed by a wall built after the fashion of the others, that from the outer base to the top was seventy-five feet high. After passing around the entire enclosure and taking a look from the summit, 250 feet high, over the beautiful scenery which lay before us for a stretch of eight or ten miles up and down the Ohio river, Prof. Putnam expressed himself as having been highly pleased with the day's work. From Charlestown we went to Lexington in Scott county. From this place we were accompanied by Doctor Jordan, Dr. Hutchinson and Mr. Powell to a locality which has excited the curiosity of the whites from the earliest settlement of the country to the present time. The location of these antiquities is in the northeast corner of Clarke county on section 32, T. 2, R. 10, about one mile below Dean's marble quarry and just south of the Jefferson county line. The land is owned by J. C. Davis, an extensive fruit grower.*

The elevated point or spur of the main ridge, containing the antiquities, was selected, as in all other instances, by the mound-builders, on account of its natural defences against sudden surprises from an enemy and the fine view which it affords of the country for many miles up and down the Ohio river. The approaches, except on the north, are defended by a mural wall of rocks composed in the descending order as shown in the accompanying section, Fig. 3, of

*Mr. Davis moved from Ohio a few years ago and selected his present farm, on the high ridges, believing it to be one the most favorable locations for never-failing crops of peaches. The fruit grown here is highly colored and of most excellent flavor. This important feature of the fruit he believes is due in a great measure, to the excellence of the soil and peculiar meteorological conditions dependent upon elevation and proximity to the river and its broad bottom lands. His peach orchard contains a total of 35,000 trees, of which 15,000 are in bearing condition. Though the season was not the best, by any means, the yield for 1874 was 3,000 bushels of marketable peaches.

Corniferous, Niagara, Clinton, and Cincinnati beds, having a total thickness of 371 feet.

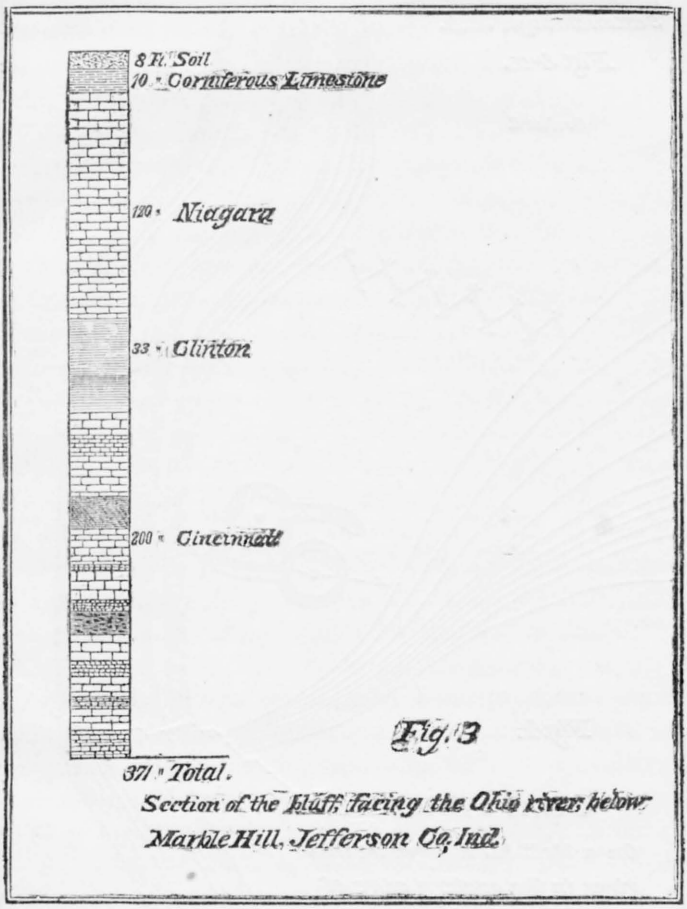
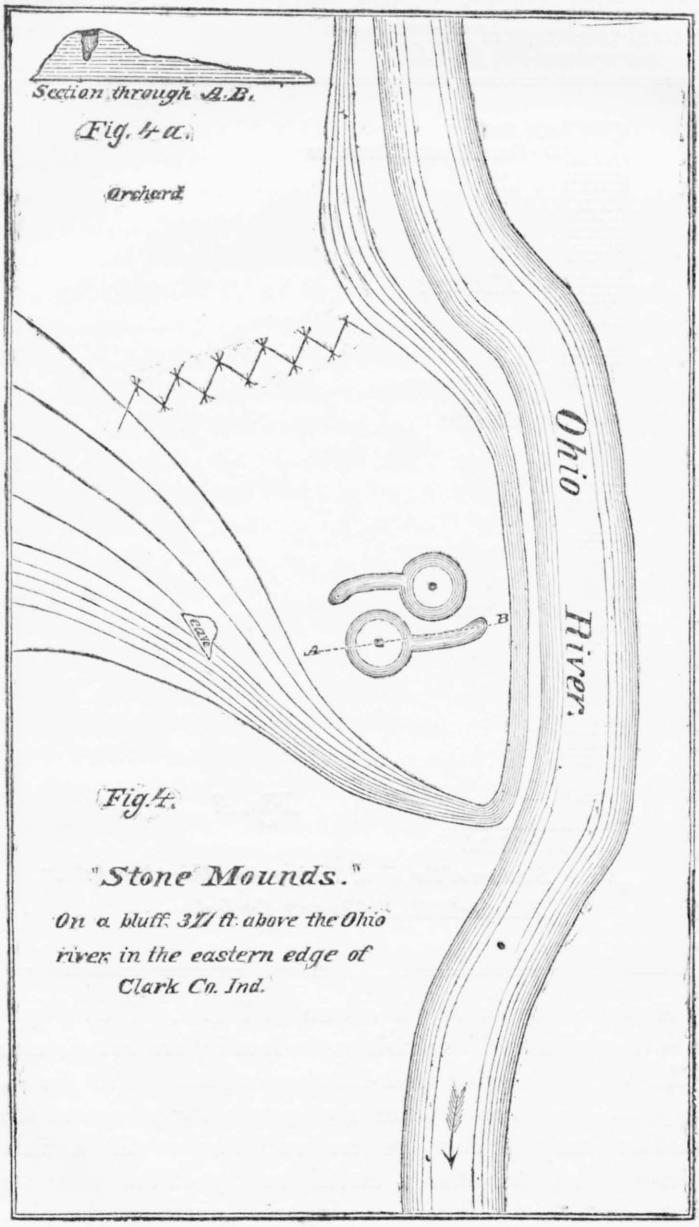


Fig. 3

Section of the Bluff facing the Ohio river below Marble Hill, Jefferson Co. Ind.

A plat of the locality is shown in Fig. 4. The antiquities that prompted our visit to the locality are two circular piles of stone with neck-like prolongations that lie in opposite directions. After giving a hasty glance at the confused heap, it must be confessed that we felt a little disappointed, but after a careful survey of the place we were enabled to discern the figures given on the plat. The most prominent parts of the mounds are twenty-two


Section through A.B.
Fig. 4a.
Orchard
Ohio River
A
B
Fig. 4.
"Stone Mounds."
On a bluff 377 ft. above the Ohio river in the eastern edge of Clark Co. Ind.

feet in diameter and forty feet long, measured in the direction of A. B. The sigmoidal passage-way is about six feet wide. In the centre of each mound there is an excavation about three feet deep, probably of modern date and made by parties under the impression that the stones had been piled up to mark the site of buried treasures. We were informed that it is the opinion of some of the old settlers in the neighborhood that the cave, seen a short distance to the west, extends beneath the mounds and that the holes in the centre of each communicates with it. If such is the fact it would furnish a very safe retreat for a small colony and may account for the absence of more extensive works for defence. A look into the excavations made in these mounds shows that the stones were piled up regularly and lapped so as to break joints, but without the use of mortar. The tumbled exterior is the work of desecration and natural decay. That the heaps of stone are the relics of the mound-building race there can not be a doubt. The location is just such as they were in the habit of selecting as a provision against the sudden approach of an enemy. Indeed the location is so well protected by natural walls of stone that it would seem almost useless to add others. These peculiar heaps of stone may have been made as monuments to commemorate some remarkable event, such as a great battle, the death of a noted leader, or the selecting of a chief. That prehistoric races were in the habit of commemorating notable events is made manifest by the numerous carvings of human tracks and the tracks of birds and quadrupeds upon massive blocks of stone which lie at horizons which mark the lowest or highest water of large rivers.

An example of this is seen at the "Foot-print rocks," in Union county, Kentucky, situated at the edge of the bottom land approaching the Shawneetown ferry. On a massive sandstone which here rises above the surface of the ground at an angle of twenty-four degrees there are a great number of carved feet of men, birds and quadrupeds, which occupy the horizon of the highest known water of

the Ohio river. Similar carvings are found at the high-water mark of the Mississippi river above St. Louis.

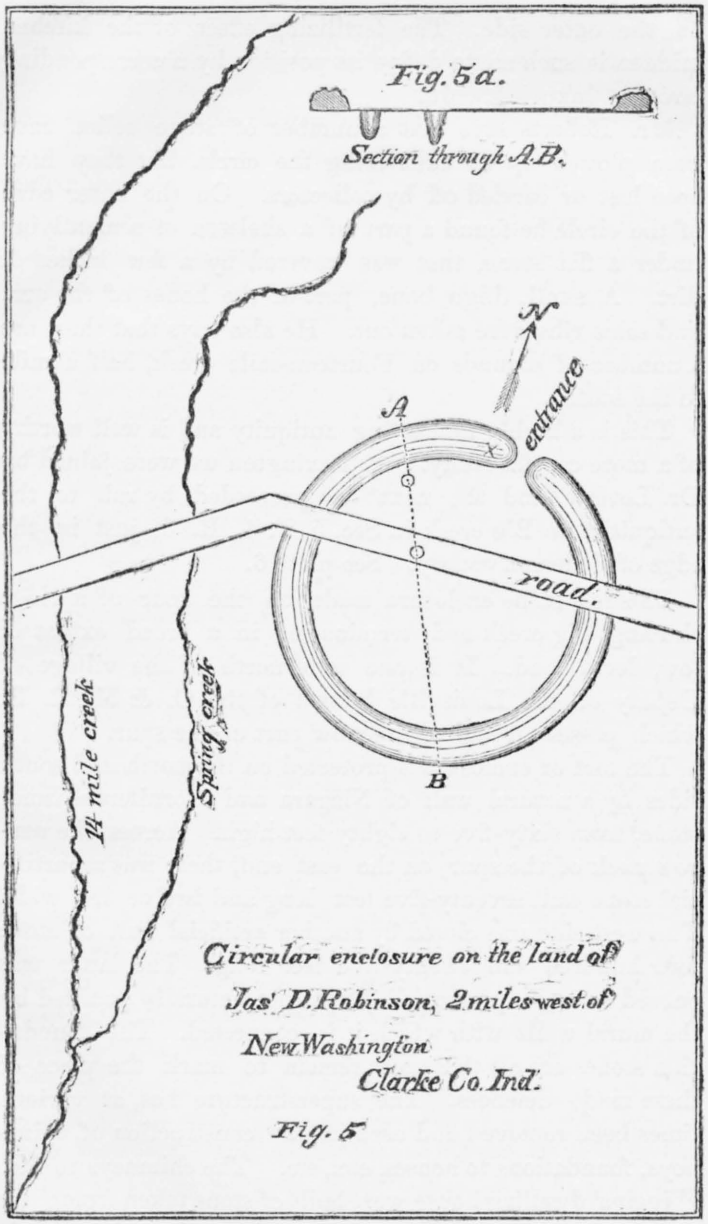
A great many stone implements have, from time to time, been picked up in the vicinity of the stone mounds and Mr. Davis very obligingly gave to the State cabinet a stone ax, large stone spear head and a number of arrow points and fleshers.

A threatening rain which set in soon after leaving the mounds, and the want of lights prevented us from exploring the cave in search of relics, fossil bones, etc.

On our way back to Lexington an opportunity was afforded Professor Putnam to make a hasty examination of a large circular earth work on Jas. D. Robinson's farm.

Fig. 5 is a plat of this circle made from measurements given by W. W. Borden. It is on a second bottom of Fourteen-mile creek and about eight miles from the "Stone fort" and two miles west of the village of New Washington. The elevation is twenty to thirty feet above the bed of the creek and four hundred yards distant. It is six hundred yards in circumference, ten or twelve feet wide and at present, fifteen to twenty inches above the general surface. On the northeast part there is a gap or passage-way six to eight feet wide. At the point marked by a + at the west side of the entrance there is an oak tree three to four feet in diameter. Within the enclosure there are two pit-holes shown in Fig. 5*a* in section along the line A. B. A farm road crosses it in an east and west direction. Prof. Putnam dug into the circular bank in several places and found it to be made up of aboriginal kitchen refuse, fragments of bones of various animals, fresh water shells, and bits of broken pottery. The fragments of pottery are marked with a variety of rude devices.

The action of the plow in cultivating over this enclosure during a great many years, for it lies in a cultivated field, has had much to do in reducing the elevation of the wall and mixing the earth of which it was constructed, with the kitchen stuff which had probably been thrown



Circular enclosure on the land of Jas' D. Robinson, 2 miles west of New Washington Clarke Co. Ind.

Fig. 5

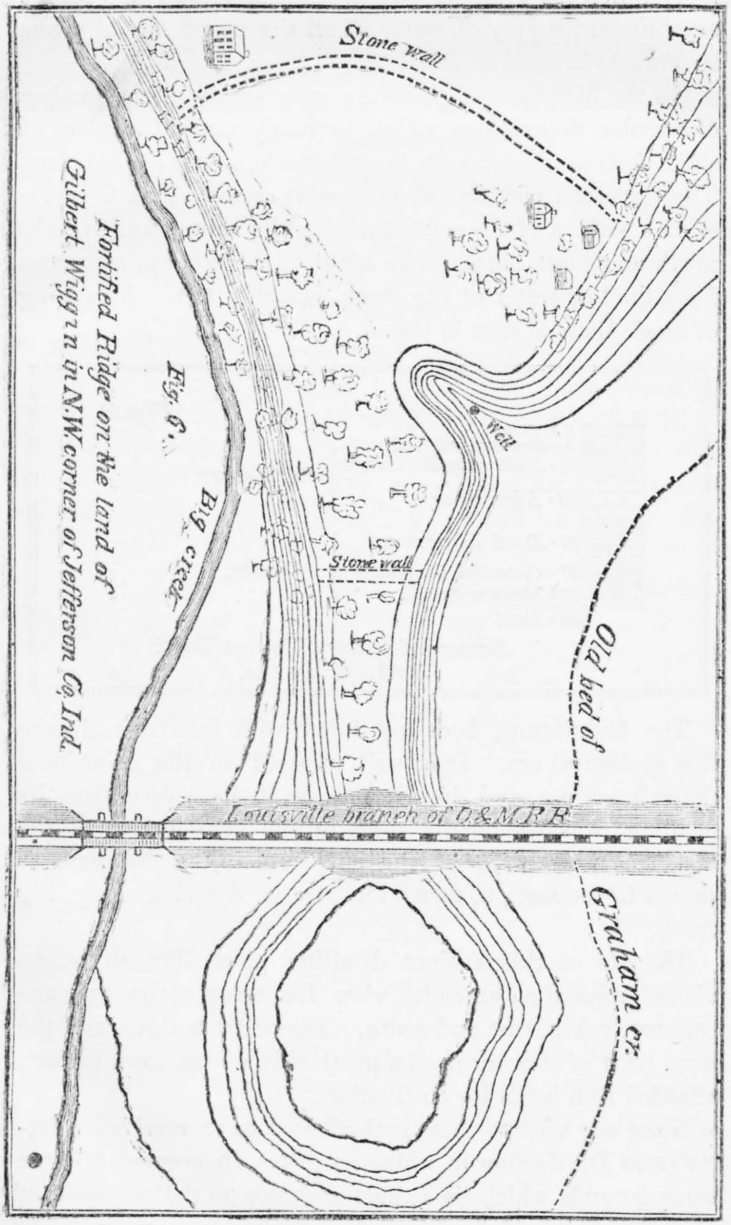
on the outer side. The fertilizing effect of the kitchen midden is such as to define its position by a corresponding circle of luxurient corn.

Mr. Roberts says that a number of stone relics have been plowed up by cultivating the circle, but they have been lost or carried off by collectors. On the outer edge of the circle he found a part of a skeleton of a man lying under a flat stone, that was covered by a few inches of dirt. A skull, thigh bone, part of the bones of the arm and some ribs were taken out. He also says that there are a number of mounds on Fourteen-mile creek, half a mile to the south.

This is a highly interesting antiquity and is well worthy of a more careful study. At Lexington we were joined by Dr. Levette and the next day proceeded by rail to the antiquities on Big creek in Sec. 5, T. 4, R. 8, just in the edge of Jefferson county. See plate 6.

This is a stone enclosure made on the spur of a ridge skirting Big creek and terminating in a broad extent of low, level land. It is one mile north of the village of Deputy on the Louisville branch of the O. & M. R. R. which passes through the narrow part of the spur.

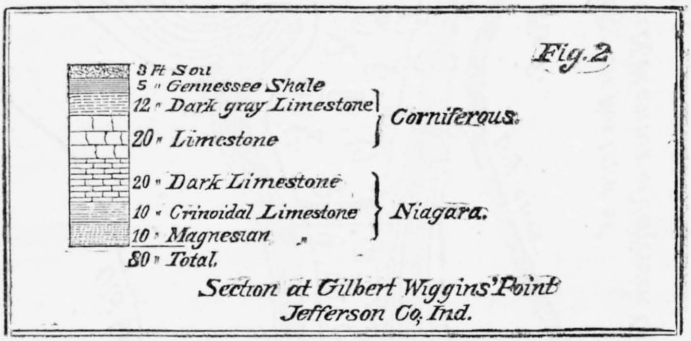
The fort or enclosure is protected on the north and south sides by a natural wall of Niagara and Corniferous limestone, from sixty-five to eighty feet high. Across the narrow neck of the spur, on the east end, there was an artificial stone wall seventy-five feet long and twelve feet wide. The west side was closed by another artificial wall of stone four hundred and twenty-five feet long. The latter was curved so as to protect all points not naturally guarded by the mural walls with which it is connected. The foundation stones are all that now remain to mark the place of these made defences. The superstructure has, at various times been removed and used in the construction of chimneys, foundations to houses, etc., etc. The chimneys to Mr. Wiggins' dwelling house were built of stone taken from these walls. On the north side of the enclosure in a short, shallow ravine, which pitches off abruptly, there is a cave spring


Stone wall
Well
Stone wall
Old bed of
Louisville branch of O&MRR
Graham cr.
Big creek
Fig. 9.
Fortified Ridge on the land of
Gilbert Wiggins in N.W. corner of Jefferson Co. Ind.

G. R.—3

from which the dwellers within the enclosure could secure an abundant supply of water at all times and would prove invaluable in time of siege.

On the high ground, near the cave spring, are a number of circular depressions which probably mark the place of sinks such as are common to prehistoric works of this class. The enclosure contains about twelve acres. Fig. 2 represents a section of the strata forming the mural walls on the north and south sides. The hight of the section, measured from the low water of Big creek, is eighty feet. A capping of black shale is seen in places.



The Corniferous beds are filled with fossils peculiar to this geological era. It is well exposed on the point near the railroad cut, and since it may be easily raised from its bedding, was principally used in the construction of the east and west walls of the enclosure. The Niagara, as shown in the section, forms the base of the cliff along Big creek.

The site of this ancient dwelling place like all others visited, affords an extended view for many miles over the country, north, east and south. Big creek bottoms and the level tract of country on the north side of the town or fort, afforded rich lands for cultivation.

Since our visit to these antiquities I have received a letter from Dr. Jordan in which he gives an account of three stone mounds which lie a short distance to the northeast of

Deputy and between that place and the fortified town above described.

In a letter to me, Dr. Jordan says: "Agreeable to promise I went to Deputy and re-examined the antiquities of which I made mention when in Indianapolis, and send you a rough sketch of the locality. The land on which these antiquities are situated was settled by Middleton Roberts in 1811. The stone mounds were, at that time, about five feet high and the oldest Indians then living in the neighborhood knew nothing of their origin. His son David fell heir to the land and it is now owned by David's son, Philander Roberts. The antiquities consist of three stone mounds built upon level ground a short distance northeast of the depot at Deputy and three hundred feet east of the railroad. The largest of the mounds is egg shape, greatest diameter 135 feet, lesser diameter 60 feet; fifty feet to the northeast of "egg-mound" is a smaller one 15 feet in diameter, and fifteen feet north of this is another, 20 feet in diameter. They are all made of stone, and as Prof. Putnam said of the Ohio bluff antiquities, they seem to be mere piles rudely thrown up. Stone was hauled from these mounds to build the stone house three-quarters of a mile to the south, and for building foundations, fire places and chimneys to nearly all the houses for miles around, so that they have been nearly leveled to the ground. Some years ago parties opened the small mounds and found stone axes, flint arrow points and one pipe. Flints, in abundance, have been found in and around the large mound. On Lewis creek, a few hundred feet to the east, there is a stone quarry and the bluff along the stream is 80 feet high."

The discovery of these stone mounds near Deputy and the testimony of the first white proprietor of the land and that of his regular descendants, in regard to their history and antiquity, and the ignorance of the savages in regard to them, can no longer leave room to doubt that they are genuine relics of the mound-builders and that they are not mere meaningless piles of stone.

The topography of Clarke, Jefferson and Scott counties

consists of high ridges separated by broad arable plains and deep streams bordered by bold bluffs. This seems to have been eminently fitted to the habits and wants of the mound-building race. Here we find some of the most interesting works which are left as monuments of their skill and industry. From the great fortified town at the mouth of Fourteen-mile creek to the fortification at Wiggins' point on Big creek, a distance of about thirty miles, there appears to be a line of antiquities that mark the dwelling places of intermediate colonies, and these, when pushed to extremes by an invading foe, may have sought protection in the strongholds at either end of the line.

Everything connected with the antiquities of the mound-builders gives evidence of a peacibly disposed people whose greatest desire was to be let alone. In this respect we may trace another resemblance to the custom prevailing with the Chinese.

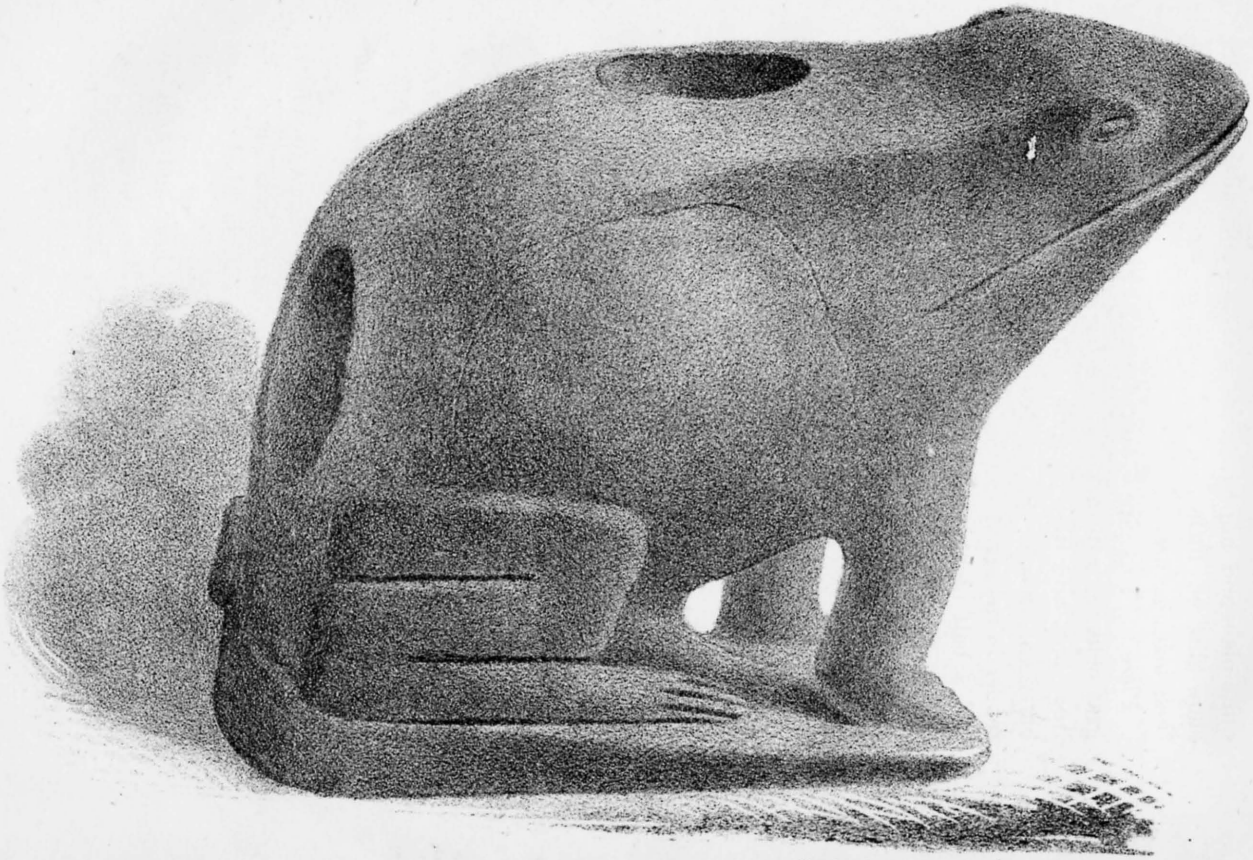
From the earliest pre-historic times to the present, man seems to have been pre-disposed to acquire and cultivate habits that are calculated to disturb the natural secretions of the body for the apparent purpose of bringing on a new and strange sensation, something to dull the sensibilities of the nervous system and induce a semi-concious state of mind.

The great number of stone and earthen pipes found associated with human remains in the tumuli of this country go to prove that the use of narcotics in the form of smoke originated with the pre-historic races of America.

After the discovery of the New World the habits of smoking tobacco, acquired from the Indians, spread with amazing rapidity all over Europe.

From the following figures of pre-historic pipes taken from mounds, and plowed up in cultivated fields, from different parts of the State, it will be seen that, though differing in form and design, the principal of a bowl in which the tobacco is burned and a communicating hole at the base through which the smoke may be drawn into the mouth, is essentially the same as in pipes of modern construction. Sometimes the pipe and stem of the aboriginal smoker is of

Plate 7.



Bridgen & Bufford Lith - Indpls

one piece as seen in Fig. 1, Pl. 2, and Fig. 1, Pl. 3, while the other figures show an arrangement for attaching artificial stems of wood. Though some of these ancient pipes are quite plain and unpretentious in their workmanship, others show that no little care and attention was bestowed upon their manufacture.

Plate 7. This pipe is carved out of a hard, course grained, gray colored, trap rock. It is a fair representation of a bull frog and, with the exception of one or two physiological omissions, would do no discredit to many a modern pretender in the art of carving. The figure is full size: Five and a half inches long and four inches high. The bowl which is situated on the back, is one and one eighth inches in diameter; the greatest diameter of the stem hole is one and one quarter inches, and tapers rapidly to its connection with the bowl. It slopes upward at an angle nearly corresponding to that of the back of the frog and forms a slightly obtuse angle with the bowl. In order to smoke such a pipe with ease it should either be held above the level of the mouth or the stem should be crooked to suit the lower position. The excellent finish and high degree of art displayed in carving so perfect an image of a frog from hard stone might at first lead one to question its authenticity as a relic of pre-historic times, but when it is compared with other pipes which belong *undoubtedly* to the mound-builders or stone age, there is little room to dispute its claim of antiquity. In all the stemless mound builders' pipes which I have seen, the bowl and stem holes are nearly equal in size at their openings; the latter opening tapers rapidly and is small where it connects with the base of the bowl and forms with it a slightly obtuse angle.

The frog is sitting upon his hind legs which are admirably folded, but the artist exhibits carelessness in minor details by only giving four instead of five toes to the hind feet and three instead of four toes to the fore feet.

The attitude is quite natural and the head and body are in good proportion. It was found by Mrs. Margaret Rogers, on her farm in Fountain county, Indiana, one mile

from Covington, and loaned to the State to be figured and described.

Plate 8, Figure 1, is a full sized earthen pipe, found by Colonel Bates near Newburg in Warrick county, Indiana, and presented to the State collection. It is made of material similar to that used by the mound-builders in the construction of pottery, *i. e.*, river mud or soft clay and pounded mussel shells: it did not require to be baked in the fire and is simply an artificial stone.

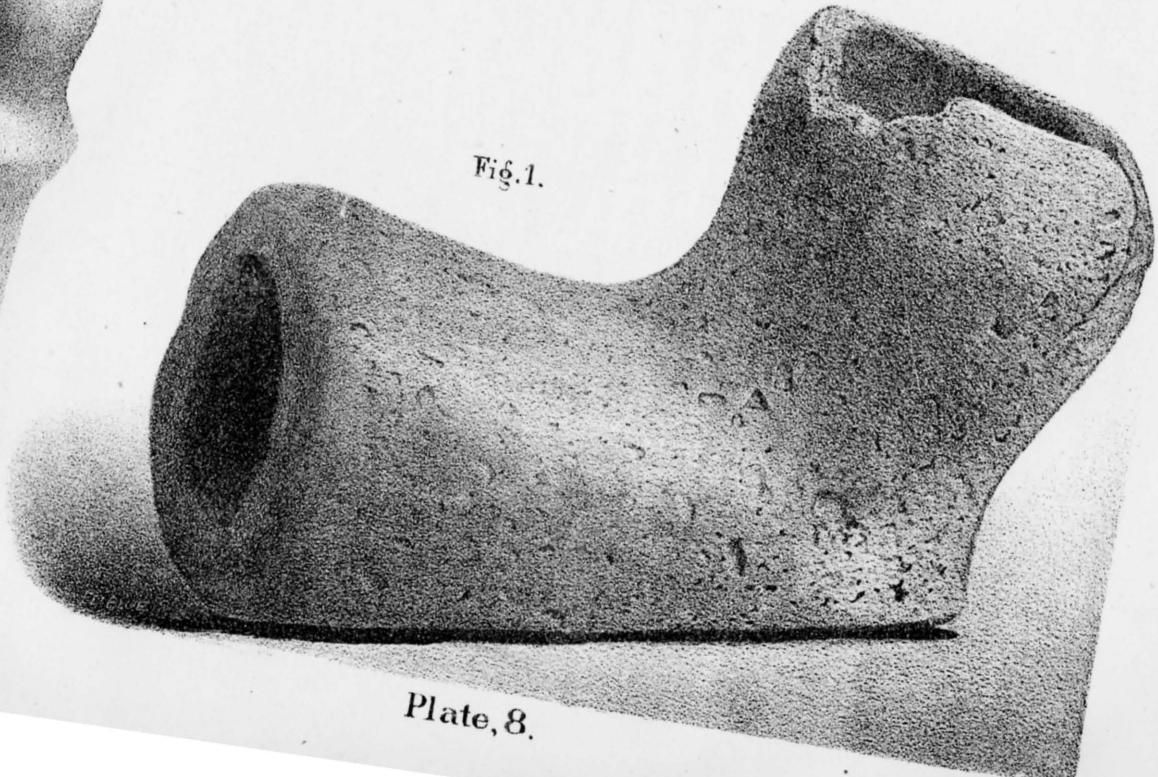
It is four and a half inches long; the opening of the bowl is one and three-quarter inches in diameter. The stem hole is ovoid, greater diameter one and seven-eighth inches, lesser diameter one and one-quarter inches and tapers rapidly to the bottom of the bowl. The bottom part of the pipe is flat and there is a knob on each side of the bowl, which served both as ornaments and as feet to prevent the pipe from falling over on its side when laid away.

Plate 8, Figure 2. This pipe is made of a fine grained, gray colored limestone, is elegantly polished and the stem and head are all of one piece. The long shank below probably served as a handle to hold it by while smoking. It is represented of natural size. This beautiful specimen of mound-builders carving was presented to the State Collection by George Hasty, M. D. He found it on black, marshy land in Harrison township, Henry county, Indiana, in 1868.

Plate 9, Figure 1. This figure is only one-third of the full size. This pipe is carved out of greenish gray, compact, steatite. It is perfect in itself and does not require an additional mouthpiece. The figure is a very good imitation of a wolf's head. The bowl is one and a half inches in diameter and three and one-quarter inches deep. From the centre of the bowl to the end of the stem is six inches, and the whole length of the pipe from the end of the stem to the tip of the wolf's nose is eleven and a half inches. The stem hole is a full half inch in diameter, of uniform size throughout and made as straight as if drilled by machinery.

Fig. 2

Fig. 1.



Plate, 8.

It appears as if the design for this pipe was intended to utilize all the stone at the disposal of the workman, for while the right side is true and well polished, there is on the left side a slight longitudinal curve and near the middle and below the bowl are some natural indentations which could not be removed without very materially destroying the symmetry of the figure, consequently they were deemed of less detriment than to dimish the size of the bowl which is in harmony with the carved image.

I am indebted to Mr. Jacob T. Wright of Indianapolis, for this beautiful specimen of mound-builders' pipe. He obtained it from a friend in Fleming county, Kentucky.

Plate 9, Fig. 2. This pipe head is made of unbaked clay and powdered mussel shells, similar to the material used in the mound-builders' pottery. It is of rude construction, nearly flat on the bottom. The only effort at ornamentation are two projecting knobs in front. The bowl tapers to a small hole which connects with a very large stem hole. The figure is natural size; it was found at the "Bone Bank" in Posey county, Indiana, and is a part of a number of mound builders' relics presented to the State collection by the Mt. Vernon Lodge of Odd Fellows.

Plate 9, Fig. 3. Sandstone pipe, head hansomely finished, being even and true. In design it resembles an urn. The bowl is deep, regularly tapered and cut as true as if drilled by machinery. The stem hole is large for the size of the pipe which is represented full size, tapers rapidly and slopes upward at an angle of about 40°. This upward slope of the stem hole seen in so many of the pre-historic pipes must have been made for a special object; and that was to enable the ancient man to smoke while taking his ease by lying on his back with his head slightly elevated, in such a position the bowl of the pipe will be vertical.

This pipe was found by Lycurgus Chaffin, associated with a copper axe of a peculiar construction, plummets made of magnetite and a number of stone axes and flint arrow points. They were plowed up in a short ridge elevated just above high water mark on the Cut Off island, one mile from New

Harmony, Posey county, Indiana, and presented to the State Cabinet by Mr. Chaffin.

Plate 9, Fig. 4. Full size representation of a pipe head, made of silicified fossil coral, *Chætetes lycoperdon sp?* The shape is ovoid, top and bottom flat, under side is beveled in front, stem hole is large, tapers to a small hole where it joins the bowl, and forms an obtuse angle with it. This arrangement also enabled the happy owner to smoke while lying on his back without danger of spilling the ignited tobacco.

I know nothing by personal experience of the pleasure derived from pipes or cigars and therefore put forth the inquiry; may there not be more real enjoyment derived from the smoke of tobacco if inhaled while lying on the back? And after all, looking to pre-historic man, with whom the habit originated, may it not be the most refined as well as most ancient way to indulge in the habit of smoking.

The figures 1, 2 and 3, Frontispiece, represent different views of a very remarkable stone implement of the mound-builders age.

It was found by Mr. Walter Bennett, of Merom, Ind., three feet beneath the surface, while digging dirt in Crawford county, Ill., to build a levee, on the opposite side of the Wabash river from Merom.

It is formed out of a small trap boulder, and is represented about two-thirds full size. The stone has been ingeniously worked, on the side represented in fig. 1, so as to exactly fit the palm of the hand. It has a raised centre and projecting rim. The opposite side is shown in fig. 2; the indentation on this side is just large enough to enclose the four fingers of the hand, while the projecting rim is high enough to shield the ends of the fingers if the implement was used as a "*stone-knucks*" for dealing blows to an enemy or in defense.

The front is regularly rounded and slopes slightly from the rim, which rests on the wrist, to that part which protects the ends of the fingers. Fig. 3 is a view showing the broad rounded edge in perspective.

It is evident that this implement may have served a variety of purposes, such as crushing and grinding corn, rubbing skins, and for other domestic pursuits, or as a convenient and effective weapon for dealing deadly blows when occasion demanded such an application.

This form of implement is entirely new to archæologists, and indicates a high antiquity for artificial "*knucks.*"

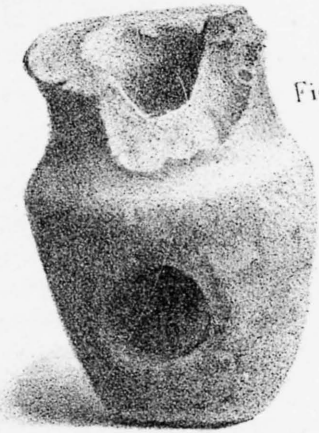
I was a little surprised at not finding in either Webster's or Worcester's excellent dictionaries the word "*knucks.*"—a word frequently used in police reports to designate a brass instrument that covers the knuckles, and is used by rowdies for striking their adversaries deadly blows.

Plate 9.

Fig. 1.

Fig. 2.

Fig. 3.



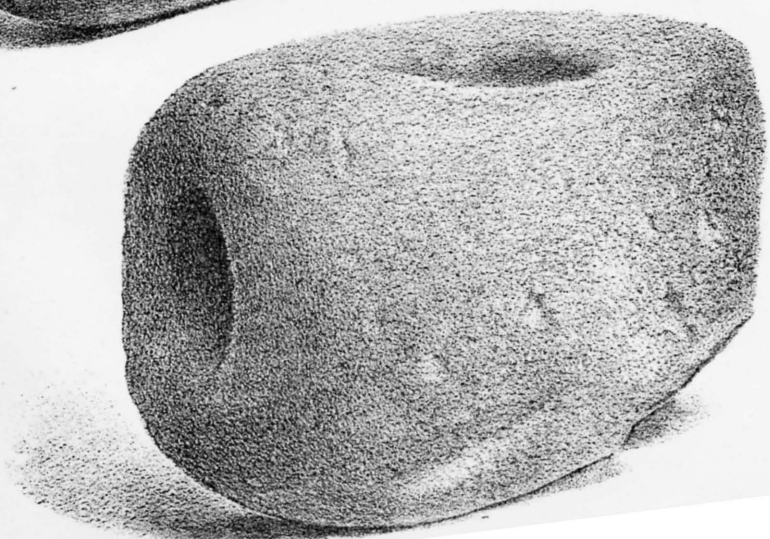


Fig. 4.

JACKSON COUNTY.

This county is of rectangular shape. The East Fork of White river enters at the northeast corner and flows through it in a southwest direction, forming two triangular shaped districts, which are, for the most part, totally unlike in topography and geological features.

In the southeast district, the country is mostly rolling, with low sandy hills fifty to one hundred feet high. An exception to this is seen in a short range of knobs south of Brownstown and a range of sandy-clay hills southeast of Seymour, called Chestnut Ridge. The Knobs at Enoch Baughman's south of Brownstown have an elevation of about 360 feet above White River. The Chestnut ridge, at the old burying ground near A. H. Adams' house and on John Clark's land, is 165 feet above the bed of Mud creek, which will make it about 200 feet above the river. This is said to be the highest part of Chestnut Ridge. The bearing of this ridge is a little east of north and west of south. The ridge proper is called seven and a half miles long and an average of one mile in width. Though it may be traced north of the railroad and beyond the county line, it is not well defined and loses the name of Chestnut ridge after passing north of Mud creek. In the ridge proper, there are four depressions or gaps which cross it at right angles.

White river bottoms are wide and bordered by sand ridges and terraces as shown on the map.

The northeast district of the county is broken and traversed in a northeasterly and southwesterly direction by

ridges that have an average elevation of 280 feet above the plains and which, in places, spread out into broad table lands. The valleys through which the small streams find their way to White river are generally narrow. In the vicinity of Sparksville and Weddlesville, there are beds of loose sand, thirty feet or more in depth, that cap the solid beds of Knob shale and sandstone at an elevation of 280 feet above White river. Sand occupies a similar elevation in the ridge near the village of Vallonia on the south side of White river. These sand deposits have the same bearing as the course of White river, but, I do not believe that they owe their origin to the cutting and shifting of the bed of that stream, as will be further alluded to, when speaking of geological changes which took place during the Quaternary period.

The Muscatatuck river and its large tributary, Graham's creek, flow in a southwesterly direction and nearly parallel to White river, until it reaches the south boundary of the county and from thence in a west course to its junction with the latter stream, at a point where its course, also, turns at a right angle to the west. All the northern tributaries of these two principal streams in the east half of the county have the same general direction.

These striking phenomena must be mainly due to geological changes which transpired during the Glacial and Champlain eras.

The head waters of Salt creek in the northwest corner of the county, have their courses determined by the Knobstone ridges and the cause is probably referable to another set of geological forces.

