

GEOLOGICAL REPORT  
ON  
Vanderburg, Owen and Montgomery Counties  
I N D I A N A .

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BY JOHN COLLETT, M. A.

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PROF. E. T. COX, .

State Geologist :

SIR :—Herewith I hand you my reports on the Geology of Vanderburg, Owen and Montgomery, together with results of examinations of the coal fields in the southeastern part of Clay, and the coal measure rocks of Putnam counties.

With acknowledgments for courtesies, I am,

Yours, etc.,

JOHN COLLETT.

Newport, Vermillion county, Ind., 31st Dec., 1875.

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VANDERBURG COUNTY.

Vanderburg is situated in the southwestern part of the State, being, except one, the extreme southwestern county. Evansville, the seat of justice, and the chief city, is one hundred and eighty miles distant from Indianapolis. It

is bounded on the west by Posey, north by Gibson, east by Warrick county, and on the south by the State of Kentucky at low water in the Ohio river, and contains an area of two hundred and forty square miles, or 153,600 acres. The southern boundary is the Ohio—the “*Belle rivière*” of the early French adventurers—the beautiful river of song and story. Always navigable, without interruption from drought or winter’s ice at this point, it is the great artery of trade and economic life to the bordering region, and bears upon its bosom a fleet of steamers equaling in value and tonnage that of some internal seas. Belted by broad alluvial plains or high bluffs, from which interesting views full of picturesque beauty may be attained, the river and valley has been compared by tourists to that Mecca of travelers, the Rhine of Europe. The eastern and northeastern parts of the county have their water-shed by Bluegrass, Locust and Little creek, through Big Pigeon into the Ohio, and the northwestern parts are drained by Big creek and its branches into the Wabash.

The river bottoms which border the Ohio are from two to six miles wide. Composed of a light sandy loam, they are very fertile, and produce profitable crops of corn, wheat, potatoes, tobacco and meadow grass. The forests comprise black and white walnut, red, white and burr oak, red and white elm, white and black gum, cottonwood, hickory, maple, willow, sycamore, cypress, pecan, etc., with many shrubs and vines. At several points, and sometimes in large areas, the cypress, the catalpa, cane and other sub-tropical plants survive as relics of the warmer clime which signalized the long past Lacustral age.

That interesting parasite, the mistletoe, was noted as common on the timber of the valleys, modestly hiding in the foliage of its victim during the summer, but in winter waving its ever-green plumes as if in triumph over the decay and death of the latter. It selects the following trees for its food and life, in numbers according to the order of enumeration; black gum and red elm seeming to be best suited for its growth. On 1,000 trees,

the following table will exhibit about the proportion attacked by this parasite:

1. Black gum .....	500
2. Red elm .....	420
3. Water birch .....	20
4. Black walnut .....	15
5. Honey locust .....	10
6. Blue ash .....	10
7. Soft maple .....	10
8. Hackberry .....	5
9. Yellow willow .....	5
10. Shell-bark hickory .....	2
11. Spanish oak .....	1
12. White oak .....	1
13. Wild cherry .....	1
Total .....	<u>1,000</u>

The other creeks flowing across the county, from northeast to south and southwest, are of no great capacity—generally small brooks, and in summer droughts are sometimes nearly dry, yet they flow through valleys from one to three miles wide, and largely greater than the probable erosive or possible usitude of the present streams and existing watershed, and demanding more powerful agencies for their excavation, than those existing at this day. This point will be further considered under the head of Glacial drift. Their “bottoms” are level, flat, and characteristically argillaceous, or hard and compact, and demand underground drainage for successful and profitable growth of the cereals. They are better adapted to meadow grass, and good crops of hay, etc., are grown upon them. The timber indicates the nature of the soil, and comprises white, burr, water and jack oaks, gum, elm, maple and sycamore, etc., with beech, sugar tree, poplar and walnut on sandy loams. These “flat bottoms,” with a soft or muddy bed in the streams and brooks, are almost universal in regions where the bluffs and table lands are composed of thin, fine, impalpable sands of the Lacustral age, and the streams contrast unfavorably with the brooks, dashing and flashing over their rocky or pebbly beds, a short distance to the north.

From the creek and river valleys we pass, sometimes by gentle ascents, along the tributaries, but often by abrupt bluffs, to the table lands. The latter, in the central and northern parts, attain an elevation of from 150 to 350 feet, and average a height of 225 feet above low water in the Ohio river; and being formed, as a rule, from lacustral, fine sands or loam, the soil is compact, and to a degree impervious to air and moisture unless drained or well intermixed with vegetable matter. The flat areas are wet and predisposed to prairies or "openings," but the slightly uneven surfaces are clothed with a thick growth of timber. Of this, post-oak, persimmon and sweet gum are characteristic if not peculiar. White, red and spanish oaks, black gum, maple, white and black hickory are common. The rolling uplands, containing a generous admixture of red calcareous material, imparted by fluvial action, is richer, and has a corresponding growth of sugar trees, poplars, black walnut and ash added to the former list. Both varieties of upland, when properly cultivated, produce fair to good crops of corn, wheat, oats and meadow grass. The hills and high ridges, by the modifying influence of their elevation, are exempt from the destroying effects of sudden changes of temperature, and admirably adapted to the growth of tender fruits and vines. Advantage has been taken of this situation by progressive farmers and gardeners, and the many extensive and profitable orchards and vineyards of this county are regarded sure sources of income by their prosperous owners. These areas, entirely elevated above the malaria of the valleys, are remarkably free from fevers attributed to that cause. Good cisterns for filtering and containing rain water for family use, would furnish an ample supply of purer water than can be obtained from wells or springs in this soil, and would probably, in a considerable degree, avert inflammatory diseases.