GEOLOGY.

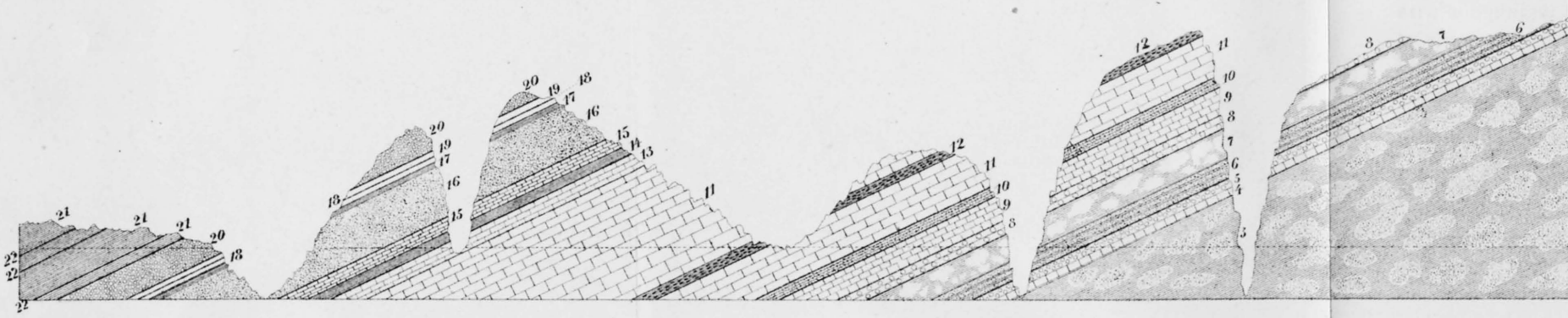
A horizontal section of the geological strata of Jackson county, is given on Plate 10. This section commences at the crop of Black Shale on East Fork of White river one mile above Rockford, and passes through the county in a southwest direction and from thence continues along the

Section from the west edge of Martin Co. to Rockford in Jackson Co., passing on or near

Ohio & Mississippi Railway.

MARTIN CO. **LAWRENCE CO.** **JACKS**

Shoals. *Huron.* *Mitchell.* *River Valley.* *Fort Ritner.* *Sparks Ferry.* *Pea Ridge.*



21 Coal measure Shales
22 Coal seams

16 Chester sandstone 70 ft.
17 Shale 20 ft.
18 Iron Ore 5 ft.
19 Kaolin 6 ft.
20 Conglomerate 100 ft.

11 St Louis limestone 220 ft.
12 Chert bed in limestone 10 ft.
13 Gray limestone 16 ft.
14 Shale 8 ft.
15 Blue limestone 16 ft.

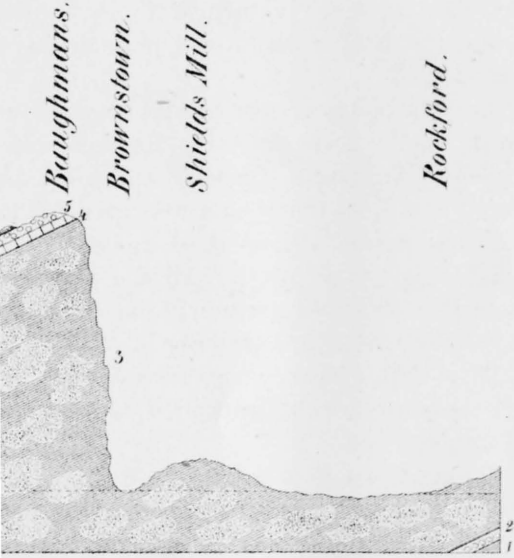
6 Sandstone & shale 20 ft.
7 Vermicular shale 40 ft.
8 Limestone & geodes 15 ft.
9 Gray limestone 30 ft
10 Oolite 10 ft.

Drawn by G M Levette.

Braden & Bucford, Steam Lith. Indianapolis Ind.

the line of the

KSON CO.



1 Black Shale 20 ft.
2 Goniatite bed 10 ft.
3 Knob stone shale 340 ft.
4 Lime stone 4 ft.
5 Geode bed 15 ft.

line of the Ohio and Mississippi railroad to the Coal-measures in Martin county. While the general dip of the strata is at the rate of about thirty feet to the mile in the direction of this section, still, at many crops of the strata, it is difficult to recognize any dip at all.

The Black Shale, Fig. 1, is the oldest formation seen in the county. Its thickness has not been determined, for the bottom is not exposed and the greatest depth seen is at a locality about one mile above Rockford on Sec. 32, T. 7, R. 6.

The section is here:

Sandy soil and sandy clay	40 ft.
Clay, with a few small granite boulders and pebbles	30 ft.
Black Shale, with large masses of calcareous concretionary stone to the bed of the river	20 ft.
Total	90 ft.

The water was five to six feet deep at the foot of the section and the shale appears to continue across the bed of the river. It is found in wells as far north as the county line. The next crop of this formation along the line of the section, is at Rockford. It is only possible to see it here at extreme low water. In digging the tail-race for the water-mill, which was recently destroyed by fire, a quantity of Black shale was thrown out and in it I succeeded in finding quite a number of small *Lingula* and *Discina*, which if not identical, resemble very closely species which are found in the carboniferous rocks.

The western boundary of the Black shale is represented on the map by a dotted line which passes near Newry, where the crop is seen in the bed of Muscatatuck creek, Langdon and Crothersville. A bituminous shale, similar to this, occurs in northern and eastern Ohio, and is there

referred, by Dr. Newberry, the able director of the Geological Survey of that State, to the Portage era; strata which, in New York, follow the Genesee in regular order. The fossil Brachiopods that have been found, in a good state of preservation, in this latter shale at Lexington Scott county, are considered by Whitfield, to be ample evidence for refering this shale to the same geological age as the Genesse of New York, with which opinion I am inclined to agree.

The following named fossils have been found in the Black shale at Lexington:

Leiorhynchus quadricosta,
Chonetes lepida,
Tentaculites fiissurella,
Lingula and *Discina.*

The section of the rocks given on Plate 10, page 42, ends with the Black Shale at Vienna and it is readily traced by crops from Lexington to Rockford.

The Chemung and Catskill groups forming the upper members of the Devonian, and several hundred feet thick in New York and Ohio, are, as far as we know at present, entirely wanting in Indiana, and we come at once in the ascending order to the Kinderhook group which lies at the base of the Carboniferous formation. In his Geological Reconnoissance of Indiana, published in 1837, the late David Dale Owen gave to this formation the name of *Sub-carboniferous Sandstone* or *Knob Sandstone,* but since there are beds of sandstone and siliceous shales of very great thickness at a higher horizon and near the top of the the Subcarboniferous period, Mr. Worthen of the Illinois Geological Survey, has thought best to substitute for Owen's name, that of Kinderhook group, and for the upper arenaceous beds, Chester Sandstone group.

Though the names given in the Illinois Reports are now generally adopted, I can see no good reason why Knob Sandstone or Shales, by which name the beds have so long been known to western geologists, should have been pushed

to one side for its reception; indeed, Knob, or Knob Sandstone group has the advantage, it is derived from a striking topographical feature due to the lithological character of the strata.

The Kinderhook beds in Indiana, are made up of marly shales, arenaceous shales and sandstones, with two or more beds of geodes associated with or replacing beds of roughly weathering entrochital limestone.

The geodes first make their appearance along the line of the horizontal section on top of the ridge at Enoch Baughman's house, then at Pea Ridge and Sparksville. Just before reaching the county line there is a bed of gray limestone and chert containing fossils belonging to the Keokuk era. On Sec. 11, T. 4, R. 2, E., this entire formation is overlaid by a bed of St. Louis Oolitic limestone that is quarried at Dixon's, in blocks of large dimensions, for building purposes.

There is usually seen in Clark and Scott counties, resting immediately on the Genesse shale, a few inches of hard green mottled limestone. This limestone, at Rockford, passes upward into greenish gray, hard, calcareous shale, filled with fossil cephalopod shells, in a fine state of preservation. The Goniatites and Nautili of this locality are among the most interesting fossils found in the country. They are eagerly sought for by collectors and have given to Rockford a world wide notoriety. The rock is easily decomposed when exposed to the air and its fossils are found ready weathered out on the newly exposed surface after floods in the river.

The children of the village keep a sharp look out for them and the crop, which is only two or three feet thick and from one hundred and fifty to two hundred feet long, is diligently searched from day to day after each freshet or heavy rain. Large numbers are collected and sold, for what they can get, to the scientists who are attracted to the locality. They go by the name of "snake rocks" and if you ask for Goniatites or Nautili, as I did, you will be told that

they know nothing of such things, but on the other hand if you inquire for "snake rocks" as my friends Messrs. Gardner and Charles, of Seymour, who understood the matter, did, you will find that nearly every boy and girl in the village will have a few and are ready for a trade.

The best known fossils occurring in the Goniatite bed at Rockford are: *Nautilus trisulcatus*, M. & W., *N. digonus*, M. & W., *Goniatites Lyonii*, M. & W., *Bellerophon crytolites*, Hall, *Cardiopsis radiata*, M. & W. There are other species found which I believe to be new. As yet this is the only locality in the State where the above species of cephalopods have been found, though the corresponding strata of greenish, marly shales have a thickness of from fifty to one hundred feet or more in Clarke county. One mile above Rockford, there are in the upper part of the Genesse shale, large concretionary masses of calcareous rock which may in part represent the Goniatite bed, but they contain no fossils.

The Black shale and Goniatite bed, by a slight dip to the southwest, is carried beneath the surface before reaching Shields' Mill, seven miles west of Seymour.

The section at Shields' Mill exhibits:

Sandy loam and clay	15 ft.
Glacial gravel and occasional small boulders	20 ft.
Arenaceous shale and sandstone with nodular iron stone	70 ft.
O. & M. railroad track	0
Total	105 ft.

The hills skirting around Brownstown come to the river at Shields' Mill and are from one hundred to one hundred and thirty feet high. It is possible that the greenish shales, of which the Goniatite beds forms the base, are

partly represented by the arenaceous shale in the above section. The latter shales have, mixed in the bed, disconnected bands of earthy carbonate of iron that carry about the same per cent. of iron as the carbonate regularly stratified in the Goniatite shales of Clarke and Scott counties. The arenaceous, reddish brown shales are seen on all sides of Brownstown, where not covered by the Quaternary deposits, and weathered lumps of iron stone are so common in the bed of Hough's creek, that parties were induced some years ago to undertake the construction of a Catlin forge to work it into swedged iron. The mill race, dug to secure a sufficient fall of water for driving the blast and trip hammer, is still to be seen, but the forge was never built, for want of funds. Catlin forges are only made to pay in inaccessible places, where ore is abundant, easy to fuse and the local demand sufficient to consume the entire yield. In early days such forges were common in the northern part of the State, where they were run on bog-ore. The process is wonderfully wasteful of fuel, which is charcoal, and it can no longer be made profitable in a State penetrated in every direction by railroads, which equalize the cost of labor and food products and introduce iron made by the indirect process at half the cost of swedged iron.

At Enoch Baughman's the knobs rise to an elevation of about three hundred and sixty feet above the East Fork of White river.

The arenaceous shale is seen at the base and the first geode bed makes its appearance on the top. In the latter there are found silicified casts of *Nautili* that are nearly a foot in diameter. They have the local name of "large snake rocks" to distinguish them from the, so called, Rockford "snake rocks" which are much smaller.

We also find in this geode bed a large *Bellerophon* and a nnmber of species of geodized corals and encrinites. A fossil Bellerophon from this geode bed presented to me by Mr. Richard M. J. Cox, measures five inches in diameter and three and a half inches across the mouth.

Section of the Knobs at Baughman's:

Clayey soil.....	
Nautili, geode bed.....	8 to 10 ft.
Vermicular siliceous shale and heavy bedded sandstone, quarried for foundations and chimneys	65 ft.
Encrinital limestone, local.....	1 ft.
Vermicular siliceous shale.....	145 ft.
Covered space containing siliceous shale and sandstone.....	50 ft.
Arenaceous shale with iron stone.....	12 ft.
To bed of Hough's creek.....	
Total.....	283 ft.

The siliceous shales in this section are remarkable on account of the number of vermicular markings which they contain.

These worm tracks have annular sub-divisions and they appear to have been made by two species of worms; one is quite small, not more than five to ten one-hundredths of an inch and the other is larger, being from two to three tenths of an inch broad. These tracks are tortuous and often many inches in length.

The large Spirifer so abundant in the Knob shale near New Providence, Clarke county: *Syringathyrus textilus*, is rarely found here.

The following section was taken near Josiah Shewmaker's on Pea Ridge, Sec. 32, T. 5, R. 3, E.:

Covered siliceous shales.....	25 ft.	0 in.
Nautili bed, geode and limestone...	10 ft.	0 in.
Bedded gray sandstone.....	20 ft.	0 in.
Vermicular shales.....	40 ft.	0 in.
Geode bed.....	10 ft.	0 in.
Limestone.....	1 ft.	6 in.

Vermicular shales and thick bedded sandstone	40 ft.	0 in.
Vermicular shales with bands of sandstone	50 ft.	0 in.
Gray arenaceous shale to grade of O. & M. railroad	100 ft.	0 in.
Total	296 ft.	6 in.

In this section we have two well defined geode beds, and each associated with a thin band of limestone; the latter is largely made up of encrinite stems and fragments of undistinguishable shells. Many of these geodes are more than a foot in diameter and run from that down to sizes not larger than a walnut. Some are solid but they are generally hollow and contain chalcedony crystals of many forms and colors. They are in such numbers that the hillsides and beds of all the branches are lined with them. Every specimen that is broken exhibits some new beauty so that one only ceases to collect from an inability to carry and take care of them.

These geodes, like the porcelain clay of Lawrence county, before alluded to, occupy the place of a limestone which has been removed by the chemical action of water, that held silica in solution. By an interchange of constituents through chemical affinity, silica was precipitated and the lime carried off in solution. In the case of the porcelain clay, which is a silicate of alumina, the latter earth was originally in solution with the silica. At some localities, where the geodes abound, the limestone is entirely removed.

Pea Ridge is also known as the "Carr Settlement." Though there are a few gaps, still, this ridge may be followed to the northern part of the county. But Pea Ridge proper is only about seven and a half miles long in a

northeast and southwest direction and a few hundred yards in width.*

On Guthries creek, Section 18, T. 5, R. 3, there is, in a narrow and deep ravine leading down to the creek, an exposure of heavy bedded, gray, sandstone which shows a face of twenty feet above the talus; good ledges of this stone are seen for some distance down the stream. Geo. W. Carr informed me that the stone used in building the abutments to the railroad bridge over East Fork of White river, at Woods ferry, were taken from the quarry on Guthries creek. It has also been used in building foundations and chimneys. When not subjected to too many sudden changes from wet to dry this stone may answer a very good purpose for masonry. The color is pleasing and it works easily under the chisel and hammer. Before reaching the top of the ridge we encounter a geode bed which is particularly rich in fine cabinet specimens.†

Just above Sparksville, where the ridge terminates in a bold escarpment on the river, there is a fine exposure of the Knob shales and sandstone, and the rocks of which it is composed have been weathered and washed bare from the summit, which is capped with sand, to the waters edge; a

*Hon. Geo. W. Carr, who lives on this ridge, is an intelligent and well to do farmer. He has represented his county many times in the State Legislature and was President of the Constitutional Convention which assembled in 1850. His brother Hon. John F. Carr and his son Geo. W. Carr, Jr., also live on Pea Ridge. Hon. John F. Carr has also represented his county in the Legislature and was a member of the Constitutional Convention of 1850. The father of these distinguished citizens moved from Mercer county, Ky., and settled in Clarke county, Ind., in 1804. He moved from Clarke county in 1808 and built the first house on Pea Ridge. Hon. Geo. W. Carr was born in 1807 and is now a hale, stout man able to do as much work on the farm as any of the younger hands. Josiah Shewmaker is the oldest man on the ridge and came to the county in a very early day, but first lived on his farm on the river bottom.

†Geo. W. Carr, Jr., has very obligingly collected and sent to the State Cabinet a barrel of beautiful crystallized geodes from Pea Ridge.

road around the point had to be blasted out for the railway track; the order of succession is:

Sand	30 ft.
Vermicular siliceous shale	70 ft.
Vermicular shale containing three bands of sandstone, respectively 8, 7 and 18 inches thick	25 ft.
Buff limestone	4 ft.
Vermicular shale	31 ft.
Vermicular, siliceous shale with six bands of hard bedded sandstone	110 ft.
Shale with thin, irregular bands of oxide of iron	10 ft.
Bed of East Fork of White river	
Total	280 ft.

This section differs but little in the general character of the strata from the section at Shewmaker's. There are no geodes associated with the limestone and the latter rock is much thicker than it is at the latter locality. A peculiar feature of this section is the heavy bed of sand found at the top of the ridge, to which attention will be drawn when speaking of the Quaternary.

Clear Spring village is located on a broad table land underlaid by:

Soil, subsoil and clay	10 to 15 ft.
Quicksand in places	
Thin band of limestone	0 ft. 4 in.
Chert bed	5 ft.
Gray and buff sandstone	30 ft.
Geode bed and thin limestone	8 ft.
Vermicular shale	72 ft.
Siliceous, vermicular shale and argo-siliceous shale with iron-stone	145 ft.
Total	275 ft. 4 in.

The heavy, bedded sandstone near the top of the section is quarried for foundations and chimneys to houses and for walling wells.*

Section at the ford on Salt creek in Section 14, T 6, R 3:

Covered, to top of hill	80 ft.
Gray shale	5 ft.
Band of ferruginous sandstone	0 ft. 2 in.
Shale	1 ft. 0 in.
Band of brown sandstone	0 ft. 3 in.
Brown arenaceous shale	2 ft. 0 in.
Band of brown sandstone	1 ft. 0 in.
Siliceous shale	4 ft. 0 in.
Band of brown sandstone...1 ft. 6 in. to	4 ft. 0 in.
	97 ft. 5 in.

The bands of sandstone in the above section are of a handsome dark brown color and the stone, where exposed to the air, has become very hard and rings under the hammer. It will make a handsome and durable building stone, but, without railroad communication, it is rather inaccessable to market. A similar stone is seen at Findley's Mill, on Salt Creek, in the northwest corner of the county.

The ridges on each side of Muddy fork of Salt creek are composed of knob stones and vermicular shales. One or two geode beds are found throughout the northeast part of

*While sitting in Mr. Browning's store at Clearspring, during a rain storm, the lightning struck a wood-house on the opposite side of the street and about forty yards distant. The house is of one low story, weather boarded, and has a shed roof covered with boards. The electricity did not touch a cherry tree, the limbs of which partly overhung the house, nor the roof itself. It struck a poplar stanchion on the inside of the house, about six inches below the roof and shivered it to pieces and tore off some of the side plank. Another stanchion, on the same side of the house, but some distance off, was also splintered, and a corner and two side posts on the opposite side; it then passed away without doing any further damage. The tree and outside of the house were saved by being wet; the water gave conductive properties to the wood.

the county with, occasionally, an accompanying thin band of limestone. The ridges are from 280 to 320 feet high.

At the crossing of the Brownstown and Bloomington wagon road, in the bed of Muddy fork, there is a gray arenaceous shale containing concretions of pyrites.

The section is:

Alluvial bottom	4 ft.
Hard, brown sandstone band	3 ft.
Arenaceous shale	6 ft.
Bed of creek	——
	13 ft.

At low water, several salt springs can be seen, which break up from the bed of the creek. Thirty-five years ago a company sunk a well to this brine. The mouth of the well was below the overflow and it was not carried to any considerable depth. The brine did not prove to be very strong; twenty-five or thirty kettles were set and the manufacture of salt was prosecuted on a small scale for some years. The well has long since been filled up and the manufacture abandoned, but it is highly probable that stronger brine could be reached by boring down to the Genesse shale which might be reached here at from 100 to 150 feet.

The brine breaking up from the bottom of the creek, is so much contaminated with fresh water, that it is impossible to tell any thing about its strength, nor could I learn how many gallons of it were required to make a bushel of salt. The strata seen in the bank of the creek are dipping three degrees nearly north.

In the bed of Little Salt creek at Findley's Mill there is a sand stone which is probably referable to the band seen at the old salt works, and it is overlaid by arenaceous shale and sandstone flags to the top of the hill, in all 180 feet. North of Findley's Mill and just in the edge of Brown county, the ridge attains an elevation of 335 feet above Salt creek. Near the top there is a massive sandstone, in beds,

from three to four feet thick, of a brownish red color. It resists weathering and will prove a durable building stone. On the other side of this ridge is a thin bed of limestone which underlies the building sandstone. The ridges around Houston have the same geological structure: Sandstone at the top, thin geode and thin limestone from one to one and a half feet thick, underlaid by arenaceous and vermicular shale containing bands of sandstone.

Salt springs rise from the bed of Lutes fork of Little Salt creek in many places near Houston. I was informed that some years ago a well was bored on the creek and, after passing through two weak veins, a strong brine was found at a depth of ninety-six feet. An accident happened to the well which shut off the strong brine and the middle brine was used for making salt for some time but the works have long since been abandoned.

The hills and table land in the vicinity of Freeport rise about 150 or 200 feet above Bradens branch of Muddy-fork. Geodes are seen in all the road cuts and on the hill sides and covering the bottoms of all the small streams.

At Andrew May's heading mill, a short distance from Freeport, there are sandstone flags in the bank along the creek, overlaid by arenaceous shale and ferruginous gravel and sand. In the latter bed there are occasionally beds of bog ore; some of this ore is seen in the road cut near Mr. May's dwelling house. It also makes a showing back of his field where several holes have been dug by some unknown adventurers in search of precious metals. Around the remains of a small rude furnace I picked up some fragments of burnt bog iron ore, from which, they, no doubt, expected to extract precious metals.

It will be seen from the foregoing that the Palæozoic rocks of Jackson county are mostly represented by knob shales and sandstone, the equivalent of the Kinderhook beds of Illinois. The limestone and Nautili geode beds in the upper part, may possibly, belong to the Burlington and Keokuk eras.

At Mr. Enoch R. Dixon's quarry, near the southwestern

line of the county the stone quarried is a moderately fine grained Oolite bed which lies above the Nautili geode bed; it corresponds, lithologically with the Bedford, Ellettsville and Spencer Oolite building stone, and is, no doubt, equivalent with the Illinois, St. Louis era. A section taken from the railroad, one and a half miles south, and extending to the school house on the hill above the quarry, contains the following strata:

Red clay and chert with *Productus cora*, *Cyathophyllum rugosum*	10 ft.
Gray limestone, covered	80 ft.
Rubble limestone	2 ft.
Oolite limestone, visible and quarried	8 ft.
Gray limestone	40 ft.
Red chert and geodes	10 ft.
Limestone	3 ft.
Arenaceous shale	30 ft.
Sandstone	3 ft.
Shale	7 ft.
Sandstone	3 ft.
Vermicular shale	77 ft.
Gray sandstone	8 ft.
Total	281 ft.

The fossils found in the lime stone under the lower geode bed of this section are:

Orthis keokuk, *Spirifer pseudolineatus*, *S. keokuk?* *Pentremites conoideus*, *Productus cora*, *P. striatus*, and *P. sp.?*

QUATERNARY.

The Quaternary rests immediately on the Palæozoic rocks described in the preceding pages. The influence which this era has had in modifying the topography of the country is unmistakable and at the same time difficult to explain in a satisfactory manner.

In the northwest part of the county there is barely a trace of glacial sand and clay, but it is well represented on both sides of White river and with the exception of a few short ridges south of Brownstown, covers the entire half of the county south of the East Fork of White river and is composed of:

Brown, reddish sand	10 ft.
Brownish clay mixed with sand, gravel, some small boulders and cherty gravel...	30 to 60 ft.
Total	70 ft.

In the northern part of the county the sandy-hills contain:

Sandy clay	30 ft.
Clay with some sand, gravel and small granitic boulders	40 ft.
Total	70 ft.

At Dannatelle's, on Chestnut ridge, we have:

Soil of sandy loam, buff colored clay and sand	30 ft.
Red clay and sand with small pebbles of granite and chert	38 ft.
Buff clayey sand with pebbles and a few small granite boulders	27 ft.
Mud creek	
Total	95 ft.

At Mr. Adams' house, on Chestnut ridge, in digging a well they passed through:

Sandy loam soil and subsoil	15 ft.
Loose sand	10 to 18 ft.

Reddish gravel and sand	40 ft.
Coarse gravel	4 ft.
Total	77 ft.

A supply of water is reached in the coarse gravel.

A fine spring breaks out of a reddish gravel bank in a ravine in Mr. Adams' garden sixty feet below the house.

Chestnut ridge, as well as the sand hills to the northeast, are, therefore, all composed of Quaternary beds, the greatest thickness, of which, can not fall much short of two hundred feet.

The moraine of sand, clay and small erratic stones composing these beds, came down from the high divide in Randolph county and from the western border of Ohio. It is most probably the work of a retreating glacier which had its forces divided into several channels by ridges that checked and partially resisted its currents. After passing diagonally through the county to its south boundary the main direction of the moraine is changed from southwest to nearly a west course.

Baughman's ridge formed an island, as it were, between the two moraines in that part of the county. The East Fork of White river and the Muscatatuck flow through valleys that were cut out by the glaciers. In these moraines are found a large number of fragments of erratic limestone and chert, with occasionally small crystalline boulders. At Col. Morgan's near Cannelsburg in Daviess county I found in the moraine, numbers of *Orthis lynx*, *O. occidentalis*, *Rynchonella increbescens*, and other well known Lower Silurian fossils, brought from the Silurian beds in the vicinity of Randolph county and western Ohio.

While the sand beds forming the upper part of the drift have, in some places, an appearance something like the deposit constituting the Loess, yet since it nowhere contains any traces of land or amphibious mollusca that are so common in the Loess, it can not, therefore, with propriety be referred to the latter age.

There exists a tradition among the old citizens of this county, that there was a large granite boulder on Tipton's island in East Fork of White river a short distance above Rockford. Mr. Geo. V. Benton of Brownstown organized a party of gentlemen in Seymour for the purpose of visiting the locality and making an examination of the character of the boulder. Mr. Benton had previously driven me, in his buggy, over the greater portion of the county, and is a gentleman who takes great interest in the mineral developments and general prosperity of his county. After his trip to Tipton's island he wrote me that they were unable to find any rock on the island; but finally heard of a large rock which had been broken to pieces and removed from the river bed, just above the railroad crossing, and used in building the foundation to a house now owned by Mrs. Fischel. He sent me some pieces which he was able to break off the foundation. The stone resembles the concretionary limestone seen in the upper part of the Black shale about a mile farther up the river Though it is not an unusual thing to find isolated erratics of very great size as far south as the Ohio river, yet I am inclined to think that this large stone had simply remained in *situ* after the shale, which crops out in the bank of the river above and below, had been denuded and washed away. I saw no erratics more than a foot in diameter in Jackson county, and such specimens are very rare.

The wells at Brownstown go to a depth of from fifteen to twenty feet and water is found in a quicksand which is underlaid by argillaceous shale; the upper strata passed through is sandy clay such as is seen covering all the country outside of the Knobs to the south. On a branch of Pond creek in Section 7, T. 4, R. 5, Mr. Kleinmeyer dug a well, at his saw mill, six feet square and twenty-seven feet deep. It passed through alluvium and drift and struck a stream of artesian water, in soapstone shale, which filled the well and ran out at the top in fifteen minutes time. The water is cool and clear as crystal, has a chalybeate taste and leaves a reddish gelatinous deposit on the side of the bold

running branch which it forms as it flows to discharge itself into a tributary of Pond creek.

It is my opinion that an artesian water may be had at a depth of from eighty to one hundred feet, at Brownstown, which is about the difference in level between that place and Kleinmeyers' well. A small bottle of the water was collected and brought to the laboratory for analysis.

It contains:
Bicarbonate of lime,
Bicarbonate of magnesia,
Carbonate of protoxide of iron,
Chloride of sodium.

There is contained in an imperial gallon, (ten pounds, twenty-eight grains of solid matter, of this, three grains were found to be carbonate of protoxide of iron, = 1.064 per cent.

It is therefore a pure chalybeate water, containing no more foreign mineral matter outside of the iron than is commonly found in potable well or spring waters.

In many cases of debility this water will prove highly beneficial as a pleasant, mild and safe tonic.

On the side of the bluff at the termination of the Knobs just above Sparksville, there are large masses of brown red clay (ochre). The color is due to iron derived from chalybeate waters. It is seen in a number of places close to the railroad track. This ochre makes a good and durable paint. The color may be changed, by calcining, to a variety of shades in which red predominates. It lies convenient for shipping on the Ohio & Mississippi railroad and it is not possible to find a better ochre, or more convenient to market.

On the bank of Judah's creek, a branch of Mill creek, in the south part of the county, Sec. 9, T. 4, R. 4, Mr. James Duncan found a large molar tooth of *Mastodon Ohioticus* and obligingly presented it for preservation in the State Cabinet. Other bones were seen, but on exposure to the air they crumbled into dust and could not be preserved. At

Sparksville some years ago the teeth and ribs of a Mastodon were found in the bank of the river and sent to Cincinnati.

I was told that Mastodon bones have been found in other parts of the county but could learn nothing definite in regard to them and do not believe that they have been preserved.

ANTIQUITIES.

Stone axes, arrow points, spear heads, knives, fleshers and other articles of stone, left by the pre-historic people who once inhabited the valley of the East Fork of White river and its tributaries, have been found in considerable abundance in Jackson county. They have mostly been gathered up by collectors from other parts of the country and removed from the State. But through the assistance of Mr. Geo. V. Benton of Brownstown of whose kindness I desire to make especial mention farther on, and the general interest taken in the subject by the citizens, I have been enabled to add a number of valuable specimens to the State collection.

His Hon. A. P. Charles, Mayor of Seymour, contributed two large, grooved, syenite axes; a symmetrically formed green stone plummet; a flat, narrow, rectangular, chloritic slate-stone with two perforations near the centre, and a number of finely shaped flint arrow points.

Mr. J. M. Browning, who lives on Section 28, T. 6, R. 4, contributed a large and handsomely finished green stone axe or celt.

A stone ax of F. M. Swope; a stone pipe of unique pattern but broken, found near Browntown by W. F. Newcomb. Richard M. J. Cox presented a stone ax and some pestles or grinders. Geo. W. Carr presented twenty-five large, finely formed, black flint arrow points of the broad pattern, with long shanks, being a part of a large lot which he plowed up in his field in the summer of 1870. They were arranged in bundles of eight with tips and shafts laid

in opposite directions and the whole buried under about twelve inches of earth. This is a most interesting find, as they appear to never have been in use and were probably buried, in the spot where found, on the eve of a hasty retreat. This locality is on the point of a high spur which stands out on the east side of the main ridge.

Geo. W. Carr, Jr., also presented a number of flint arrow points. Robert J. Esham gave a green stone celt or flesher, a grooved granite ax and some arrow points. Josiah Shewmaker contributed a unique grooved syenite ax. W. H. Sparks, a grinding pestle of gray granite which has a large and peculiar indentation in the lower part, a nether grinding stone and some arrow points. Mr. Wm. L. Alexander, who lives on Sec. 7, T. 7, R. 3, has sent a number of relics, for the collection, to Brownstown, but they have not yet been forwarded. There are also some other relics there for the collection which I can not more particularly mention for the same reason. Edward L. Wells, near Vallonia, presented a syenite pestle or grinder, and Dr. E. T. Finch, a gray granite pestle or grinder.

Though I could find no earthen or stone wall enclosures the numerous mounds that are scattered along the streams give abundant evidence that the district once contained a large population of mound-building people. In the northeast corner of the county on Sec. 33, T. 7, R. 6, there is a large, symmetrical mound thirty-five feet high, one hundred feet long and about sixty feet across the shorter diameter. It is in a short easterly bend of East fork of White River, one hundred steps from the left bank and commands an extended view up and down the stream. The section from the bed of the river to the top of the mound is:

Mound	35 ft.
Alluvium	2 ft. 6 in.
Gravel and sand	2 ft. 0 in.
Coarse, reddish sand	15 ft. 0 in.
Low water	0 ft. 0 in.
	54 ft. 6 in.

The bank at this point never overflows. One hundred and twenty paces to the south there is a small branch which forms a circuit nearly around the mound, while on the north side a larger branch lies so near as to cut well into its base.

I counted between forty and fifty large forest trees growing on the mound, mostly sugar trees (*Acer saccharinum*,) some beach, poplar and ash. A sugar tree near the top measures three feet in diameter one foot above ground. At the west side of the mound there is a popular tree which measures seven feet in diameter, three feet from the ground and estimated to be seventy feet to the first limb.

On the north side of the large branch in Geo. Shilling's old field, I thought I could detect the remains of a number of mounds, but the land has been so long in cultivation that it is difficult to pronounce upon it with certainty. Though it is reasonable to suppose that since the river overflows its banks a short distance to the south and this being the nearest high ground outside of the branches that enclose the great mound, it formed a most eligible site for the purpose. The large mound served the double purpose of an assembly ground for sun worship and a lookout.

A small hole has been, at some time, dug into the top of the large mound but there is no account of any relics being found in it.

A visit was made to the so-called mound between the waters of Mutton Creek and the Muscatatuck River near Newry. It is a hill detached from the spur of a low range of hills that divide the bottoms of the two streams. It lies about a quarter of a mile from the main ridge and the same distance from the Muscatatuck, and sixty steps from Mutton Creek. The long diameter is seventy-six feet, the short diameter sixty feet and the hight twenty feet. These measurements were made before it was discovered, in a hole made by the uprooting of a large tree, that the revealed strata corresponded with that seen in the main ridge. I have made mention, therefore, of this isolated hill, not from any scientific interest which attaches to it, but from the fact that it has been so generally recognised as an artificial mound.

When making inquiries about antiquities, in different parts of the county, I was always cited to the above hill as being one of the largest mounds known in the country.

Before discovering that the stratification of the clay and sand in the hill corresponded with that of the ridge, my suspicions were aroused by seeing that it was on a bottom subject to a deep overflow from freshets in the Muscatatuck river. It is only in rare instances that you will find mounds built by prehistoric men on land subject to inundations.

On the east side of East fork of White river, one-half mile from Mahan's ferry and on the south side of the wagon road there is a large mound situated on a low ridge a few feet above overflow. In digging the foundation for a house now standing on the mound a great many human bones were found. Human bones were also thrown out in digging the well and in digging post holes. Though I noticed this mound while passing along the road, it was not until Dr. Wilson of Medora informed me of the above facts that I was aware of any special interest being attached to it. The old dwelling house on Daniel P. Henderlider's place, two miles south of Medora, is built on a mound. It is on a sandy terrace which borders on the flats. The elevation is about eight feet above high water. The land here has been in cultivation for a great many years which has had the effect to equalize the surface and to partially obliterate the mounds which exist over the entire length of the terrace, which is about a mile and a half long. In some of the mounds of this district human bones have been found together with great numbers of stone axes, celts, and arrow points.

On the very top of the ridge near Sparksville, two hundred and eighty feet above the river, there are still to be seen traces of four mounds in a sandy field that has long since been in cultivation. It is said that they were rich in stone relics but the constant wearing away by the plow had left but little to reward our search, only a few arrow heads were picked up.

On the high ridge which divides the waters of Luts fork from the waters of Muddy fork of Salt creek, one and a

half miles southeast of Houston, I was informed that there are four or more deep mortar holes worn into sandstone, which have shallow traces leading from the top of the cavities to the edge of the rock.

I could hear of many other mounds in the county, but with the exception of the mortar holes above mentioned, which are probably the work of modern Indians, the most important localities and antiquities have been visited and reported upon.

AGRICULTURE.

Few counties in the state can boast of greater agricultural resources than Jackson. About three-fourths of the county is composed of table land and river bottoms and one-fourth clay land and sandy loam. The latter is for the most part in a fine state of cultivation and yields large crops of Indian corn, wheat and other cereals, clover and grass. This character of land though best adapted for Indian corn, is excellent for wheat, while the clay land is best for wheat, but produces also good crops of Indian corn. The sandy land is largely devoted to growing water-melons.

Mr. Richard M. J. Cox, a very intelligent farmer and observing man, has, in addition to fruit, grain and grass, twenty-five acres in water melons. He informs me that it requires about twice the labor to cultivate melons that is necessary for Indian corn. They are planted in hills, made by the hoe, from eight to ten feet apart. Six hundred to eight hundred to the acre is considered a good crop. They are cultivated by running through with a single shovel plow which is followed by a double shovel so as to leave the ground as level as possible. A dry season gives the best yield. The vines are preyed upon by a striped beetle which makes its appearance about the twentieth of May and lasts seven days, they are fought with a mixture of sulphur and ashes or lime; Mr. Cox thinks the best remedy is to cultivate, this drives them over to the neighbors fields. I did not get to see any of these beetles as they were out of

season at the time of my visit and the specimens promised for the determination of the species have not been received. Water melons commence to ripen about the middle of July and run to the middle of September. The first ripe bring a fine price but the average is about six cents a melon, delivered on the cars at the depot. Thirteen hundred are a car-load and the principal markets are Indianapolis and Cincinnati; from these cities they are sent all over the country. About two thousand acres are cultivated in melons and the revenue derived from this branch of agriculture alone will not fall far short of $60,000 annually. The clayey soil of the ridges and low table lands is very greatly improved by under-draining and it is gratifying to see that attention is being paid to this all-important branch of farm improvement.

Chestnut ridge is peculiarly adapted to the growing of fruit. The elevation is above the usual line of spring frosts and the warm sandy loam soil gives fine flavor and color to the fruit. There are 85,000 peach trees on this ridge and 75,000 are bearing fruit. The principal growers are:

H. C. Dannetelle	7,000
I. C. Ferris	7,000
J. H. Green	6,000
John P. Clark	6,000
A. H. Adams	5,000
Butler & Love	5,000
John Cliver	4,000
Mr. Collins	4,000
Geo. Holinsbee	4,000
Wm. Willhouser	4,000
Collins & Bro	3,000
Nathan Lewis	3,000
Abraham Love	3,000
Hiram Love	2,500
D. Blair	2,000
Geo. Cox	2,000
Jas. Blair	1,500

H. Girker	1,500
Andrew Cox	1,000
Wesley Densford	1,000
G. Froelich	1,000
Jas. Lewis	1,000
John Cox	500
Jas. Love	500
Total	75,500

Peach trees, not bearing	10,000
Apple trees	10,000
Pear trees	3,000
Cherry trees	3,000
Plum trees	3,000
Quince trees	1,000

All kinds of small fruits grow well on the Ridge and attention is being given to their cultivation, especially strawberries, of which they have fifteen acres under cultivation, also three acres of Lawton and Kittatinny black berries.

But no kind of fruit does better than grapes, of which there are 40,500 bearing vines comprising the following varieties :

Ives' Seedling	25,000
Concord	5,000
Catawba	3,000
Clinton	2,500
Norton's Virginia	2,000
Other varieties	3,000

The vines are healthy, bear well and the crop never fails. The flavor of the fruit is remarkably fine and wine made from Clinton or Ives' Seedling is equal in flavor, color and body to the best Burgundy wines of France, to which they bear a close resemblance. Indeed, I am fully satisfied that the ridge lands of Jackson county furnish a soil and climate

that is not surpassed by any locality in Europe for the growing of grapes.

Grapes that are not sold in the bunch are made into wine. Though the manufacture of wine is just in its infancy, seventy-two and a half barrels were made this fall, 1874, distributed among six growers as follows:

J. P. Clark	40 barrels.
A. H. Adams	20 barrels.
H. C. Dannetelle	4 barrels.
H. Girker	4 barrels.
George Holinsbee	4 barrels.
J. C. Ferris	½ barrel.

The Jeffersonville, Madison & Indianapolis Railroad have built a depot at Conway especially to accommodate the fruit growers on Chestnut Ridge. When the peaches are ready for market special fruit trains are run from this depot to Indianapolis, which is the principal market for all the fruit grown in the Knob counties of the State.

Fruit of all kinds is extensively grown on Baughman's ridge and in the Carr settlement on Pea Ridge, also on the ridge south of Freetown.

Enoch Baughman has 3,000 peach trees in bearing and a number of pear, plum, cherry and apple trees; he has also, a fine vineyard, mostly Ives' Seedling, and makes a little good wine. He ships his fruit to Indianapolis.

On Pea Ridge, Hon. George W. Carr has a fine peach orchard of 1,200 trees, that is made in old worn out land.

Geo. W. Carr, jr., has an orchard of 750 peach trees set out last spring. Andrew Holmes, 2,500; John W. Owens, 500; J. Trueblood, 500; Thomas J. Plummer has a large orchard of pears and cider crabs. Jeremiah S. Tanner has an orchard of 700 Hughes' crabs just in bearing. Besides the above there are a great many other farmers who have turned their attention to the cultivation of grapes and orchard fruit: peaches, pears, apples and cider crabs, but I failed to obtain their names.

Enoch Baughman was the first person to plant a peach

orchard on the Knobstone ridges, and the marked success which has attended his pioneer work has given an impetus to fruit culture, which is rapidly developing into one of the most important agricultural interests in the county. The sale of fruit from this county in 1874, did not fall short of one hundred thousand dollars.

With but a few unimportant exceptions the entire crops are sold in Indianapolis.

The following list comprises the favorite varieties of peaches grown on the knobs, and are given in the order of their ripening.

1, Hale's Early.
2, Troth's Early Red.
3, Honest John.
4, Crawford's Early.
5, Yellow Rare Ripe.
6, Old Mixon Free.
7, President.
8, Royal Kensington.
9, Red Cheek Melocoton.
10, Grosse Mignonne.
11, Stump the World.
12, White Imperial.
13, Heath Free.
14, Heath Cling.
15, Smock's Free.
16, Noblesse.
17, Late Yellow Admiral.

In order to secure the best crops and finest flavor to the fruit, all the orchards in the knob region of the county should be underdrained with tile. This will render the soil porous, mellow and warm. Air charged with moisture and ammonia will be drawn through the earth into the drains and, circulating around the roots, supply them with air and food through the chemical decomposition which it induces in the soil. Much of the blight in fruit trees is due, in my opinion, to the want of a properly underdrained soil.

It is likewise asserted that the soil should be under-drained if it is desired to raise large crops of grain or grass.

It is gratifying to see that a few farmers in the county have commenced to under-drain, and it is to be hoped that the good results which it will evelop may lead others to follow their example. It is a never-failing sign when you find a field pierced by crayfish holes that there is a stratum of water resting on the sub-soil. These animals live in the water below and cut holes to the surface, which serve the double purpose of furnishing light and a pit-fall to entrap food. It is a useless waste of time and money to undertake to cultivate such land without it is first properly under-drained.

TIMBER.

Jackson county was formerly covered with a dense growth of forest trees, such as are usually found in this latitude. On the river bottoms and Champlain terraces the principal trees are Poplar, Black walnut, White oak, Overcup oak, Black oak, Water oak, Beech, Sugar maple, Water maple, Ash, Hickory, Elm and Sycamore. On the knobs and high table lands, Chestnut oak, White oak, Red oak, Chestnut, Sweet gum, Hickory, Poplar, Black walnut, Beech and Sugar tree or hard maple, the latter mostly on the hillsides and in the ravines.

There are no less than eighteen saw mills at this time engaged in cutting lumber and making barrel heads and staves. Among the most noted saw mills for making lumber are Gleason's mill, cutting daily from 4,000 to 6,000 feet of poplar; Thomas' mill, making from 4,000 to 6,000 feet of beech, gum and oak; Spraytown mill, cutting poplar, oak, etc.; Courtland mill, running on poplar and walnut; mill near Shields, poplar, walnut and oak; May & Welch's mill, Freetown, principally poplar; Houston mill, assorted lumber; Kleinmier's mill, poplar and walnut. There are ten or twelve mills each cutting daily from 4,000 to 7,000 pieces of barrel timber. A mill four miles north-east of Seymour is cutting plow handles, plow beams, hoe handles, wagon wheel felloes, chair stuff and shingles.

At Seymour there is a mill and factory for making vast numbers of wagon and buggy spokes, grain cradles, mowing scythe snaths, etc. The spokes are prepared for the Chinese market by giving them a fine polish and finishing with a coat of beeswax to prevent the grain from being raised by the damp atmosphere to which they are subjected on a long sea voyage. The hickory wood of this State, I am told, is prized above all other for wagon spokes, tool handles, etc. The principal markets are Hartford, Boston and New York.

Now, notwithstanding the rapid consumption of trees by the many mills and wood industries, there still remains on much of the uncultivated lands, forests of noble trees. In the south part of the county there are to be seen standing, immense poplars and black walnuts. On T. F. Belding's land, Sec. 15, T. 4, R. 5, I measured four poplar trees that stood within a few feet of each other; the largest was thirty-eight feet in circumferance three feet from the ground, one hundred and twenty feet high, and about sixty-five feet to the first limb. The others were, respectively, eighteen and a half feet, eighteen feet and seventeen feet in circumference at three feet from the ground. On the same farm a red elm measured eighteen feet in circumferance. A poplar standing near Mr. Belding's house is twenty-one and a half feet around.

On Chestnut ridge, in Mr. John W. Clark's vineyard, I measured a chestnut stump which is nine feet two inches in diameter. These are the largest trees that came under my notice but it is common to see large trees still standing in various parts of the county. The knobs in the northwest part of the county are particularly noted for supporting fine forests of chestnut oak. These trees flourish upon the most rugged sides of the ridges and furnish the numerous tanneries of the district with their supply of "tan-bark."

In the Carr settlement, on Pea Ridge, there are a number of large poplar, oak and black walnut trees standing as witnesses to the former grandeur of the point. On the Hon. Geo. W. Carr's farm I saw the singular phenomenon

of the limb of a dog-wood tree which was bent to the ground and had taken root and was growing vigorously. The parent tree is eight inches in diameter and the Banyan-like limb two inches. This is the more remarkable, since it is difficult to transplant a dog-wood and have it grow under the most favorable treatment.

MINERALS.

The principal minerals of economical value, in the county, are, building stone, brick-clay and ochre. The heavy bedded, buff and gray colored sandstone, which occurs under the nautilus-geode bed in the knobs, can be quarried in good sized blocks at Baughman's, Sharpsville and at Rockcastle on Pea Ridge. This stone is easily worked, looks well and may be used in the construction of foundations to houses, but can not be looked upon as a very desirable stone since it is liable to crumble when exposed to the action of frost.

The Oolitic limestone, which is found of good thickness in the western part of the the county, is a handsome and durable building stone; the color is whitish gray, it works easily under the hammer and chisel and is susceptible of high ornamentation. Mr. Thomas Dixon has opened a quarry for working the Oolitic stone, one and a half miles north of the O. & M. railroad on Sec. 11, T. 4, R. 2. He employs a number of stone cutters who are engaged in the manufacture of tombstones, sills and lintels for doors and windows, etc., etc. The foundation and other stone work in the excellent Court House at Brownstown is of stone from this quarry. It also furnished the stone for abutments and piers to the superb bridges built across White river at Seymour, Brownstown and Courtland crossing. These bridges were built by Mr. J. J. Daniels of Rockville who makes a specialty of this kind of work. Mr. Daniels has great confidence in the strength and durability ot Dixon's stone and speaks in high terms of the facility with which it may be worked into required shapes.

Clay suitable for common bricks is found in most parts of the county; but I saw none that can be considered of the best quality in close proximity to the principal towns. As a general rule the common clays do not make the best bricks.

MANUFACTURES AND IMPORTANT TOWNS.

The leading industries of the county in the way of manufactures are: Mills for making lumber of which there are seven or eight. Ten or twelve mills for cutting barrel headings and staves. Eight or ten establishments for tanning and dressing leather. Nine grist mills. Two large establishments for manufacturing wagon spokes, grain cradles, etc., etc. A large mill four miles northeast of Seymour, on the O. & M. railroad, for making tool handles and other kinds of wood work, and a small rolling mill at Seymour engaged in rolling scrap iron into rods and bars for the large machine shops of the O. & M. railroad.

BROWNSTOWN, the county seat, is a very pleasant town of about 1000 inhabitants, and has a large and handsome Court house. It is one mile from the O. & M. Railroad and elevated about sixty feet above the track. Ewing is the name of the depot; the two may be considered as one town. It contains a number of mercantile houses which are doing a good business.

SEYMOUR, situated at the crossing of the O. & M. and the J. M. & I. Railroads, is a city of about 4000 inhabitants. It is in a highly prosperous condition, being by far the most important business center in the county. Besides the manufactures already alluded to, there are a number of minor establishments, cabinet, boot and shoe, blacksmith shops, etc., etc. This city is surrounded by a fine agricultural country and is the centre of an extensive grain trade. It sustains a bank and a great many mercantile houses, some of which do a wholesale business. The dwelling houses at Seymour are tastefully built, have well kept grounds and the

city contains as intelligent, genial and hospitable a people as can be found in any city of its size in the State.

Some years ago this place obtained considerable notoriety on account of the hanging of a few desperadoes, but forebearance had ceased to be a virtue and an outraged community rose in its might to smite a set of villians against whom the law had failed to be a protection.

ROCKFORD, once an important business town, has, on account of its proximity to Seymour, lost the best part of its trade. It has a world-wide reputation as a remarkable locality for fossil Nautili and Goniatites.

Medora, Vallonia, Shields, Crothersville, Sparksville, Clearspring, Houston, Freetown and Tampico are all pleasantly located villages. Clearspring is noted as having been the seat of a flourishing female seminary. Vallonia was, at an early day, a French trading post and the seat of block-houses and military operations when the State was in the condition of a territory. Maj. John Tipton was in charge of the fort at Vallonia in 1813 and made various marches from that point in pursuit of the Indians who were committing depredations on the exposed settlements. Near this village I was pointed to the spot where the Indians shot and killed a man who was riding along the bluff bank of a small ravine. The horse sprung into the ravine where the rider dropped from his back.*

When the Territorial government was moved from Vincennes to Corydon, in Harrison county, Vallonia came within one vote of being honored as the Capital of the Territory.

CONCLUSION.

In conclusion I desire to assure the citizens of Jackson county of my high appreciation of the kindness which has been uniformly extended to me while prosecuting the survey. Though it is not possible to give the names of all, still I should be wanting in courtesy should I fail to make mention

*See Dillon's History of Indiana, page 521.

of those who so obligingly left their own business to accompany me and aid the prosecution of the work. The Hon. A. P. Charles, Mayor of Seymour, James T. Gardner, Cashier First National Bank of Seymour, A. Andrews, Dr. Jas. H. Green, Samuel W. Stairs, J. H. Andrews and Jas. L. Galbraith of Seymour, were untiring in their endeavors to make my stay at Seymour pleasant and as profitable as possible to the county. Messrs. Charles and Gardner saw that I had a comfortable conveyance and accompanied me to every point of interest in the neighborhood. They also, in connection with Mr. A. H. Adams, his wife and daughter, arranged for a delightful dinner party at Mr. Adams' residence on Chestnut Ridge. There were present, on this enjoyable occasion, besides the above named gentlemen, Mr. H. C. Dannetelle, J. P. Clark and Abraham Love, fruit growers on the Ridge; Mrs. G. H. Charlton and Mrs. J. H. Blish of Seymour. On the way to Mr. Adams' place, a section showing the geological structure of Chestnut Ridge was obtained at Mr. Dannetelle's orchard and here the party took a rest while enjoying refreshments at Mr. Dannetelle's hospitable home.

After partaking of Mr. Adams' sumptuous dinner and taking a look at his fine orchards and vineyards, we made a visit to Dr. Green's large peach orchard, and J. P. Clark's large and well kept vineyard, and after enjoying the kind hospitality of Mr. and Mrs. Clark the labors of a well spent day were terminated by returning to Seymour.

At Brownstown, I met with the same marked attention from the citizens. Mr. Baughman and Richard M. J. Cox piloted me to Baughman's ridge, south of Brownstown, and pointed out the most interesting exposures of rocks. Mr. Thomas J. Bowen, then sheriff of the county, drove me in his carriage to Freetown, Clear Springs, and a number of other interesting points north of White river. Judge Applewhite, Auditor of the county, assisted me on a trip to Mr. Kleinmier's artesian well in the south part of the county. Mr. George V. Benton, proprietor of the Mammoth store in Brownstown, with his characteristic courtesy

to visitors, stowed away in his carriage all the comforts essential to a protracted journey through unexplored geological regions, and drove me over the entire western half of the county.

I am also especially indebted to John Scott, Clerk of the Circuit Court, Hon. Geo. W. Carr, Hon. John F. Carr, Geo. W. Carr, Jr., Robert J. Esham, Colonel Samuel T. Wells, Dr. William Ireland, Jabez H. Nixon, Daniel P. Henderlider, and his mother Mrs. Ellen Henderlider, one of the early settlers on Pea Ridge, Josiah Shewmaker, another pioneer settler on the Ridge, Dr. Marshall, V. Wilson, Jno. R. Browning, Daniel B. Dodds, Dr. Geo. W. May, William Alexander and John Cummings, one of the county commissioners. Major Cummings lives on the road from Seymour to Brownstown, and has one of the best kept farms in the county. You approach his residence, which sets back some distance, through an avenue of trees and the grounds are richly adorned with shrubbery and flowers.

PROFESSOR E. T. COX:

State Geologist of Indiana:

DEAR SIR:—Herewith I hand you my report on Geology, etc., of Brown county. I join with you in felicitating the people of Lawrence county, on the deposits of Plastic Clay, which, developed by the opening of the iron beds, were not exposed at the time of my visit.

Yours, etc.,

JOHN COLLETT.

NEWPORT, December, 1874.

GEOLOGY

OF

BROWN COUNTY.

BY JOHN COLLETT.

Brown county was organized in 1836, and is bounded east by Bartholomew, south by Jackson and Monroe, west by Monroe, and north by Morgan and Johnson counties. It contains an area of 320 sections, or square miles, of 640 acres each, with a totality of 204,800 acres. The surface is generally hilly—almost mountainous—but about one-fifth part consists of valleys and rich bottoms, with a like amount of level table lands in the southeastern corner. The timber on the hill sides is, white, black, and chestnut oaks, hickory, etc., with poplar, cherry, jack-oak and sassafras on the summit of the highest hills, and in the bottoms, poplar, maple, walnut, cherry, elm, sycamore, etc. Good crops of corn, potatoes and wheat, are grown on the river bottoms; some of the first averaging full 60 bushels to the acre. Fair crops of wheat, oats and grass are gathered on the ordinary hill lands, and on the table lands the crops are of excellent quality.

Salt creek, the principal stream, is composed of three main branches, the "North," "Middle," and "South Forks," which unite near the southwest corner of the

county, and flow thence through Monroe and Lawrence into East White River. Thus almost the whole watershed of the county together with a considerable portion of Jackson on the south, is drained by this stream. Bean Blossom creek has its source in the northeastern part and flows in a general western direction, passing across Monroe, and is discharged into West White River near Gosport. Just across the northern boundary in Morgan county, and in a valley nearly parallel with the county line, flows Indian creek, having the same direction as the last. To the east, small creeks and brooks are discharged in a few miles into Driftwood Fork of White River and its affluents.

Highland ridges, approaching the square form of the county surround it on the cardinal sides, while from east to west and southwest three other ridges traverse the county, all connecting on the divide near Trafalgar, in Johnson county. The first constitutes the southern bluff of Indian creek, and is called "Indian Creek Ridge;" the second, south of Bean Blossom, is known as "Bean Blossom Ridge," and the third, passing nearly through the middle of the county, is named "Central Ridge." All these ridges slope gently to the south and west but present steep faces to the north and east.

SURFACE GEOLOGY.

The surface configuration is remarkably diversified, and presents in epitome a vivid view of mountain scenery; central ranges and peaks overlook wide areas bristling with subordinate ridges or black with deep valleys. It is the Alpine region of the State of Indiana, and is well worthy of the leisurely visit and study of those who would by the toil of mountain paths gain the pure air, the romantic scenery, and broad outlook which may be enjoyed on the summit of the central knobs, or along the elevated roadway north of Nashville.

The careless observer has often wondered at this grand series of hills and valleys, surrounded to a great degree by

level plains, and comparing the volume of water discharged by Salt creek with other streams and their erosive results, would at once attribute their origin to upheaval and earthquake action. Close observation shows that this is not so. The uniform dip and parallelism of the rocks prove that no local disturbance of the crust of the earth has taken place by subsidence or upheaval. The body of the hills consists of soft, disintegrating shales and local beds of sandstone dipping to W. S.-W. Along the western side of the county, in Monroe, massive beds of limestone, at the base cherty and hard, cover these shales. Now, this chert bed of Keokuk limestone is found capping the highest peaks in the county, sometimes in place, but often in fragments, with underlying rocks, in regular succession beneath, showing conclusively that the Keokuk beds once formed a level surface covering nearly the whole county, some 400 to 500 feet above the bottom of the present valleys. As a consequence the hills remain as they were originally deposited. The valleys have, since the waters of the ocean withdrew, been eroded by fresh water.

But as heretofore hinted, the volume of the streams now flowing from the county and the limited area of their greatest possible water shed is not commensurate with the phenomena presented, and in seeking some extraordinary cause, we are at once referred by the facts in the case, to the great ice flow which inaugurated the Quaternary age.

GLACIAL PERIOD.

The Glacial or Boulder drift,* a well known feature in the Central and Northern part of the State, does not exist in place in the Southern part. It is a vast sheet of pasty, unlaminated blue clay, with occasional partings and beds of sand, and contains a variable but large amount of metamorphic, eruptive and crystalline rocks, minerals, etc., of extreme Northern origin. With a Southern limit in the

*Used as synonymous terms in my reports.

Northern part of this county, but of no great thickness, it increases in extent in the northern half of Indiana, and exhibits a depth of from 150 to 250 feet. It is sheeted down upon a polished, grooved and striated floor of underlying rocks, which often still retain these markings that record to this day the track of the ancient glacier as plainly and indisputably as the inscribed tablet tells some story of the past. This portion of the drift has been heretofore studied and elsewhere discussed.

But Brown county, from its peculiar position and elevation, reveals a chapter of the glacial history, as to its Southern limit, not so well exposed at any other point, and some features we believe not before recorded.

In my examination for report* on Lawrence county, the effect of powerful erosive torrents was noted, degrading the central areas of that county, excavating great depressions now waterless, and hewing out valleys to a depth and width beyond the possible energy or needs of the actual streams. These phenomena I attributed to the glacial period, and predicated them upon a torrent of water rushing southward from the foot of the stranded or obstructed ice-flow at some unvisited point in an adjoining county to the north. This was an assumption based upon indirect evidence. Facts observed in Brown county prove that the assumption was well taken. Approaching the central areas from the East, from the West,† and from the valley of Bean Blossom Creek at the North, it was found that the county was enclosed by a wall of hills ranging from 350 to 450 feet in hight. In valleys to East, West and North, glacial drift was present, mounting well up on the sides of the hills. But within this walled space, the scarcity or entire absence of boulders showed that the ice-drift had only for a short period, or *never* intruded—Bean Blossom Ridge marking the extreme Southern limit of the local glacier

*Geological Survey of Indiana, 1873, page 268.

†The western ridge is within Monroe county, with strike to the South-west.

foot. Against and upon this *wall like* ridge the stranded ice seems to have been continually massed; and, melted by each recurring summer's sun, it sent torrents of water south across the county, wearing slight depressions in the ridge as at Low Gap and the source of Greasy creek, bearing fine sediment, some gold dust and black sand, and but few or no pebbles or boulders. Pebbles and boulders would have been present in quantities had the water carried floating ice. The power of these escaping torrents may be inferred from the fact that a continuation of such "sluiceways" from Bean Blossom Ridge may be noticed on the South side of Central Ridge, striking right across the latter with osars of sand and silt filling the ancient depressions and entirely ignoring the present *valley of North Salt Creek, for it did not then exist. This flood was long continued—first flowing clear across the county, at a high level, and even across parts of Jackson—next following the synclinal axes of the underlying rocks, it excavated South and Middle forks of Salt creek, and finally following another synclinal, adopted the direct line of dip by the North fork. Obscure bench marks and terrace lines, widely separated on the elevated ridges, show the successive standpoints and cuts of this flood-like stream.

During this time the underflow from the glacier was also working a channel in the disintegrating shale along the east side of the county, and directly with the local dip, West 16°, by Bean Blossom, and finally left the interior basin of the county subject only to the action of its own water-shed. Down these side-cuts to White river immense bodies of water, bearing some ice with boulders and gravel, have flowed. The long continued melting of ice loaded with the most enduring debris of the Laurentian rocks, as greenstone, quartzite, quartz, gold and magnetite, deposited large

*A glance at the map will show that valleys exist in nearly every case on the South sides of the Central and Bean-blossom ridges, corresponding to the initial valleys and creeks on Indian Creek ridge.

quantities of these imported materials in Bean Blossom valley. The rapid current of the ice water would naturally carry down stream the lighter sand and gravel, and sort out and leave behind the heavier rocks, gold and magnetite in considerable quantities. Afterwards as the ice-foot withdrew toward the North* this melting, sorting, sifting process was carried on North of Indian creek ridge, for a *longer time*, as is indicated by the greater width and depth of that creek valley, where gold and the heavier minerals will only be found beneath the present surface which is largely built up above the bed rock.

Still above the outside wall of the county, several peaks, notably the Weed Patch Knob, rise from 50 to 125 feet. Around their sides the ice water has deposited slight terraces containing minute pebbles and some imported material, as if to record the highest flood upon this meter of the great glacial river; while white and bare, these storm-scarred summits looked out over the wintry wild, and saw that rigid river of ice menace their base, or turn to right and left into the two White river valleys, and float by in a stream of ghostly silver. Remarkable as witnesses of the early Quaternary, their elevation above the ocean reaches back beyond the time which saw the Carboniferous, Mesozoic and Tertiary seas to the West, bury their treasures of warmth and wondrous animal life as they shrunk from existence.

LACUSTRAL PERIOD.

After the close of the Glacial Period large bodies of fresh water covered the interior of the continent, forming two extensive lakes—one in the Northern basins, and the "*Central Post-Glacial Lake*," separated by the line of the greatest and highest accumulation of true boulder drift, which runs through central and Northwestern Ohio and

*It is known that the ice-foot of the glacier was withdrawn gradually; reasoning from analogy, it approached by the slow march of ages.

Northern Indiana. The first occupying the whole basin of great lakes, was still within the influence of Northern cold, and gives evidence of the presence and transporting work of ice by the deposits known as the Boulder Beds of the "*Iceberg epoch.*" The paucity *or entire absence* of angular rocks and striated or polished boulders and the presence only of rolled, battered and well rounded pebbles and fine silt, indicate the absence of transporting ice in the warmer Southern lake. Remains of sub-tropical flora and fauna on the lower Wabash corroborate this view.* The central lake covered a large part of Southwestern Indiana and adjoining regions to South and West, and reached up the *fiord-like* valleys cut out of the solid rocks by the glacial torrents. Where the water-shed was considerable, the central chasms were deeply silted up with quick-sand and a black tenaceous mud,† containing much vegetable matter, known as "Noah's barn yard," and sometimes remains of the Elephant, Peccary, Great Beaver and other large tropical animals. Along the shore lines and shallows of this lake, a light ash gray soil is found, known as the "Loess" or Lacustral beds. A large area of this is seen in the Southeastern part of the county furnishing a good, level, somewhat tenaceous, but productive soil. Parts of this deposit formed in shallow water, or subsequently modified, is known as the White creek flats or slashes. Where slow running currents struck the shore line, these Lacustral loams are thickened up containing much, and sometimes composed largely of coarse sand.

*Geol. of Indiana, 1873.

†This deposit was termed "Erie Clay," in my reports of Geol. of Ind. for 1873. Since the present rivers and streams have been in existence, this deposit has been almost wholly removed, the sand, clay, etc., carried away, and the gravel and coarse material deposited in terraces of modified drift. Traces of this silt were seen on Bean Blossom and North Salt Creek; in a well adjoining Elkinsville it was pierced over nine feet without reaching the bottom.

ALLUVIUM.

The alluvial deposits which border the water courses are derived principally from the disintegration of the native aluminous shales and sandstones, and in such cases, although fertile, are often cold and tenaceous,—at other points, as on Bean Blossom, and at the upper part of the branches of Salt creek they are enriched by sand and calcareous clays from the glacial drift and from the former overlying limestones, and are very fertile. On the bluffs of the streams and particularly in the vicinity of Nashville, benches of ancient alluvium are seen containing a few pebbles of the most oburate material of the drift, as quartz, jasper, etc., marking the former bed of the creek, and showing that at the broader terraces (50 to 120 feet above its channel), the creek was long stationary.

These beds deposited upon and against the sides of the underlying rocks, with the most recent in the bottom of the valleys, are tabulated as follows, in the order of their sequence in time:

Quaternary Beds.

		Ft. in.
1.	Alluvium	2 to 40.00
2.	Lacustral Loess	10 " 20.00
	do Silt	0 " 50.00
3.	Glacial Drift	0 " 40.00
		150.00

PALEOZOIC GEOLOGY.

The rocks of this county comprise two members of the Sub Carboniferous period, and one of the Devonian. They dip regularly to W. S. W., but show probabilities of anticlinals of small extent beneath each of the ridges which traverse the county from east to west. The parallelism of the formations is *without fault*, and they seem to be conformable. Sections taken at isolated points give the following general view:

GENERAL SECTION OF BROWN COUNTY.

SUB-CARBONIFEROUS GROUP.

Keokuk Beds.

		Ft. in.
1.	Reddish crinoidal Limestone (disturbed)	0 to 1.00
2.	Lower geode band,(disturbed)	0 " 2.00
3.	Lower chert band	0 " 8.00
4.	Gray, buff and black pyritous clays and shale	5 " 25.00

Knobstone Beds.

5.	Red ferruginous Coarse Sandstone, rarely massive, generally with irregular bedding	4 " 50.00
6.	Gray aluminous shales, with wedge shaped layers and bands of blue and buff Sandstone	375.00
7.	Quarry beds—wedge-shaped layers and massive bands of white and gray sandstone	35.00
8.	Shale with thin plates of Sandstone	40.00
9.	Clay shale with iron stones	5.00
10.	Gray aluminous shale becoming ferruginous at base	10 to 85.00

DEVONIAN AGE.

Hamilton Group.

11.	Black Slate (*Genessee Shale*)	110.00
	Total	736.00

GENERAL DESCRIPTION

The above geological formations are almost wholly non-fossiliferous. They are identified from lithological and stratigraphic reasons, but with certainty.

Keokuk Beds.

These are well developed and persistant in adjoining parts of Monroe along the western boundaries of the county. Broken and disturbed fragments of the reddish crinoidal limestone, the most persistent stony strata, were found at Baughman's, Browning's and Weed Patch hills, sufficient to identify them as belonging to the "fish bone" strata, but none of it in place. Of the next lower strata, the Geode bed, disturbed or floated remains are common at the points named, but as well in nearly every ravine in the county, indicating that once this deposit was spread out over and paved the whole surface on a plane passing through the tops of the highest hills. Geodes locally known as "nigger heads" and "boulders," are especially abundant on Bear Creek, near the northwest corner of the county, their exterior always roughly mammalated and homely, but within filled with variously tinted or pellucid crystals of silica, with occasional beautiful specimens of calcspar and sulphuret of iron and zinc. On Bear Creek at the "placer" of John Richards, Esq., many of them are geodized fossils of the genera *Zaphrentis, Bellerophon, Goniatites* and *Nautilus.* In the southern and eastern part of the county the rough exterior of the geodes found in the beds of creeks is worn and smoothed as if long washed and polished by running water. No. 3 of general section, the lower chert band was found in place on Baughman's hill, S. E. ¼ Sec. 9, T. 9, R. 2 E. and although the outcrop was of small extent, it was prized as a sure means of identifying the geological position of the rocks. Below a variously colored shale is the bed of passage to the underlying strata. Crystals and a glittering band of sulphuret of iron (pyrites) in this shale has occasioned much

fruitless search for the precious metals. There is little or no probability of finding any valuable mineral at this horizon.

Knobstone Shales.

Excepting the few disturbed fragments or thin isolated outliers of the lower Keokuk beds above mentioned, these shales form almost the entire rocky substratum of the county, building up the hills and ridges and paving the floor of the deepest valleys, having an average thickness of about 500 feet. A careful search discovered no fossils. These shales and sandstones were deposited in the shallows or along the shore of an ocean, generally quiet, but sometimes swept by currents sufficiently powerful to pick up and transport the sands which form the frequent bands and pockets of sandstone. The circumstances were probably not favorable for marine life or for the preservation of animal remains.

The upper member, No. 5 of general section, is often seen near the tops of the hills and high ridges. It is well developed and of maximum thickness on Bean Blossom ridge north of Nashville, where highly ferruginous the harder bands have been utilized in "metaling" the excellent gravel road which leads to town; good exposures in massive out crop were noticed on the north side of Weed Patch hill, becoming hard and in thick bands to the south. At Browning's hill south of Elkinsville, great cubes and columns are scattered on the hillside as if relics of a Titan's quarry. No. 6 is uniformly a disintergrating shale, or soft aluminous sandstone with plates and strata of thin bedded quarry stone at irregular spaces. The dark clayey shales contain considerable pyrites (*Sulphuret of iron,*) which decomposing on exposure, sometimes gives a sulphurous ordor to the air and the iron in the change becoming a soluble sulphate colors black the vegetable matter in brooks and ponds. It varies in thickness from 325 to 400 feet.

The quarry bed No. 7 of section, is found well up on the hills in the eastern side of the county. Dipping west

and southwest at from 30 to 35 feet to the mile it soon approaches the level of the streams, and passes below them in the western parts. Many quarries are opened and worked. The stone is of beautiful drab color, and although often stained with iron, is enduring and of excellent quality. It is used for the foundations, door and window sills, and caps of the Nashville Court House, and is in much requisition for buildings at Columbus, an adjoining county-seat. Some massive outcrops were seen near Nashville, in layers varying from one to three feet thick, but often thinning to a great degree within a few feet or rods.

This stone has a good reputation and is well liked by all who have used it. Blocks which had been in use some 40 years and were tested with fire were in good preservation. Tombstones and monuments after an exposure of over 30 years, showed their inscriptions sharp and well cut. Polishing and grind stones of good quality are manufactured and marketed at Columbus and Taylorsville.

The lower members, 8, 9 and 10 are composed of gray shales, becoming aluminous toward their base with thin plates of sandstone. The latter, often attaining a thickness of several inches, are remarkable for their tendency to thin out, wedge like, in the space of a few feet, as at the water line below the mill near Nashville. In the southern part of the county this member contains concretions and nodules of excellent iron ore. In the same region thin shells of siliceous iron ore are weathered from cavities in the shales, and form the bed and bars of the creeks. This deposit is found to be a superior material for repairing roads.

Black Slate.

An outcrop near the county line on the Columbus road, exhibiting bituminous shale and some carbonaceous matter is referred with doubt to this age. The exposures seen were not entirely satisfactory. The slate is well exposed a short distance East in Bartholomew, and has been pierced and measured at two bores within Brown county, showing an average thickness of 110 feet.

LOCAL DETAILS.

An elevated back-bone of glacial drift dividing the watershed into East and West forks of White river, has its Southern termination near the northeast corner of the county. On this, several of the principal streams of the vicinage, as Indian, Bean Blossom, Salt and Nineveh creeks have their origin. It is crossed by the Martinsville railroad near Trafalgar. Going West by rail along the valley of Indian creek, (from one to two miles wide,) a good view of Indian creek ridge may be had, which guards with great exactness the northern boundary of Brown county, and rises from 100 to 300 feet above that stream. The broad valley indicates that for a very long period, glacial ice was piled up against the ridge to the South, and melting, found outlet for its waters to the West. It is also evident that the valley was at that time much deeper at some central channel than now, and has since been built up by fluviatile action. It s probable that by shafting down at such points, considerable amounts of gold, even if not in paying quantities, may be found.

Indian creek ridge is deeply covered with glacial drift, but exhibits some considerable surface areas of Loess. The soil is good to fair. Some excellent grain and stock farms and extensive orchards were observed. Bear creek and the numerous branches in the Northwest part of the county have immense quantities of geodes on their bars and some goeodized fossils from the eroded or disturbed Keokuk beds. They are filled with sparkling crystals of many forms and hues.

Bean Blossom valley contains a large area of rich and very productive land, bearing good crops of corn and wheat. Near and just above the mouth of Bear creek it also comprises several hundred acres of modified Loess, here rather a heavy soil and devoted chiefly to meadows and grazing grounds. All the brooks and streams which have their origin on Indian creek ridge and have cut their beds in its sides, scatter on their bars, rocks, sand and other debris of imported material,

including considerable magnetite (black sand) and gold, which will be treated of in Economical Geology. These materials, survivors of the long crushing, grinding rolling and sifting processes of the glacial age, are principally derived from the Laurentian rocks of Canada, which contain partings and seams of magnetite and veins of quartz that are often gold bearing. A white quartz pebble was found West of Georgetown, which plainly contained bright particles of gold, indicating the origin of that metal here found adrift. Mr. George Staples, who is an extensive manufacturer of gold and silver fabrics, called my attention to "a polishing and grinding sand," outcropping on the hillsides near his factory one mile east of Georgetown. He finds it superior to any obtained elsewhere in the States, and considers it of great value when accurate finish of metals is desired. His experience of more than twenty years in the business, entitles his opinion to great weight. The following section was here taken :

Section East of Georgetown.	Ft.	in.
Soil	1 to	2.00
Loess	10 to	50.00
Polishing sand	0 to	1.00
White potters clay, apparently of excellent quality	2 to	4.00
Modified glacial drift with quartz, black sand, gold, etc		25.00
Indurated tough dark clay silt, to creek, depth unknown		2.00
		84.00

The extensive "Spectacle Factory" near Georgetown, is conducted by Mr. Staples—at once manager, proprietor and head workman. Ponderous machinery manipulates gold, silver and nickel like wax, drawing them out into wire or with the impress of dies moulding the different parts ready to solder together ; and a furnace and crucible are ready

to purify the metal or prepare ingots for rolling. He manufactures spectacle frames amounting to $10,000 worth per annum, which meet a ready market in the cities of Louisville, Cincinnati, Indianapolis and the central Northwest. He also prepares gold and silver wire for making rings, chains, etc., to the amount of $5,000 per annum. He finds the Indiana gold 24 karats fine, and has used about $1,000 worth.

Two and a half miles east of Georgetown is located the extensive "Steam Tannery" of Parmalee Bros. They use 5,000 cords of chestnut oak bark yearly, and have sale for their products amounting to $100,000 per annum. Their leather is of superior quality, having won first prizes at state, national and international fairs. The success of these enterprises indicates the wisdom and good sense of their projectors, who believed that cheap homes and food for their operatives, accessible raw material, and an immediate home market, would insure fair profits. This belief has been confirmed by results.

Going South from Georgetown, the road passes up the steep Northern face of Bean Blossom ridge, nearly 400 feet, while a "gap" a little to the East surveyed for a railroad, is reported as having an elevation of 337 feet above the creek valley. The crest of the ridge and of adjoining knobs is capped with the red sandstane No. 5 of general section, here highly ferruginous, and at places hardened with pyrite, or semi-crystalized silica. This bed has furnished good materials for the excellent and well conditioned gravel road leading to Nashville. In loamy deposits along this ridge and near Bald Knob, are pointed out "Bear wallows"; basins thirty to forty feet in diameter, with a depth rarely exceeding two or three feet, but tramped by these animals in early times and cemented with fine clay, never become dry except in times of excessive drought. The gravel road passes along a North-South ridge having a gentle slope to the South. To the right and left is a broad valley-like depression, filled with sharp North-South ridges, like supporting ranges along a mountain chain. The views

stretching away in the blue distance are full of a wild and romantic beauty hardly equaled in the State.

From an outlook ou the road a prominence was pointed out as Baughman's hill, Sec. 9, T. 9, R. 2. Here was afterwards seen on a soil of yellow sandy loess, which yields fair crops of corn, wheat and clover, a thrifty and extensive orchard, comprising the peach, apple, quince and cherry trees. The protecting effects of the deep surrounding valleys was apparent. At an elevation of 405 feet above Salt creek at Nashville, green leaves were still clinging to the trees and shrubs while all in the valleys below was brown and sere. The following section was taken at the hill and along the brook below leading toward Salt creek:

SECTION AT BAUGHMAN'S HILL.

	Ft. in.
Soil: Yellow Loess	12.00
Keokuk beds with geodes, and chert containing *Hemipronites crenistria*, *Productus semi-reticulatus* and Crinoid stems	8.00
Sand rock	2.00
Knob shales with plates and bands of Sandstone	230.00
Quarry Knob Sandstone to water level	4.00
	256.00

In the valley of Owl creek near by are several quarry beds of sandstone. Many geodes are seen on the bars of the creek and a few northern boulders. One of the latter, 2x3 feet, ot yellow quartzite, is of remarkable size for this latitude. At the source of this stream a "Low Gap" in Bean Blossom ridge, shows that the valley was long a thoroughfare for ice water and accounts for these intruding rocks.

Needmore is situated upon a bench of modified drift. Floods of water which scalped the original deposit, bearing away the finer and lighter materials, has left in this vicinity considerable beds of boulders, and an unusual amount of "black sand," as at "Colorado placer," northeast and at John Chitwood's, south of town. At the latter place the "black sand" containing fragments of garnet is so abundant, "that a bushel may be panned out in a day." Mr. Chitwood had a fine specimen of blende, (Sulphuret of Zinc) in calcspar, and some delusive masses of pyrite. The village shows an air of thrift indicative of a fertile soil and valuable forests.

Nashville, the county seat, is situated near the center of the county, on the north bank of Salt creek, and at the southern foot of Bean Blossom ridge. The valley of the creek is here from a half, to one mile and a half wide, averaging about three fourths of a mile. To the west the bottom soil, composed of modified Loess and detrital matter from the argillaceous Knobstones, is often tough and cold; eastwardly it contains a larger proportion of sand, sifted from the glacial drift or torn from the upper sandstone bed, and is lighter and productive. Of the latter class, the fine farm of Hon. Alfred Williams, near the mouth of Clay Lick, may be mentioned. In the edge of town, near the school house, the following beds are exposed:

Nashville Section.

	Ft. in.
Soil and slope	5.00
Hard Sandstone	.8
Shaly.....do	5.6
Laminated Sandstone	2.4
Blue Argillaceous Shale with plates of Sandstone	12.00
Quarry in brook	1.8
	27.2

Half a mile west of town, Judge Hester has opened a quarry of excellent stone. It is in strata from one to three feet thick, and the purity of the material indicates that it might be sawed to advantage. The following section was there taken, measuring up the hill by the road leading north:

Section at Hester's Quarry.

	Ft. in.
Soil on first terrace containing a few small quartz pebbles and minute grains of black sand from glacial drift.....	10.00
Soft friable reddish Sandstone.....	43.00
Shaly Sandstone with ferruginous bands	25.00
Sandy Shale with ferruginous plates and concretions.....	65.00
Quarry Sandstone.....	6 to 12.00
	155.00

In the western part of the county several "Licks" or salt springs, were known to the Indians, who kindly allowed their white friends to make use of them as well. These gave name to the streams. Salt was scarce and precious. The poor natives refused to sell the land upon which they were situated, fixing a boundary which would still reserve these Licks; but by fraud and deception they were outwitted. The salines, I am informed, were donated by Congress to the State, and constituted a part of the old "Saline Fund." Jackson's Lick, six miles southwest of Nashville, was one of the best. Mr. Jackson, at an early day, bored a well 300 feet deep and found a fair flow of brine. He boiled salt for many years, with considerable yield and of superior quality. When the price of salt became reduced below one dollar per bushel, the enterprise did not pay, and work was abandoned. At "Howe's Lick," about ten miles W. S.-W. from town, a bore was put down during the "oil

fever." Dr. Arwine, of Columbus, one of the proprietors, kindly furnished the following statement of the stra in bore, taken "from the Superintendents' account:"

Howe's Lick Bore.

(On Storey's Farm.)

		Ft. in.
Sand stone		100.00
White or blue soapstone (shale)		220.00
Red soapstone		45.00
Black slate	75.00	
Carbonaceous soot (parting)	0.00	
Black slate	35.00	110.00
Sulphur rock		1.00
White sandstone (?) (Others interested in the bore report this stratum as limestone)		45.00
Fire clay, or something like it		15.00
White sandstone or limestone		4.00
		540.00

Burning gas (carburetted hydrogen), was found in considerable quantities all through the black slate, with a small quantity of oil (petroleum). A stream of good brine was struck near the base of the slate.

Mr. Eugene Cully described the gas when struck as having burst up with great power, throwing the brine to a hight of forty feet. This violent ebullition ceased after 24 hours, when brine continued to flow gently until shut down by plugging. The gas brought up much carbonaceous "soot," and a small quantity of very odorous, heavy lubricating oil. The quantity of brine was deemed sufficient to make one barrel of salt per day, with gas enough for evaporation.

East of Nashville several good outcrops of the "quarry" sandstone were noticed. At Watkin's mill, half a mile southeast, the following strata are seen:

Section at Watkins' Mill.