Dr. D. D. Owen describes this Lacustral loam as a silico-calcareous earth, of pale reddish gray or ashen flesh tint. Says that, when in part composed of decomposed material

of coal measure rocks, it gives rise to some of the best tobacco land. He gives the following analysis :

Combined moisture.....	1.35
Soluble organic matter.....	.30
Insoluble silicates.....	73.30
Carbonic acid.....	10.00
Lime .....	6.80
Magnesia .....	3.78
Alumina and per oxide of iron.....	2.80
Chlorine.....	.12
Loss and alkalis.....	1.55
	<u>100.00</u>

An analysis of water leached through this material is found to contain an excess of magnesia, and observation shows that it has a deleterious effect on the health of those who habitually employ it for domestic and drinking purposes. During the prevalence of cholera, Owen observes, that those who habitually used this kind of water were apt to be more frequently and seriously attacked. In such localities, at times of drought, erysipelas and typhoid fevers are liable to prevail. Magnesia and its metallic combinations, rendered deliquescent by exposure to atmosphere, are not acute poisons, perhaps, in the small quantity which exists, but long continued use produces a chronic irritation which may tend to incite disease. Hence the use of pure, filtered rain water is earnestly urged.

#### RECENT GEOLOGY.

##### *Alluvium.*

The "river bottoms" or alluvial flats bordering the creeks and rivers, are due to causes now in action, and are composed of fine and coarse sand, gravel and smooth stones torn from older deposits and rounded by rolling over the rough bed by water in motion; clay and much vegetable matter, leaves, sticks and trunks of trees are often found buried at great depths, even more than 100 feet below the bottom of the present streams, and at the same time fluvial sand-bars and gravel beds are found from 100 to 200 feet above

the high water line, indicating the extreme range of our rivers, and the time necessary to erode and remove or sort and modify such an immense amount of material. This deposit is always found above or thrown against the banks or excavated edges of the older deposits, and never beneath.

#### LACUSTRAL EPOCH.

The Loess or Lacustral beds succeed in age, and are represented by an ash gray or brownish buff loam, composed principally of a siliceous material in a finely powdered condition, with a small amount of clay, and rarely containing shells of tropical or sub-tropical animals. A list of some of the typical shells is given in our report on Sullivan county, 1870. From the black muddy sediment deposited in the deepest water and in pre-existing canyon-like valleys, have been found teeth and bones of the *Megalonyx*, *Castoroides* and American elephant, and some other large animals not yet determined. The great Post Glacial lake covered a large area of the interior of the continent, including southwestern Indiana and regions adjoining to the south and west, marking its extreme high water line at between 700 and 800 feet above the level of the ocean, thence gradually decreasing in size and level to mere ponds and lagoons not over 300 feet above tide-water. Facts heretofore observed seem to indicate that some relics of the flora and fauna of that age have survived in sheltered spots—in the last lagoons—to this day, as the cypress, persimmon, pecan, smooth honey locust, catalpa, thorny sumac and cane, with the paroquet, cotton-mouth and grass snake and red-mouthed salamander, which are all of tropic or sub-tropic life.

The Lacustral deposits consist of:

Redish yellow loam, sandy .....	5 to 15 ft.
Gray and buff silicious loam .....	10 to 50 ft.
Black quicksand—muck with much vegetable matter in pre-lacustral valleys and channels...	0 to 50 ft.

115 ft.

In the last deposit, or in a cherty gravel lying on it, have been found in this and adjoining counties the bones of monster tropic animals, often of South American type, as the *Megalonyx* and other great Sloths, the mammoth or *Elephas Americanus*, the great beaver *Casteroides Ohioensis*, etc., part of which are described by Leidy in a memoir of the extinct Sloth tribe of North America, in Smithsonian contributions.