	Ft.	In.
Slope, mostly friable sandstone and siliceous shale	175	00
Coarse sandstone	1	8
Shaly sandstone	15	00
Irregular strata of good sandstone, in wedges one to two feet thick, but rapidly thinning to a sharp edge, with partings of blue shale	5	00
Blue argillaceous sandstone with conchoidal fracture, to low water	8	4
	205	00

At Clay Lick Branch, four miles northeast of Nashville, another oil well was bored by the same company that put down the Howe's Lick well. Dr. Arwine, in a letter reports the strata pierced as almost identical with the Howe's Lick well, excepting only that the depth to the Black Slate in this was considerable less than in the other. This indicates the conformability of the Black Slate with the Knobstone beds of the Sub-carboniferous. The report referred to, is added, although other members of the company say the depth to the slate was less than here given:

Section in Clay Lick Bore.

(On Curry's Farm.)

	Ft.	In.
Sandstone and shale	120	00
White or blue soapstone	110	00
Red soapstone	85	00
Flint (?)	1	5
Black slate (Devonian) with a heavy bed of (carbonaceous) "Soot," 45 feet from its roof	110	00
White sandstone (limestone?)	24	00
Gray limestone	10	00
	460	5

The black slate was found to contain some gas and asphalt. Salt water in no great quantity was struck near its base. The "Soot" was reported to burn freely, emitting a strong offensive odor of bitumen. The bottom limestone seemed to be saturated with petroleum.

Passing up Henderson branch the road gradually ascends the high central divide which separates North and Middle forks of Salt creek. At this elevation many peach trees were noticed loaded with luscious fruit, while in the valleys below the trees were barren. The soil was a reddish lively loam, indicating that it contained a generous wealth of calcareous matter from the now eroded ferruginous limestone (Keokuk) which once superimposed this region. These lands seem to invite the cultivation of tobacco as well as corn and wheat. Mr. Eli T. Moore, to whom I am indebted for much information, finds that clover and red top yield better returns than other grasses. The latter is indigenous throughout the county. His orchard has failed to bear peaches only twice in eighteen years, and on the highest hills has never failed. This region is noted for native fruits, as grapes, plums and persimmons. The latter exhibits two varieties, one the common, small, blue kind, filled with seeds; another of larger size and growth, matures early, dusky yellow when ripe—an examination of 175 specimens shows that as a rule they contain but one, and not a specimen contained more than two seeds. The latter are surely worthy of their expressive Greek name, *Diospyros*, or "fruit of the Gods." Quails and Pheasants are numerous in the fields and forests, collecting at winter in flocks to feed on the red partridge berry which is abundant at favored localities. The farmers of this vicinity regret the destruction of these birds by hunters and city "bummers." Repeated examinations prove that the Chintz bug, is the principal food of quails, when they are attainable. It seems wrong to destroy the only reliable enemy of these pests.

Belleville is situated on the head waters of Middle Salt creek. A broad, well cultivated valley, leads away to the

southwest. On John D. Malott's farm, S. E. quarter, Sec. 13, T. 8, R. 3, is a quarry formerly worked by Henry Cross. The stone is in layers of favorable thickness for work, homogeneous, evenly bedded, and has been tested for over thirty years, with the best of results for building purposes, and for grind and tomb stones; some of the latter bear inscriptions well defined and sharp, although dating back a quarter of a century.

South of the creek an elevated plateau of level land, except where cut by ravines and branch valleys, stretches well away to the south line of the county, and is well timbered. The soil is the peculiar ash gray loess or Lacustral loam, and when cleared produces a fair yield of corn, oats and tobacco, and extra crops of wheat. Buffalo ridge is noted for the quantity and quality of wheat produced, as well as for the thrift and energy of its inhabitants. Several good orchards were visited and sampled. The apples were well colored, of superior flavor and size, free from "knots" and "specks," and equal to the best. The peaches were perfect, and seemed to be unsurpassable. These fruits have failed but once since the settlement of this region. The Chintz bug (*Micropus leucopterus*, Say.) has lately become a serious pest, threatening, if its future is to be judged by the past increase, to seriously damage or destroy the cereal crops. Hon. J. A. McKinney informed me that his son shot a quail for the experiment, and on examination, found that it had fed on these bugs alone—that its craw or crop contained fifty-seven of these destructive pests by actual count. A. Carmichael has noticed quails eating the bug, and that they become fattened when the supply of such food is abundant; no other bird or animal is known to be fond of them.

Half a mile west of Christiansburg, Sec. 35, T. 8, R. 3, is an outcrop of "quarry bed" sandstone. Layers four feet thick were noticed of a quality similar to the Cross and Nashville quarries; also bands and concretionary nodules of excellent iron ore. At Wadsworth's mill in same section, another quarry occurs. The stone may be secured in large slabs or pillars, from layers one to four feet thick; it

has been in use for over thirty years, and as the sharp edges of the outcrops indicate, withstands atmospheric action satisfactorily. The bed and bars of Hamilton creek are deeply covered with scales and small pebbles of siliceous iron ore washed from concretionary deposits in the shaly hills. This material forms a first rate road bed. A short sample road near Christiansburg, demonstrates its great value, and invites its use.

At Hendricks' mill, Section 30, T. 8, R. 3, the creek cuts against the bluff and at west end of the dam exposes quarry stone, outcropping in beds from one to three feet thick. Pillars torn out by the water were seen from ten to fifteen feet long and two by three feet in cross dimensions. Just below the dam in the rock bottom of the creek, iron-stone concretions had decomposed, giving origin to circular "pot holes," one to one foot and a half in diameter and seven feet deep. This whole region is noted for the quantity and quality of the fruit grown on the hills and ridges. The hills contain also much valuable timber including white, red and black oak and hickory. The chestnut oak seems to require an equable climate and is found only on the top of the highest hills and ranges.

Near Elkinsville, the South and Middle branches of Salt creek unite in a broad deep valley. The bottoms, as usual, are rich and productive. The creek rarely, if ever, has cut down through the black Lacustral *Silt* to the bed rock of the ancient ice-water river. A well in the center of the valley half a mile southwest of the village, discovered a considerable bed of unmodified *Silt*.

Section in Well at Elkinsville.

	Ft. in.
Alluvial Soil	4.00
Quicksand, dark	7.00
Black and blue Laeustral clay and sand (Silt), including wood and vegetable remains	9.00
	20.00

Browning's Knob, south of the village, (N. E., quarter, Sec. 10, T. 8, R. 2), was surmounted by a steep almost precipitous ascent of over 250 feet. On the upper part and sides were found fragments of Keokuk limestone and chert, which once covered this region, and will yet probably be discovered *in place* at this or some adjoining peak. They contained crushed and broken specimens of *Zaphrentis*, *Archimedes* and other *Bryozoans*, and *Crinoid* stems. A short space below the summit a massive strata of choice sandstone outcrops, which belongs to the upper member of the Knobstone beds. The stone is of superior quality. Undermined by disintegration and wasting of the underlying shales, grand cubes three by four feet, and pillars three by four and twenty feet long, ready squared and dressed as from a giants workshop, are scattered along the crest of the hill. One of them has been named by the proprietor "Professor's Dining Table," in remembrance of a jovial dinner discussed thereupon by Professor Cox and friends at the time of his visit. From the summit of the Knob a good view may be had ranging up and down the valley for miles, and across toward the Central ridge.

Mr. Jesse Hall informs me that quails seek fields infested with Chintz bugs in search of this special food, and he believes that the protection of these *friends* of the farmer, demand careful thought.

The road from Elkinsville to Nashville, passes up the North-South, deep canyon-like valley of Little Blue creek, and thence toward Schooner, by a gap or depression over the Central ridge or Back-bone of the county. The highest point in the road is little less than three hundred feet above Middle Salt creek at Elkinsville. The greater part of this wide area of knobby peaks and deep cut valleys, is a wild forest, in a state of nature, unimproved, and to a great extent not susceptible of cultivation. On the benches and hill sides was some valuable oak timber, and an immense number of hoop-poles. These for cooper's ware, are the main product and resource of this region. Chestnut

oak is found only on the top of the ridges and knobs, but in considerable quantity.

In the road near the top of the ridge, a somewhat sandy soil and a few minute quartz pebbles, hint that in true glacial times a heavy current of water may have swept across from the north. A glance at the map indicates that in early times North Bean Blossom, by Owl creek and Little Blue, took this route to Middle Salt creek before the more northern valleys had existence. This indication is supported by the great width, considering the small extent of its watershed, and depth of the Middle fork valley, now much built up above the former bed rock with gravel, silt and debris. This would also give priority in age to Middle and South, over the North or Main Salt creek. The Central ridge although somewhat uneven and diversified with peaks, traverses the county, I learn from Dr. Arwine, without break, from West to East. It there unites with the Wall ridge which guards the eastern side of the county and from an eminence of four hundred feet, looks down over the broad level valley of Driftwood-White river, in Bartholomew to the bluffs of Flat Rock ten to fifteen miles away in the eastern horizon.

"Weed Patch Hill," four miles southeast of Nashville, is the highest part seen of the central ridge and of the county.*

It reaches up nearly 120 feet above the other knobs visited, and has a much greater altitude than any recorded for the State. Terrace-like benches some distance below the summit indicate stand points of flowing water. Some contain very minute pebbles or sand of northern origin, and are probable representatives of the ice water flow. But still above is a short space of *loamy* soil, indicating its origin from decomposition of limestone, fragments of which were here found. The summit has not been under water since it emerged from the subcarboniferous ocean, and, from all the evidence seen, was an unconcerned spectator of the grand

*The comparative elevation may be seen by the table of altitudes page 103.

phenomena which signalized the glacial age. "Weed Patch Hill" takes its name from the fact that just before it was first visited by the early pioneer, a tornado had scalped some 100 acres of the tip-top plateau, prostrating a magnificent forest of large poplar, walnut, oak and cherry trees. Weeds and grass succeeded in luxuriant growth, which, together with the trunks and branches of the fallen trees, were burned by each summer's fire, and commenced a miniature prairie; weeds and vines became the prevailing vegetable growth, and hence the name. Where not cultivated, a second growth of sassafras, jack, black and red oak and hickory, a vagabond race, take the place of the royal forest dethroned by the tornado.

The wild fruits flourish here in perfection. Following this hint Dr. Phillips and others have planted extensive orchards and vineyards, which, if *properly cared for*, will prove a first-class investment. In the latter part of November, the time of my visit, grass, and the leaves on shrubs and bushes were still green on the Phillips farm, but below in the valleys, frost and ice had seared and stricken every leaf.

Descending the northern slope toward the mouth of Clay Lick creek, the following section was taken:

Section at "Weed Patch Knob."

(Sec. 82, T. 9, R. 3.)	Ft. in.
Light brown loam, containing angular fragments of Keokuk limestone and geodes, shading down to loess on the hill slope...	10.00
Coarse ferriferous sand rock in bands of 1 to 2 feet.....	4.00
Siliceous shale, with plates and bands of sandstone, the latter from a few inches to 4 feet thick.....	300.00
Coarse ferruginous S. S., in layers from 1 to 3 feet.....	16.00
Argillaceous and Siliceous shales.....	80.00

Quarry sandstone in bands	12.00
Clay shale with iron stone concretions, (*septaria,*) to low water in branch	9.00
	441.00

The following table of altitudes, and others mentioned heretofore, are calculated from Stansbury and Williams' determination of the elevation of White (Driftwood) river at Columbus above the ocean. They result from a single line of observation made with an Aneroid barometer, and are therefore subject to a probable error of from one to fifty feet. When the observations were repeated this range of "probable error" was found sufficient to cover the variation of the instrument.

TABLE OF ALTITUDES.

Nashville above the ocean	652	feet.
Nashville above the mouth of the Wabash	355	feet.
Nashville above Columbus	35	feet.
Nashville above Wabash at Terre Haute	167	feet.
Nashville below Georgetown	42	feet.
Nashville below Spearville	285	feet.
Nashville below Indianapolis	46	feet.
Nashville below Bloomington	132	feet.
High wall ridge above valleys	300 to 400	feet.
High wall ridge above ocean	1002	feet.
Weed Patch Knob above ocean	1147	feet.
Weed Patch Knob above Nashville	495	feet.
Weed Patch Knob above highest altitude recorded in the State	221	feet.
Weed Patch above highest glacial drift at Elizabeth, Hendricks county	269	feet.
Extreme height of glacial ice above the ocean, this county	975	feet.

ECONOMICAL GEOLOGY.

Brown county was originally settled by emigrants from Carolina, Kentucky and Virginia, but now a large proportion of the inhabitants are from Ohio. In the East and Northeast corner of the county, on "German Ridge," quite a number of Germans have bought the neglected hills and "slashes," and with characteristic industry and economy have made productive farms and comfortable homes. Owing to the unusual proportion of hilly and broken land, a large area is still a wild forest, and the population is scant compared with other parts of the State.

Population by census of 1860	6,503.
" " " " 1870	8,680.
Attending schools of 1870	1,597.

In the foregoing general description and local details, mention is made as to the quality of the different kinds of soil. It may not be amiss to suggest that even the rich bottoms will wear out by continued planting and much sooner the thin clay uplands. This may be avoided by careful rotation of crops and the cultivation of plants that draw their food from the air. Clover or Alfalfa will deeply open up the ground by their long sub-soiling roots, and profitably restore its fertility. As an indication of the capacity of these bottoms, I may say that several fields were seen on Bean Blossom and Salt creek in which the growing crops, (Autumn of 1874), would average 50 to 60 bushels of corn to the acre, and I am informed that the wheat crop of Buffalo Ridge for the harvest of 1874 averaged 25 bushels per acre, yet the average of the county could not be put at over one-third of these amounts.

On the thin hill lands it is probable that orchard grass would grow and prosper if thickly seeded, and prove much more profitable than the indigenous "Red-top." Rye is known also to prosper on such lands, furnishing a profitable crop, as well as much winter pasture. A great many hogs

are fatted on the acorns and nuts ("mast") of the forests, the food which produces the "mellow touch and nutty flavor," that gives favorable pre-eminence to the celebrated Westphalian hams in the European markets.

Timber.

This county possesses a large amount of valuable timber. The poplar and walnut trees, once common in the bottoms and on the loamy hill tops, have been mostly cut and used, but of white and red oaks, the supply is abundant, with a large surplus for export. A large amount of staves and hoop-poles are marketed, affording a precarious support to many.

Tan Bark is a large source of revenue. The bark of the "Chestnut Oak" is found to be of superior quality for tanning, and is largely sought for that purpose. Leather prepared with this bark has taken prizes at European fairs. The bark is sold on the trees at one dollar, cut and piled at $3.00 to $4.00, and brings $10.00 per cord at the railway station in Columbus. Annual product, 20,000 cords. This species of oak grows only on the rich, brown loam of the highest hills—does not survive in the valleys—and with the present wasteful consumption, will soon cease to exist.

Tobacco.

Tobacco is cultivated with profit, yielding fair crops of good quality. The harvest of 1873, from actual weights or estimates of Mr. E. T. Moore, amounted as follows:

	Lbs.
Van Buren Township.....	430,000
Jackson "	25,000
Washington "	10,000
Total pounds	465,000

The soil and climate is well adapted for the cultivation of this plant, and it is said to yield handsome returns.

Fruit.

This county is noted for the quality, size and superior flavor of its fruit. Apple orchards yield best on the hillsides or lower ridges, but the tender fruits as peach, pear, apricot and grape thrive best and mature to fullest fruitage and perfection on the warm tops of the high knobs and ridges. The advantages found to exist are: 1. *An equable temperature,* the deep surrounding valleys, in time of sudden "cold snaps*" receive and modify the heavier cold air, until the plants became hardened to the regular winter temperature; 2. The warm absorbant nature of the porous soil; 3. Decomposition of pyrite in the knob shales sets free sulphurous gases, which are believed to prevent or mitigate the growth of fungus parasites, and protect from some of the injurious insects. These advantages coupled with unlimited markets in the surrounding cities, are worthy the attention of fruit growers, and will insure with careful persistent cultivation, satisfactory returns. Jacob Baughman, NE ¼ Sec. 9., T. 9, R. 2, has 10 acres planted with choice varieties of peaches and apples in thrifty condition, and he reports that it pays well. Levi B. Dubois, SW ¼ Sec. 17, T. 9 R. 2, has devoted 15 to 20 acres to fruit culture, comprising peaches, apples, pears, apricots, plums, quinces and grapes. Dr. M. E. Phillips has planted the summit of Weed Patch knob with peaches, 10

*At such an occasion Gen. Carrington found a temperature of—48° in a Western canyon modified by an ascent of 200 feet to—27° Fah., a difference of more than 1° for every 20 feet of ascent. The same authority also mentions, in a sudden *cold storm* on Piney fork of Tongue river, it was found that the mercury was 11° lower in the valley than it was on an ascent of less than 100 feet. The survival of tender trees as the Chestnut and Chestnut oak, at elevated points, but which perish on the lower lands, indicates that this equilibrium in temperature has characterized Brown county for centuries.

acres in bearing and 20 acres in young trees. His two-acre vineyard of Concord and Ives' seedlings was in good order and will soon fruit. Several other orchards and vineyards ranging from five to eight acres in extent were noted. From one of the latter Mr. E. Carter annually sells $500 of fruit. The product is generally marketed at Indianapolis. Mr. John Gemolin planted 4 acres of Catawba and Isabella vines in the valley adjoining Nashville, but as might be expected in this low valley they failed to fruit. Wine made by Mr. G. was excellent. Garden and field crops which require sulphur for their growth, as cucumbers, turnips and sweet potatoes, thrive and produce well, fed and protected by the decomposed pyrite in the soil. Common potatoes rarely fail or are stricken with the "rot."

Water.

The many creeks and brooks which traverse this county become low or cease to flow after an extreme drought. The rain fall furnishes a purer and better supply. It may be cheaply preserved in cisterns for drinking or culinary purposes, while for stock the "bear wallows" prove that slight basins will afford a resource.

Gold.

Gold is found in the bed, or on the bars of all the brooks that flow into Bean Blossom from Indian Creek ridge, and on the streams which flow from the foot of the "Drift backbone" in the northeast corner of the county, as South Bean Blossom, North Salt Creek, etc. Fine dust and minute scales may be found further within the the county wherever black sand and small pebbles indicate former currents of ice water, even as far south as Elkinsville. The metal is of unusual purity, averaging, I am informed by Mr. Geo. Staples, who has used in his shops $1,000 worth, 24 carats fine. This purity is due to the long beating and squeezing process to which it has been subjected under the ice. Single

individuals, at favorable points, by hard, patient labor, have been able to make from one to one dollar and a half per day. Companies and careless workers have not averaged more than twenty-five cents per day. During the excitement a few years since, several companies took leases, made sluice-ways and prepared long-toms and rockers. The returns were not satisfactory. It is probable that the best "pay dirt" lies at the deepest part of the rocky trough in which the creeks now have their course. By bores the line of greatest depth may be ascertained, and by shafting the richest dirt—possibly in paying quantities—may be brought to the surface. Reasoning from the facts observed, this would be true of Bean Blossom, and especially, from its greater width and probable great depth, also of Indian Creek valley. This is mentioned as a reasonable deduction, warranted by the facts, and not for the purpose of exciting a mining fever. Mr. J. B. Richards gives an estimate of the amount of gold found, as follows:

Richards' farm and adjoining	$ 400.00
Plum Creek	60.00
Chris Stumps—Georgetown	500.00
Anderson's	300.00
Salt Creek	1000.00
Value	$2900.00

This includes all within his knowledge; and he states the heaviest nugget found, worth one dollar. Mr. Staples, with more extended opportunities of securing information, estimates the total product at $10,000 in value, and the best nugget weighed, at one dollar and ten cents.

Gold is the product of veins and beds in igneous and metamorphic rocks. Such rocks are not found in place within this State, consequently our gold is not native, but imported. In the "diggins" are found boulders and pebbles from the Laurentian and metamorphic formations of Canada and Lake Superior, which are often auriferous; these were

brought here by the great ice-flow which overspread the whole region to the North, broken, crushed and pulverized in the mills of nature; the gold was left in Bean Blossom sluice-way, and the lighter sands and clays borne away to build up the alluvium of Southern rivers.

Other Minerals.

Iron stone concretions were noticed near Christiansburg, of good quality, but not in sufficient quantity to be of economic importance. Facts observed, indicate that beds of silver, lead and copper, do not exist in the county. Pieces of copper and lead ore are found among the imported rocks of the glacial drift, and should attract interest merely as relics.

Building Stone.

In the foregoing general description and local details, mention has been made of numerous quarries in different parts of the county and of the good quality of the stone. Geologically it is from the same horizon which furnishes the justly celebrated Waverly freestone of Ohio and it presents qualities which, in some respects, compare favorably with that stone. It is of a beautiful buff or gray neutral tint, easily accessible, readily quarried in blocks or slabs of suitable size for architectural purposes, may be moulded by chisel and hammer into suitable forms for capitals, mouldings and tablets and its enduring qualities are proverbial. Samples which had passed the ordeal of fire in burned houses, indicate great heat resisting properties; and outcrops were noticed, which record the lapse of centuries, showing great resistance to atmospheric changes.

Prior to the introduction of marble into the west by rail this stone was used for tombstones and monumental purposes, which perpetuate the memories of departed friends and at the same time proclaim its enduring quality. At many stations, in fact generally, it is a sharp grit, and makes grind, currier and whetstones of a quality that invites a

larger manufacture that would bring wealth to the county. Much of this stone is shipped at Columbus and Taylorsville, on the Jeffersonville, Madison & Indianapolis Railroad to market.

At several stations the stone is free from iron stains, is close grained and homogeneous and may be sawed into caps, lintels and blocks for facings. Large quantities are quarried for exportation at the county line east of Nashville and from the "Wall Knobs" west of Taylorsville.

With facilities for transportation, now greatly needed, this stone would form a considerable industry.

Summer Resort.

Our pleasure-loving people require summer resorts for rest and recreation. We may suggest, that Brown county offers to those who can enjoy them, wild life, mountain scenery, dense forests, untrodden wilds and romantic lookouts, that will vie with more noted localities. Many of our citizens visit Little Mountain (Geauga county, Ohio), to catch the mountain air and purchase relief from "hay fever," not knowing that our Indiana mountain is fairly its rival in hight, and needs only a hotel to become an acceptable resort.

In conclusion, thanks are returned to the county officers and citizens generally, for information and assistance. Acknowledgements for special favors are due to Judge J. Hester, E. T. Moore, Eugene Cully, W. W. Browning, James McKinny, George and William Carmichael, Jesse P. Browning, Jno. Chitwood, J. B. Richards and Dr. Arwine.

PROFESSOR E. T. COX:

State Geologist of Indiana:

DEAR SIR:—In compliance with your letter of instructions of June 17th, 1874, I proceeded to make a Geological Survey of Scott and Jefferson counties, Indiana, and herewith, respectfully, submit my report on the same.

Yours truly,

WM. W. BORDEN,

NEW PROVIDENCE, IND., January 1st, 1875.

SCOTT COUNTY.

BY W. W. BORDEN.

Scott county is situated in the southeastern part of the State, eighty miles S.S.E. from Indianapolis. It is bounded on the north by Jackson, Jennings and Jefferson, east by Jefferson, south by Clarke, and west by Washington and Jackson counties, and contains 213 square miles. The outlines are very irregular; the surface of this county affords quite a variety of scenery. The north and northwestern and central parts are very flat, as about Scottsburg, Austin and especially in Johnson township; here the drainage is poor excepting in the immediate vicinity of Big Creek and north of William Davis' farm in Sec. 26, where the land is slightly rolling. The eastern part is rolling, and the southern and southwestern is very much broken by a continuation of the Knob range of hills of Clarke county, which have an elevation of from three to four hundred feet. From White-oak Point, Rocky Point, Piney Point, and many other elevations, we have a fine view of almost the entire county. Five miles south and west of Vienna, and on the dividing ridge between the headwaters of Silver Creek, in Clarke county, and the waters of Pigeon Roost fork, in Scott county, the view is very commanding. On the day of my visit to these high lands, the atmosphere was damp and in a favorable condition for the conveyance of sound, the whistle of locomotives and other noises could be heard

for many miles, and the valley through which the Jeffersonville, Madison & Indianapolis Railroad runs, could be traced beneath the overhanging mist, to the Falls of the Ohio, and to the west and north, could be seen the highest land of Jackson and Jennings counties.

The principal streams of Scott county are Big creek, with its tributaries, the Southern branch or Brushy Fork of the Muscatatuck, Woods' Fork, Home Fork at Lexington, Pigeon Roost Fork, Little and Big Ox and Fourteen-mile creek, which rises in Jefferson county and flows through the southeastern part of Scott, and through Clarke county to the Ohio river.

Big creek is the largest stream, and rises in Ripley county, and flows in the direction of the Ohio river, and forms a part of the northern and western boundary of the county. It affords a number of mill sites.

The outcrop of the Niagara limestone on this stream, in the northern part of Jefferson county, is very fine and may be followed in the direction of Bryantsburg to the Ripley county line. This outcrop will be noticed more fully in the Geological Report of Jefferson county. Big creek has a deep channel where it flows with the dip of the Niagara and Corniferous Limestone in Jefferson county and over the New Albany Black Slate in the western and northwestern part of Scott county, thus reaching a higher geological horizon where it empties into White river. This stream with many others in this section, where they flow over a persistent formation, as the Niagara, has shifted but little from its primative bed, hence the presence of very little bottom land, and frequent abrupt banks along this part of the stream; but upon reaching the Black Slate it has rich alluvial bottoms, noted for their never failing corn crop.

The rich Muscatatuck bottoms are referred to by the inhabitants of the county as a standard of comparison. This season (1874) will be long remembered as one of great drouth, yet the "flats" of Scott county and the bottom lands of Big creek have the heaviest corn crops known for years. Woods' Fork rises at the base of the New Albany Black

Slate in Jefferson county and flows over the Corniferous and Niagara limestone before reaching Big creek. The lands bordering on this stream have a limestone substratum and are very productive. Home Fork rising in the southern part of the county flows by Lexington into Woods' Fork. Along this stream there is a good exposure of Hydraulic and other Devonian limestone. Kimberland creek flows almost exclusively over the Black Slate. Pigeon Roost creek with a number of its tributaries, also Little and Big Ox creeks rise in the "Knob regions" of this county and flow into Big creek. The romantic "Knobs" in the southern and western part of the county, form the divide between the head waters of the latter streams, and the waters of Silver creek in Clarke county which flow into the Ohio river. Pigeon Roost Fork and Big Ox rise at or near the same point, and flow the same general direction, with a very narrow ridge between them. Their valleys are more than half a mile in width, at some points, and afford some of the best farming lands in the county.

Pigeon Roost creek received its name from the abundance of wild pigeons which have, within the memory of the "oldest inhabitants," sought this wild and broken region year after year, as a favorite roosting place, especially in the fall and winter season. Their favorite food, the beech nut, is found in great abundance within a radius of fifty miles. The first settlers relate that they have seen the ground in this region covered to the depth of several inches with their droppings. The roosts of the pigeons, in earlier days, was not confined to the hills, but extended to the valleys. I have on several occasions, visited the pigeon roosts, on the adjoining hills, in Clarke county, when the birds were in countless numbers and covered many square miles of territory.

The timber of this Knob region is Pine, from which tar is made in considerable quantities, Chestnut, White-, Red-, Black- and Chestnut-Oak. In the valleys, Beech, Sugar Maple, Poplar, Sycamore and Walnut are the principal varieties.

The "Pigeon Roost" defeat, or massacre, as it is called, occurred during the Indian war of 1812 and 1813 on the high lands east of or near Pigeon Roost creek, and on the land of William Collings, and from two to two and a half miles southeast of Vienna; a large sassafras tree marks the place where, in three graves, fourteen persons are buried, being a part of the twenty who were killed by the Indians. The incident was related to me by Sichy Richie, now 82 years of age, who still retains a vivid memory of those tragic days.

The geological formations of Scott county are represented in the following section; all of which outcrop on the eastern border of the county within a short space from the summit of the knobs near Vienna, to Wood's Fork creek, two miles northeast of Lexington:

AGES.	PERIODS.	EPOCHS.	STRATA.
Quaternary System.	RECENT. Champlain. Glacial.	Alluvium. Champlain. Glacial.	2 to 13 feet. 4 to 0 to 8 feet.
	Sub-Carboniferous.	KNOB SERIES. Equivalent of Chemung, (Hall); Waverly, (Ohio); Kinderhook, (Illinois).	Knob flagstones, A. S. Stone, 2 to 4 feet; Massive sandstone, 20 to 80 feet; Knob shale 100 to 180 ft. Greenish marly sh'le, N. Providence shale, 6 to 100 feet.
Devonian.	Hamilton. Corniferous.	New Albany Black Shale. Genesse, N. Y. Corniferous. Mollusk and radiate Corals.	0 to 70 feet. Hydraulic limestone, Limestone containing Sperifer gregaria fossil varieties of Favosites, Zaphrentis gigantea, etc.
Upper Silurian.	Niagara.	Niagara.	A gray crystalline limestone, 4 to 6 feet, with fossils.

The Alluvium or Recent is to be traced along the streams, and is derived from decayed and decaying vegetation and the weathering of the rocks and the washing of sand from the

clays, along Big Creek and Woods Fork. The alluvium lands rarely fail to produce an excellent corn and wheat crop; the average yield of wheat per acre on these lands during the past season, being from sixteen to thirty bushels per acre. On the Black Shale lands of this county, excepting where they have been enriched by skillful farming, as by the cultivation of clover and grasses, the average yield of wheat was not fifteen bushels per acre, and suffered greatly from the depredations of the Chinch Bug, (*Micropus leucopterus*, Say,) which had also the year previous made their appearance on the poorer grass lands of this county.

The alluvial bottom on Big Ox and Pigeon Roost fork, (branch of Big Creek,) are worthy of note. The valleys of these streams are one-half mile or more in width and among the best lands of the county, and were formerly covered with a large growth of timber, as Sugar, Black Walnut and giant Poplars.

An ancient alluvial bed of chemical and mechanical origin is seen on the Big Ox creek of from two to three feet in thickness, composed of a conglomerate mass of fragments from the iron ore, which out-crops in the knob region about the head waters of this stream. This deposit is found several feet above the present bed of the stream, and marks its former bed.

The Champlain Period, is so called from the occurence of beds of this period, on the borders of Lake Champlain New York. It includes two subdivisions: First, "Diluvium Epoch," or that of the deposition from the melting glaciers of substratified and stratified drift. The unstratified drift consists of sand, gravel and stones lying pell-mell together as they were thrown down from the melting glaciers. Second, The Alluvial Epoch, characterized by deposition of a more quiet character, and composed of clays deposited by the water after the melting of the glacier, and from the subsequent wear and decomposition of the rocks.

The boulder clays of this county are best seen in the vicinity of Vienna, where the country is somewhat broken. A section of these deposits, seen four or five miles southeast

of Vienna in an out-crop on Pigeon Roost fork, and on the land of L. F. Collings, is as follows:

1st.	Ash colored sandy clay.....	6 ft. to 10 ft.
2d.	Ochreous clay of various shades, stratified	5 ft. to 8 ft.
3d.	Blueish clays with flint gravel and granite boulders.....	2 ft. to 6 ft.
4th.	Hard-pan, siliceous gravel.....	1 ft. to 4 ft.

Good beds of sand suitable for mortar are found in these out-crops. On the road from Vienna to Lexington, boulders 2 to 3 feet in diameter, are quite numerous. They are mostly granite and conglomerates of agatized pebbles variously colored. Some of these conglomerates make beautiful cabinet specimens. A characteristic marking of the boulder clays of this region is a trace of a very dark and fine grained iron sand which adheres readily to the magnet. From six to eight miles southeast of Vienna in the Guinea Hills of Clarke county, and in the vicinity of J. Cruson's mill, in Scott county, as mentioned in the report of last year (1873) are to be found an abundance of boulders. Still farther south in Clarke county, three miles west of Charlestown, near the Sinking fork of Silver Creek, and on the land of John Carr, Jr., there is a boulder measuring four or five feet through and of several thousand pounds weight. Boulders of a large size are also quite abundant along Pigeon Roost creek. From Scottsburg to Vienna they are almost the only stones met with, as the streams have clay banks and flow over the Black Shale. The gravel which is so abundant at L. F. Collings', a few miles above Vienna, is almost entirely wanting.

In Floyd, Clarke and Scott counties we find extensive valleys reaching to the Ohio river, with their general direction North-west by South-east, and they may be traced on the opposite side of the Ohio river to the southern boundary of the knob formation in Kentucky. These ridges are not produced by an upheaval but by erosion as the rock

strata are not tilted; but dip gently to the South-west. The small valleys connecting with the larger are cut out by the streams which flow through them. The Louisville branch of the O. & M. Railway, and the Jeffersonville, Madison and Indianapolis Railway, also the Louisville, New Albany and Chicago Railways all follow these valleys and natural plains as they approach the Falls of the Ohio.

At the base of the boulder clay thoughout the county, is found a bed of hard pan, composed of clay with siliceous gravel two to three feet or more in thickness, very compact and difficult to penetrate in sinking wells, but as a general thing water is found at this depth. Rock can usually be removed by blasting, and the numerous joints and fissures found in the strata enable the workmen to break it up in large blocks; but this hard pan has neither cracks nor joints. It will not blast, and to pick it to pieces is a slow and laborious process.

PALEOZOIC GEOLOGY.

The order and average thickness of the rocks of this age having been given we will notice them as they occur. The most recent of the series found in the county are in the elevated Knobs, a noted range of conical-shaped hills that commence at the Ohio river below New Albany in Floyd county and extending across Clarke county, skirt along the south and southwest part of Scott county.

1st. *Knob Sandstone.*—Equivalent of Chemung, Hall, N. Y.; Waverly of Ohio; Kinderhook of Illinois. The upper beds are a flag sandstone, from a few inches to a foot or more in thickness, easily quarried, with straight edges and often with square corners, hardens upon exposure, and has a brown appearance on the surface by oxidation. These layers are almost bare of fossils. An occasional fucoidal impression is seen and some ripple marks that are on the under surface.

2d. *Massive* and *stratified sandstone*, easily worked, of yellow color with an occassional shading of light blue. In the sandstone are small cavities filled with white and yellow sand or a concrete of oxide of iron. These rocks are in some parts micaceous, cleaving with the stratification. In some places it is a good building stone, but in others it is liable to chip by freezing. The fossils of this bed are: *Syringathyrus textilis*, Hall; and *Streptorhynchus keokuk*, Hall; one or two species of *Productus* and an occasional *Conularia*; and large Fucoids. The knob formation is confined to the district south and west of Vienna.

3d. In the series are the shales which constitute the principal part of the knob range in this county and in Floyd and Clarke counties. There are two kinds. ne is a bluish, friable micaceous shale, with occasional thin layers of ferruginous sandstone and contains an abundance of worm tracks and some fucoidal impressions, large and small concretions of iron stone, the nucleus in most cases being a fossil. At the junction of this shale, with the sandstone above, is the spirifer bed of the knobs, in which are found: *Syringathyris textilis*, Hall; *Streptorhychus keokuk*, Hall; *Productus reticulatus*, also *Bryozoa*, and at some points *Crinoid* stems and other fossils.

4th. *Knob Shale.*—Immediately below the shale mentioned above there is a fine-grained, greenish-colored marly shale, designated in the report of Clarke and Floyd counties of last year, (1873,) as the New Providence shale. It contains the iron ore beds mentioned in that report and can be traced from the crop on Big creek two miles west of Austin, at the Jeffersonville, Madison and Indianapolis R.W. crossing to Jackson county, where the stream forms the county line, from thence to the head waters of Big Ox creek.

The Iron-stone bands crop out on all the small branches which flow into Big Ox, southwest of Vienna, as the streams cut the shale in a great number of places as high up as William Richie's eight miles southwest of Vienna, on the S. E. quarter, Sec. 21, T, 1, R. 6, E.

There is a good outcrop of the stratified iron-stone, and kidney ore on this stream four and one-half miles west of Vienna in Finley township on the land of W. L. Applegate, N. half of the N. W. Q, of Sec. 11, T. 2, R. 6, E. The land west of this is very broken as it borders the base of the Knobs. Samples of this ore have been forwarded for analysis. The mineral water noticed in the report of last year with an analysis, and found in the shale in Clarke and Floyd counties, is here as elsewhere invariably found in this shale. It has many of the properties of the mineral water of Crab Orchard, Kentucky, from which Epsom Salts is manufactured.

The following analyses show the constituents of the two mineral waters:

Alumina and Oxide of Iron.....	2.001	grains.
Sulphate of Lime.....	71.806	"
Sulphate of Magnesia.....	429.660	"
Chloride of Sodium.....	286.090	"
Sulphate of Sodium and Potash...	204.400	"
	993.947	

CRAB ORCHARD, KENTUCKY.

Sulphate of Magnesia.....	63.00
Sulphate of Soda.....	4.00
Sulphate of Potash.....	2.00
Chloride of Sodium.....	5.00
Sulphate of Lime.....	2.50
Chloride of Lithium.....	0.75
Carbonate of Lime (Magnesia) Silica, Bromide and Iron.....	2.75
Water of crystallization.....	20.00
	100.00

The iron ore deposits of this county are confined to Finley and Vienna townships, and are seen from the head waters of Pigeon-roost creek, and along that stream to Pigeon-roost summit of the Jeffersonville and Indianapolis Railroad, and some distance beyond towards Kimberland's creek. The stratified iron stone with the kidney ore outcrops on the southeastern side of Pigeon-roost creek, on the farm of L. F. Collings, where there are several strata of 4 to 8 and 10 inches in thickness. This is the western outcrop of the iron stone noticed as occurring in the Guinea Hills of Clarke county.

There are some outcrops of this ore about J. Cruson's mill, near the Clarke county line, six miles west of Henryville and on the land of L. F. Collings, section eighteen, Vienna township, and within less than one mile of the Jeffersonville and Indianapolis Railroad. A section near Pigeon creek, in an outcrop of 20 feet, from the summit to the base of the hill, shows as follows:

1.	Ash colored and ochreous clay...	5 ft. 00 in.
2.	Shale containing 5 in. band of iron stone.....4 to	5 ft. 00 in.
3.	Three to four feet shale with kidney ore.....	4 ft. 00 in.
4.	Band of iron stone.....	6 to 8 in.
5.	Shale two to four ft., with band of iron stone.....	8 to 10 in.
6.	Shale three to five feet, with band of iron stone.....	8 to 10 in.

Specimens from the 10 inch band were sent to the State collection. Many sections showing the outcrops of this iron stone might be given, but the above is a representative of what occurs in the knob region of this county, and in the less elevated hills which are found in some instances extending some distance from the base of the higher knobs.

Along Big Ox creek and at some points on Pigeon Roost creek, is to be found an outcrop of from 1 to 3 feet of

pebble bog ore, composed of the scales and weathering of the iron stone of this region. This deposit is above the present high water marks of the streams. Samples were sent to the State collection for examination.

The "Button-mold wash," so called from the disk-shaped fragments of encrinite stems which are found in it, is but another name for the greenish marly shale contained in the iron-stone banks.

The characteristic fossils of these washes are *Spirifer (Kentuckensis,) keokuk*, Hall; and some very small spirifers undescribed. Two species of *Chonetes*, very like *C. Illinoiensis*, Meek and Worthen, *Orthis michelini*, *O. penelope* and other species. There also occur imperfect specimens of crinoidea belonging to the genus *Cyathocrinus*, *Platycrinus*, *Synbathocrinus*, *Actinocrinus*, and *Forbesiocrinus*. The corals are represented by very beautiful fragments of a species of *Alopora* undescribed, and a number of *Bryozoans*, and a very diminutive, moss-like coral. The Kidney iron contains a *nucleus* of *Spirifer murchisonia*, *Goniatites* and a variety of other fossil forms. In the outcrop of this shale at the Knobs below New Albany, are found concretionary masses containing good specimens of a *Conularia*. There is also found associated with this shale specimens of transparent sulphate of lime, plates and needle-shaped crystals of this mineral were seen in this shale on Ox fork in this county.

DEVONIAN AGE. HAMILTON PERIOD.

New Albany Black Shale. Genesse Shale of N. Y.

In my survey of Clarke, Floyd and Scott counties I have invariably found a *Ferruginous Limestone*, capping the Black shale, *a true index to the shale*, from two feet to four feet nine inches thick as shown in the following section taken at Thos. Baker's mill, (at present owned by Robert Grimsley) on Big creek, below the crossing of the Jeffersonville, Madison and Indianapolis Railroad, and on the land of John Hornaday, two or three miles west of Austin.

1. Soil—alluvial—recent.....15 ft. 0 in.
2. Boulder drift, clay, sand and gravel with boulders.....6 to 10 ft.
3. New Providence shale, with iron stone.....2 to 3 ft.
4. Goniatite bed of Rockford, Jackson county, Ind..... 3 to 6 in.