The remains just referred to are few and fragmentary and have been regarded as rather indirect and circumstantial. It is therefore gratifying that the present year should give facts which may be relied on to determine the "climate and time" about the close of the Lacustral period. In sinking a coal shaft at Henderson, Kentucky, at a considerable depth, a bed of animal and vegetable remains was passed, including many mussel shells. During the past months, in sinking the Avondale shaft at Evansville, a similar bed containing an immense quantity of fresh water shells was passed through. A small lot of the mussels were secured and submitted to competent authorities,\* who, on comparing them with authentic specimens from type localities in the extreme Southern States of the Union, separately and then jointly united in the following determination:

- No. 1 is closely allied to, if not a typical specimen of *Unio chunii*, Lea, from Trinity river, Texas and sparsely northward.
- No. 2 is between *Unio lincecumii*, Lea, of Trinity river, Texas, and *U. plicatus*, Lesueur, of Ohio valley.
- No. 3 is a good specimen of *Unio asper*, Lea, of Alabama river, a species nearly allied, *Unio asperrimus*, Lea, of lower Wabash and Ohio rivers.
- No. 4, *Unio obliquus*, Lamarck, common in Ohio river and near tributaries.
- No. 5, *Unio purpuratus*, Lamarck, of Gulf State streams, occasionally found in Tennessee and Arkansas. A single specimen was taken by F. Stein, C. E., about two years ago in Ohio river near Mt. Vernon.

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\*Dr. G. M. Levette and Mr. John W. Byrkit.

- No. 6, *Trypanostoma unciale*, Haldeman, Tennessee and sparsely in Ohio valley.
- No. 7, *Trypanostoma canaliculatum*, Say, common in Wabash river.
- No. 8, *Trypanostoma alveara*, Conrad, var. *torquatum*, Lea, of Alabama river.
- No. 9, *Lioplax cyclostomatiformis*, Lea, var. *contorta*, Shutt, Alabama river.
- No. 10, *Melantho ponderosa*, Say, common in Wabash river.

These shells, wholly extinct, or barely existing as survivors from our ancient sub-tropic climate, reveal in their story a hitherto unknown chapter of past events, indicating a change of climate nearly equivalent to 10° of latitude, and which, according to Mr. Hopkins' paper before the British Scientific Association, must have taken place within from 20,000 to 70,000 years.

That our climate is still becoming colder is shown by the fact that in "shell heaps" of the pre-historic races and on ancient river beaches, the following shells are not rare: *Unio foliatus*, Hild., once common in lower Wabash, is almost extinct, but common in Cumberland river at Nashville, *Unio varicosus*, Lea, once abundant in lower Wabash is now rare, *Margaritana confragosa*, Say, is sparingly taken in lower Wabash but common in Green river, Kentucky, and South.

#### GLACIAL PERIOD.

There was no true glacial drift seen in the county; no boulders, or even pebbles and stones, except those which showed by their smoothness and absence of the marks of the glacial mill, evidence of the rolling transportation of river currents. The absence of a deposit of such magnitude, in the northern half of the State, was marked and emphatic, and proved not only that the glacier did not extend so far south, but also that its terminal foot rested on land, and not a body of berg-bearing water, for, had it terminated at or in a body of water casting off icebergs, boulders of large size would have been scattered along the path of its water discharge.



In the absence of the ordinary drift, still the glacial age is not silent. A primary set of ancient valleys, from 100 to 150 feet above the river, having a course from north  $18^{\circ}$  to  $24^{\circ}$  west, traverse the county. These are not continuous now, but are often cut across or partially silted up by a second, more recent system of valleys, passing from northeast to south and southwest. Now, in either of these sets of valley thoroughfares, after a rain, may be seen in the ditches, fine white quartzose and black sand or *magnetite*, from the Laurentian rocks of Canada. The most obdurate material of the glacial drift is here ground to powder, but easily recognized by its specific gravity and magnetic quality, and seems unmistakably to point to the glacial period for the origin of these valleys, the first being called into existence at the beginning of that phenomenon, before the Wabash valley had been excavated by the great flood of ice water which subsequently passed that way. The secondaries probably date to the time when the ice water, which sought sluice-way during the summer months, by what is now known as White and Patoka valleys, after excavating the great basin of South Patoka, described in the geology of Pike county, flowed, at different points, over the ragged rocky rim of that basin, to the south and west, leaving Snake Knob and Dittany Hill in Warrick county, and Mt. McGregor, Kennedy Knob, etc., in Gibson county, as monumental trophies of its prowess and power.

During this period, each summer's sun would drive back the northern sea of ice, melting away its winter's growth, and send floods of ice water down the sharply inclined surface of the country to the south, the winter's advance often obstructing and filling up older channels, causing the waters to vary much in course and volume. This flood was magnified by the great precipitation of moisture incident to the cold, foggy, arctic climate that prevailed. To this flood is referred the excavation of Pigeon, Black creek and other valleys, so much wider than can possibly be attributed to the present streams and water-sheds. At this time

facts show that the northern lake regions were at an elevation of not less than 800 or 900 feet above the ocean greater than at present, plunging this flood of water with violence down the rapid southern incline. As a consequence, these ancient glacial sluice-ways are not only wider than necessary for the present streams, but as further attestation of their extent, it has been recently found by artesian bores that they were also deeper than now; thus the Wabash valley at Terre Haute and at Lafayette is found to have been excavated to a depth of sixty feet below the present bottom of that river. White river fifty-two feet, and Eel river and Walnut fork of same, respectively, ninety-five and one hundred and twenty-three feet. Dr. Newberry has reported a similar state of affairs as to the Ohio river at Louisville, and all the streams flowing into that river through the State of Ohio.\*

On Dittany hill, in Warrick, near the northeast corner of the county, my attention was called to a remarkable excavation locally known as the "Buffalo wallow," and the "Mineral diggins." Dittany hill is an elevated ridge over a mile long from north northeast to south southwest, with two spurs nearly parallel extending to northwest. The top of the ridge and spurs is one rod to five or ten rods wide, nearly level and is capped with Merom sandstone persistently underlaid with the hard, clinky, double limestone, from six to ten feet thick, which marks the top of the coal measures. The hill and spurs is a grand land mark, towering up like peaks, from one hundred and fifty to two hundred feet above the valley plains surrounding in every direction, which have been denuded to that extent, leaving this monumental remnant to tell the story of its former greatness and present degradation. The excavation was often visited and mentioned with knowing emphasis by mineral diviners, to whom such a mystery was vantage ground. A strange sight it was. An excavation had been

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\*A concise statement of the circumstances attending the Glacial and Lacustral periods is given in my report on Lawrence and Gibson counties, Indiana Geological Report, 1873, and Brown county *ib.* 1874.

made, removing, for a space of three hundred feet, the top of one of the spurs to a depth of thirty feet. The cut was made clean and was fresh as if of recent date. A careful examination detected no evidence of the "storied" lead or silver, nor even iron, clay or coal. Nothing unnatural was visible which could incite the blindest of the unwary to dig. Natural causes were therefore sought, and it was soon noticed that the excavated matter was all "wasted" in one direction—to the south. In studying this debris it was found that the heavy cubes of sandstone and limestone had first been thrown or violently rolled to the side of the spur and the talus made up according to the specific gravity of the material, the lightest clay and shale being the farthest removed. It was evident that a violent current of water, flowing across the top of this hill before the surrounding valleys were formed, or afterwards, when the Lacustral waters covered the ridge, was the force which made the "diggins." A similar excavation is seen on the same spur less than half a mile to the west, while two complementary gaps opposite the two first mentioned, are found in the parallel spur to the north, showing that two currents of water swept across these spurs from the north  $8^{\circ}$  west, all washing the excavated material southward. Time did not admit of extended examination, but the facts observed indicate that this cut occurred after the glacial erosion had completed the denudation of the surrounding low lands, and rather at a time during the Lake period, when the Lacustral waters covered the top of the hill, and some sudden access of water in great volume, released from adjacent lake or lagoon, swept eroding currents across this sunken island in its bosom.

#### GENERAL GEOLOGY.

The rocky formations of this county consist of two members. The lower one, the regular coal measures, has been explored by outcrop, or shafts and bores, to a depth of about 1,000 feet, exhibiting the seams of coal, shale

sandstone, with thin limestones in much the same order mentioned in previous reports.

Covering the coal measures, in fact so allied as to seem to be their continuation, are two limestones, sometimes brought together, at others separated by small spaces, and generally accompanied by one or more rash coals, in which, although coal measure fossils predominate, a considerable number are found characteristically of Permian type. Some of these have never been found in the regular coal measures, as the broad-winged *Myalina* and *Meekella*, and allow the inference that these limestones may be synchronous with the so-called "Permo-carboniferous" formation, of Kansas and Nebraska, here thinned to less than sixty feet. Still above these carboniferous beds is a sandrock, to which the name of "*Merom sandstone*" is given, in report on Sullivan county, (Ind. Reports, 1870). In each of my succeeding reports, I have retained this stone in the carboniferous, although suggesting that reasons existed which allowed their reference to a higher position and later age. The facts which seem to allow this suggestion, will be briefly stated hereinafter, and although not conclusive, are given as a furtherance towards the goal which we all seek—the truth. These beds range in thickness from ten to seventy feet.

CONNECTED SECTION OF THE ROCKS, ETC., VANDERBURG COUNTY.

	Ft.	Ft.	In.
1. Buff, brown, red and mottled slabs. ....	2	to	0 00
2. Merom sandstone, soft, shaly, upper div.	20	to	25 00
3. Merom sandstone, massive, in quarry bed. ....	10	to	30 00
4. Dark gray or buff shales and flaggy sandstones with clay iron stone.....	10	to	20 00
3. BROWN IMPURE COAL, 3d rash coal .....	1½	to	00 00
4. Flaggy on thick-bedded sandstone, ripple- marked.....	9	to	4 00
5. Hard, clinky, gray limestone, at bottom irregular and sometimes flinty, passing to the west to a calcareous shale...	2	to	6 00
7. Argillaceous shale and shaly sandstone.	34	to	0 00
7. Black slate with fish spines and fossils...	1½	to	0 00