Containing *Goniatite ixion*, Hall, *G. oweni*, Hall, an *Orthoceras*, and *Zaphrentes*.

5. Ferruginous limestone, variegated, without cleavage, very persistent, and in this locality contains an abundance of crinod stems, and crinoridea in crushed state, and firmly imbedded, a durable stone, and used in the piers of the R. R. bridge.....4 ft. 9 in.
6. New Albany black shale, to the bed of the creek.....6 ft. 0 in.

This Ferruginous Limestone is a very continuous formation, and is traceable throughout this State and Kentucky at this horizon, where it attains the thickness of five feet or more. This stone becomes coated with a brown oxide of iron upon exposure, and is called an "iron stone." It has a fetid odor when struck, breaks with an uneven fracture, is very compact and durable, and is extensively used at various points, where convenient to quarry, for building purposes.

NEW ALBANY BLACK SHALE.

Equivalent of Genessee Epoch, N. Y.

This shale has been so named on account of a fine exposure seen at New Albany, Indiana. It is usually of a jet

black color, but on being exposed to the weather it exhibits a thin, laminated cleavage and then assumes a variety of colors. It contains pyrites of iron in concretionary forms, needle-shaped crytals and cubes known as "fools Gold" or Sulphur balls. This slate contains some bituminous matter and gas, and yields from eight to ten gallons of oil per ton, but the present cheap supply of petroleum precludes its manufacture from these shales. It has been used for roofing when ground and spread on felt with coal tar, but this failed to give satisfaction and has been abandoned. It is imagined by the uninitiated that if followed to some distance into the hills, this shale will be changed to good coal, but this is a mistake, as it crops on a hundred hillsides and has every stratum exposed to view. I have occasionally met with thin seams of one to two inches of pure coal in the slate. This slate burns quite readily when a large quantity is once ignited, and in certain localities has been known to burn in its original bed for months. This formation embraces a wider area than any other formation in the county. It is traceable on Pigeon Roost creek below Vienna to Scottsburg, thence to Austin, where it is struck in wells, and in outcrops west of the latter place on Big Creek or Muscatatuck, at Baker's Mill, and above the mill at Slate Ford on the same stream, and is the surface rock in all the flat regions in the northwestern part of the county, where it is occasionally used for walling wells. It is met with at Wooster and in the direction of Doty's mill and is twenty to forty feet high about Holman where the Louisville Branch of the O. & M. Railway cuts it to the south of that place. It continues to Lexington, and on to Knob's Station on the Branch railway. The Black Shale outcrops in all the hillsides about Lexington, where it is from a few feet to sixty feet or more thick. On the east branch of Kimberland creek four and a half miles west of Lexington, it thickens to seventy-five or eighty feet. It is first seen near Vienna on little Kimberland creek two and a half miles east of the town. The Black Shale in the eastern part of the county is cut through by the streams which

have a bed twenty feet to seventy-five feet below the general surface. "Pot Rocks" from one to three or four feet in diameter, are occasionally met with, imbedded in the black shale. Their general form is conical, and they are very hard to remove in excavating the slate. Large and small specimens of fossil wood, and an occasional specimen of the wood containing imbedded crinoid stems are met with.

The Black Shale is extensively used in this county for mending roads, being abundant and having the good quality to make soft places firm and dry, and the testimony of the farmers is that it answers for that purpose better than any other material they can use.

It would certainly act mechanically upon clay soils and make them porous and warm, dark colors being absorbent of heat. All dark soils are warmer than light colored soils, other things being equal.

Resting on the black shale, are found large fossil trees. Some of these specimens are of great size; all are silicified and so hard that a fragment with a sharp edge will scratch glass.

The fossil tree exhumed from the black shale by J. Richardson and myself on the land of E. B. Gurnsey, near Henryville, in Clarke county, and exhibited at the Indianapolis Exposition of 1873, measured over 16 feet in length and two feet in diameter, and had a jointed structure, which is a characteristic feature of all these fossil trees. Another large specimen of tree measuring 19 feet in length and three feet in the broadest part, being somewhat flattened, was taken from the black shale, a short distance northeast of Vienna, by James Powers of Lexington, and exhibited at the Indianapolis Exposition for 1874.

This fossil wood is very closely associated with the black shale, and large specimens are found in almost every outcrop on the head waters of Silver creek in Clarke county. I have never yet met with a specimen above the summit of the black shale. A stump of one of these fossil trees is to be seen in Finley Township.

Immediately below the Black Shale is the horizon of the Crinoidal limestone of Clarke county, Ind., and the Falls of the Ohio. This formation caps the cement beds of that region, and is well marked about Lexington and on Woods' Fork; also, east of Lexington on some of the small streams. In Scott county this rock is a very hard crystalline limestone containing an abundance of fossil shells, *Tropidoleptus carinatus* and *Chonetes coronta*, Con. (Hamilton group of N. Y.) The crinoidea referred to are wanting. East of Lexington at the Branch Railroad Depot on Town Fork creek the following section occurs:

1. Light colored clay soil, terminating in ochre shales..... 2 to 15 ft.
2. New Albany Black Shale with fossils, commencing four feet from the base of the slate, as follows: "*Leiorhynchus quadricosta*, Hall, *Chonetes lepida*, Hall, *Tentaculites fissurella*, Hall, also a specimen *Cardiola radians* or allied to that species"—(Whitfield)..... 6 to 30 ft.
3. Dark gray limestone, very hard, with numerous fossils: *Tropidoleptus carinatus*, *Chonetes coronata* Con. (Hamilton group).... 2 to 3 ft.
4. Hydraulic limestone, equivalent, of the cement beds of Clarke county 2 to 3 ft.
5. White limestone, with darker shades, containing *Spirifer gregaria* in the upper part, *Spirifer acuminatis* and *Nucleocrinus*.....11 to 15 ft.

Due east of Lexington on Nicholas Murphy's land, N. W. Q. S. 2, T. 2, R. 8, the following outcrop is seen on Switzer's Fork: Strata dipping very much to the south west:

1.	Clay soil	4 to 10 ft.
2.	Black slate	5 to 6 ft.
3.	Brown oxide of iron	6 to 8 in.
4.	Hydraulic limestone	4 to 6 ft.
5.	Corniferous limestone, with fossils, *Combophyllum sulcatum* to branch	6 ft.

South of this point, on the line of Clarke county and the head waters of Fourteen-mile creek, on Mr. Barnes' land the cement beds become heavier.

On the farm of W. D. Hutchings, M. D., one and a half miles north of Lexington, on Wood's fork, on the road to Paris, the following section occurs:

1.	Clay soil with very few boulders	5 ft. to 30 ft.
2.	Black shale	5 ft.
3.	Soft magnesian limestone, dark, with fossils, *Atrypa*, etc.	4 ft.
4.	Hydraulic limestone, very light drab and soft	2 ft.
5.	Coral bed, Corniferous, to branch	4 ft.

The formations here dip very much to the southwest. The Hydraulic limestone maintains the same stratigraphical position bordering Jefferson county, but does not have the same lithographical appearance as at the Falls of the Ohio. The manufacture of cement has not yet been attempted in this section, nor is it supposed that it would pay, as the Clarke County Cement Co., have extensive mills and the control of the market, (see report for 1873). We have traced the Hydraulic cement four and a half miles east of Lexington, where it outcrops on the land of Mr. Cromwell, on the head waters of Fourteen Mile creek. This rock is only accessible to quarry in Scott county, where it outcrops on the streams. At Lexington and east and north of that place to Wood's fork, it is superimposed by thick beds of black shale.

No. 5 of the above section, on the land of W. P. Hutchings, M. D., makes excellent lime. The only limestone outcrops are in the eastern and northeastern part of the county, the Knob measures in the southern and southwestern, and black slate in the western and northwestern.

A section on the west side of the town of Lexington shows the following strata:

1.	Ash-colored clay.....	2 ft. to 15 ft.
2.	Black slate with fossils, to slate branch.....	40 ft.
3.	Hard gray limestone with fossils.....	2 ft. 6 in.
4.	Two grades of cement stone 1st light color, 2 ft 6 in., darker	3 ft. 6 in.
5.	Blue shaly crinoidal and coralline limestone, with *Combophyllum sulcatum* and other fossils.....	2 ft.

The Corniferous Limestone, which has an extensive outcrop on Fourteen-mile creek in Clarke county, and is so largely exposed about the Ohio Falls, is, perhaps, the best fossil coral bed known, and has its representative in the eastern part of this county, where the streams have cut low enough to reach it.

A good outcrop of this formation is to be seen one-half mile north of Lexington, on the land of E. G. English:

1.	Clay soil.....	3 to 12 ft.
2.	Black Slate.....	4 to 7 ft.
3.	Oxide of iron.....	6 in.
4.	A light gray shaly limestone with an abundance of fossils, *Spirifer gregaria*, *S. acuminatus* corals, etc.....	4 ft.

5.	Limestone, darker shade, with fossils.....	8 ft.	
6.	Corniferous limestone, very white, with an abundance of characteristic fossils, makes good lime.	6 ft.	

Section on Town Branch, below the Vernon depot, at the *salt well* bore, sunk many years ago:

1.	Clay soil.....10 to 16 ft.		
2.	Black Slate..... 4 to 10 ft.		
3.	Oxide of iron.....		6 in.
4.	Very hard blue limestone, with fossils.....	2 ft.	6 in.
5.	Hydraulic cement, without cleaveage.....	3 ft.	6 in.
6.	Light brown limestone, with fossils, *Spirifer gregaria*	2 ft.	6 in.
7.	Gray limestone, with fossils, makes lime.....	2 ft.	
8.	A very hard blue limestone with abundance of fossils	3 ft.	6 in.
9.	A coarse grained shaly limestone, with fossil corals and bryozoa.....	2 ft.	6 in.
10.	White limestone, with Corniferous fossils.....	6 ft.	

The lowest rocks in this county are one and a half to two miles north of Lexington, where Wood's fork has cut down four to ten feet into the Niagara limestone. At the railroad crossing of this stream the stone for the construction of the large, substantial and durable, arched viaduct was obtained. Wood's fork is one of the large tributaries of Big creek. At the Louisville Branch railroad crossing, it flows over the

Niagara at the Jeffersonville, Madison and Indianapolis crossing. Big creek is at the summit of the black slate.

The most abundant crinoidea found in the limestone beds capping the hydraulic at the Falls of the Ohio and in Clarke county along Silver creek, and on Beargrass, Kentucky, are:

Anchyrocrinus spinosus, Hall.
Actinocrinus kentuckensis, Shumard.
Elentherocrinus cassedayi, Y. & S.
Cyathocrinus sculptiles, Lyon.
Dolactocrinus, (nov. sp.)
Megistocrinus abnormis, Lyon.
M. rugosus, Lyon and Casseday.

Of the Mollusca are found:

Atrypa reticularis, Lyon.
Cryptonella leos, Hall.
Orthis livia, Billings.
Pentamerilla arata, Hall.
Platyostoma lineata, Hall.
Rhynconella tethys, Billings.
Terebratula harmonia, Hall.
Trematopora hirsuta, Hall.

In the Niagara, at Utica, Clarke county, Crinoidea:

Caryocrinus ornatus, Say.
Eucalyptocrinus cœlarus, Hall.
Melocrinus obconicus, Troost.
Lecanocrinus, (nov. sp.)

In the same rocks on the opposite side of the river:

Actinocrinus meekii, Lyon.
Saccocrinus christii, Hall.
Hapleocrinus maximus, Troost.

Pentremites reinwardtii, Troost.
Lingula subspatulata M. &. W.
Orthis livia. Billings.
Strophomena rhomboidalis, Wahl.
Strophodonta inequistriata, Conrad.
Strophodonta hemispherica, Hall.
Strophodonta perplana, Conrad.
Chonetes acutiradiata, Hall.
Chonetes yandellana, Hall.
Productella subaculeata, var. *cataracta.*
Spirifer acuminata, Conrad.
Spirifer arctisegmentus, Hall; *Spirifer duodenaria?* Hall.
Spirifer euruteines, Owen; *Spirifer fimbriata*, Conrad.
Spirifer gregaria, Clapp; *Spirifer medialis*, Hall.
Spirifer owenii, Hall; *Spirifer raricosta*, Conrad; *S. undulata.*
Spirifer segmenta, Hall; *Spirifer varicosa*, Conrad; *Cyrtina crassa* Hall; *Cyrtina hamiltonensis*, Hall.
Trematospira hirsuta, Hall; *Nucleospira concinna*, Hall.
Athyris spiriferoides, Eaton; *Athyris vittata*, Hall.
Meristella (*Pentagonia*) *unisulcata*, Conrad.
Atrypa reticularis Lin. Atrypa *aspera*, Schlotheim.

ECONOMICAL GEOLOGY.

The agricultural interests of this county appear to be prosperous, and the farmers the past season, have been favored with good crops, which can not be said of all other sections of the State. Agriculture is the chief source of wealth, and for that reason it should receive due attention. Much of the lands of this county would be improved by lime. Every one has noticed that where limestone is the prevailing rock the crops are generally good, especially wheat.

The water power of this county is very limited. The streams, in a general way, have fall enough, but of late years, from the destruction of the forests, or some other cause, the water supply is very limited, for mill purposes.

In the southern, south and southwestern part of the county, the sandstone of the Knobs is resorted to for building purposes. Where the ferruginous limestone capping the Black slate is to be had, this is also used, but the principal limestone beds are in the eastern part of the county, and while some of the beds are suitable for building, no extensive stone quarries are worked in the county. The gravel and sand from the boulder drift and the Black Slate are the principal material used for mending roads. The latter material makes a better road to drive on, and is more durable than limestone.

Iron ore is extensively exposed in the region of Vienna and Finley township by the weathering away of the Knob shales. It can be collected in all the ravines and along the streams with very little trouble; transportation being the principal item of cost. The ore is a continuation of the beds of Clarke and Floyd counties. It was analyzed by Prof. E. T. Cox and reported in the survey of last year under the head of "Manganiferous iron stone" or "Knob iron ore." The analyses of ten different bands show that it contains from 26.41 to 31.51 per cent. of iron, with from 5 to 7 per cent of manganese. The latter metal is considered a valuable addition to the ore. Two and three-quarter tons of the ore will yield a ton of pig iron. Samples have been sent from Scott county to the State Cabinet. Samples of the conglomerate, which is somewhat abundant on Big Ox, have also been forwarded.

TIMBER.

In former days this county was heavily timbered, and various sections afforded all the varieties of merchantable

lumber. The principal use made of timber at this time is to cut it up into coopers' stock. Quite a number of mills are engaged in cutting staves for "tight work," coal oil barrels and pork barrels, and for "slack work," cement and flour barrels. Wilson, Jones & Co., two miles west of Austin, cut annually 700,000 slack barrel staves, using a variety of timber, sugar, beech, oaks, etc. Mr. Gibson's "bucking" machine at Austin cuts 500,000 white oak staves exclusively for oil and pork barrels, and pays $18.00 per thousand for sound staves. J. H. McFadden cuts from 700,000 to 800,000 staves, and manufactures annually in Jeffersonville 40,000 to 50,000 barrels. Montgomery & Foster's mill at Lexington cuts 50,000 set of heading for slack work, per year.

SALT.

Several saline springs occur in the Corniferous, east of Lexington, at which salt was manufactured in early days. A spring of very salt water is found on the Lower Fork (creek) one-half mile above the Louisville Branch Depot, and two bores have been sunk in the bed of the stream to a depth of two or three hundred feet, but without an increased flow of water. A bore sunk on Switzer Fork, east of town, to the depth of several hundred feet, affords a quantity of gas (carbureted hydrogen) which may be ignited by a match.

ANTIQUITIES.

There are no very large mounds found in this county. Yet the usual amount of Indian or Mound-builders' relics are found in various localities, and occasional bone beds or kitchen heaps are met with. More evidences of a pre-historic race have been found on the larger streams.

CONCLUSION.

My thanks are returned to the citizens of Scott county for courtesy and aid, and to the following persons for special favors:

James Powers, P. M., H. D. Hutchings, M. D., T. Jordon, M. D., G. W. Barr, C. R. Hardy of Lexington; J. H. J. Lierp, Scottsburg; John S. Swope, E. Swope, Lorenzo Dow Whitson, Vienna; Daniel Blocher, Jesse D. B. Blotcher, M. D. Holman; John Freedly, M. Hoover, Wooster; Jos. Van Buskirk, Thomas Hughbanks, Austin; L. F. Collings, Wm. Richie, W. S. Applegate, of Vienna and Findley township.

JEFFERSON COUNTY.

BY W. W. BORDEN.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

STREAMS.

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

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

GEOLOGICAL FORMATIONS.

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

CONNECTED SECTION OF JEFFERSON COUNTY, INDIANA.

Quaternary System.

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

DEVONIAN AGE. *Hamilton Period.*

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

UPPER SILURIAN AGE.

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

LOWER SILURIAN AGE.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

PALEOZOIC GEOLOGY.

Devonian Age, Hamilton Period.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

1. Soil.....

DEVONIAN.

2. New Albany Black Shale..... 0 ft. to 5 ft.
3. Very dark gray stratified limestone12 ft.
4. Corniferous limestone.....20 ft.

NIAGARA.

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

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

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

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

Bed of Neal's creek .....

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

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

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

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

NIAGARA.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

NIAGARA.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

The next well-marked and distinct formation is the

UPPER SILURIAN.

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

The Clinton formation, noticed in the survey of 1873,

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

FOSSILS OF THE CLINTON.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

NIAGARA.

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

CLINTON.

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

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

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

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

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

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

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

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

UPPER SILURIAN AGE.

Niagara Epoch.

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

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

CLINTON EPOCH.

6. Very dark gray and hard limestone in strata of 16 to 22 inches..... Clinton fossils.

7. Light brown sandstone, of various shades, in varying strata from 2 feet to 4 feet 3 in. containing iron in some parts and producing all the water falls on the eastern border.....30 ft. Cincinnati fossils.

LOWER SILURIAN AGE—TRENTON PERIOD. CINCINNATI EPOCH.

Tetradium fibratum horizon..... 319 ft.

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

Tetradium fibratum.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

PORK PACKING.

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

COOPERS.

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

FLOUR MILLS.

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

SADDLE-TREE MANUFACTORY.

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

SCHOOLS.

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

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

HANOVER COLLEGE.

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

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

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

AGRICULTURE.

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

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

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

CLAY.

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

WATER POWER.

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

ROAD MATERIALS.

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

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

MINERAL SPRINGS.

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

STONE.

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

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

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

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

ELEVATION AT OTHER POINTS ABOVE MADISON.

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

Levels of water works at Madison:

Top of shut off in supply pipe	38 ft.
Top of dry well	47 ft.
Top of valves of pump above low water	21 $\frac{8}{100}$ ft.
Top of plug corner of Ohio and Ferry street	45 ft,
Top of plug corner of Ferry street and Lawrenceburg road	92½ ft.
Top of plug corner of Ferry and Second street	89½ ft.
Top of reservoir	210½ ft.
Top of reservoir above Lawrenceburg road and Ferry street	94 ft.

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

FRUIT.

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

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

GRAPES.

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

BEE CULTURE.

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

FARM CROPS

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

CONCLUSION.

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

To W. W. BORDEN, ESQ.,

Assistant Geologist, Geological Survey of Indiana:

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

Lingula melia (?) Hall, from Lebanon, Ky.
Lingula spatula, Hall, from Lebanon, Ky.
Discina minuta (?) Hall, from Lebanon, Ky.
Discina (*Trematis?*) *truncata*, Hall, from Lebanon, Ky.
Chonetes lepida, Hall, from Lexington, Scott county, Ind.
Leiorhynchus limitaris, Vanux. from Lexington, Scott county, Ind.
Leiorhynchus quadricosta, Hall, from, Lexington, Scott county, Ind.
Cardiopsis, sp.? from Lexington, Scott county, Ind.
Tentaculites fissurella, Hall, from Lexington, Scott county, Ind.

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

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

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

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

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

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

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

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

LEIORHYNCHUS QUADRICOSTATA Hall Pal. N. Y. Vol.

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

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

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

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

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

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

Lingula spatula, Discina [Trematis,] truncata, Leiorhynchus quadricosta. } peculiar to the Genesse slate.

Leiorhynchus limitaris, peculiar to the Marcellus shales.

Chonetes lepida, Tentaculites fissurella. } Common to the entire Hamilton group.

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

Yours very truly,

R. P. WHITFIELD.

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

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

LOWER SILURIAN AT MADISON.

TRILOBITES.

Asaphus gigas, Calymene senaria, Dalmanites earleyii, Phacops gallicephalus.

ORTHIS.

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

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

Atrypa cuspidata.

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

S. nutans, S. planoconvexa, S. planumbona, S. plicata, S. filitexta, S. sulcata, S. rhomboidalis.

Rhynchonella capax, R. dentata.

Zygospira modesta, Z. headii.

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

Avicula insueta, A. demissa.

Modiolopsis modiolaris.

Leptæna sericea, L. transversalis?

Streptelasma corniculum, S. parvulum.

Cyrtoceras lamellatum.

UNIVALVES.

Murchisonia bicincta, M. bellacincta.

Cyclonema bilix, Cyclora minuta.

Pleurotomaria tropidophora.

Cyrtolites ornatus.

Orthoceras junceum, O. bilineatum, O, spinale.

Ormoceras tenuifilum.

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

Monticulipora dalei.

Stenopora fibrosa, Stellipora antheloides.

Tetradium fibratum.

Favistella stellata.

Tentaculites flexuosa.

PARASITIC CORALS.

Stenopora petropolitana.
Aulopora arachnoidea.
Ortonia minuta.
Protorea vetusta.

ENCRINITES.

Heterocrinus subcrassus.
Graptolithus mucronatus.

PLANTÆ.

Butrothephis gracilis, B. succulosus.

UPPER SILURIAN FOSSILS FOUND AT MADISON.

CLINTON ROCK.

Zaphrentis bilateralis.
Fenestella prisca.
Cyclonema cancellata.
Atrypa reticularis.
Illœnus insignis.
Dalmanites, two or three varieties.
Cariocrinus ornatus,
Orthis biforata,
Strophomena rugosa,
Leptœna sericeæ,
Rhynconella neglecta,
Orthoceras, several varieties,
Stromatopora concentrica,
Hadrophyllum orbignyii ?
Platyostoma niagarensis,
Chœtetes, several varieties undetermined.

FOSSILS IN THE CLIFF ROCK.

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

FOSSILS FROM THE WHITE LIMESTONE WHICH OVERLIES THE CLIFF ROCK.

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

FOSSILS FROM THE UPPER NIAGARA.

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

DEVONIAN FOSSILS

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

Spirifer arenosus, S. acuminata, S. mucronatus, S. gregarius.
Conocardium trigonale, C. ohioense,
Nucleocrinus vermeuillii,
Platyceras attenuatum,
Platyceras, undetermined,

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

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

THE SISCO OF LAKE TIPPECANOE

AND ITS

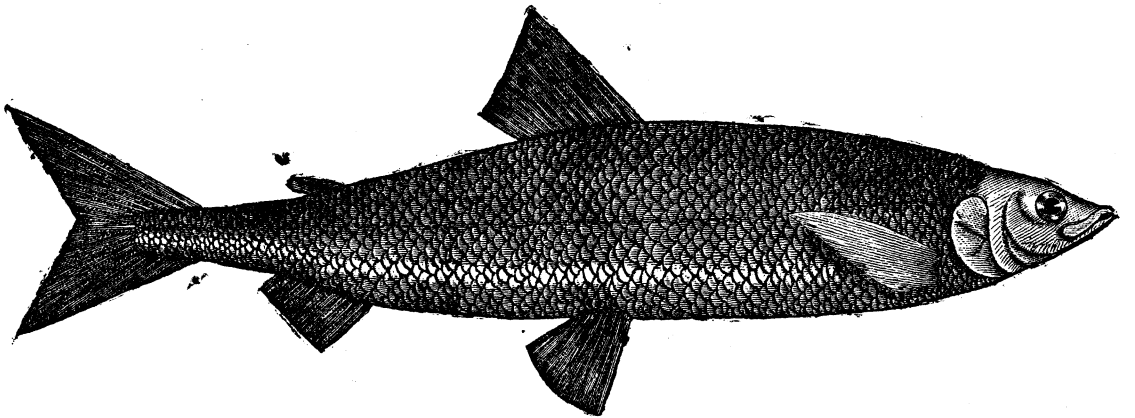
RELATIVES.

BY PROF. DAVID S. JORDAN, M. D.

Some time last winter, a collection of deep water "Siscoes," from Lake Tippecanoe, Kosicusko county, Indiana, was sent to Prof. Cox, by Hon. J. H. Carpenter of Warsaw. These fishes, Prof. Cox turned over to me, with the request that I should examine them and prepare an account of their characters and relationships, as considerable interest is attached to them as well as to other inhabitants of the "bottomless" lakes of Northern Indiana.

They belong to the *Salmonidæ* or Trout family, a group distinguished at once among our fresh water fishes by the presence of the so called "adipose" fin, behind the dorsal fin, in connection with a scaly body, naked head with no barbels about the mouth. The Cat-fishes, (*Siluridæ*,) also have the adipose fin, but they are scaleless, and they have long barbels about the mouth, besides other important differences.

Our fishes belong to the Genus *Argyrosomus* of Agassiz (Greek *arguros*, silvery; *soma*, body,) a group closely allied to the White Fishes, (*Coregonus*,) from which they were separated in 1850, but distinguished by the greater development of the lower jaw, which projects decidedly



ARGYROSOMUS SISCO, JORDAN.

ONE HALF NATURAL SIZE.

AGUS WAITE.

beyond the upper, (except in *A. hoyi*,) the reverse being true of *Coregonus*. The maxillary bones are rather longer, the bones of the mandible rather heavier and the teeth on the intermaxillaries and tongue, although very minute are slightly stronger than in *Coregonus*. Compared with *Coregonus*, the species are small and, (excepting *A. tullibee*,) much more slender in form, approaching the slimness of herrings, hence their popular name of "Lake Herrings," although their resemblance to the Sea Herring, (*Clupea harengus L.*,) is quite superficial. Excepting in the general form and color, the Siscoes and Herrings have little in common.

To the above distinctive characters, Prof. Milner adds: Supra-orbital bones, long and narrow, extending considerably beyond the middle of the orbit, intermaxillaries relatively short. This character and the projection of the lower jaw make the snout more pointed than in Coregonus.

On careful comparison with the other species known to me, I have ventured to describe this Indiana fish as a distinct species under the name of *Argyrosomus sisco* JORDAN (Am. Nat. March 1875, p. 135). The description there given is reproduced below, and I accompany it here with a wood cut, representing the fish reduced one-half. I also give a short account of each of the other species of the genus known in our waters together with their full synonymy.

Genus ARGYROSOMUS. Agassiz. Siscoes.

Salmo (ARTEDI) LINNÆUS and early writers, (*not type*).
Coregonus (ARTEDI) CUVIER and most writers, (*not type*).
Argyrosomus, AGASSIZ, Lake Sup. p. 339, (*type S. clupeiformis*, Mit).

ARGYROSOMUS CLUPEIFORMIS. (Mit.) Ag. The Lake Herring.

SYNONYMY.

Salmo clupeiformis. MITCHILL. Am. Month. Mag. 1818, p. 321.
Coregonus artedi. LESUEUR. Jour. Ac. Sci., Phil., 1818, p. 321. (First respectable description). RICHARDSON. Fauna. Bor. Am. III, p. 203. KIRTLAND. Bost. Jour. Nat. Hist. 1842, p. 231. STORER Synopsis, p. 199 and of some lists, etc.

Coregonus clupeiformis. DEKAY. N. Y. Fauna, Fishes, p. 248. CUVIER & VALENCIENNES. XXI p. 523. AGASSIZ. Lake Sup. p. 339 GUNTHER. Cat. Brit. Mus. VI, p. 198, and of various lists etc.
Salmo (Coregonus) lucidus. RICH, op. cit. p. 207.
Coregonus lucidus. GUNTHER, l. c.
Salmo (Coregonus) harengus. RICH op. cit. p. 210.
Coregonus harengus. DEKAY, op. cit., GUNTHER op cit. p. 199.
Coregonus clupeoides. GUNTHER, l. c. (slip of pen for *clupeiformis*).
Coregonus albus. AGASSIZ op. cit. (not of LeSueur).
Argyrosomus clupeiformis. AGASSIZ. HOLMES Maine Ag. Rep. 1862. JORDAN. Am. Nat., March, 1875. MILNER. Rep. Fish Com., 1872-3, (published 1875) and of other recent writers.

This species, the common "Lake Herring" or "Shad-Salmon," abounds in all of the great lakes and in all bodies of clear water tributary to them. I am not aware that it occurs in the Mississippi valley. Unlike most of the others it is a shallow-water species and may also be generally distinguished by its relatively larger size and looser scales. This fish varies much in different waters and the characters assumed to distinguish *A. harengus, A. lucidus,* etc., seem to be of little value. The specific name (*clupeiformis,* herring-shaped,) has been already alluded to.

ARGYROSOMUS SISCO. JORDAN. The Sisco of Lake Tippecanoe.

SYNONYMY.

Argyrosomus sisco. JORDAN. Am. Nat. March, 1875, p. 135.

DESCRIPTION.

Form regular, spindle-shaped, compressed, slightly elevated at the beginning of the dorsal fin; general outline not very different from others in the genus.

The greatest depth of the body is contained 4 1-10 times (4 1-4 in males, 4 1-2 in *A. hoyi*), in length from tip of snout to the end of the scales at base of caudal. The thickness of the body is about half its depth. The head is moderate, pointed, compressed and depressed. The skull is flattish above, with a longitudinal ridge. The interorbital space is slightly wider than the eye. The length of the head is less than

the hight of the body (nearly equal in males), and is contained 4 1-2 times (4 1-3 to 5; 4 in *A. hoyi*) in length of body exclusive of caudal. The eyes are large and circular, and their diameter is contained 3 3-5 (3 1-2 to 3 3-4; 3 1-2 in *A. hoyi*) times in the length of the side of the head. The nostrils are large, nearly midway between eye and tip of snout, and on the upper surface of the head.

The opening of the mouth is rather small and quadrangular. The lower jaw is longer than the upper, rather less so than in *A. clupeiformis*, very much more so than in *A. hoyi*, which is almost Coregonus-like in this respect. A slight elevation at the tip of the lower jaw, suggesting the "nail" on the bill of ducks, overlaps and fits into a slight emargination at the end of the upper jaw. Margins of lower jaw with slight roughnesses representing teeth. Intermaxillaries with minute asperities. Tongue provided with minute teeth which, however, are readily evident.

Maxillaries rather strong, weaker than in *A. hoyi*, contained 3 1-3 (2 3-4 in *A. hoyi*) times inside of head, not reaching a vertical line through the centre of the eye.

Length of mandible much more than least depth of tail, 2 1-8 (2 in *A. hoyi*) times in head. General character of opercular bones, branchial openings and branchiostegals as in other species.

Distance from occiput to tip of snout contained 2 1-3 times (1 7-8 in *A. hoyi*) in distance from occiput to beginning of dorsal. Depth of head at occiput 2-3 the length of the side of head.

The scales are relatively smaller than in most of the other species, the lateral line having 84 developed scales (81 to 86; 75 in *A. hoyi*, 73 in a specimen of *A. clupeiformis* 80 in *A. nigripennis*,) besides several small ones at the base of the caudal, which form a concave margin somewhat parallel with the fork of the fin, as in other species.

The scales, though thin, are quite firm, rather less so than in *A. hoyi*, very much more so than in the "Lake Herring."

The lateral line is very evident, nearly straight, and rather nearer the back than belly. There are eight series of scales between the lateral line and the ventrals.

The radial formula is D. II, 9 or 10, P. 15, V. 12, A. I, 12.

The dorsal fin begins in front of the ventrals at a point about equidistant between the front margin of the eye and the front rays of caudal. It is short and rather high. Its greatest hight is a little more than 2-3 the length of the head. Its length is 2-3 of its greatest hight. Its longest ray is a little more than 3 times the length of the shortest, thus giving the fin a different form from that of *A. hoyi*, in which the longest ray of the dorsal is nearly 4 times the length of the shortest. The adipose fin is rather slender and reaches slightly beyond the termination of the anal.

The pectorals are rather long and pointed, about as long as the ventrals and of course not reaching nearly to them.

The ventrals are rather large, more than 2-3 the length of the head, falling considerably short of vent. The accessory scale at their base is rather short and triangular, less than half the length of the fin. The depth of the body at the vent is contained 5 3-4 (6 3-4 in *A. hoyi*) times in the length of the body.

The caudal fin is deeply forked, its lobes are long and pointed, but in all my specimens more or less mutilated. The distance from the vent to the rudimentary caudal rays is contained 4 3-5 (4 1-2 in *A. hoyi*) in the length of the fish.

The color, (from fresh specimens,) deep steel-blue above becoming gradually paler to below the lateral line, where it changes to silvery. The arrangement of the scales gives an appearance of longitudinal lines which are conspicuous in certain lights.

All the scales, except those of the belly, are finely dotted with black, except on their free margins, which being transparent, show the dots on the scales below.

Vertical fins and tips of paired fins also thickly punctate,

as well as the skin of the head, particularly above and on the maxillaries and suborbitals.

These black dots seem to be of some importance as they occur in both Wisconsin and Indiana specimens. They are not noticeable on *A. hoyi*, excepting on the head. The latter is a more brilliantly colored fish, its scales having a peculiar rich silvery lustre, wanting in the Sisco.

Average length of specimens examined, 9 1-2 inches, including the caudal fin, being thus larger than *A. hoyi*, which rarely exceeds 7. The largest specimen of the Sisco seen measures 10 1-2 inches. Larger individuals sometimes occur. Mr. Carpenter writes that "occasionally one is caught weighing 1 1-2 to 2 pounds, but it is very unusual to find them so large."

Although not described till lately this fish has been for some time known to naturalists. Besides Lake Tippecanoe, it occurs in Geneva Lake, in Walworth county, Wisconsin, and in Lake Mendota, Dane county, (probably introduced, from Geneva Lake, *Milner*). It should be noticed that these lakes belong to different water systems, Geneva Lake being drained by Fox river, a tributary of the Illinois, Lake Mendota, by Catfish river, a branch of Rock river, while Lake Tippecanoe is one of the sources of Tippecanoe river which flows into the Wabash. I have not heard of these fishes in any water flowing into Lake Michigan. In Lakes Winnebago and Buttes des Morts, the name "Sisco" or "Cisco," (of Indian origin, allied to Siscowet?) is transferred to the common white bass of the Lakes (*Roccus chrysops*, Gill).

Types—Several specimens male and female, (the latter less elongated) taken in the spawning season at Lake Tippecanoe, about November 25, 1874.

The single specimen of the Wisconsin Sisco now in my possession, agrees in the main with the above, but it is a slimmer fish (perhaps owing to sex or season), the depth being contained 5 times in the length of the body, the head 4 2-3 and the eye four times in the head. The maxillary is longer,

2 7-8 in length of head, the depth at the vent 6 3-4 in the length of the body, and the distance from vent to base of caudal only 4 times. The scales are obviously larger, there being but 77 in the course of the lateral line. To how much weight these differences are entitled can only be told by a comparison of a number of specimens.

Concerning the habits of the Indiana Sisco we have the following from Judge Carpenter:

"Some years ago, probably five, these fish were discovered on the north side of Tippecanoe Lake by Isaac Johnson, and at each return of their spawning season, which is the last of November, they have reappeared in large numbers. They are not seen at any other season of the year, keeping themselves in the deep water of the lakes. The general opinion is that they will not bite at a hook, but Mr. Johnson says that he has on one or two occasions caught them with a hook. To my knowledge they have never been found in but two of our lakes, Tippecanoe and Barber's which are both large lakes and close together, as will be seen by reference to the map.

"The spawning season lasts about two weeks and they come in myriads into the streams which enter the lakes. There are large numbers of persons who are engaged night and day taking them with small dip nets. They are caught in quantities that would surprise you, could you witness it. Those who live in the neighborhood put up large quantities of them, they being the only fish caught in the lakes that will bear salting. Some gentlemen who have been fishing to-day (Dec. 8) inform me that the run is abating and that in a few days the fishes will have taken their departure for the deep water of the lakes and will be seen no more until next November."

As far as I can learn, the habits of the Wisconsin Sisco are similar, but they seem to be much less abundant. Fishermen say that specimens were once sent from Geneva to Prof. Agassiz, who pronounced them new to science and extremely interesting. Specimens procured for me last year by Prof. H. E. Copeland, cost a dollar apiece

of the fishermen, which shows the high value attached to to these fishes, as *A. clupeiformis* when taken from the nets is not worth more than ten cents a dozen.

Argyrosomus sisco is most nearly related to *A. clupeiformis*, and perhaps it may ultimately be considered as a variety of that species, modified and improved by long residence in the small lakes, perhaps since the time, (if ever,) when Lake Michigan extended over this region.

A parallel case is that of *Coregonus otsego*, DeWitt Clinton, the noted white fish of Otsego Lake, which is said to differ from the common white fish, (*Coregonus albus* Le Sueur,) in much the same way.

ARGYROSOMUS NIGRIPINNIS, Gill. The Black-fin.

SYNONYMY.

Argyrosomus nigripinnis. GILL MSS., HOY. Trans., Wisc., Acad., Sc. 1872, p. 100. (Name only.) JORDAN. Am. Nat. March, 1875, p. 135. MILNER Rep. Fish Com., 1872-3. (First description.)

A large, magnificent fish of an average weight of 1¼ pounds and a length of 16 inches. It may be known at once from the others by its larger black fins, its stouter form and its greater size. Thus far it has been found only in Lake Michigan and it is especially abundant in Grand Traverse Bay. "It is never caught in less than 60 fathoms and not in large numbers, till you reach a depth of 70 fathoms."—(Hoy).

ARGYROSOMUS HOYI. Gill. The Sisco of Lake Michigan, Deep water Moon-Eye.

SYNONYMY.

Argyrosomus hoyi. GILL MSS. Hoy, Trans. Wis. Acad. 1872, p. 100, (name only). JORDAN, Am. Nat. March, 1875, (diagnosis), MILNER, Rep. Fish Com. 1872-3, (description).

This beautiful little fish is noticeable for its silvery brightness, the scales having a lustre similar to that of the common Moon Eye (*Hyodon tergisus*, LeSueur). It is one of the smallest of the *Salmonidæ*, rarely exceeding 7 inches in length and not reaching the weight of half a pound. It is found in the deep waters of Lake Michigan and in Lake Superior (Milner) and I believe also in some of the inland

lakes of Michigan. In a fine specimen sent me by Dr. Hoy, who discovered this species and the preceding, the upper jaw is slightly but distinctly longer than the lower, a charrcter unusual in this genus. In fact the prolongation of the lower jaw is usually considered the principal generic character of *Argyrosomus*. This peculiarity is not mentioned in Milner's description, his specimen being perhaps not perfect in this respect. Dr. Hoy writes: "This little beauty never approaches shoal water where *A. clupeiformis* is only found. About 30 or 40 fathoms is as near shore as it has ever been captured here." (Racine, Wis).

ARGYROSOMUS TULLIBEE, (Richardson) Agassiz. The Tullibee.

SYNONYMY.

Salmo (*Coregonus*) *tullibee*. RICH. F. B. A. III, p. 201.
Coregonus tullibee
GUNTHER, op. cit. p. 198, AGASSIZ, L. Sup.

I do not know this species. It was originally described from Arctic America, but Professor Agassiz mentions finding it in Lake Superior. It differs widely from all of the foregoing, the body being much more elevated, the depth being about one-third of the length of the fish. Nothing special is recorded concerning its habits.

SYNOPSIS OF THE GENERA OF FISHES

TO BE LOOKED FOR

IN INDIANA.

BY PROF. DAVID S. JORDAN, M. D.

It is the intention of the author of this paper to publish as soon as sufficient material is procured, a complete account of the fishes of this State. In order to aid the observations of others, I have here prepared a simple artificial "Key," based on the most obvious external character, by the use of which, it is hoped, little difficulty will be found in referring any one of our fishes to its proper place in the system of classification.

My materials thus far, have been my own collections, made the past autumn in White River; my collections the past year in Wisconsin and Lake Michigan; the valuable collections of Dr. John Sloan, in the Ohio River and its tributaries about New Albany; a few specimens from the southern part of the State, in the State Cabinet and many specimens from the Wabash River, procured of fishermen.

It is hoped that the publication of this synopsis will encourage observers in different parts of the State, to identify the fishes of their localities and to send lists of the same to Prof. Cox, or to me. We also desire specimens of any unusual forms, and we will be very happy to examine and identify such specimens and as far as possible to answer any questions concerning them.

But few technical terms have been used in the following synopsis, and those few are either defined where they occur, or are explained in the succeeding paragraphs.