8. SECOND RASH COAL.....	0 to 0 03
9. Fire clay.....	1 to 0 00
10. Gray shale.....	6 to 0 00
11. Limestone, yellow ferruginous.....	3 to 12 00
11½. Gray shale.....	98 to 0 00
12. FIRST RASH COAL, and black slate.....	0 to 0 08
13. Fire clay.....	1 to 2 06
14. Soft, flaggy, blue, buff and gray sandstone, with much gray shale and beds of clay ironstone and nodules.....	60 to 121 00
15. Yellow and gray sandstone, often giving good quarry beds.....	15 to 29 00
16. Gray and buff alluvium, arenaceous or shaley, or flaggy sandstone, with ironstone nodules and shaly concretions.....	29 to 8 00
17. Black slate or clod, with fossils.....	1 00
18. COAL N, choice, gassy, caking.....	2 03
19. Fire clay, at bottom shaly, with iron balls.....	5 08
20. Buff or gray limestone with <i>Chaetetes</i> .....	8 to 5 00
21. Gray or white shale, with nodules of iron stone and bands of sandstone.....	30 to 40 00
22. Siliceous shale, passing to massive sandrock to south and west; alluvial rock? of Lesquereux and Owen.....	60 to 71 00
23. Black slate and clod, with many alluvial and vegetable fossils.....	2 to 1 08
24. INGLESIDE COAL M: Laminated coal, 1 ft. 4 in.; parting, 2 in. to 0; solid cubic coal, 2 ft. 8 in.....	4 00
25. Fire clay.....	4 00
26. Fire clay, with pyrite balls.....	3 08
27. Siliceous shale.....	11 09
28. Argillaceous sandstone.....	5 00
29. Gray shale and soapstone.....	64 05
30. Soapstone, with plant remains.....	0 03
31. COAL L: Impure cannel coal, 1 ft. 6 in.; Pyritous argillite, 1 ft. 4 in.; slaty cannel, 1 ft. 2 in.; free burning coal, 1 ft. 3 in.....	5 03
32. Fire clay..... (Extra-limital.)	2 06
34. Siliceous shales and coarse massive ferruginous sandstone.....	90 to 120 00
35. Best limestone and black slate.....	2 to 8 00

36. COAL K, caking, pyritous.....	0 to 1 06
37. Laminated fire clay.....	2 to 1 04
38. Siliceous and black aluminous shales, with rich bands and pockets of nodu- lar iron ore.....	10 to 30 00
39. Conglomerate sandrock.....	110 to 180 00
40. COAL A.....	3 to 0 00
41. Dark or black shale, with iron ore.....	30 to 5 00
42. Chester sandstone and sub-carbonifer- ous limestone.	

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## MESOZOIC TIME.

Cretaceous beds exist in parts of Kentucky and Tennessee, and their mode of deposit authorized the expectation of meeting outliers in this county. No such beds were seen in place, although beds of plastic clay sometimes reported in deep wells, and generally referred to the decomposition of the hornstones of the sub-carboniferous limestones, may possibly result from the trituration of cretaceous material wholly eroded by the violent currents of glacial water; for such beds, friable and easily removed by such a sheet of water, is reported, by Prof. White, to have once existed over large areas in Iowa, but now entirely removed; a few characteristic fossils alone remaining to prove the existence of the mother rock. It can scarcely be doubted that relics of the cretaceous period may yet be found here.

## TRIASSIC PERIOD?

At the horizon usually occupied by rocks of this period Safford reports an hiatus in Tennessee, all the intervening beds being absent, and more recent deposits are met in a line "along which the older formations are suddenly and deeply beveled off." If ever deposited, shaved off by aqueous currents. There is no positive evidence that such beds ever existed in this State, but a few facts will be briefly given which suggest the question as to whether the upper beds of sandstone and shale heretofore comprised in the coal measures may not possibly be referred to this period.

The sandstone and shales, Nos. 1 to 4 of the general section—the “*Merom sandstone*” of former reports—are the strata to which reference is made, and it is done for the purpose of turning investigation toward this point, rather than to ask attention to the few facts here mentioned.

This sandstone is well developed in Vanderburg and adjoining counties, capping the tops of the highest hills in the northeastern, and forming the surface rock in all the uneroded parts of the central and western regions. Judging from observations made in this county alone, it is regular in sequence, uninterruptedly covering the coal measures. But this bed extends for a considerable distance along the Wabash valley, and is well exhibited in Pike, Gibson and Sullivan counties, Indiana, and has been traced northward through several counties in Illinois. Although nearly continuous throughout this area, at several stations it is greatly thinned, sometimes, but rarely, passing into or covered with gray, blue, purple, pink and red shales. Always above the coals, it does not maintain such horizontality in reference to itself, as a deposit of such persistence should show. As to the coals, it is regular only in irregularity. Although always superior to all coals, at several stations it is deposited on escarped or eroded surfaces of the coal measures as low as seam M, the three higher seams with accompanying shales, slate and stone having been removed. It is therefore *unconformable* to the coal measure deposits, and this fact, when found, as in this case, to extend over wide areas, is generally considered an important point in fixing the demarkation between formations.

Next, the rock is unlike the regular sandstone of the coal measures. As a rule, soft, often so incoherent as to be easily cut with pick or shovel, and in such cases readily disintegrating into coarse, angular sand, yet it generally carries a “massive” or heavy bed, sometimes compact enough for coarse masonry. It is always feriferous, and at many stations the iron is in irregular veins, rather than seams. Examples similar to the following description, extracted from report on Sullivan county, may be seen very

often in Knox, Gibson, Pike and Vanderburg counties. "The 'Merom sandstone' is here, at its northern terminus, well developed. Deep, narrow gorges, with precipitous or overhanging sides, give a romantic boldness to the scenery, and afford good exposures for observation. It may be characterized as a very coarse grained sandstone, varying in color from brown to yellowish red, with occasional strata of snowy whiteness, irregularly laminated."

False and diagonal bedding and coarseness of materials, show that it was deposited by strong currents of water, subject to frequent change of direction and to cross currents. Portions are compact quarry rock, which, however, on exposure, generally tend to disintegrate. The coloring matter is derived from small partings and veins of iron, which, being harder than their sandy matrix, fret the sides and over-hanging arches of the gorges with an irregular tracery of network in relief. To this may be added that fossils are rare or entirely absent, and confined, as far as my observation extends, to *Acrogens*, (*Calamites*). With this description may be compared the western higher sandstones, as given in last edition of Dana's Manual of Geology, page 404. Again, the surest demarkation between formations, is the occurrence of siliceous beds, especially carrying a conglomeratic or pudding stone character. Such beds do not often occur in a regular formation, but are known to indicate a vigorous change of conditions, as exemplified, not only by stratigraphic novelties, but as well by partial disappearance of the older flora and fauna, and the introduction, in some degree, of new ones. At the base of this sandrock, we have heretofore had frequent occasion to mention a conglomerate or pudding stone underlying the Merom sandstone, in Gibson, Knox and Sullivan counties; the pebbles partly from coal measure rocks, and fossils in part from the older sub-carboniferous Devonian and Silurian formations. But especially significant, with these are found rounded pellets or pebbles of coal, in which the square or rhomboidal crystals are rounded by attrition, and seeming to indicate that they are fragments eroded by



currents, subsequent in age to their deposit, placed here by fluvial and wave action. The same facts are noted in Edgar and Vermillion counties, Illinois, where the conglomerate beds are well developed and remarkable. In Illinois Geological Report, IV, pages 247, 248, a bed of this stone is described, and its irregularity properly attributed to "the heavy erosion which the beds, (coal measures), in that region evidently suffered, before the deposition of the sandstone." This erosion is found exhibited at that place on a grand scale, and the author cited "observed that a portion of the upper coal measures including shales, argillaceous limestones, and two coal beds, were carried away to a depth of sixty feet, and in the depression thus made, a sandstone, ('Merom sandstone'), which belongs at the top of the series, was laid down so as to fill and overlie it." The same authority, page 249, mentions the accompanying conglomerate, which has since been traced sporadically, for 150 miles to the southeast, and looking at it from a coal-measure standpoint, remarks, as others have done before and since in that line of vision, "that he is unable to conceive of any circumstances which could have produced just such a bed of rock."

Adjoining this locality, section 25, township 19, range 13, Vermillion county, Ills., Dr. J. C. Winslow, of Danville, Ills., discovered a bed of fossils which is named in his honor "Winslow's Bluff." They occur in a bed of black, brown, gray, red and pink shales, backed with sandstone, filling a depression denuded by forces acting at the close of the coal age, which has carried away the regular deposits, including probably three seams of coal. They consisted of separate vertebræ, teeth and other elements of several skeletons, amounting to about 93 bones and fragments, and were submitted by the writer to that distinguished comparative anatomist, Prof. E. D. Cope. After a careful study, Prof. Cope found that they comprised two new genera and species of Reptilia, and two of fishes. In a paper read by him and published in proceedings of Academy of Natural Sciences of Philadelphia, September 28 1875,

page 404, the Professor says that "A remarkable peculiarity of the vertebræ of the series is the longitudinal axial perforation of the centrum. They present the character observed in *Archegosaurus* and other *Stegocephalus* Batrachia; but which also exists, according to Gunther, in the living *Rhynchocephalous* lizard—the *Sphenodon* of New Zealand. The bones of the limbs and scapular arches are so decidedly reptilian, and so unlike those of any Batrachia with which we are yet acquainted, that I am disposed to refer them to the former class. And as there are several points in which the fossils resemble the order *Rhynchocephalia*, I refer them provisionally to that neighborhood. *They constitute the first definite indication of the existence of animals of that type in the Western hemisphere.* Associated with these Saurians were found teeth of two species of fishes, which are important in evidence of the position of the beds in which they occur. One of these is a new species of *Ceratodus*, Agass., and the other a *Diplodus*. The former genus is characteristic of the Triassic period in Europe, one species having been found in the Oolite. It still lives in North Australia. In both these respects the *Rhynchocephalian* lizards present a remarkable coincidence. *They also belong to the horizon of the Trias in Europe*, and the only living species is found in New Zealand. Thus it would seem that a fragment of this fauna, so ancient in the Northern hemisphere, and so remarkably preserved in the Southern, has been brought to light in (the Wabash valley of) Illinois" He names the new *Reptilia*, *Cricodus heterolitus*, and *Clepsydrops Colletti*, the fishes *Ceratodus basilatus* and *Diplodus Vinslovi*, and adds that while the first are so *distinctly of Triassic type*, that the last has not before been found above the carboniferous, and waits further material before venturing a decision whether they belong to *Triassic* or *Permian* time.