HOW TO USE THE KEY.

Let us suppose that we have caught a certain species of fish, about a foot long, which abounds in almost every stream in this country and which is known, like some thirty or forty others, by the general name of sucker.

We begin with "A." "*Tail homocercal.*" The two lobes of the forked tail are about alike, and following the directions given at the end of the line, we pass to "B." Our fish is scaly and we may note, that the scales are "Cycloid," (smooth and showing concentric rings) not "Ctenoid," (rough edged). We are sent to "C." There is no barbel about the mouth nor does our fish agree with the characters ascribed to "Lota," so we pass to "D." It is not one of the blind cave-fishes. So we go to "E."

Here we find that the ventral fins are abdominal (under the abdomen) and that the dorsal fin is single, composed of soft rays only, without any spines. Here we desire to know the names of the fins: On the back is the "dorsal," sometimes divided into two, in that case a first and second dorsal. Sometimes behind the dorsal we have a fleshy expansion, (in trout and cat fishes). Although this is not a true fin, it is known as the adipose dorsal.

Immediately behind the gill covers (opercles) we find the pectoral fins, one on each side, representing the arms or fore limbs, and below or behind these are the ventral fins, likewise paired, and representing the hind limbs. Behind the ventrals is the anal fin and at the end of the tail, the caudal fin.

Each fin is made up of "rays" which when more or less stiff and unbranched, are termed "spines," and when weaker and branching or jointed "soft rays." The number of rays is often of some importance and in counting them pains should be taken not to overlook any of the

smaller ones. The hindmost in the dorsal and anal is usually split to the base and should be counted as one.

From E, we go for some distance to G^2 thence to $L.^2$ There are no teeth in the mouth, but deep in the throat below the gills we will find on dissection two curious arched bones, in these fishes covered with small teeth. These are the pharyngeal teeth, very important in the study of these fishes, but here neglected because not easily got at. We now pass in succession to M^2, N^2, O^2, P^2, U^2. Here we find that our fish has a "lateral line"—a row of modified scales bearing mucous tubes, running along on each side of the fish. Often it becomes necessary to count these scales, and often their number affords specific characters of value.

Under V^2 the first set of characters best suits our fish, and we are sent to the genus, CATOSTOMUS No. 44. We find on turning to the second part, 44, CATOSTOMUS. LeSueur, White Suckers. Catostomus which means in Greek "low mouth," the force of which term we see readily, LeSueur, the name of the naturalist who introduced that term and White Sucker their most common general designation. We also learn that our fish belongs to the family of Catostomidæ or Suckers, and we find a short account of the characters of that curious family. Below are the common vernacular names of the species, the localities from which they are recorded in Indiana, and finally the scientific name of the species most likely to occur here, viz: *Catostomus teres*, the common Sucker of the Eastern States.

ARTIFICIAL KEY TO GENERA.

A. Tail *homocercal*, i. e., upper and lower halves symmetrical, the backbone terminating in the middle of the tail, (as in most fishes.) B.

A. Tail *heterocercal*, i. e., unsymmetrical, the backbone running into the upper lobe, (as in sturgeons, etc.) A^4.

B. Body with scales large or small. C.

B. Body entirely scaleless. X.

C. A barbel (fleshy filament,) at the tip of the lower jaw, dorsal fins two; second very long, (i. e., many rayed,) scales very small. LOTA. 78.

C. No barbel at tip of lower jaw. D.

D. Eyes well developed. E.

D. Eyes concealed, (colorless cave-fishes. T[3].

E. Ventral fins thoracic, (i. e., under the pectoral fins,) first 3 or more rays of dorsal, or whole first dorsal of simple, usually stiff spines. F.

E. Ventral fins abdominal, (i. e., decidedly behind pectorals,) dorsals two, first short and weak, of 4 or 5 flexible spines; body very slender, translucent, a bright silvery band along the sides. LABIDESTHES. 28.

E. Ventral fins abdominal; rayed dorsal single, sometimes preceded by one or two spines. G[2].

E. Ventral fins entirely wanting. V[3].

F. No teeth on the vomer, (front part of roof of mouth); head scaly; anal fin with two spines, the second of which is very strong. HAPLOIDONOTUS. 21.

F. Vomer with teeth (or if not, anal spines weak). G.

G. With two distinct dorsal fins, or one deeply divided. H.

G. A single dorsal fin not deeply divided, spinous part usually rather longest; soft part highest. S.

H. Anal with one or two spines, sometimes slender, appearing like soft rays, (3 in Microperca?) I.

H. Anal with three stout spines. Q.

I. Jaws with stout canine teeth, besides the ordinary small teeth; body elongated, 1 to 2½ feet long. LUCIOPERCA. 2.

I. Jaws with bands of small even teeth. J.

J. No lateral line; body compressed; dorsal with 6 or 7 spines; greenish with dark markings; smallest of all our fresh water fishes; length less than 2 inches.
MICROPERCA. 13.

J. Lateral line present, wanting or indistinct behind. K.

J. Lateral line present, obvious throughout its course. M,

K. Dorsals entirely separate, dorsal spines 8 to 10, sides often with red dots, lateral line arched over pectorals; small compressed species. HOLOLEPIS. 11.

K. Dorsals slightly connected. L.

L. Spinous dorsal elevated, scarcely lower than soft part; about 10 dorsal spines; colors gaudy, green, blue, orange, etc.
ASTATICHTHYS. 9.

L. Spinous dorsal low, little more than half as high as soft part, the spines in adult (males ?) ending in little fleshy knobs, in others pointed; color plain or with black bars or lines of dots. CATONOTUS. 10.

M. Body exceedingly slender (depth 6 or more in length,) scales on sides obvious only along lateral line; 10 dorsal spines; very small fishes, translucent, dotted with black.
PLEUROLEPIS. 12.

M. Body stouter, (depth 6 or less in length,) sides scaly throughout. N.

N. Upper jaw decidedly longest; cheeks, etc. scaly; 13 dorsal spines; sides with dark bars; length 4 to 6 inches.
PERCINA. 5.

N. Upper jaw little if any longer than lower. O.

O. No teeth on the vomer; snout blunt; cheeks, etc., scaly; soft dorsal much larger than anal. HYOSTOMA. 8.

O. Teeth on the vomer; body deep; depth less than 4 times in length; dorsal spines, 13; length, 6 inches or more; sides with dark bars. PERCA. 1.

O. Teeth on the vomer; body slender; depth more than 4 times in length; length less than six inches; sides not truly barred. P.

P. Second dorsal not much, if any, larger than anal or than spinous dorsal; belly with a series of caducous plates along the middle line; mouth wide; cheeks bare; sides with a chain of dark blotches; dorsal spines 12 to 15. ETHEOSTOMA. 6.

P. Second dorsal decidedly larger than anal and spinous dorsal; mouth small, sub-inferior; cheeks scaly; colors various, usually tessellated above; one or two dark lines in front of eye. BOLEOSOMA. 7.

Q. General color, dark greenish; mouth large; young usually with the tail black-tipped and one or more dark lines along sides and on cheeks. MICROPTERUS. 14.

Q. General color silvery, with several dark longitudinal stripes. R.

R. Anal with 12 soft says; the third anal spine longest. ROCCUS. 3.

R. Anal with nine soft rays; the second spine stoutest; large scales on opercles. MORONE. 4.

S. Anal with 8 or 9 spines; dorsal with 11 or 12. CENTRARCHUS. 20[2]

S. Anal with 5 or 6 spines; fins mostly barred. T.

S. Anal with 3 spines. V.

T. Soft dorsal moderate with 10 or 12 rays; scales dark at base giving an appearance of dark stripes; eyes large. AMBLOPLITES. 18.

T. Soft dorsal very high of 15 or more rays. U.

U. Dorsal with 6 spines. POMOXYS. 20.

U. Dorsal with 7 or 8 spines; silvery and greenish mottled. HYPERISTIUS. 19.

V. A supernumerary maxillary bone; mouth very large, oblique, much as in the black bass; lower jaw longest; dorsal spines 10. CHÆNOBRYTTUS. 15.

V. Sides with 5 or 6 distinct black vertical bars; no supernumerary maxillary.
MESOGONISTIUS. 15 (2).

V. No supernumerary maxillary bone; mouth moderate; no black bars. W.

W. Opercle ending behind in a long flap, longer than broad, black, usually not tipped with scarlet.
ICHTHELIS. 17.

W. Opercular flap broader than long, black, usually tipped with scarlet. POMOTIS. 16.

X. No barbels about the mouth. Y.

X. With eight fleshy barbels about the mouth, 4 on each jaw. C^2

Y. No ventral fins; body serpent-like; dorsal and anal united around the tail. Z^2

Y. Ventral fins each of a single sharp spine and a rudimentary ray. Y^3.

Y. Ventral fins developed, of three or more rays each. Z.

Z. Head spineless; ventral fins united into a roundish disk. GOBIOSOMA. 25.

Z. Head very large, with two or more spines; eyes close together; pectoral fins large. A^2.

A^2. Ventrals with 5 rays; teeth on the palate; length 3 to 6 inches. POTAMOCOTTUS. 23.

A^2. Ventrals with 4 rays; no palatine teeth; length 2 to 4 inches. B^2

B^2. Dorsals near together; preopercle with 1 to 3 spines.
URANIDEA. 22.

B^2. Dorsals remote; preopercle with 4 needle-like spines. TRIGLOPSIS. 24.

V. A supernumerary maxillary bone; mouth very large, oblique, much as in the black bass; lower jaw longest; dorsal spines 10. CHÆNOBRYTTUS. 15.

V. Sides with 5 or 6 distinct black vertical bars; no supernumerary maxillary.
MESOGONISTIUS. 15 (2).

V. No supernumerary maxillary bone; mouth moderate; no black bars. W.

W. Opercle ending behind in a long flap, longer than broad, black, usually not tipped with scarlet.
ICHTHELIS. 17.

W. Opercular flap broader than long, black, usually tipped with scarlet. POMOTIS. 16.

X. No barbels about the mouth. Y.

X. With eight fleshy barbels about the mouth, 4 on each jaw. C^2

Y. No ventral fins; body serpent-like; dorsal and anal united around the tail. Z^2

Y. Ventral fins each of a single sharp spine and a rudimentary ray. Y^3.

Y. Ventral fins developed, of three or more rays each. Z.

Z. Head spineless; ventral fins united into a roundish disk. GOBIOSOMA. 25.

Z. Head very large, with two or more spines; eyes close together; pectoral fins large. A^2.

A^2. Ventrals with 5 rays; teeth on the palate; length 3 to 6 inches. POTAMOCOTTUS. 23.

A^2. Ventrals with 4 rays; no palatine teeth; length 2 to 4 inches. B^2

B^2. Dorsals near together; preopercle with 1 to 3 spines.
URANIDEA. 22.

B^2. Dorsals remote; preopercle with 4 needle-like spines. TRIGLOPSIS. 24.

C^2. Adipose fin long, keel-like continuous with the rounded caudal. NOTURUS. 75.

C^2 Adipose fin distinct from caudal. D^2.

D^2 Eyes concealed beneath the skin; blind cave fishes, (thus far found only in E. Penn.) GRONIAS. 77.

D^2 Eyes well developed. E^2.

E^2 Dorsal spine short, enveloped in the thick skin; body elongated. HOPLADELUS. 76.

E^2 Dorsal spine well developed, usually serrated behind. F

E^2. Caudal usually rounded; body short and stout; supra occipital bone, (bone running backward from head under the skin,) free behind. AMIURUS. 74.

F^2. Caudal deeply forked; body elongated; supra occipital bone meeting the bone at base of dorsal fin. ICTALURUS. 73.

G^2. With a second (adipose) dorsal. H^2.

G^2. With no adipose dorsal fin. L^2.

H^2. Dorsal fin high, of 20 or more rays, fins marked with blue. THYMALLUS. 37.

H^2. Dorsal of less than 20 rays. I^2.

I^2 Teeth very stout, scales small, imbedded in the skin. SALMO. 36.

I^2 Teeth feeble or wanting. J^2.

J^2 Scales moderate, ctenoid; teeth small but perfect. PERCOPSIS. 40.

J^2 Scales rather large, cycloid; teeth reduced to slight roughnesses. K^2.

K^2. Body high in our species, much compressed; upper jaw decidedly longest. COREGONUS. 38.

K^2. Body slender in our species, somewhat compressed; lower jaw usually longest. ARGYROSOMUS. 39.

L^2. Jaws entirely destitute of teeth. M^2.

L^2 Jaws with teeth, large or small. V^2.

M^2 Belly not serrated. O^2.

M^2. Belly compressed to an edge, with bony serratures; body compressed, silvery. N^2.

N^2. Last ray of dorsal prolonged into a filament; upper jaw longest. DOROSOMA. 42.

N^2. Last ray of dorsal not filamentous; lower jaw longest. ALOSA. 41.

O^2 Dorsal elongated; high in front, of more than 20 rays; lips fleshy, sucker-like; fishes of large size with large scales, (Buffalo fishes). R^2

O^2 Dorsal moderate of less than 20 rays. P^2

P^2 Lips fleshy, sucker-like, forming a rounded mouth when protracted; pharyngeal teeth numerous, small; fishes of moderate, rarely large size, (Suckers). U^2

P^2 Without fleshy lips, mouth usually small but not truly sucker-like; pharyngeal teeth few and rather large; fishes of small size, rarely a foot in length, (Dace and Minnows). Y^3

R^2. First rays of dorsal very long, half the length of the base of the fin or more, mouth small; inferior; back arched. CARPIODES. 49.

R^2. First rays or dorsal moderately long, less than half the length of the base of the fin. S^2

S^2. Dorsal very long, of about 35 rays; anal 8 rayed. far back, the abdomen therefore being unusually long. CYCLEPTUS. 52.

S^2. Dorsal shorter, of about 30 rays; anal of 9 rays or more; eye small; head large. T^2.

T^2. Mouth inferior, protractile downwards. BUBALICHTHYS. 51.

T^2. Mouth nearly terminal, protractile forwards. ICHTHYOBUS. 50.

U^2. No lateral line; body elliptical; color brassy; young with dark bands. MOXOSTOMA. 48.

U^2. Lateral line present. V^2.

V^2. Scales very small on the front part of the body, becoming much larger behind; air bladder in two parts. CATOSTOMUS. 44.

V^2. Scales nearly as large on the front part of the body as on the tail. W.^{2}.

W^2 Length of the head greater than depth of body; head square on the sides, flattish above and concave between the eyes, which are well back and high up; brownish; young with black blotches. HYLOMYZON. 45.

W^2 Length of head less than depth of body, head rounded above, air bladder in three parts. X^2

X^2 Scales silvery or reddish with bright reflections, in several species black at base; lower fins usually red; pharyngeal bones many toothed below, (as usual among suckers.) PTYCHOSTOMUS. 46.

X^2 Pharyngeal bones with but seven teeth each on the lower half, upper half many toothed; scales reddish; lower fins not red, (a single specimen known of this curious genus procured by Prof. Cope, from Wabash River.) PLACOPHARYNX. 47.

Y^2 Native species; dorsal and anal without serrated spine. Z^2

Y^2 Introduced species; dorsal and anal, each with a stout spine which is serrated behind. S^3

Z^2 Upper jaw notably longest. A^3

Z^2 Jaws about even or lower slightly projecting. I^3

A^3 Lower jaw 3-lobed, the middle lobe longest, resembling a projecting tongue; general color dusky. EXOGLOSSUM. 53.

A^3 Lower jaw not 3-lobed. B^3

B^3 Dorsal preceded by a short spine which is connected

by a membrane to the soft rays; snout short and blunt, in the males covered with tubercles in the breeding season. C³

B³ Dorsal without spine, the rudimentary rays in front united to the first developed ray. D³

C³ Lateral line incomplete; head broad, blackish in males. PIMEPHALES. 69.

C³ Lateral line complete. HYBORHYNCHUS. 68.

D³ Intermaxillaries not projectile; skin of lip and forehead continuous; snout long; scales quite small, 60 to 70 in the lateral line; males in spring with bright red band along sides which fades in summer to orange or white. RHINICHTHYS. 57.

D³ Jaws projectile; scales larger. E³

E³ Intestinal canal 8 times length of body, its numerous convolutions entirely surrounding the small air bladder; lips with cartilaginous sheaths; head rather long and narrow; cheeks more or less vertical; eye small, well back and high up; head and whole upper surface of males more or less covered with rather large tubercles in the spring; dorsal and anal with a blackish bar, which is then bordered with bright orange. CAMPOSTOMA. 70.

E³ Intestines not enveloping air bladder. F³.

F³ Suborbital bone, interopercle and base of the lower jaw much dilated, crossed by mucous cavities readily visible externally through the skin; small, silvery fishes. ERICYMBA. 54.

F³ Bones of head without such mucous cavities. G³.

G³ Jaws with sharp cutting edges; upper jaw heavy; intestines much convoluted, 4 times length of body; moderate-sized silvery species. HYBOGNATHUS. 67.

G³ Intestines scarcely longer than body. H³

H³ A minute, but distinct barbel at each angle of the mouth; silvery, a bluish or dusky band along side; head large, tuberculate in spring. CERATICHTHYS. 56.

H² No barbel; rather weak species of small size; silvery or with a plumbeous or dark band along side; head short, not tuberculate. HYBOPSIS. 65.

I³ Anal with 13 rays or more; much compressed; lateral line strongly decurved; silvery with bright reflections. STILBIUS. 62.

I³ Anal with 12 rays or less. J³.

J³ Lateral line incomplete or wanting. K³.

J³ Lateral line complete; (rarely interrupted on the last 5 or 6 scales.) M³.

K³ Scales rather large; lateral line less than 40; small dusky, Hybopsis-like species, HEMITREMIA. 66.

K³ Scales very small; lateral line 70 or more. L³.

L³ Sides with two longitudinal black bands, separated by a silvery interspace; which is crimson in the spring. CHROSOMUS. 59.

L³ Sides with a single band. PHOXINUS. 60

M³ Lateral line with 45 scales or more, males with tubercles in spring. N³.

M³ Lateral line with less than 45 scales. O³.

N³ Scales small; body elongated; compressed; mouth large, oblique; tubercles minute: sides crimson in spring. CLINOSTOMUS. 58.

N³ Scales larger, rather largest behind; tubercles rather large; no distinct crimson on sides or belly; usually a black spot at base of dorsal in front; largest of our native Dace. SEMOTILUS. 55.

O³ Scales large, loosely imbricated, the exposed portion much higher than long; body compressed, silvery, usually bluish above; males with small tubercles on the head in spring; fins in spring rosy or else pure satin-white. HYPSILEPIS. 60.

O³ Scales not specially higher than long; head not tuberculate (except in Ceratichthys.) P³

P³ Origin of dorsal distinctly behind ventrals; anal rather long; body slender and compressed, silvery.
ALBURNELLUS. 63.

P³ Dorsal not behind ventrals; anal rather short. Q³

Q³ Stout species with large heads which are convex and tuberculate in spring; mouth broad, horizontal; scales scarcely silvery. CERATICHTHYS. 56.

Q³ Weak or slender species, with small oblique mouths, and heads not tuberculate. R³

R³ Head short; lower jaw not projecting; sides silvery or more commonly with plumbeous or dark band.
HYBOPSIS. 65.

R³ Elongated; lower jaw slightly projecting; scales silvery. PHOTOGENIS. 64.

S³ Barbels 4; color olivaceous. CYPRINUS. 71.

S³ No barbels; color usually orange.
CARASSIUS. 72.

T³ Ventral fins present. AMBLYOPSIS. 29.

T³ No ventral fins. TYPHLICHTHYS.

U³ Body short; dorsal, anal and caudal distinct.
CHOLOGASTER.

U³ Body serpentiform; dorsal and anal uniting around the tail. ANGUILLA. 79.

V³ Snout much elongated, flattened; head somewhat scaly; jaws armed with strong teeth; size large, (2 to 6 feet long.) ESOX. 35.

V³ Head short, naked; body much compressed; tongue with sharp teeth; scales large, silvery; length 8 to 12 inches. HYODON. 43.

V³ Head moderate, scaly; teeth small; small fishes, (2 to 6 inches long.) W³

W³ Dorsal short, commencing behind the anal; a dark band along side, passing around snout; head flat on top; length about 2 inches. ZYGONECTES. 33.

W^3 Dorsal beginning in front of origin of anal. X^3

X^3 Pale, sides with several dark bars; intermaxillaries forming whole margin of upper jaw; lat. l., about 40.
FUNDULUS. 32.

X^3 Dusky; a broad dark bar at base of caudal; maxillaries forming most of margin of upper jaw; lateral line 35 or less. MELANURA. 34.

Y^3 Dorsal with 4 to 6 free spines in front.
APELTES. 26.

Y^3 Dorsal with 7 or more free spines.
PYGOSTEUS. 27.

Z^2 Mouth with true jaws provided with teeth; fins with rays; (scales present but very small). ANGUILLA. 79.

Z^3 Mouth round, without true jaws; fins without true rays; gill openings 7 rounded apertures in each side. F^4

A^4 Scales cycloid; dorsal many rayed; jaws moderate, with strong teeth; a broad buckler between branches of lower jaw; color dusky, males with a black spot bordered with orange at the base of tail. AMIA. 80.

A^4 Scales ganoid (*i e.*, diamond-shaped, bony enamelled plates;) dorsal few rayed. B^4

A^4 Scaleless or else with bony plates, five rows of which are larger than the others; dorsal short. D^4

B^4 Snout very long; much longer than the rest of head; olivaceous; more or less spotted. LEPIDOSTEUS. 81.

B^4 Snout not longer than rest of head. C^4

C^4 One row of large teeth in upper jaw; snout rather narrow; size moderate. CYLINDROSTEUS. 82.

C^4 Two rows of larger teeth in upper jaw; snout broad; size very large. ATRACTOSTEUS. 83.

D^4 Mouth broad; terminal; with many small teeth; snout forming a leaf-like blade. POLYODON. 84.

D⁴ Mouth small, inferior, toothless, with 4 barbels in front. E⁴

E⁴ Snout very broad, shovel-like.
SCAPHYRHYNCHUS. 86.

E⁴ Snout rather narrow, conic or pointed.
ACIPENSER. 85.

F⁴ Dorsal fins two, distinct; maxillary teeth with two cusp'. PETROMYZON. 87.

F⁴ Dorsal fin continuous; maxillary teeth tricuspid.
ICHTHYOMYZON.

NOTE.

In the list below is given under its appropriate family, the name of each genus, its author and the meaning of the appellation as well as the vernacular name by which the species are known thoughout the country. In most cases, I have indicated the recent synonymy. Thus, under *Roccus*, "> *Labrax Cuvier*," implies that Cuvier included the modern '*Roccus*" in his genus *Labrax* and the mark of inequality indicates that the extent of *Labrax* as understood by Cuvier, is greater than that of *Roccus* as at present understood.

The sign ot equality (=) indicates that the name following it is a synonym, *i e.*, another term for the same group.

Localities from which I have personally examined specimens are indicated by a *.

In most cases I have added the specific names of the leading species or the species most likely to be found in this State. In some large genera (*Ptychostomus*, *Amiurus* etc.,) a full list of species that may occur here could not well be given, as their distribution is very imperfectly known. In many other cases the name which our species should bear is uncertain as many forms described as distinct will on closer comparison be found to be identical with others already known.

Probably a third of the "species" described from our fresh waters are purely nominal. Thus our two species of black bass (*Micropterus*) have been described by more than eighteen different specific names, under more than nine different genera. A recent French author, August Dumeril, has very painfully sub-divided our *Amia calva* into upwards of a dozen "species." Prof. Gill has well said that the state of our knowledge concerning many groups of our fishes is a "disgrace to American Science."

Family I. PERCIDÆ. The Perches.

Body oblong, covered with ctenoid (rough edged) scales. Some or all of opercular bones serrated. Two dorsal fins, the first of stout spines, both well developed. Teeth on jaws and vomer; ventrals under pectorals. Carnivorous fishes, of moderate or large size, mostly in fresh water.

1. PERCA. *Linnæus.* Perches.

(Latin name, from a Greek word meaning "dusky.")

Common Perch, Yellow Perch.

L. Mich.* *P. flavescens.*

2. LUCIOPERCA. *Cuvier.* Pike Perches.

(Latin—Lucius, Pike, Perca, Perch.) = Stizostedion Rafinesque.

Pike Perch, (Books), Yellow Pike and Gray Pike, (Lakes), White Salmon and Black Salmon (Southern States). Dory (Green Bay). Wall-eyed Pike (Lakes). Glass Eye (Lakes). Okaw or Horned Fish (British America). Pickerel (L. Champlain), L. Mich.* Ohio R.* Wabash R.* *L. americana, ? L. grisea.*

3. ROCCUS. *Gill.* Striped Bass.

(Bad Latin for Rock Fish.) ◁ Labrax Cuvier.

White Bass. L. Mich.* *R. chrysops.*

4. MORONE. *Gill.* White Bass.

(Name unexplained.) ◁ Labrax Cuvier.

Short-Striped or Brassy Bass.

Lower Mississippi, (probably not in Indiana.) *M. interrupta.*

Family II. ETHEOSTOMIDÆ. The Darters.

Small fishes of the fresh waters of eastern North America, not found elsewhere, like the Percidæ in most respects, but of much smaller size, and the fins proportionally much larger. The pectoral fins are especially developed, and the jerky swimming of these fishes is accomplished by them, and not as in others by the use of the caudal. These little fishes remain motionless on the bottom unless disturbed, when they dart quickly up stream for a short distance. They may be best caught by dragging the net with the current, (Baird.) Many of them are brilliantly colored.

In the original diagnosis of this group, by Professor Agassiz, (Lake Superior. p. 298,) one of the distinctive characters given is "no air bladder." This statement has been generally copied. Dr. Gunther (Catalogue of fishes, Vol. 1, p. 51,) remarks that the air bladder present in other Percidæ is "in *Pileoma* (*Percina*) and *Boleosoma* absent." In several specimens of *Percina caprodes* which I have receutly examined, I find the air bladder present and of the same form as in *Perca*, *Pomotis* and allied genera, *i. e.* adherent to the walls of the abdominal cavity so that it cannot be taken out whole. In all our Percoid fishes (excepting Lucioperca and possibly others) it appears like a membrane stretched from one side of the cavity to the other above the intestines. In all, especially when punctured or shrunken in spirits, it is very inconspicuous, and it is as obvious in *Percina* as in specimens before me of *Amblopliles* of the same size. Hence the absence of the air bladder cannot distinguish Etheostomoids from Percoids. In fact there is no reason except convenience for keeping the two groups apart.

5. PERCINA. *Haldeman.* Barred Darters.

(Latin—little Perch.) =Pileoma Dekay.

Hog Fish. Johnny. Jack Pike.

L. Mich.,* White R.,* Ohio R.,* etc. *P. caprodes.*

6. ETHEOSTOMA. *Rafinesque.* Black-sided Darters.

(Greek—strainer mouth.) =Diplesion Ord.

Ohio R.,* White R.,* L. Michigan*, *E. blennioides.*

7. BOLEOSOMA. *DeKay.* Tesselated Darters.

(Greek—dart-body).

⊱ Cottogaster, Putnam.
?⊱ Nanostoma, Putnam MSS.
⊱ Arlina & Estrella, Grd.
?⊱ Boleichthys, Girard.
⊱ Hadropterus, Agassiz.

Little Johnnies (Ind.) Tessellated Darter (books), Variegated Darter.

L. Mich.* White R.* Ohio R.,* etc. *B. olmstedi.* *B. variatum.*

8. HYOSTOMA. *Agassiz.* Hog-fish.

(Greek—hog-mouth.)

Eastern and southern streams. I have seen none in this region.

9. ASTATICHTHYS. *Le Vaillant.* Variegated Darters.

(Greek—a fish which never stands still).

= Pœcilosoma, Ag. (preoccupied).
= Pœcilichthys, Ag. (but the original type of *Pœcilichthys* (*Eth. variatum* Kirt.) seems to belong to *Boleosoma*. Hence it becomes necessary to adopt the above name lately proposed by LeVaillant.)

Blue Darter. Blue and Orange Darter. Red bellied Johnny.

White R.* Ohio R.* etc. *A cœruleus* and perhaps others.

10. CATONOTUS. *Agassiz.* Low-backed Darters.

(Greek—low back; low dorsal fin). ▷ Nothonotus, Ag.

L. Mich.* Upper Ohio (Cope) S. Ills. (Putnam). *C. lieolatus. C. flabellatus. C. maculatus.*

11. HOLOLEPIS. *Agassiz.* Little Darters.

(Greek—solid-scale)

L. Mich.* *? H. erochrous.*

12. PLEUROLEPIS. *Agassiz.* Slim Darters.

(Greek—scaly side.)

White R.* Upper Ohio (Cope). *P pellucidus.*

13. MICROPERCA. *Putnam.* Least Darters.

(Greek—small Perch.)

Mich., Wis., Ills. and Ala., (Putnam,) Rock R. Wis.* (Bundy, Struthers). *M. punctulata.*

Family III. ICHTHELIDÆ. The Sun Fishes.

Fresh water fishes, chiefly North American, resembling the Percidæ, but having, mostly, but a single dorsal, and the body usually deeper, and the scales and opercles smoother than in the Percidæ.

14. MICROPTERUS. *Lacepede.* Black Bass.

(Greek—small-fin.) (Huro and Grystes Cuvier,)
(X Centrarchus Cuvier.)
(X Calliurus Raf.)

Large-mouthed Black Bass, Moss Bass, Oswego Bass, Small-mouthed Black Bass, Green Bass.

L. Mich.,* White R.,* Wabash R.,* Ohio R.* (*M. nigricans. M. salmoides.*)

15. CHÆNOBRYTTUS. *Gill.* Wide-mouthed Sun-fish.

(Greek—gaping Sun-fish.) = Calliurus Ag. but not of Raf.

Southern and Western streams. I have seen none from this region.

15(2) MESOGONISTIUS. *Gill.* Barred Sun-fish.

(Greek—middle, angle, sail, *i. e.*, dorsal angled in the middle?) Bryttus and Pomotis of authors.

Dr. Levette informs me that he saw, some years ago, in an aquarium in the southern part of this State, several specimens of a sun-fish, sharply barred with black, after the manner of the salt water *Chætodon*. These fishes were said to have come from a neighboring stream, but the only sun-fish with such markings which is known to me (*Mesogonistius chaetodon* (Baird Gill,) has not, I believe, hitherto been noticed outside of New Jersey.

16. POMOTIS. *Cuvier.* Short-eared Sun-fishes.

(Greek—eared opercle.)

Common Sun-fish, Pond Fish, Sunny, Bream, Ruff Kiver, Pumpkin Seed.

L. Mich.,* White R.,* *P. aureus.*

17. ICHTHELIS. *Rafinesque.* Long-eared Sun-fish.

(Greek—Sun-fish.) = Lepomis, Rafinesque, which name should probably [be adopted.

Sun-fish,* Red Eyes, Eared Pond Fish, etc.

L. Mich.,* White R.,* Ohio R.,* Wabash R.* *? I. auritus, I. nitidus, I. macrochira, I. notatus, etc.*

18. AMPLOPLITES. *Rafinesque.* Rock Bass.

(Greek—blunt-armed.) ◁ Centrarchus Cuvier.

L. Mich.,* Ohio R.,* White R.,* etc.

Rock Bass, Goggle Eye, Red Eye, *A. rupestris.*

19. HYPERISTIUS. *Gill,* Bar Fish.

(Greek—high sail = dorsal fin.) ◁ Pomoxis. Agassiz.

Bar Fish, 6-Spined Bass.

L. Mich.,* Ohio R.,* *H. hexacanthus.*

20. POMOXYS. *Rafinesque.* Crappies.

(Greek—sharp opercle.)

Crappie.

White R.,* and all Western rivers (fishermen). *P. storerius.*

20(2) CENTRARCHUS. *Cuvier.* Many-spined Bass.
(Greek—anal spined.)
Southern, probably not in Indiana. *C. irideus.*

Family IV. SCIÆNIDÆ. The Drum-Fishes.

Mostly salt water fishes, resembling the Percidæ but having the vomer toothless and the bones of the head traversed by mucous cavities. The air bladder is usually much larger than in the Percidæ.

21. HAPLOIDONOTUS. *Rafinesque.* River Sheepshead.
(Greek—simple-back). = Amblodon Raf.
Sheepshead. Grunting Perch. River Drum. White Perch. (Ohio R.) Corbeau (Frenchmen). Campbellite (Posey Co.) White Fish (Potomac).
Great Lakes* (a coarse and worthless fish). Ohio R.* (eaten for food but rather tasteless). Wabash R.* White R.* *H. grunniens.*

Family V. COTTIDÆ. The Sculpins.

Mostly salt water fishes, remarkable for the form of the suborbital bone, which extends backwards over the cheeks, joining with the preopercle. Head always very large and more or less spinous. Mouth wide; eyes usually close together near the top of the head. Ours are scaleless.

22. URANIDEA. *DeKay.* Miller's Thumbs.
(Greek—Star Gazer). ◁ Cottus Girard.
Miller's Thumb (Europe). Jack Fish (Maryland). Upper Ohio.* Wis.* (Bundy). Undoubtedly in Indiana but I have not yet met with any species.

23. POTAMOCOTTUS. *Gill.* River Sculpins.
(Greek—River Sculpin.) ◁Uranidea.
Big Miller's Thumb—Caves in Southern part of Indiana.* Ohio, (Girard).

24. TRIGLOPSIS. *Girard.* Lake Sculpins.
(Greek—Gurnard-like). =Ptyonotus Gunther.
Deep water, Lake Michigan, (Dr. Hoy,) known chiefly from remains in stomach of Trout and Ling. *P. thompsoni.*

Family VI. GOBIIDÆ. The Gobies.

General appearance something like the Cottidæ but with the head smaller and smoother and the spines in the dorsal fin much weaker. In many species the ventral fins are united. Chiefly in salt water and of small size.

25. GOBIOSOMA. *Girard.* Naked Gobies.

(Greek—Goby-body.)

Texas.—A specimen taken in the Ohio river near Louisville, is in the Agassiz Museum. (Putnam.) *G. molestum.*

Family VII. GASTEROSTEIDÆ. The Sticklebacks.

Small fishes in salt or fresh waters, either naked or covered with bony plates. Dorsal spines free; ventrals of a single spine each. Voracious little fishes, remarkable for their nest-building habits. The male in the breeding season is very much darker than the female and somewhat different in form.

26. APELTES. *Dekay.* Smooth Sticklebacks.

(Greek—without shields.) ◁Gasterosteus Cuvier.

Brook Stickleback. Ohio Stickleback. Burnstickle. About Lake Erie.* Throughout Wis.* N. Ind. (undoubtedly.) *A. inconstans.*

27. PYGOSTEUS. *Brevoort.* Many spined Sticklebacks.

(Greek—bony rump.) ◁Gasterosteus. Cuvier.

L. Superior, (Agassiz,). Near Racine, in L. Mich. (Dr. Hoy.) *P. nebulosus.*

Family VIII. ATHERINIDÆ. The Silversides.

Elongated fishes of small size, mostly of salt water. Two dorsal fins, the first of which is short and of a few weak spines; sides always with a bright silvery band by which the family can be at once recognized.

28. LABIDESTHES. *Cope.* Brook Silversides.

(Greek—lip eater.)

Jumping Jack, Silver Sides, Silver Darter. White R.* Fall Creek.* Ohio R.* L. Erie.* L. Mich. (Milner.) *L. sicculus.*

Family IX. AMBLYOPSIDÆ. The Cave Fishes.

Small fishes allied to the Cyprinodonts, but with the vent at the throat. Genera 29 and 30 are blind and 30 and 31 are without ventral fins; 4 species are known, 3 from our Western Caves and one (*Chologaster cornutus*) from the rice ditches of South Carolina.

29. AMBLYOPSIS. *DeKay.* Larger Blind Fish.
(Greek—blunt-vision).

Wyandot Cave.* Mammoth Cave* and various other caves in Southern Indiana and Kentucky. *A. spelæus.*

30. TYPHLICHTHYS. *Girard.* Small Blind Fish.
(Greek—Blind Fish).

Wyandot Cave.* Mammoth Cave (Girard) (Putnam). *T. subterraneus.*

31. CHOLOGASTER. *Agassiz.* Ditch Fishes.
(Greek—bile stomach).

Mammoth Cave (Putnam). Well in Tenn. (Putnam) not yet seen in Indiana. *C. agassizii.*

Family X. CYPRINODONTIDÆ. The Killifishes.

Small fishes of fresh or brackish waters; dorsal single, well back; head scaly, flat on top; mouth with teeth; females usually different from the males and of larger size.

32. FUNDULUS. *Lacepede.* Killifishes.
(Latin—bottom fish.)

Killifish, Mummichog, Barred Minnow, Toothed Minnow.

Tributaries Rock river, S. Wis.* Detroit river, (Cope.) Brackish water fishes, but ascending far up the rivers, doubtful whether found in Indiana. *F. multifasciatus* (Var.?)

33. ZYGONECTES. *Agassiz.* Toothed Minnows.
(Greek—Yoke Swimmers.) ⊢ Haplochilus, McClelland.

White river.* Ohio river.* *Z. pulchellus.*

Family XI. UMBRIDÆ. The Mud Minnows.

Small fresh water fishes, allied to the Cyprinodonts, but with the mouth entirely different in its structure. But two species are known, one in Austria, and the other in our brooks and ditches, in mud or weeds.

34. MELANURA. *Agassiz.* Mud Minnows.
(Greek—black-tail.) ◁ Umbra Gunther.

Mud Minnow, Black-tailed Dace. Everywhere in S. Wis.,* etc., in company with the Stickleback, but I have as yet seen neither in Indiana. *M. limi.*

Family XII. ESOCIDÆ. The Pikes.

Fresh water fishes, chiefly American, of rather large size, with elongated bodies, broad depressed snouts, strong teeth and small scales. Dorsal far back, opposite anal.

35. ESOX. *Linnœus.* Pickerels.
(Latin—a pike).

Muskallunge, Pike, Pickerel, Green Pickerel, Black Pickerel, etc.
Lake Michigan.* White R.* Ohio R. (Fishermen) and every stream of importance in the State. *E. nobilior, E. estor, E. americanus.* Several others perhaps identical with the one here called *americanus* are mentioned by Cuvier, Kirtland, Cope and others.

Family XIII. SALMONIDÆ. The Trout.

Chiefly fresh water fishes, various in appearance and habits, but all having an adipose dorsal fin behind the rayed dorsal. The variations according to sex, season and waters are very great in these fishes.

36. SALMO. *Linnœus.* Salmons.
(Latin—a Salmon). ▷ Hucho, Trutta, Fario, Salar, etc., authors.

Lake Salmon, Mackinaw Trout or Namaycush, Siscowet, Brook Trout or Speckled Trout.
Lake Michigan.* I have seen no Brook Trout from this State. *S. namaycush, S. siscowet, S. fontinalis.*

37. THYMALLUS. *Cuvier.* Graylings.
(Latin—a Grayling.)

Lakes in northern part of S. peninsula of Mich. *T. tricolor.*

38. COREGONUS. *Cuvier.* White Fish.
(Greek—angled head.)

White Fish of the Lakes, Laveret.
L. Mich.* *C. albus.*

39. ARGYROSOMUS. *Agassiz.* Siscoes.
(Greek—silvery-body.) ◁Coregonus Cuvier.

1, Lake Herring, Michigan Herring; 2, Sisco; 3, Moon Eye; 4, Black Fin.

L. Mich.,* L. Tippecanoe,* etc., in Kosciusko co., Ind., Lakes in S. Wis.,* Lakes in W. Mich.*

A. clupeiformis. A. sisco. A. hoyi. A. nigripennis.

Family XIV. PERCOPSIDÆ. The Trout Perches.

Small fresh water fishes, allied to the Salmons, but with the mouth and scales decidedly perch-like. But one species of this curious family is definitely known, although another has been noted from Kansas.

40. PERCOPSIS. *Agassiz.* Trout Perches.
(Greek—Perch like.)

L. Superior, (Ag.) L. Mich.,* Ohio R.,* (a single specimen in Dr. Sloan's collection. *P. guttatus.*)

Family XV. CLUPEIDÆ. The Herrings.

Chiefly salt water fishes, various in habits and appearance, but mostly with rather large, silvery scales. Our species may be known by the form of the abdomen, which is compressed to an edge and serrated.

41. ALOSA. *Cuvier.* Shads.
(German—Alse, English—Allis, a Shad.) = Pomolobus Raf.

Ohio Shad, Skip Jack, Ohio Herring.

Ohio R.* *A. chrysochloris.* (The Sea Shad, *A. sapidissima,* has also been introduced into Western streams.)

42. DOROSOMA. *Rafinesque.* Hickory Shads.
(Greek—lance Body.) ◁ Chatoessus. Cuvier.)

Hickory Shad, Gizzard Shad, Thread Shad, Winter Shad.