The foregoing facts are given without recapitulation. They strongly hint, although still meagre, at a solution of the *query* as to age and time with which this subject is headed, and it may be hoped that they will stimulate

research, which alone can definitely answer the question, *Triassic or Carboniferous?*

#### PALEOZOIC AGE.

##### *Carboniferous Period.*

The beds Nos. 3 to 14 of the general section, including two or three thin seams of rash coal, and two strata of limestone, each from two to eight feet thick, occupy the hill-tops in the northeastern parts, and thence dipping to the southwest, are found at or near the level of the streams in that part of the county. These beds are a notable horizon. Besides the advantage of the stone, which is burned for the lime, they form an unmistakable directrix from which to measure down to the probable level of the lower workable coals. The limestones Nos. 5 and 11, at their northeastern outcrop, are hard and clinky, and are frequently brought close together or found in contact. Going westward, they first become more plainly calcareous, are separated by a parting which widens at some points to a space of nearly fifty feet, and allows the introduction of a rash coal, becoming persistent to the west, but only represented by fire clays in the eastern parts. Persistent in the eastern parts, they become somewhat inconstant in the western, and pass into calcareous shales. In all adjoining regions, these limestones contain a multitude of fossils in great variety, which have given rise to bitter personal quarrels and disputes between eminent scientists. Some of these fossils, as *Meekella*, *Syntriellasma*, a *Myalina*, *Bellerophon crassus*, *Pleurotomaria turbiniformis*,\* etc., are closely allied to Permian forms of Europe. These fossils, with many others are not found, in my knowledge, below the upper coal measures included by the numbers (5 to 14) under consideration. So many new fossils from this horizon have been described as of "the coal measures," that deciding from such determination, the rocks, notwithstanding the introduction, in part, of a new fauna, are coal measures. As a

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\*These fossils have not been found west of the Wabash river, but are abundant in equivalent beds in Illinois, adjoining to the west.

compromise, equivalent beds in Kansas and Nebraska have been termed by eminent geologists "*Permo carboniferous*," a designation which seems properly applied.

In this county these limestones, although often crowded or almost wholly composed of fossils, as *Athyris*, *Spirifer lineatus*, and *Lophophyllum proliferum*, do not offer good cabinet specimens. The coals, Nos. 3, 8, 12, are generally absent and never persistent over considerable areas. Impure and thin, they are consequently of no great economic importance. The thin fire clays, Nos. 9, 13, are of even more value, for generally unctuous and plastic, they afford as a rule a clay which, purified by exposure to atmospheric agencies, will work well for crocks, coarse pottery and terra-cotta ware.

No. 14, a soft, flaggy, blue, buff and gray sandstone, interchanging with gray shale, carrying iron stones, is found in the upper part of Ingleside shaft, in the bed and bluffs of Pigeon creek, and thence northeast of Evansville in the hills and banks of all the brooks and creeks. At several stations on Pigeon, a local stratum is quarried for rough masonry. Such beds are not persistent, soon passing into shale with wedge-shaped terminals.

The yellow and gray sandstone, No. 15, is found well down in the Evansville shafts, and is exposed only in the east and southeastern parts of the county. It has been quarried to some extent in the vicinity of Newburg, in Warrick county, and is well exposed in all the hills from five to seven miles northeast of Evansville. An extensive bed has been opened on the land of S. Stevens, northwest quarter of section 7, township 6, range 9, affording stone of excellent quality, which deserves the attention of builders, for foundations and hammered masonry. Blocks of good size may be obtained, and it is easily dressed when fresh from the quarry. Between this stone and the first workable coal, N, occurs gray and buff shales, passing into flaggy sandstones, carrying at several stations, nodules and thin shelly concretions of ironstone, but of no economic importance.

The black shale or clod, No. 17, is pretty constant, and differs from the slate usually found covering coals by the predominance of aluminous matter, rendering it soft. It usually carries a considerable number of fossils, most of which are pyritized, as *Productus cora*, *P. costatus*, *Athyris subtilita*, *Macrocheilus*, several species, *Bellerophon*, two species, etc., etc.