Ohio R.* *D. notatum,* (same as Eastern *D. cepedianum?*)

Family XVI. HYODONTIDÆ. The Moon Eyes.

American fresh water fishes, compressed and brilliantly silvery, resembling the Shads in many respects, but with stronger teeth on the tongue, etc. But one species is known.

43. HYODON. *LeSueur.* Moon Eye.
(Greek—hog tooth, or curved tooth?)

Moon Eye, Silver Bass, Toothed Herring.
L. Mich.,* Ohio R.,* *H. tergisus.*

Family XVII. CATOSTOMIDÆ. The Suckers.

Fresh water fishes of North America, distinguished by the toothless protractile jaws, which are surrounded by fleshy lips; pharyngeal teeth, numerous and small; scales rather large.

44. CATOSTOMUS. *LeSueur.* White Suckers.
(Greek—low Mouth.)

Common Sucker, Boston Sucker, White Sucker:
Ohio R.,* L. Mich.,* White R.,* Wabash R.,* etc.
C. teres.

45. HYLOMYZON. *Agassiz.* Mud Suckers.
(Greek—Mud Sucker). ◁ Catostomus LeSueur.

Mud Sucker, Black Sucker, Big Stone Roller, Shoemaker. L. Mich.* Ohio R.* White R.* *H. nigricans.*

46. PTYCHOSTOMUS. *Agassiz.* Red Horses.
(Greek—folded-mouth).

Red Horse, Mullet, Striped Sucker, White Sucker, etc. L. Mich.* Wabash R.* White R.* Ohio R.* and every other river in the West. *P. erythrurus*, *P. carpio, P. maerolepidotus* and many others.

47. PLACOPHARYNX. *Cope.* Few Toothed Mullet.
(Greek —— throat).

Wabash R. (Cope). *P. carinatus.*

48. MOXOSTOMA. *Rafinesque.* Chub Suckers.
(Greek—Sucker mouth).

Chub Sucker, White-nosed Sucker, Creek Fish, (Wis).
L. Mich.* Ohio R.* Wabash R.* WhiteR.* *M. oblongum* and others (if there are any others).

49. CARPIODES. *Rafinesque.* Carp Suckers.
(Greek—Carp-like).

Carp Sucker, Spear Fish, High Backed Buffalo, Carp.
L. Mich.* White R*. Wabash R.* OhioR*. *C. cyprinus*, *C. velifer* and others.

50. ICHTHYOBUS. *Rafinesque.* Straight-backed Buffaloes.
(Greek—Bull-fish).

Buffalo Fish. Buffalo Perch.
Wabash R.* Ohio R. (Agassiz.) *I. bubalus.*

51. BUBALICHTHYS. *Agassiz.* Buffalo Fishes,
(Greek—Buffalo Fishes.)

Common Buffalo Fish. Large and small-mouthed Buffalo.
Ohio R.* *B. bubalus?* *B. niger?* *B. urus?*
(The species are uncertain.)

52. CYCLEPTUS. *Rafinesque.* Long Buffaloes.
(Greek—slender circle.)

Missouri Sucker. Black Sucker. Long Buffalo. Ohio R. (Authors.)
C. elongatus.

Family XVIII. CYPRINIDÆ. The Carps.

Small fishes found in the fresh waters of nearly every part of the globe. Mouth toothless, usually without fleshy lips and with the pharyngeal teeth few and proportionally large. No group in all the range of Zoology is more puzzling than this and in none is it more difficult to distinguish species. The following genera seem well characterized but they shade closely one into another. The spring or breeding dress of many species is peculiar.

53. EXOGLOSSUM. *Rafinesque.* Stone Toters.
(Greek—tongue outside.)

Stone Toter. Nigger Chub. Day Chub. Cut-lips.
Susquehanna R.* Headwaters of Ohio R. (Gunther), probably not in Indiana.
E. maxillingua.

54. ERICYMBA. *Cope.* Silver Chubs.
(Greek—truly a cup, in allusion to the mucous cavities?)

Hurricane Creek, Johnson Co.* White R. (W. P. Clark). *E. buccata.*

55. SEMOTILUS. *Rafinesque.* Chubs.
(Name unexplained.) = Leucosomus, Hæckel.

Common Chub, Horned Chub, Horned Dace, Fall Fish. Ohio R.* L. Mich.* White R.* *S. corporalis, ?* *S. rhotheus.*

56. CERATICHTHYS. *Baird.* Horned Chubs.
(Greek—horned fish).

Horned Chub, Horned Dace, Minnows, Spotted Shiner. Ohio R.* White R.* L. Mich.* *C. biguttatus, C. dissimilis, C. stigmaticus, C. hyalinus,* and probably others.

57. RHINICHTHYS. *Agassiz.* Black-nosed Dace.
(Greek—snout-fish). = Argyreus, Hæckel.

Black-nosed Dace, Long-nosed Minnow, Red-sided Minnow.

Ohio R.* L. Mich.* White R.* *R. lunatus, R. atronasus, R. nasutus,* etc.

58. CLINOSTOMUS. *Girard.* Rosy Dace.
(Greek—inclined mouth.)

Blue Minnow, Red-bellied Shiner of the Lake.

L. Mich.* *C. elongatus* and probably others.

59. CHROSOMUS. *Rafinesque.* Red Minnows.
(Greek—colored-body).

Red-bellied Minnow, Red Minnow, Striped Minnow, Soldier Fish.

L. Mich.* White R.* Wabash R.* Ohio R.* *C. erythrogaster.*

60. PHOXINUS. *Cope.* True Minnows.
(Greek—a Minnow, from a word meaning tapering.)

L. Mich., (Cope), not known from Indiana. *P. neogæus.*

61. HYPSILEPIS. *Baird.* Fall Fishes.
(Greek—high scale.) = Plargyrus Girard.

Red Fin, Horned Shiner, Fall Fish, White Shiner, Silver Fins, White Dace, Blue Shiners, Horned Minnows. *H. cornutus, H. kentuckiensis, H. diplœmia,* and perhaps others, in every permanent stream throughout the West.

62. STILBIUS. *Gill.* Shiners.
(Greek—shining.)
= Stibe Dekay, (used in Botany.)
⊳ Abramis Gunther.
X Luxilus Raf.

Common Shiner. Bream.
White R.,* L. Mich.* *S. americanus.*

63. ALBURNELLUS. *Girard.* Bleaklings.
(Latin—a little Bleak, a European Minnow.) ⊲ Leuciscus. Gunther.

Silvery Minnows, Red-faced Minnows.
Ohio R., (Sloan), L. Mich.,* St. Joseph's R., (Cope), *A, rubellus, A. rubrifrons, A. arge, A. jaculus,* etc.

64. PHOTOGENIS. *Cope.* White-faced Minnows.
(Greek—light or white.)

Head waters of Ohio R., (Cope.) *P. leucops,* etc.

65. HYBOPSIS. *Agassiz.* Blunt-nosed Minnows.
(Greek—blunt-faced.)

Little Minnows, Minnies, Black-sided Minnows, *H. storerianus, H. tuditanus, H. hæmaturus, H. plumbeolus, H. stramineus,* etc.

66. HEMITREMIA. *Cope.* Minnows.
(Greek—half aperture (lateral line running half-way?)

L. Michigan,* (Cope.) *H. heterodon.*

67. HYBOGNATHUS. *Agassiz.* Blunt-jawed Minnows.
(Greek—blunt-jaw.)

White river,* Ohio river,* Wabash river.* (Cope.) *H. argyritis, H. nuchalis.*

68. HYBORHYNCHUS. *Agassiz.* Prickly-nosed Minnows.
(Greek—blunt-snout.)

Lake Michigan,* Ohio river.* *A. notatus.*

69. PIMEPHALES. *Rafinesque.* Fat-headed Minnow.
(Greek—fat-head.)

Fat-head, Black-head. Southern Indiana. (Cope.) Ohio river. (Agassiz.) *P. promelas, P. agassizii.*

70. CAMPOSTOMA. *Agassiz.* Stone Rollers.
(Greek—curved (?) mouth.)

White river,* Ohio river.* *C. dubium* and others (if there are any others.)

71. CYPRINUS. *Linnæus.* European Carps.
(Greek—a Carp.)

Carp. European Carp. (Introduced into some eastern streams.) *C. carpio.*

72. CARASSIUS. *Nilsson.* Crucian Carps.
(Latin name.)

Gold Fish.
Introduced into many eastern streams and commonly domesticated. *C. auratus.*

Family XIX. SILURIDÆ. The Cat Fishes.

Fishes, chiefly fresh water, scaleless, naked or with bony plates; mouth with long barbels; dorsal and pectorals usually each with a short spine which has a complicated movement. Adipose fin usually present.

73. ICTALURUS. *Rafinesque.* Channel Cats.
(Greek—Cat Fish.)

Channel Cats, Fork-tail Cats, Blue Cats, Silver Cats.
L. Michigan,* Ohio river,* Wabash river.* *I. cœrulescens* and possibly others.

74. AMIURUS. *Rafinesque.* Horned Pouts.
(Greek—without notch, *i. e.*, tail not forked.) ◁ Pimelodus Lacepede.)

Horned Pouts, Bull-heads, Yellow Cats, Black Cats, Little Cats, Ministers, etc., etc.
Every stream east of Rocky Mountains. *A. nebulosus*, *A. nigricans*, etc., etc., species uncertain.

75. NOTURUS. *Rafinesque.* Stone Cats.
(Greek—back-tail.)

White river,* Ohio river.*
N. flavus and possibly others.

76. HOPLADELUS. *Rafinesque.* Mud Cats.
(Greek—visibly armed.)

Southern States, perhaps in Indiana, but I have not seen it. *H. olivaris, H. limosus.*

77. GRONIAS. *Cope.* Blind Cats.
(Greek.—a Cavern.)

Cave in southeastern Pennsylvania, probably not in Indiana. *G. nigrilabris.*

Family XX. GADIDÆ. The Cod Fishes.

Chiefly salt water fishes, with the dorsal and anal fins very long, or divided into 2 or 3 fins each; ventral fins under the throat scales, usually small.

78. LOTA. *Cuvier.* Lings.
(Latin—a Ling).

Ling, Burbot, Lawyer, Methy, Eel Pout, Barbel.
L. Mich.* Ohio R. very rare (Dr. Sloan). *L. maculosa.*

Family XXI. ANGUILLIDÆ. The Eels.

Fishes of all waters, with the body serpentiform, the scales very minute and teh dorsal and anal fins meeting around the tail. Ventral fins wanting.

79. ANGUILLA. *Thunberg.* Eels.
(Latin—an Eel).

Yellow Eel, Ohio Eel, Common Eel(?)
Ohio R. (Kirtland, Sloan). Not found in the Lakes till the opening of the canals. (Sloan). *A. bostoniensis* (?) (*A. flava*, Raf.)

Family XXII. AMIADÆ. The Amias.

Large fishes of the fresh waters of the U. S. Scales large, cycloid; jaws moderate, strong; teeth stout; dorsal fin very long; anal fin moderate. But a single species known, having no near relatives among living fishes, but allied to some fossil species. The males are smaller and have a bright black tail spot.

80. AMIA. *Linnæus.* Bow Fins.
(Latin—a Bonito, or some other sea fish.)

Dog Fish, Mud Fish, Marsh Fish, Poisson de Marais, Bow-fin, Lawyer, (so called because "it will bite at anything, and is good for nothing when caught.")
Said to occur in all the larger streams. L. Mich.* *A. calva.*

Family XXIII. LEPIDOSTEIDÆ. Gar Pikes.

Scales ganoid, rhombic, bony and enamelled; dorsal fin short, air bladder as in Amia, lung-like; general structure almost as reptilian as fish-like. Fresh waters of the warmer parts of North America; closely related to fossil forms long extinct.

81. LEPIDOSTEUS. *Lacepede.* Long-nosed Gar Pikes.

(Greek—bony scale.)

Gar Pike, Bony Pike, Bony Gar, Bill Fish, Buffalo Pike, Sword Fish, Snake Fish, Land Shark, Serpent Fish.

Ohio R.,* L. Mich.* Occurs in all the larger Western streams. More than 20 species are described, but I can recognize but one. *L. osseus.*

82. CYLINDROSTEUS. *Rafinesque.* Short-nosed Gar Pikes.

(Greek—bony cylinder.)

Short-nosed Gar Pike, Duck-billed Gar Pike.

L. Mich.,* Ohio R., (Agassiz). *C. platystomus.*

83. ATRACTOSTEUS. *Rafinesque.* Alligator Gars.

(Greek—bony dart.)

Alligator Gar, Great Gar Pike.

Lower Mississippi,* Ohio R., (Rafinesque.) *A. ferox.*

Family XXXIV. POLYODONTIDÆ. The Spoon Bill Sturgeons.

Scaleless; snout prolonged into a thin blade; mouth wide, with many small teeth. Fresh waters of North America and China.

84. POLYODON. *Lacepede.* Spoon Bill Sturgeon.

(Greek—many teeth.)

Spoon Bill Sturgeon, Duck Bill Sturgeon, Duck Bill Cat.

Wabash R. (Fishermen.,) Ohio R.,* White R.* *P. folium.*

Family XXV. ACIPENSERIDÆ. The Sturgeons.

Fishes chiefly of the fresh waters of northern regions; skin more or less covered with bony plates; mouth beneath the long snout, preceded by four barbels.

85. ACIPENSER. *Linnœus.* Sturgeon.

(Latin—Sturgeon—Sharp-fin.)

Lake Sturgeon, Red Sturgeon, Black Sturgeon, River Sturgeon, Rock Sturgeon, etc.

L. Mich.,* Ohio R.,* *A. rubicundus, A. maculosus.*

83. SCAPHYRHYNCHUS. *Hœckel.* Shovel Nosed Sturgeon.

(Greek—skiff snout.)

Shovel-Nosed Sturgeon, Broad-Nosed Sturgeon.

Ohio R.,* *S. platyrhynchus.*

Family XXVI. PETROMYZONTIDÆ. The Lampreys.

Scaleless fishes with no pectoral or ventral fins, and with several round apertures or gills. Skeleton cartilaginous; mouth destitute of jaws; eel-like fishes of fresh and salt waters, attaching themselves by their sucker-like mouths to various bodies on which they feed by means of their rasp-like teeth.

These fishes undergo a metamorphosis, the young having the eyes rudimentary and the teeth different.

87. PETROMYZON. *Linnœus,* Lampreys.

(Greek—stone sucker.) ⊳ Ammocœtes Dumeril. (Larval forms.)

Lampreys, Lamper eels, Black Lamprey.

L. Mich.,* Ohio R.,* *? P. fluviatilis* and others.

88. ICTHYOMYZON. *Girard.* Lampreys.

(Greek—Fish Sucker.) ⊲ Petromyzon L.
⊳ Scolecosom a Girard. (Larval forms.)

Lamper Eels, Lampreys, Silver Lamprey.

L. Erie,* Ohio R.,* *I. argenteus* and others.

HANOVER, IND., December 1, 1874.

PROF. E. T. COX:

State Geologist.

SIR:—I send you a list of the plants of Jefferson county, as far as worked up. Subsequent investigations will undoubtedly make many additions, but they will be of rarer plants, as it is believed that nearly all the common flowering plants of the county are included in this list. I have used as a basis the fine list made out by Mr. A. H. Young, and published in your report for 1870; and I would here express to him my thanks for his botanical labors in this county. I have included from his list many species of which I have seen no specimens and have called attention to them by an asterisk (*). The order of Gray's Manual has been followed, and no apology need be made for the free use made of that noble work in describing the habitat of plants. There should be a systematic working up of the flora of every county in the State, for in many of them strange forms are lurking, and I hope soon to hear from our sister counties. Thanks are due to M. Stanley Coulter for his list of Sedges and Grasses, and also to Messrs. Karr and Eastman, of the College, for their kindly aid in making out the list.

I remain, Sir,

Your obedient servant,

JOHN M. COULTER.

A PARTIAL LIST OF THE FLORA

OF

JEFFERSON COUNTY, INDIANA.

BY JOHN M. COULTER, OF HANOVER COLLEGE.

RANUNCULACEÆ.

Clematis viorna, L. (Leather Flower.) May, August. Grows in abundance along the edge of the cliffs.

Clematis virginiana, L. (Common Virgin's Bower.) July, August. Common along water courses and ascending the ravines, climbing over shrubs, and producing great abundance of white flowers. "In autumn the fertile flowers are succeeded by the conspicuous feathery-tails of the fruit."

Amenone virginiana, L. (Wind-Flower.) June, August. Rocky ledges.

Hepatica triloba, Chaix. (Liver Leaf.) March. Good specimens of *H. acutiloba*, D. C., were found; but as in this locality *H. acutiloba*, D.C., undoubtedly runs into *H. triloba*, Chaix, all the specimens have been included in the latter species.

Thalictrum anemonoides, Michx. (Rue-Anemone.) March, May. Common in open woods.

Thalictrum dioicum, L. (Early Meadow Rue.) March, May. Common in rocky woods.

Thalictrum purpurascens, L. (Purple Meadow-Rue,) April, June.

Thalictrum cornuti, L. (Fall Meadow-Rue.) June, September. "Wet meadows and along rivulets."

Ranunculus alismæfolius, Geyer. (Water Plantain, Spearwort.) June, August. Common in marshy places.

Ranunculus flammula, L., var. *reptans*, Gr. (Creeping Spearwort.) June, September.

Ranunculus abortivus, L. (Small-flowered Buttercup.) March, June. Very abundant.

Ranunculus recurvatus Poir. (Hooked Buttercup.) April, June. Common.

Ranunculus fascicularis, Muhl. (Early Buttercup.) April, May. Rocky hills.

Ranunculus repens, L. (Creeping Buttercup.) April, August. Extremely variable in size and foliage.

Isopyrum biternatum, Tor. & Gr. (False Rue-Anemone.) March, June. Very abundant in moist, shady places. This species is very apt to be mistaken for *Thalictrum anemonoides*, Mx.; but differs from it in the fact that it invariably has five sepals; the four pistils are divaricate in fruit, and the root fibres are thickened here and there into little tubers.

Aquilegia canadensis, L. (Common Wild Columbine.) April, June. Common on rocks.

Nigella damascena, L. (Common Funnel Flower. Ragged Lady. Devil-in-a-bush.) June, September. Has escaped from cultivation and grows spontaneously along roadsides.

Delphinium tricorne, Mich., (Dwarf Larkspur) March, May. Flowers bright blue and white.

**Delphinium azureum* Michx., (Azure Larkspur. June.

Hydrastis canadensis, L., (Orange Root, Yellow Raccoon.) March, June. Recognized by the thick and knotted yellow rootstock.

**Actæa spicata*, L. var. *rubra*, Michx. (Red Bane-berry.) April, May.

Actæa alba, Bigel, (White Bane-berry.) April, May.

Cimicifuga racemosa, Ell, (Black Snake Root.) June, July. Specimens have been found with the stem over eight feet high, the racemes being three feet long.

MAGNOLIACEÆ.

Magnolia acuminata, L., (Cucumber-tree.) May, June. Rich woods.

Liriodendron tulipifera, L., (Tulip-tree.) Commonly and wrongly called Poplar. May, June. About the largest tree in the forest.

ANONACEÆ.

Asimina triloba, Dunal, (Common Papaw.) March, May. The fruit ripens in September and October.

MENISPERMACEÆ.

Menispermum canadense, L., (Moonseed.) May, July. Found climbing over fences in the neighborhood of dwellings.

BERBERIDACEÆ.

Berberis vulgaris, L., (Barberry.) May, June. Occasionally spontaneous.

Caulophyllum thalictroides, Michx, (Blue Cohosh, Pappoose Root,) March, May.

Jeffersonia diphylla, Pers., (Twin Leaf.) March, May. Very abundant in early spring along hill sides with southern exposure, also called *rheumatism root.*

Podophyllum peltatum, L., (May-Apple, Mandrake.) April, May. The apple is not ripe before July. The leaves and roots are said to be poisonous.

PAPAVERACEÆ.

Papaver somniferum, L., (Common Poppy.) May, July. Spontaneous near dwellings.

Stylophorum diphyllum, Nutt, (Celandine Poppy.) March, June. Very abundant, almost covering some hill sides.

Sanguinaria canadensis, L., (Blood Root.) March, May. Very common in open rich woods.

FUMARICEÆ.

Dicentra cucullaria, D. C., (Dutchman's Breeches, White Ear Drop,) March, May. Grows in large patches, along with the next, in rich woods.

Dicentra canadensis, D. C., (Squirrel Corn.) March, May.

Corydalis flavula, Raf., (Yellow Corydalis.) April, July. This species very much resembles *C. aurea*, Willd, and has by some authors been placed as a variety of it. It can always easily be distinguished, however, by the tips of the outer petals being wing-crested and pointed. Every specimen collected in this locality had these characteristic crests. Their color, however, better suited *C. aurea*, Willd. Very abundant in shady, rocky places.

CRUCIFERÆ.

Nasturtium officinale, R. Br., (True Water-cress.) May, June. Brooks and ditches; escaped from cultivation.

Nasturtium armoracia, Fries, (Horse Radish.) July, August. Escaped from cultivation.

Dentaria diphylla, L., (Two-leaved Pepper-root.) April, May. Rare.

Dentaria laciniata, Muhl, (Pepper-root.) March, May. Grows in greatest abundance in rich soil. This species is one of the most variable and most perplexing we have met. A long list might be made of the various forms in which it occurs. *D. maxima*, Nutt., *D. heterophylla*, Nutt., *D.*

lacineata, Muhl, and *D. multifida*, Muhl. All undoubtedly run together in this locality. Specimens of these different species have been found growing in the same patches, and even from the same root.

The leaves vary from almost entire to finely dissected. Sometimes there are three leaves in a whorl; sometimes these leaves are alternate; sometimes there are four alternate leaves; often there are but two leaves either opposite or alternate. In fact there is no kind of division or position of leaves which is not represented in this species.

Cardamine rhomboidea, D. C. (Spring Cress.) March, June. Not very abundant.

* *Cardamine rhomboidea*, D. C. Var. *purpurea*, Torr.

Cardamine hirsuta, L. (Small Bitter-cress.) April, July. Very common and very variable.

* *Arabis petræa*, Lam. May.

Arabis patens, Sullie. April, May.

Arabis lævigata, D. C. March, May. Grows in great abundance in rocky places, and is the common *Arabis* of this region.

Arabis hesperidoides, Gr. May, June. Along the banks of Ohio river and running a little up into the ravines.

Barbarea vulgaris, R. Br. (Common Winter Cress.) April, May.

Sisymbrium officinale, Scop. (Hedge Mustard.) May, September. Common in gardens and meadows.

Brassica sinapistrum, Boisser. (*Sinapis arvensis*, L.) (English Charlock.) May. Common in grain fields.

Brassica (or *Sinapis*) *alba*, Gr., (White Mustard.)

Brassica (or *Sinapis*) *nigra*, Gr., (Black Mustard.)

Alyssum maritimum, L., (Sweet Alyssum.) June, October. Escaped from cultivation.

Camelina sativa, Crantz, (False Flax.) June.

Capsella bursa-pastoris, Mœnch, (Shepherd's Purse.) The commonest of weeds; blooms from March until killed by cold weather.

Lepidium virginicum, L., (Pepper-grass, Tongue-grass.) May, November. A common weed.

CAPPARIDACEÆ.

Polanisia graveolens, Raf. June, August.

VIOLACEÆ.

Solea concolor, Ging., (Green Violet.) April, June. Found along rocky hillsides.

Viola lanceolata, L., (Lance-leaved Violet.) April, May. Grows abundantly in wet meadows.

Viola blanda, Willd. (Sweet White Violet.) April, May. Common in damp places.

Viola cucullata, Ait, (Common Blue Violet.) March, May. Grows everywhere; very variable.

Viola cuculata, Ait, var. *palmata*, Gr., (Hand-leaf Violet.) April, May.

Viola sagittata, Ait, (Arrow-leaved Violet.) April, June. Dry or moist open meadows.

Viola canina, L., var. *sylvestris*, Regel, (Dog Violet.) May, July.

Viola striata, Ait, (Pale Violet.) April, October. Common in low grounds.

Viola canadensis, L., (Canada Violet.) April, August. Common in rich woods.

Viola pubescens, Ait., (Yellow Violet.) March, June. Varies in the amount of pubescence. Found everywhere.

HYPERICACEÆ.

Hypericum prolificum, L., (Shrubby St. Johnswort.) July, September.

Hypericum perforatum, L., (Common St. Johnswort.) June, September. A well known weed in fields.

Hypericum corymbosum, Muhl, June, September. Distinguished from the last in having larger leaves, smaller flowers, and petals marked with black lines as well as dots.

Hypericum mutilum, L., (Dwarf St. Johnswort.) July, August. Found everywhere in low ground.

CARYOPHYLLACEÆ.

Saponaria officinalis, L., (Common Soapwort, Bouncing Bet.) July, September. Escaped from cultivation.

**Vaccaria vulgaris*, Host, (Cow Herb.) July, October.

Silene stellata, Ait., (Starry Champion.) June, July.

Silene nivea, D. C., July, August.

**Silene pennsylvanica*, Michx., (Wild Pink.) June, July.

Silene virginica, L., (Fire Pink. Catchfly.) April, August.

Silene antirrhina, L., (Sleepy or Snap-dragon Catchfly.) May, September.

**Silene noctiflora*, L., (Night-flowering Catchfly.)

Lychnis githago, Lam., (Corn Cockle.) May, July. A common weed and a nuisance in wheat fields.

Stellaria media, Smith, (Common Chickweed.) February, November. Everywhere in damp grounds and in this locality the earliest bloomer.

Stellaria pubera, Michx, (Great Chickweed.) March, June. Grows in clumps among shaded rocks.

Stellaria longifolia, Muhl, (Long-leaved Stitchwort.) April, July. Common along the grassy banks of creeks.

Cerastium vulgatum, L., (Mouse-ear Chickweed.) April, July. Some of the earlier specimens had petals a little longer than the calyx. Very common in grassy places.

Cerastium viscosum, L., (Larger M.) May, August. Common in fields and thickets.

Cerastium nutans, Raf. April, July.

Anychia dichotoma, Michx, (Forked Chickweed.) May, July. Varies exceedingly.

Mollugo verticillata, L., (Carpet-weed.) June, September. Very common in gardens.

PORTULACACEÆ.

Portulaca oleracea, L., (Common Purslane, Pigweed.) July, August. A troublesome weed in gardens.

Claytonia virginica, L., (Spring Beauty.) March, April. The leaves vary from narrowly linear to linear-lanceolate. Very common in moist open woods.

Claytonia caroliniana, Michx. March, April. I very much doubt the genuineness of the specimens placed under this species. The leaves are really broad linear-lanceolate or lanceolate, but hardly spatulate-oblong or oval-lanceolate. I strongly suspect it to be nothing more than an extreme form of *C. virginica*, L.

MALVACEÆ.

Malva rotundifolia, L., (Common Mallow.) May. Common in cultivated grounds and along road sides.

Sida spinosa, L. July, August. Common everywhere.

Abutilon avicennæ, Gaertn, (Velvet Leaf, Indian Mallow.) July, September. Escaped from gardens.

Hibiscus militaris, Cav., (Rose Mallow.) July, August. Grows along the banks of Ohio river.

TILIACEÆ.

Tilia americana, L., (Basswood, Lime-Tree, White-Tree, Linden.) May, July.

Tilia heterophylla, Vent., (White Basswood.) May, June. Leaves larger than the last. River bluffs.

LINACEÆ.

Linum striatum, Walt. Wet grounds.

Linum usitatissimum, L., (Common Flax.) June, July. Occasionally spontaneous.

GERANIACEÆ.

Geranium maculatum, L., (Wild Cranesbill.) April, July. Abundant in open woods and fields.

Impatiens pallida, Nutt; (Pale Touch-me-not.) Moist, shady places, and along streams in rich soil. Grows in large patches along with the next. July, September.

Impatiens fulva, Nutt, (Spotted Touch-me-not.) June, September.

Oxalis violacea, L., (Violet Wood-Sorrel.) April, June. Grows in grassy as well as rocky places.

Oxalis stricta, L., (Yellow Wood-sorrel.) May, September. Common in woods and along old fences.

RUTACEÆ.

Zanthoxyllum americanum, Mill., (Northern Prickley Ash, Toothache Tree.) April, May.

Ptelea trifoliata, L., (Shrubby Treefoil, Hop Tree.) June.

Ailantus glandulosus, Desf., (Tree of Heaven.) April, June. The staminate flowers exhale a very disagreeable odor.

ANACARDIACEÆ.

Rhus glabra, L., (Smooth Sumach.) June, July. Rocky soil.

Rhus copallina, L., (Dwarf Sumach.) July, August.

Rhus toxicodendron, L., (Poison Ivy, Poison Oak.) April, June. Affects persons very differently, some can handle it with impunity, while others are badly poisoned by simply coming near it.

Rhus aromatica, Ait., (Fragrant Sumach.) April, May. Found along the bluffs of the river. Not poisonous in most cases.

VITACEÆ.

Vitis labrusca, L., (Northern Fox Grape.) May, June. Fruit ripe in September or October. Common in thickets.

Vitis aestivalis, Michx, (Summer Grape,) May, June.

Vitis cordifolia, Michx, (Winter or Frost Grapes.) May,

June. Flowers very sweet-scented, exhaling the odor of mignonnette.

* *Vitis indivisa*, Willd. June.

Ampelopsis quinquefolia, Michx, (Virginia Creeper.) July. Also called American Ivy and Woodbine. A very common woody vine, climbing extensively over fences and trees. Easily recognized by its five leaflets.

CELASTRACEÆ.

Celastrus scandens, L., (Wax-work, Climbing Bittersweet, Staff tree.) May, June.

Euonymus atropurpureus, Jacq., (Burning Bush, Wahoo.) June.

**Euonymus americanus*, L., var. *obvatus*, T. & G.

LAPINDACEÆ.

Staphylea trifolia, L., (American Bladder-nut.) April, May. Common.

Æsculus glabra, Willd, (Ohio Buckeye.) April, June. Common in this neighborhood.

Æsculus flava, Ait., (Sweet Buckeye.) April, May.

Acer saccharinum, Wang, (Sugar or Rock Maple.) March, May. A common forest tree.

Acer dasycarpum, Ehrhart, (White or Silver Maple.) March, April. River banks.

Acer rubrum, L., (Red or Swamp Maple.) March, April. An early bloomer, with beautiful crimson blossoms.

Negundo aceroides, Mœnch, (Box Elder, Ash-leaved Maple.) Not very adundant.

Cardiospermum halicacabum, L., (Balloon-vine, Heart-seed.) July, August.

POLYGALACEÆ.

Polygala nuttalii, Torr & Gr. June, July. Found only on a sandy flat, back from the river.

Polygala verticillata, L. July. Found along the terraces of streams.

LEGUMINOSÆ.

Trifolium pratense, L., (Red Clover.) May.

Trifolium repens, L., (White Clover.) April, September.

Melilotus alba, Lam., (Sweet Clover.) July, August.

Robinia pseudacacia, L., (Common Locust.) April, June. Very valuable for timber.

Astragalus canadensis, L., (Milk-vetch.) July, August. Principally along the river banks.

Desmodium nudiflorum, D. C. July, August. Very common in dry woods.

Desmodium acuminatum, D. C. July, August. Rich woods.

Desmodium pauciflorum, D. C. July, August.

Desmodium rotundifolium, D. C. August. Dry, rocky woods.

**Desmodium viridiflorum,* Beck. August.

Desmodium dilleni, Darlingt. July. Open woods.

Desmodium paniculatum, D. C. July, August. Very common in thickets.

Desmodium canadense, D. C. August.

Desmodium rigidum, D. C. August.

Desmodium ciliare, D. C. August.

Phaseolus perennis, Walt., (Wild Bean.) July, August. Thickets.

Phaseolus diversifolius, Pers. August, October. Common in the sand of river banks.

Phaseolus helvolus, L. August, September. Sandy fields and fence corners.

Amphicarpœa monoica, Nutt., (Hog Pea-nut.) July, September. Rich woods.

Baptisia australis, R. Br., (Blue False Indigo.) May, August. Along the river bank.

Baptisia leucantha, Torr. & Gr. May, July.

Cercis canadensis, L., (Red Bud, Judas Tree.) March, May. Common on rich hillsides.

Cassia marilandica, L., (Wild Senna.) July, August Common along streams.

Cassia obtusifolia, L. July. Bank of the Ohio river.

Cassia chamœcrista, L., (Partridge Pea.) August. Very common in sandy fields.

Gymnocladus canadensis, Lam., (Kentucky Coffee Tree.) May, July. Rich woods near the river.

Gleditschia triacanthos, L., (Honey Locust.) May, June. The wood is very white and compact, and might be worked to advantage. Used for hedges.

ROSACEÆ.

Prunus americana, Marshall, (Wild Yellow or Red Plum.) March, May. Common in thickets.

Prunus serotina, Ehrhart, (Wild Black Cherry.) April, June. Wood very hard and used for cabinet making.

Spiræa opulifolia, L., (Nine-Bark.) June, July. River banks.

Spiræa salicifolia, L., (Common Meadow-Sweet.) July, August.

Spiræa tomentosa, L., (Hardhack, Steeple Bush.) July, August. Common in old meadows and thickets.

Spiræa lobata, Murr, (Queen of the Prairie.) June, July. Grows in grassy meadows near the line between Jefferson and Scott counties.

Spiræa aruncus, L. (Goat's Beard.) May, July.

Agrimonia eupatoria, L., (Common Agrimony.) July, September. Very common in thickets and in fence corners.

Agrimonia parviflora, Ait. July, August. Woods and meadows.

Geum album, Gmelin. May, August. Common in thickets and borders of woods.

Geum virginianum, L. June, August.

Geum strictum, Ait. July, August. Moist meadows.

Geum vernum, Torr & Gr. April, June. Very common in thickets.

Potentilla norvegica, L. June. Very few specimens of this species were found.

Potentilla canadensis, L., (Common Cinquefoil or Five Finger.) April, August. Common in dry fields.

Fragaria virginiana, Ehrhart, var., *illinoensis*, Gr., (Wild Strawberry.)

Fragaria vesca, L. April, May. Fields and rocky places.

Rubus strigosus, Michx, (Wild Red Raspberry.) May, July.

Rubus occidentalis, L., (Black Raspberry, Thimble Berry.) April, May. Fruit ripe in June and July.

Rubus villosus, Ait, (Common or High Blackberry.) Very common in this region, making dense thickets.

Rubus villosus, Ait, var. *humifusus*, Gr. May, June.

Rubus canadensis, L., (Low Blackberry, Dew Berry.) April, May. Larger and more palatable than the former.

Rubus hispidus, L., (Swamp Blackberry.) May, June.

Rosa setigera, Michx, (Climbing or Prairie Rose.) June, July.

**Rosa carolina*, L., (Swamp Rose.) June, July.

Rosa lucida, Ehrhart, (Dwarf Wild Rose.) May, July.

Rosa, rubiginosa, L., (Eglantine, Sweet Brier.) May, August.

Cratægus coccinea, L., (Scarlet Fruited, Hawthorn.) April, May.

Cratægus tomentosa, L., (Blackthorn.) April, May.

Cratægus tomentosa, L., var., *punctata*. Gr. April, May.

Cratægus tomentosa, L., var., *mollis*. Gr. May.

Pyrus coronaria, L., (American Crab-Apple.) April, May.

Pyrus arbutifolia, L., (Chokeberry.) May, June.

Amelanchier canadensis, Torr. & Gr., var., *alnifolia*. Gr., (Shadbush, Serviceberry.) April, May.

SAXIFRAGACEÆ.

Ribes cynosbati, L., (Wild Gooseberry.) April, May. Grows among the rocks.

Ribes hirtellum, Michx., April, May. Moist grounds.

Ribes rotundifolium, Michx., March, April. Rocks.

Ribes floridum, L., (Wild Black Currant.) May. Common in woods.

Ribes rubrum, L., (Red Currant.) April, June.

Hydrangea arborescens, L., (Wild Hydrangea.) May, July. Common among rocks.

Sullivantia ohionis, Torr. & Gr. June, August. Grows in considerable abundance in certain localities, especially seeking damp limestone cliffs. Fine patches cling to the cliffs just above Clifty falls.

Heuchera americana, L., (Common Alumroot.) June, July. Rocky woodlands.

Mitella diphylla, L., (Mitre-wort, Bishop's Cap.) March, May. Very common along the rocky slopes of streams and rich hillsides.

CRASSULACEÆ.

Penthorum sedoides, L., (Ditch Stone-crop.) July, October. Common in wet places.

Sedum ternatum, Michx., (Stone-crop.) April, June. Clings to the rocks everywhere.

HAMAMELACEÆ.

Hamamelis virginica, L., (Witch Hazel.) Blossoms late in autumn and retains its flowers until the next spring, ripening its seeds in the summer.

Liquidambar styraciflua, L., (Sweet Gum, Bilsted.) April. A large and beautiful tree, rather common in our forests.

HALORAGEÆ.

Proserpinaca palustris, L., (Mermaid-weed.) June. Common in swamps.

ONAGRACEÆ.

Circœa luteliana, L., (Enchanter's Nightshade.) June, Common in rich woods.

Circœa alpina, L. June, July. Readily distinguished from the former by being smaller, and having leaves plainly heart-shaped. Grows in darker, damper woods.

Epilobium coloratum, Muhl. July, September.

Ænothera biennis, L., (Common Evening Primrose.) July, August. Very common in old dry fields.

Ænothera biennis, L., var. *parviflora*, Gr. August.

Ænothera fruticosa, L., (Sundrops.) June, August. Open fields.

Ludwigia alternifolia, L., (Seed-box, False Loosestrife.) July, September. Very common in swampy meadows.

MELASTROMACEÆ.

Rhexia virginica, L., (Deer-Grass, Meadow-Beauty.) July, August. A beautiful plant growing in moist meadows.

LYTHRACEÆ

Cuphea viscosissima, Jacq., (Clammy Cuphea.) July, August. Common in dry fields.

PASSIFLORACEÆ.

Passiflora lutea, L., (Passion Flower.) June, September.

CUCURBITACEÆ.

Sicyos angulatus, L., (One-seeded Star Cucumber.) July, September. Common along river banks and in back yards.

UMBELLIFERÆ.

Some of the *Umbelliferæ* of this region are as yet uncertain, owing to the great difficulty of obtaining proper specimens for determining the species. I give what have been worked out with tolerable certainty.

Sanicula canadensis, L., (Sanicle, Black Snakeroot.) May, August.

Sanicula marilandica, L. July.

Daucus carota, L., (Common Carrot.) June, September. Very abundant in old fields, sometimes completely taking possession of them.

Pastinaca sativa, L., (Common Parsnip.) May, July. Fields. Said to be poisonous when run wild.

Archemora regida, D. C., (Cowbane.) June, August. Very poisonous.

Thaspium barbinode, Nutt, (Meadow Parsnip.) May, July.

Thaspium aureum, Nutt. May, June. Damp places along the river bank.

Thaspium trifoliatum, Gr. April, June.

Cicuta maculata, L., (Spotted Cowbane, Musquash Root, Beaver Poison.) July, August. Common in swamps. Very poisonous.

Cryptotœnia canadensis, D. C., (Honewort.) June, September. Common in thickets.

Chœrophyllum procumbens, Lam., (Chervil.) April, June.

Osmorrhiza longistylis, D. C., (Smoother Sweet Cicely.) May, June. Not so common as the next.

Osmorrhiza brevistylis, D. C., (Hairy Sweet Cicely.) April, May. Found everywhere.

Erigenia bulbosa, Nutt, (Harbinger-of-Spring, Pepper and salt.) March, May. Very convenient in rich woods. Sometimes called Turkey Pea, and much eaten by children.

ARILIACEÆ.

Aralia spinosa, L., (Angelica tree, Hercules Club.) July, August. A common shrub.

Aralia racemosa, L.. (Spikenard.) July, August. Has very large, spicy roots.

Aralia quinquefolia, Gr., (Ginseng.) May, July.

CORNACEÆ.

Cornus florida, L., (Dwarf Cornel, Bunchberry.) March, June. Common everywhere.

**Cornus sericaa*, L., (Silky Cornel, Kinnikinnik.) June. Rare.

**Cornus paniculata*, L. Her., (Panicled Cornel.) May.

Nyssa multiflora, Wang., (Tupelo, Pepperidge, Black or Sour Gum.) April, May.

CAPRIFOLACEÆ.

Symphoricarpus racemosus, Michx., (Snowberry.) May, September.

Lonicera sempervirens, Ait., (Trumpet Honeysuckle.) May. Sparingly spontaneous.

Triosteum perfoliatum, L., (Fever-wort, Horse-Gentian.) April, May. Very common in rich woods.

Sambucus canadensis, L., (Common Elder.) May, June. Found in most all thickets, especially along fence rows.

Sambucus pubens, Michx., (Red-berried Elder.) May, June.

**Viburnum lentago*, L., (Sweet Viburnum, Sheep berry,) April, May.

Viburnum prunifolium, L., (Black Haw.) April, May.

**Viburnum dentatum*, L., (Arrow-wood.) May, June. Rather common.

Viburnum nolle, Michx. June.

Viburnum acerifolium, L., (Maple-leaved, Arrow wood, Dockmackie.) Grows on the College Hill.

RUBIACEÆ.

Galium aparine, L., (Cleavers, Goose-grass.) April. Common in thickets as well as all the following species.

Galium concinnum, T. & G. May, June.

Galium trifidum, L., (Small Bedstraw.) June, wonderfully variable.

Galium trifidum. L., var., *tinctorium*, Gr. May. Very common.

Galium triflorum, Michx, (Sweet-scented Bedstraw.) June, July.

Galium circœzans, Michx, (Wild Liquorice.) May, June.

Spermacoce glabra, Michx, (Button Weed.) River bank. May, June.

Cephalanthus occidentalis, L., (Button Bush.) June, August.

Mitchella repens, L., (Partridge-berry.) May, July. Common among moss, especially at the roots of trees.

Houstonia purpurea, L. April, July. Very common in woods and meadows.

Houstonia purpurea, L., var. *ciliolata*, Gr. July.

Houstonia cœrulea, L., (Bluets, Innocence.) April, May. Very abundant in moist meadows.

VALERIANACEÆ.

Valeriana pauciflora, Michx., (Valerian.) May, June. Common on shady hillsides and in open woods.

Valeriana sylvatica, Richards. May, June.

DIPSACEÆ.

Dipsacus sylvestris, Mill., (Wild Teasel.) June, July. Exceedingly common along roadsides and hillsides.

COMPOSITÆ.

Vernonia noveboracensis, Willd, (Iron Weed.) July, September. A very common, coarse weed.

Elephantophus carolinianus, Willd, (Elephant's foot.) August, September. Very commmon on dry, sandy banks.

Eupatorium purpureum, L., (Joe-Pie-Weed, Trumpet-Weed.) July, August. Common and varies greatly. Includes several nominal species in this locality, prominent among which is *E. fistulosum*, Barratt, and *E. mactulatum*, L.

Eupatorium perfoliatum, L., (Thoroughwort. Bone-set.) July, October. Very common.

Eupatorium serotinum, Michx., August, September.

Eupatorium ageratoides, L., (White Snake-root.) August, September. Very common along rich hillsides.

Conoclinium cœlestinum, D.C., (Mist-flower.) August, October. Very abundant everywhere.

Aster shortii, Boott. September, October. A beautiful and showy Aster, common among cliffs.

Aster undulatus, L., September, October. Common.

Aster cordifolius, L., September, October. Very common among shaded rocks and found growing along with the next.

Aster sagittifolius, Willd. October.

Aster ericoides, L., September.

Aster multiflorus, Ait. October. Common in dry open fields.

Aster dumosus, L., August. Very common in thickets and along fence rows.

Aster tenuifolius, L., August, November.

Aster puniceus, L., Very common in thickets.

Aster prenanthoides, Muhl. September, October. This species does not occur in any abundance but is unmistakable.

Erigeron canadense, L., (Horse-weed, Butter-weed.) July, October. A common and vile weed.

* *Erigeron bellidifolium*, Muhl. (Robin's Plantain.)

Erigeron philadelphicum, L.. (Common Fleabane.) May, August. Common.

Erigeron annuum, Pers. (Daisy Fleabane, Sweet Scabious.) May, August. Very common.

Erigeron strigosum, Muhl. June, August. Found everywhere.

Boltonia glastifolia, L'Her. August.

Solidago latifolia, L., September, November. Grows in abundance among shaded rocks along with the next.

Solidago cæsia, L., September, November. Common.

* *Solidago petiolaris*, Ait. September, October.

Solidago neglecta, T. and G. Swamps.

* *Solidago arguta*, Ait. June.

Solidago altissima, L., August, September. Very common in borders of fields and thickets. Specimens were found from two to three feet high.

Solidago ulmifolia, Muhl. August, September. Very near the last and probably runs into it.

Solidago nemoralis, Ait. July, September. Very common in dry fields. About the earliest *Golden-rod* in this region.

Solidago canadensis, L. August. Exceedingly common in old fields. Easily distinguished from the next two species by its rough, hairy stem. In other characters it very much resembles them.

Solidago serotina, Ait. August. The leaves are rough above and very smooth beneath.

Solidago gigantea, Ait. August, September. Leaves are very smooth both sides.

Solidago lanceolata, L. August. Very common along streams.

Inula helenium, L., (Common elecampane.) June, August. Very abundant on certain hillsides.

* *Pluchea fœtida*, D. C., (Marsh fleabane.) August. Rather common.

Polymnia canadensis, L., (Leaf-cup.) Grows abundantly in shaded ravines along with the next. In the specimens collected the rays were all pure white, and invariably 3-lobed. July, September.

Polymnia uvedalia, L. August September.

* *Parthenium integrifolium*, L. June.

Ambrosia trifida, L., (Great ragweed.) August. Grows

in dense thickets along the river bank, from which stems have been preserved eighteen feet high.

Ambrosia artemisiæfolia, L., (Wormwood, Hogweed, Bitter-sweet.) August, September. Found everywhere and varies greatly.

Xanthium strumarium, L., (Common Cocklebur.) August, September. Found everywhere, especially in worn out fields.

Xanthium spinosum, L., (Spiny Clotbur.) Common along road sides.

Eclipta procumbens, Michx. June, October. Especially abundant along river banks where it attains a very rank growth.

Heliopsis laevis, Pers., (Ox-eye.) July, August. Not so common as the variety.

Heliopsis laevis, Pers., var. *scabra*, Gr. June, October. Very common in thickets.

Rudbeckia laciniata, L., (Cone-flower.) July, September.

Rudbeckia triloba, L. July, August.

Rudbeck ia speciosa, Wenderoth. Dry soil. July, August.

Rudbeckia hirta, L. June, August. Very common in meadows and about the earliest showy composite.

Helianthus annuus, L., (Common Sunflower.) Escaped from cultivation.

Helianthus microcephalus, Torr. & Gr. August. Grows in thickets.

Helianthus hirsutus, Raf. July.

Helianthus decapetalus, L. July. Probably *H. tracheliifolius*, Willd. Was also found but the specimen was so similar to some forms of *H. decapetalus*, L., that they were all included under the latter.

Actinomeris squarrosa, Nutt. August, September. Common along rivulets back from the river.

Coreopsis tripteris, L., (Tickseed, Tall Coreopsis.) August, September. In all the specimens gathered the heads strongly exhaled the odor of mignonette, and that too, without bruising.

Bidens frondosa, L., (Commom Beggar-ticks.) July, October. Very common.

Bidens connata, Muhl, (Swamp Beggar-ticks.) August, October.

Bidens bipinnata, L., (Spanish Needles.) July, August. Very common.

**Dysodia chrysanthemoides*, Lag., (Fetid Marigold.) August.

Helenium autumnale, L., (Sneeze Weed.) August, September.

**Leptopoda brachypoda*, Torr. & Gr. August.

Maruta cotula, D. C., (Common May Weed, Dog Fennel.) May, July. Very common and very disagreeable.

Achillea millefolium, L., (Common Yarrow or Milfoil.) May, August.

Leucanthemum vulgare, Lam., (Ox Eye, or White Daisy, White Weed.) May, July. Is becoming more abundant every year and almost takes possession of certain old pastures.

Tanacetum vulgare, L., (Common Tansy.) August. Along roadsides.

Gnaphalium polycephalum Michx., (Common Everlasting.) Very common. Called in this region "Indian Tobacco," because when chewed it yields a dark brown spittle.

**Gnaphalium uliginosum*, L., (Low Cudweed.) May.

Gnaphalium purpureum, L., (Purplish Cudweed.) June

Antennaria plantaginifolia, Hook, (Plantain-leaved Everlasting.) April, May.

Erechthites hieracifolia, Raf. (Fire Weed.) August, September.

**Cacalia reniformis*, Muhl, (Great Indian Plantain.) June, July.

Cacalia atripicifolia, L., (Pale Indian Plantain.) July, September.

Senecio aureus, L., (Golden Ragwort, Squaw Weed.) March, August. Common and very variable.

**Senecio aureus*, L., var. *obovatus*, Gr. April.

Cirsium lanceolatum, Scop., (Common Thistle.) July, September.

Cirsium attissimum, Spreng. August.

Onopordon acanthium, L., (Cotton, or Scotch Thistle.) June, September. A beautiful thistle growing on the College Hill.

Lappa officinalis, Allioni, (Burdock.) Very common all summer.

Cichorium intybus, L., (Succory, or Cichory.) July, October. Spontaneous in old gardens.

Cynthia virginica, Don. May, July.

Hieracium scabrum, Michx, (Rough Hawkweed.) August.

Hieracium gronovii, L., (Hairy Hawkweed.) July, September. Common.

Hieracium paniculatum, L. August. Common and easily distinguished by its very diffuse branching.

Nabalus asper, Torr. & Gr. August, September.

Nabalus crepidineus, D. C. August, October. Not very abundant, and at a casual glance mistaken for a form of *Vernonia noveboracensis*, Willd., although so widely differing from it.

Taraxacum dens-leonis, Desf. (Dandelion.) April, November. Everywhere.

Lactuca canadensis, L., (Wild Lettuce.) June. Common.

Lactuca canadensis, L., var. *integrifolia*, T. & G. June, August.

Mulgedium floridanum, D. C. August, September. "Leaves runcinately pinnate-parted. Segments few, serrate-dented, upper ones triangular, acute or acuminate." Vide Wood. A good description. Common.

Mulgedium leucophæum, D. C. August.

Sonchus oleraceus, L., (Common Low Thistle.) May, September.

Sonchus asper, Vill., (Spiny-leaved Low Thistle.) June, September.

LOBELIACEÆ.

Lobelia cardinalis, L., (Cardinal Flower.) July, September. Grows in abundance along the shaded banks of rivulets.

Lobelia syphilitica, L., (Great Lobelia, Blue Cardinal Flower.) July, September. Common.

Lobelia puberula, Michx. July, August.

**Lobelia leptostachys*, A. D. C. June, July.

Lobelia inflata, L., (Indian Tobacco.) July, September. Very abundant.

**Lobelia spicata*, Lam. September.

CAMPANULACEÆ.

Campanula americana, L., (Tall Bell-flower.) June, August. Common.

Specularia perfoliata, A. D. C., (Venus' Looking-glass.) May, August.

ERICACEÆ.

Gaylussacia resinosa, Torr. & Gr., (Black Huckleberry.) April, June.

Monotropa uniflora, L., (Indian Pipe, Corpse Plant, Bird's Nest.) June, September. Becoming hard to find.

AQUIFOLIACEÆ

**Ilex verticillata*, Gr., (Black Alder, Winterberry).

EBENACEÆ.

Diospyros virginiana, L., (Common Persimmon.) April, June. Fruit edible after frost.

PLANTAGINACEÆ.

Plantago major, L., (Common Plantain,) June, September.

Plantago lanceolata, L., (Ribgrass, Ripplegrass, English Plantain.) June, September.

Plantago virginica, L. May, September.

PRIMULACEÆ.

Dodecatheon meadia, L., (Shooting Star, American Cowslip, Pride of Ohio.) April, June. A very handsome plant, growing in abundance on rocky ledges.

**Lysimachia quadrifolia*, L. May. June.

Lysimachia ciliata, L. June, July. Very common in thickets.

Lysimachia lanceolata, Walt. June. Common in wet meadows.

Lysimachia lanceolata, Walt., var., *augustifolia*, Gr. June, July.

**Lysimachia longifolia*, Pursh. July.

Lysimachia nummularia, L., (Moneywoot.) Escaped from cultivation.

Anagallis arvensis, L., (Common Pimpernel.) June. Hard to find as it is easily concealed by the grass.

**Centunculus minimus*, L. May. Common.

Samolus valerandi, L. var., *americanus*, Gr., (Water Pimpernel, Brook Weed.) May, September. Abundant in marshy places.

BIGNONIACEÆ.

Tecoma radicans, Juss, (Trumpet Creeper.) June, August.

Catalpa bignonioides, Walt., (Catalpa, Indian Bean.) June, July. Common in cultivation as a shade tree.

OROBANCHACEÆ.

Epiphegus virginiana, Bart, (Beech-drops, Cancer-root.) August, October. Very common.

Conopholis americana, Wallroth, (Squaw-root.) April, June. Very common on the sand.

Phelipæa ludoviciana, Don., (Broom-rape.) August, October.

**Aphyllon uniflorum*, Torr. & Gr., (One-flowered cancer root.)

SCROPHULARIACEÆ.

Verbascum thapsus, L., (Common Mullein.) June, August. Too common.

Verbascum blattaria, L., (Moth Mullein.) June, July. Common along roadsides.

Linaria vulgaris, Mill., (Common Toad-flax. Butter and Eggs. Ramsted.) June, September. Very common along hillsides and in the ravines.

Scrophularia nodosa, L., (Fig Wort.) July, October.

Collinsia verna, Nutt. April, June. Damp woods.

* *Chelone glabra*, L., (Turtle-head. Snake-head.) September, October.

Pentstemon pubescens, Solander. May, July.

Mimulus ringens, L., (Monkey-flower.) June, August. Common along with the next.

Mimulus alatus, Ait., July, August.

Conobea multifida, Benth., July, September. Common.

Gratiola virginiana, L., (Hedge-hyssop.) May, June. Thickets and along fence rows. Very common.

**Gratiola viscosa*, Schweinitz.

Ilysanthes gratioloides, Benth. (False Pimpernel.) July, September. Wet places.

Veronica virginica, L., (Culver's Root.) July, August. Fence rows.

Veronica anagallis, L., (Water Speedwell.) June, August.

Veronica americana, Schweinitz. (American Brook Lime.) June, August. Common in ditches.

Veronica officinalis, L., (Common Speedwell.) May, July. Everywhere.

Veronica serpyllifolia, L., (Thyme leaves. Speedwell.) April, August. Roadsides and fields.

Veronica peregrina, L., (Neckweed. Purslane Speedwell.) April, June.

Veronica avrensis, L., (Corn Speedwell.) April, June. Common.

Seymeria macrophylla, Nutt. (Mullein Foxglove.) July, August. Bluffs of the river.

Gerardia tenuifolia, Vahl. August. A beautiful plant growing in thickets.

Gerardia flava, L., (Downy False Fox Glove.) August.

Geradia quercifolia, Pursh. (Smooth False Foxglove.) August. Rare.

**Gerardia auriculata,* Michx. August.

Pedicularis canadensis, L., (Louse Wort.) April, May.

ACANTHACEÆ.

Dianthera americana, L., June, September. Common along the river bank.

Ruellia ciliosa, Pursh. June, September.

Ruellia strepens, L., May, September.

VERBENACEÆ.

Verbena augustifloia, Michx. All summer. Dry soil.

Verbena hastata, L., (Blue Vervain.) June, August. Very common.

Verbena urticifolia, L., (Nettled-leaved or White Vervain.) Very common all summer in old fields and along roadsides. The flowers sometimes are purple.

Verbena stricta, Vent., (Hoary Vervain.) July. Sandy soil. A very showy Vervain.

Verbena officinalis, L., (European Vervain.) June, July. Not at all abundant.

Verbena brackosa, Michx. May, September. Very common everywhere in waste places, and very variable.

Verbena aubletia, L., April, September. Is very generally cultivated but grows spontaneously.

Lippia lanceolata, Michx, (Fog-fruit.) July, September. Common along shady banks. In all the specimens collected the heads were decidedly purplish-white rather than bluish-white.

Phryma leptostachya, L., (Lopseed.) June, August. Very common.

LABIATÆ.

Teucrium canadense, L., (American Germander, Wood Sage.) June, September.

Isanthus cœruleus, Michx, (False Pennyroyal.) July, October. Very common along sandy banks.

Mentha viridis, L., (Spearmint.) July, September. Common in marshy places.

Mentha piperita, L., (Peppermint.) July, September. Common along brooks.

Mentha sativa, L., (Whorled Mint.) August.

Mentha canadensis, L., (Wild Mint.) July. Common and exceedingly variable, probably including the last.

**Lycopus virginicus*, L., (Bugle-weed.) August.

Lycopus europœus, L., var. *integrifolius*, Gr. August.

Lycopus europœus, L., var. *sinatus*, Gr. August. This and the last are very common.

Pycnanthemum lanceolatum, Pursh, (Mountain Mint.) June, August.

**Calamintha glabella*, Benth., var. *nuttallii*, Gr. August, September.

Calamintha clinopodium, Benth., (Basil.) August. Common in thickets.

Melissa officinalis, L., (Common Balm.) June, July.

Hedeoma pulegioides, Pers., (American Pennyroyal.) Abundant all summer.

Collinsonia canadensis, L., (Horse-balm, Rich-weed, Stone-root.) July, September.

Salvia lyrata, L., (Lyre-leaved Sage.) May.

Monarda fistulosa, L., (Wild Bergamot.) May, September. Very common in the woods.

Monarda bradburiana, Beck. May, July.

Blephilia ciliata, Raf. Summer.

Belephilia hirsuta, Benth. June, August. Very abundant and very variable.

Lophanthus nepetoides, Benth, (Giant Hyssop,) August. Thickets.

Lophanthus scrophulariæfolius, Benth. August.

Nepeta cataria, L., (Catnip.) June, September. Very common.

Nepeta glechoma, Benth., (Ground Ivy, Gill-over-the ground.) March, August. Very abundant, and grows in beautiful patches.

Synandra grandiflora, Nutt. May, June. Abundant in Clifty ravine. "Stamins covered with red hairs and corolla, streaked with pinkish lines." Young.

**Physostegia virginiana*, Benth., (False Dragon-head.) August.

Brunella vulgaris, L., (Common Self-heal, or Heal-all.) June, September. Common.

Scutellaria versicolor, Nutt., (Skull Cap.) June, July.

Scutellaria nervosa, Pursh. May, June.

Scutellaria lateriflora, L. July, August.

Marrubium vulgare, L., (Common Hoarhound.) May, June. Common.

Galeopsis tetrahit, L., (Common Hemp, Nettle.) June, September.

Stachys palustris, L., var. *aspera*, Gr. June.

Stachys palustris, L., var. *glabra*, Gr. September.

Stachys palustris, L., var. *cordata*, Gr. June. By far the most common form.

Leonurus cardiaca, L., (Common Motherwort.) June. Very common.

Lamium amplexicaule, L., (Dead Nettle.) March, June. Abundant in cultivated grounds.

BORRAGINACEÆ.

Symphytum officinale, L., (Common Comfrey.) April, June. Common in open woods.

Onosmodium carolinianum, D. C. July.

**Lithospermum latifolium*, Michx. May.

Lithospermum hirtum, Lehm, (Hairy Puccoon.) April, June.

Mertensia virginica, D. C., (Virginian Cowslip, or Langwort, Blue Bells.) March, May. Grows in large patches in certain favorable locations.

**Mysotus verna*, Nutt. Rare. May.

Echinospermum lappula, Lehm, (Stickseed.) July.

Cynoglossum officinale, L., (Common Hounds' Tongue.) April, July. Too common.

Cynoglossum virginicum, L., (Wild Comfrey.) May.

Cynoglossum morisonii, D. C., (Beggar's Lice.) Found everywhere and at all seasons.

Heliotrophytum indicum, D. C., (Indian Heliotrope.) August. Grows in tolerably large patches along the river bank.

HYDROPHYLLACEÆ.

Hydrophyllum macrophyllum, Nutt. April, June. Common in the woods.

Hydrophyllum virginicum, L., April, July.

Hydrophyllum canadense, L., May, August. In some of the specimens referred to this species, the leaves were rough and calyx hispid.

Hydrophyllum appendiculatum, Michx. April, July.

Phacelia bipinnatifida, Michx. April, June. Very common.

POLEMONIACEÆ.

Polemonium reptans, L., (Greek Valerian.) March, June.

Phlox paniculata, L. June, August.

Phlox paniculata, L., var. *acuminata*, Gr. June.
Phlox maculata, L., (Wild Sweet William.) June.
Phlox glaberima, L., June, July.
Phlox pilosa, L., April, June.
**Phlox procumbens*, Lehm. June, July.
Phlox divaricata, L. March, May.

CONVOLVULACEÆ.

Ipomœa purpurea, Lam, (Common Morning Glory.) June, August. Frequently escaped.

Ipomœa nil, Roth, (Smaller M.) August. Very common along the river.

Ipomœa lacunosa, L. August. The peduncles were found to be 1-5-flowered, rather than 1-3-flowered.

Ipomœa pandurata, Meyer, (Wild Potato-vine, Man-of-the-Earth.) June, August.

Calystegia sepium, R. Br., (Hedge Bindweed.) July.

Cuscuta gronovii, Willd, (Dodder.) Every *Cuscuta* in this region seems to belong to *C. gronovii*, Willd., although we have desired to place some of them elsewhere.

SOLANACEÆ.

Solanum dulcamara, L., (Bittersweet.) May, September.

Solanum nigrum, L., (Common Nightshade.) June, November.

Solanum carolinense, L., (Horse-Nettle.) May, August. Common.

Physalis philadelphica, Lam. June.

Physalis pubescens, L. June. The most common *Physalis*.

**Physalis viscosa*, L. Summer months.

**Physalis pennsylvanica*, L. June.

Nicandra physaloides, Gærtn, (Apple of Peru.) June. Common.

Lycium vulgare, Dunal, (Common Matrimony Vine.) May, June. Escaped.

Datura stramonium, L., (Common Jamestown Weed, or Thorn Apple.) June, October. The common name has long since been corrupted into *Jimson Weed.*

Datura tatula, L., (Purple T.) June, August.

GENTIANACEÆ.

Sabbatia angularis, Pursh. July, August. Common in dry ground.

Gentiana andrewsii, Griseb, (Closed Gentian.) September, October. Common.

**Obolaria virginica*, L. Rare. April.

APOCYNACEÆ.

Apocynum androsæmifolium, L., (Spreading Dogbane.) June, July.

Apocynum cannabinum, L., (Indian Hemp.) June, September. Common along the river banks.

Apocynum cannabinum, L., var. *hypercifolium*, Gr. Along with the former.

ASCLEPIADACEÆ.

Asclepias cornuti, Decaisne, (Common Milkweed, or Silkweed.) June, July. Very abundant.

**Asclepias phytolaccoides*, Pursh, (Poke Milkweed.) June.

**Asclepias purpurascens*, L., (Purple Milkweed.) Rare. June.

Asclepias variegata, L. June.

Asclepias quadrifolia, Jacq., (Four-leaved M.) April, June. Common dry woods.

Asclepias perennis, Walt.

Asclepias incarnata, L., (Swamp Milkweed.) August.

Asclepias incarnata, L. var. *pulchra*, Gr. July, August.

Asclepias tuberosa, L., (Butterfly-weed, Pleurisy root.) June, Angust. A very showy plant, and rather common.

In the specimens collected the leaves were decidedly petioled and plainly auriculate at base.

Enslenia albida, Nutt. July, September. Common along the river bank.

OLEACEÆ.

Fraxinus americana, L., (White Ash.) March, May.

Fraxinus sambucifolia, Cam., (Black or Water Ash.) April, May.

Fraxinus quadrangulata, Michx., (Blue Ash.) March, May.

ARISTOLOCHIACEÆ.

Asarum canadense, L., (Wild Ginger.) March, May. Grows in abundance on rich hillsides. The full-grown leaves have a rich, satin lustre.

PHYTOLACCACEÆ.

Phytolacca decandra, L., (Common Pokeweed, Scoke, Garget, Pigeon-berry.) June, September.

CHENOPODIACEÆ.

Chenopodium album, L., (Lamb's-Quarters, Pigweed.) Common in cultivated ground.

**Chenopodium ambrosioides*, L., (Mexican Tea.) August.

AMARANTACEÆ.

Amarantus retroflexus, L. August. Common.

Amarantus spinosus, L., (Thorny Amaranth.) August.

**Montelia tamariscina*, Gr. August.

Iresine celosioides, L. August, September.

POLYGONACEÆ.

Polygonum orientale, L., (Prince's Feather.) August. Escaped to the ravines.

**Polygonum pennsylvanicum*, L. August.

Pylygonum incarnatum, Ell. May, July.

Polygonum persicaria, L., (Lady's Thumb.) June.

Polygonum hydropiper, L., (Common Smartweed or Water-pepper.) June.

Polygonum acre, H. B. K., (Water Smartweed.) June, July.

Polygonum hydropiperoides, Michx, (Mild Water-pepper.) July.

**Polygonum amphibium*, L. July.

Polygonum virginianum, L. August. Common in rich soil.

Polygonum aviculare, L., (Knotgrass, Goose-grass, Door-weed.) June, December. The commonest of all weeds.

Polygonum aviculare, L., var. *erectum*, Roth. June, August.

**Polygonum ramosissimum*, Michx. May.

Polygonum sagittatum, L., (Arrow-leaved, Tear-Thumb, Scratch-weed.) August, September.

Polygonum convolvulus, L,, (Black Bindweed.) June, August.

Polygonum dumetorum, L., (Climbing False Buckwheat.) May, July.

Polygonum dumetorum, L., var. *scandens*, Gr. August. Thickets. Climbing high.

Fagopyrum esculentum, Mœnch. (Buckwheat.) August. Growing spontaneous.

Rumex longifolius, D. C. June.

Rumex orbiculatus, Gr. (Great Water Dock.) May, June.

Rumex britannica, L., (Pale Dock.) August.

Rumex verticillatus, L., (Swamp Dock.) July. Common in swamps.

Rumex obtusifolius, L., (Bitter Dock.) August.

Rumex acetosella, L., (Field or Sheep Sorrel.) May, June.

LAURACEÆ.

Sassafras officinale, Nees. April, May. Common.

Linbera benzoin, Meisner. (Spice-bush. Benjamin-bush.) March, April. The bark and young twigs are very spicy to the taste.

LORANTHACEÆ.

Phoradendron flavescens, Nutt. (American Mistletoe.) Most commonly parasitic on the elm, though found growing on other trees. The flowers and fruits may be found hanging in the same clusters at any time from November to March.

SAURURACEÆ.

Saururus cernuus, L., (Lizard's tail.) June, August. Common in swamps and very fragrant.

EUPHORBIACEÆ.

Euphorbia maculata, L., July, November. Very common.

Euphorbia humistrata, Engelm. August.

Euphorbia hypericifolia, L., July, October.

Euphorbia marginata, Pursh. August, October. Grows in abundance along roadsides and is not at all cultivated.

Euphorbia corollata, L., July, August.

Euphorbia commutata, Engelm. May, July.

Acalypha virginica, L., (Three seeded Mercury.) July, September. Very common.

URTICACEÆ.

Ulmus fulva, L., (Slippery or Red Elm.) March April. A common tree.

Ulmus americana, L., (American or White Elm.) March, April.

Celtis occidentalis, L. (Sugar-berry. Hackberry.) March, April.

Morus rubra, L., (Red Mulberry), April, May.

Morus alba, L, (White Mulberry.)

Urtica gracilis, Ait, (Nettle,) June, August.

Laportea canadensis, Gaudichaud, (Wood Nettle.) July, September. Common in rich woods.

Pilea pumila, Gr., (Richweed, Clearweed.) July, September. Exceedingly common in rich ground. At once recognized by its watery, translucent stems and veins.

Bœhmeria cylindrica, Willd, (False Nettle.) July, September. Common everywhere.

Parietaria pennsglvanica, Muhl. May, August. Common on shaded banks.

Cannabis sativa, L., (Hemp.) July, August.

Humulus lupulus, L., (Common Hop.) July.

PLATANACEÆ.

Platanus occidentalis, L., (American Plane, or Sycamore, Buttenwood.) April, May.

JUGLANDACEÆ.

Juglans cinerea, L., (Butternut.) April, May. Fruit ripe in September.

Juglans nigra, L., (Black Walnut.) April, May. A valuable timber tree.

Carya olivæformis, Nutt., (Pecan-nut.) May. There are several trees in the river bottom.

Carya alba, Nutt, (Shellbark, or Shagbark Hickory.) April. Very common.

Carya macrocarpa, Nutt, (Small-fruited Hickory.) May.

Carya sulcata, Nutt, (Western Shellbark Hickory.) April.

Carya tomentosa, Nutt, (Mocker-nut, White-heart Hickory.)

Carya porcina, Nutt, (Pig-nut or Broom H.) April.

CUPULIFERÆ.

Quercus alba, L., (White Oak.) April.

Quercus bicolor, Willd, (Swamp White Oak.) April. Common.

Quercus prinus, L., var., *acuminata*, Michx, (Yellow Chestnut Oak.) April, May.

Quercus coccinea, Wang, (Scarlet Oak.) April. Common.

Quercus coccinea, Wang, var., *tinctoria*, Gr. (Quercitron, Yellow-barked, or Black Oak.) May.

Quercus rubra, L., (Red Oak.) April. Common.

Castanea vesca, L., (Chestnut,) var. *Americana*, Mich. June, July.

Fagus ferruginea, Ait, (American Beech.) March, April. Very abundant in our forests.

Corylus americana, Walt., (Wild Hazel-nut.) March.

Ostyra virginica, Willd, (American Hop, Hornbeam, Lever-wood.) April. Common.

Carpinus americana, Michx, (American Hornbeam, Iron-wood, Blue or Water Beech.) April. Common along streams.

SALICACEÆ.

**Salix humilis*, Marshall, (Prairie Willow.) April.

Salix discolor, Muhl, (Glaucous Willow.) April, May.

Salix viminalis, L., (Basket Osier.) April.

Salix livida, Wahl., var. *occidentalis*, Carey. May.

Salix nigra, Marsh, (Black Willow.) May, June.

Salix alba, L., (White Willow.) April.

**Salix alba*, L., var. *cærulea*, Carey. April. River bank.

Salix babylonica, Town, (Weeping Willow.) Commonly planted for ornament.

Salix longifolia, Muhl, (Long-leaved Willow.) May, June. Very abundant along streams.

Populus monilifera, Ait., (Cotton-wood, Necklace Poplar.) Along the river. Grows to an immense hight, sometimes over 100 feet.

Populus balsamifera, L., (Balsam Poplar, Tacamahac.) March. Grows along the river bank.

CONIFERÆ.

Juniperus communis, L., (Common Juniper.) May, June. By no means abundant.

ARACEÆ.

Arisæma triphyllum, Torr, (Indian Turnip.) April, May. Very common in rich woods.

Arisæma dracontium, Schott, (Green Dragon, Dragon Root.) June.

**Acorus calamus*, L. Rare.

LEMNACEÆ.

Lemna minor, L., (Duckweed.) Very common in stagnant waters. With the next it covers whole ponds with green.

Lemna polyrrhiza. L. Rather more abundant than the former.

TYPHACEÆ.

Typha latifolia, L., (Common Cat-tail or Reed-mace.) June, July.

ALISMACEÆ.

Alisma plantago, L., var. *americanum*, Gr., (Water Plantain.) July, September.

Sagittaria variabilis, Engelm, (Arrow-head.) July, August.

HYDROCHARIDACEÆ.

Anacharis canadensis, Planchon, (Water-weed.) July. Common in slow streams and millraces, along with the next.

Vallisneria spiralis, L., (Tape-grass, Eel-grass.) July, August

ORCHIDACEÆ.

Orchis spectabilis, L., (Showy Orchis.) May.

Habenaria psycodes, Gray. July, August.

Habenaria peramœna, Gray. August.

Spiranthes cernua, Richard. August, October.

Corallorhiza odontorhiza, Nutt. May, June.

Aplectrum hyemale, Nutt, (Putty-root. Adam and Eve.) May.

AMARYLLIDACEÆ.

Agave virginica, L., (False Aloe.) September. Hard to find but undoubted.

Hypoxys erecta, L., (Straw-grass.) May, June. Rare.

IRIDACEÆ.

Iris versicolor, L., (Large Blue Flag.) May, June. Common.

Pardanthus chinensis, Ker., (Blackberry Lily.) July, September. Several large patches have escaped from cultivation.

Sisyrinchium bermudiana, L., (Blue-eyed Grass.) May.

Sisyrinchium bermudiana, L., var., *anceps*, Gr. May, June.

DIOSCOREACEÆ.

Dioscorea villosa, L., (Wild Yam-root.) May, July. Abundant, twining over bushes among thickets.

SMILACEÆ.

Smilax rotundifolia, L., (Common Green-brier.) May, June. Common.

Smilax glauca, Walt. May, June.

**Smilax hispida*, Muhl. May.

Smilax herbacea, L., (Carrion Flower.) June.

Smilax herbacea, L., var., *pulverulenta*, Gr. May, June. More abundant than the former.

LILIACEÆ.

Trillium sessile, L., March, April. Very common in early spring. It often has its sepals changed into leaves, and also appears with other modifications of the typical form.

Trillium recurvatum, Beck. April, May. Common.

Trillium erectum, L., (Purple Trillium, or Birthroot.) April, May.

Trillium erectum, L., var., *album*, Pursh. March, April. Common in rich woods.

Trillium erectum, L., var., *declinatum*, Gr. May.

Trillium cernuum, L., (Nodding, or Wake-Robin.) April. Moist woods.

Trillium cernuum, L., var., *atrorubens*, Wood, (2d Indiana Geol. Survey, p. 286.) This variety was found by Mr. Young, and described by Prof. Wood.

Uvularia grandiflora, Smith. April.

Uvularia perfoliata, L., April.

Uvularia sessilifolia, L., May.

Smilacina racemosa, Desf., (False Solomon's Seal, or Spikenard.) April, June. Common.

Smilacina stellata, Desf. April, May.

Polygonatum biflorum, Ell, (Smaller Solomon's Seal.) May, June. Common.

Polygonatum giganteum, Dietrich, (Great S.) April, August. Grows rank in the corners of cultivated fields.

Asparagus officinalis, L., (Garden Asparagus.) May, escaped.

Lilium philadelphicum, L., (Wild Orange-red Lily.) June. Common on the sand flats.

Lilium canadense, L., (Wild Yellow Lily.) July.

**Lilium superbum*, L., (Turk's-cap Lily.) July.

Erythronium americanum, Smith, (Yellow Adder's-tongue.) March, April. Common along with the next.

Erythronium albidum, Nutt, (White Dog's-tooth, Violet.) March. Not so common as the last.

Ornithogalum umbellatum, L. April, May. Escaped.

Scilla fraseri, Gray, (Squill, Eastern Quamash, Wild Hyacinth.) April, May. Grows along the hillsides.

Allium tricoccum, Ait., (Wild Leek.) July.

Allium cernuum, Roth, (Wild Onion.) July, August. Common.

Alium canadense, Kalm, (Wild Garlic.) May, June.

Muscari botryoides, Mill, (Grape-Hyacinth.) March, April. Escaped.

Hemerocallis fulva, L., (Day-Lily.) May, June. Escaped.

JUNCACEÆ.

Luzula campestris, D. C. March, May. Very common in dry fields and woods.

Juncus tenuis, Willd. Common.

COMMELYNACEÆ.

Commelyna erecta, L., (Day-flower.) August, September. Shaded ravines.

Commelyna virginica, L., Damp, rich hillsides.

Tradescantia virginica, (Common Spiderwort.) May.
Tradescantia pilosa, Lehm. May, July.

CYPERACEÆ.

The following list of Sedges and Grasses were named by Dr. Geo. Vasey, of the Agricultural Department, Washington, D. C., from specimens sent by M. Stanley Coulter:

Eleocharis tenuis, Schultes.
Eleocharis tenuis, Schultes, var.
Scirpus atrovirens, Muhl.
Scirpus lineatus, Michx.
Carex vulpinoidea, Michx.
Carex stipata, Muhl.
Carex sparganioides, Muhl.
Carex cephalaphora, Muhl.
Carex lagopodioides, Schk.
Carex crinita, Lam.
Carex buxbaumii, Wahl.
Carex shortiana, Dew.
Carex granularis, Muhl.
Carex gracillima, Schw.
Carex triceps, Michx.
Carex laxiflora, Lam.
Carex laxiflora, Lam., var., *plantaginea*, Boott.
Carex novæ, Angliæ, Schw., var.
Carex pennsylvanica, Lam., var.
Carex pubescens, Muhl.
Carex debilis, Michx.
Carex lanuginosa, Michx.
Carex tentaculate, Muhl.
Carex tentaculate, Muhl, var.
Carex intumescens, Rudge.
Carex lupulina, Muhl.
Carex squarrosa, L.

GRANIMEÆ.

Dactylis glomerata, L., (Orchard Grass.)
Eatonia pennsylvanica, Gr.
Glyceria nervata, Trin., (Fowl Meadow Grass, in part.)
Festuca nutans, Willd, (Fescue Grass.)
Bromus ciliatus, L., (Broom Grass.)
Gymnostichum hystrix, Schreb., (Elymus Hystrix, L.,) (Bottle-brush Grass.)
Danthonia spicata, Beam, (Wild Oat Grass.)
Panicum dichotomum, L.

EQUISETACEÆ.

Equisetium arvense, L., (Common Horsetail.)
Equisetum robustum, Braun.

FILICES.

The Ferns of this locality have not been carefully worked up. I only give the most common.

Pellæa atropurpurea, Link. (Cliff-Brake.) Grows in abundance upon our limestone rocks where they are found all the year around, good fruiting specimens having been collected in February, of course wintered from the previous season.

Asplenium ruta muraria, L., April. Not in fruit. Limestone cliffs.

Asplenium angustifolium, Michx. August, September. Common.

Camptosorus rhizophyllus, Link. (Walking-Leaf or Walking-Fern.) Very common on limestone cliffs, forming large patches.

Phegopteris hexagonoptera, Fee. July, August. Common in open woods.

Aspidium filix-mas, Swartz. August.

Aspidium marginale, Swartz. July, August. Some most beautiful specimens of this species were obtained.

Aspidium acrostichoides, Swartz. July, August. Very common along hillsides.

Cystopteris bulbifera, Bernh. July, August. Common in shaded ravines.

Cystopteris fragilis, Bernh. July. Common and very variable.

LICHENES.

The following species, two lichens and three fungi, were sent to Chas. H. Peck, Esq., of Albany, N. Y., who has kindly given their names. A vast field is presented here to the enterprising *mycologist*, and it is to be hoped that it will soon be occupied by laborers competent to do it justice.

Theloschistes parietinus, L. March.

Cladonia degenerans, Flk. March. "Has the appearance of *C. mitrula*, T., but from the dark color of the apothecia I should refer it to *C. degenerans*, Flk."

FUNGI.

Agaricus (collybia) *velutipes*, Curt. March.

Polyporus boucheanus, Fr. March.

Peziza coccinea, Jacq. February.

This is one of the earliest fleshy fungi, and may be readily recognized by its beautiful little cup with scarlet lining. Grows on half decayed sticks.

SUMMARY.

Number of *Families*..	98
Number of *Genera*.....	367
Number of *Species*	721

INDEX TO FAMILIES

NAMED IN

LIST OF PLANTS IN JEFFERSON COUNTY.

INDEX.

ERRATA.

Page 3, line 10, erase "also, a report on Morgan county."
Page 5, line 4, erase "and Morgan."
Page 81, line 26, erase "16°" and "commas" preceding and following "West."
Page 82, line 20, erase ", and."
Page 99, line 16, for "seven," read "several."
Page 116, line 29, for "substratified," read "unstratified."
Page 119, line 14, for "ne," read "one."
Page 122, line 19, for "contains," read "often contains."
Page 124, line 28, for "high," read "thick."
Page 124, line 38, for "Knobs," read "Knab's."
Page 130, line 1, after "Niagara," insert "Big Creek flows at the summit of the Black Slate at the Jeffersonville, Madison & Indianapolis Railroad crossing."
Page 133, line 18, for "lower," read "town."
Page 138, line 3, for "form," read "are found on."
Page 141, line 4, for "Loudon," read "London."
Page 146, line 26, after "Sheldon" erase "near."
Page 164, line 8, for "of" read "at."
Page 164, line 19, after "purposes" insert "contains *Calymene senaria*," and erase these words from line 20.
Page 164, line 20, for "limestone" read "Limestone."
Page 168, line 30, for "without having" read "retaining."
Page 184, after line 29, add "*Orthis flabellum*, *Platyceras niagarensis*."
Page 186, after line 22, add "*Favosites pleurodyctioides*, *Rhynchonella carolina* and *Macropetalichthys sullivanti*, Norwood & Owen."
Page 239, line 14, for "Lapindaceae" read "Sapindaceae."