Coal N, No. 19 of the general section, is a choice gassy coal, of excellent quality; for analysis, I refer to the chemist's report of Millersburg coal as a type specimen. From appearances it is believed that this is equal to the best western coal for gas and coking, and although the seam will average but little over two feet, yet the purity and richness in volatile matter will justify removing the fire clay for potteries, and thus secure this valuable coal. It is passed in the Ingleside shaft, and was formerly worked by a shaft not now in use, on Steven's land, northwest quarter section 7, township 6, range 9. This coal will be found near the surface or in the hills in the southeastern parts, as it is just caught in the top of the bluff at Newburg, passes near the surface at Chandler's shaft, and below the the water level a short distance north of Millersburg. It is also pierced by Priest's bore at West Franklin in the extreme southwest corner of the county, and by the Kentucky shafts at Henderson—in fact at every point at which this horizon has been explored. These facts indicate a uniform persistence throughout this region of Coal N, a seam that is characteristically inconstant and unreliable in all the basin to the north and east. It is locally known as the "Little Newburg coal." Below the fire clay of N is found a buff or gray limestone, No. 20. This is not exposed in the county, but is met in all the shafts in regular position, and outcrops at Newburg, and thence north along the county line in Warrick county. It contains a few specimens of *Productus* and *Spirifer*, but is remarkable for the wonderful size of *Lophophyllum proliferum*, (some of the cups were seen from three-fourths to one and one-fourth inches in

diameter,) and a great profusion of the coral *Chonetes milleporaceus*. Next succeeds a gray or white shale carrying bands and nodules of iron ore of good quality, but not in sufficient quantity to be of any great value.

The siliceous shale and sandstone passing into massive sand rock along Green river and generally to the north and west, is a marked horizon at stations where exposed, forming quarry beds of economic importance, and bold river bluffs. In this county it is entirely below the surface and is seen only in shafts.

The black, slaty clod, No. 23, is generally persistent throughout this region, and carries a large number of beautiful and well preserved fossils. Generally pyritized, they form desirable cabinet specimens, viz: *Productus cora*, *P. longispinus*, *P. punctatus*, *Bellerophon carbonarius*, *B. Montfortianus*, *B. percarinatus*, *Macrocheilus inabilis*, *M. fusiformis*, *M. (sp?) Pleurotomaria carbonarius*, *P. sphaerulata*, *P. Grayvillensis*, *Orthoceras Rushensis*, *Nautilus decoratus*, *Aviculopecten rectilateraria*, *A. (sp?) Leda bellastrata*, *Nucula inflata*, with crinoid stems. These are only a partial list of its marine life. Comb-like spines of fishes and dermal plates, named *Petrodus occidentalis*, are not uncommon; white bones and coprolites are frequent though crushed and fragmentary.

The Ingleside coal M, locally known as "Main Newburg" No. 24 of the general section, is the chief mineral resource of this region. This seam has been pierced, by shaft or bore, at a great many different points in this county and in regions immediately adjoining. At every station, with the single exception of the "Crescent City Park" bore, it has shown a thickness of not less than four feet. It is a strong coking coal, burns to a gray or red ash, and is an excellent fuel for steam or grate use, and commands, as it deserves, a ready market. It drives the wheels of commerce, pulls mighty railway trains, and gives energy to the thousand arms and fingers of iron which manufacture, with the strength of a million giants, the wealth of this favored city and county. From absence

of faults or barren places indicated by bores conducted up to this time, we may infer that it underruns southern and eastern parts, at least two-thirds of the area of the county, with a possibility if not a probability that it may be found in the remainder. A coal of such continuity is unusual, not often met in our coal field, and combining so many good with but few bad qualities, it may be looked upon as a grand source of wealth for ages, and assures for this region an enviable prosperity and progress for the future.

This coal has long been worked at Ingleside shaft, in Evansville, and at Newburg, Henderson and Green river of Kentucky. A new shaft has been put down at Chandler station, on the Boonville road; all of which find the seam regular in thickness, and differing but little in quality, as may be seen in the chemist's report of analysis. Another shaft is in progress at Avondale. These mines are more fully reported in local details. It is believed that in the near future, this grand body of coal will be more extensively mined; that far-seeing capitalists will erect the necessary machinery for crushing and washing, to remove the small amount of sulphur contained, and by coking in "Belgian furnaces," furnish a coke which is so much needed for smelting iron and the precious metals, in the west. The usual fire clay, below coal M, Nos. 25 and 26, in its upper member, is plastic, and in the future demand for fire-proof buildings, will be extensively used in terra cotta. Usually, it will be necessary to remove the diffused particles of pyrites by aeration. Strata of limestone are not reported in the sections to which access was had above N and immediately above M, as was found to be the case in Gibson county, but in the new shaft at Henderson, and in the bore at Ingleside, beds are found confirming the unexpected phenomenon of massive limestones in the coal measures, so unwillingly admitted in my report on Gibson and Knox counties. The space represented by Nos. 27, 28 and 29, has been pierced only by the lower shaft, in Ingleside mine. It is highly argillaceous, hardly rising above

the grade of clay shale; even the tough blue sandstone readily yields to air and moisture. This was to be expected, as similar material, in eight cases out of ten, characterize the horizon between coals M and L, in the counties I have visited in Indiana. Similar outcrops were seen at the same horizon, along Green river, especially at and near Cromwell Landing. A thin bed of soapstone, (indurated clay), is ordinarily found, succeeding which is rich in leaves and stems of carboniferous plants, and is known as the "fern bed." Sometimes the soapstone is replaced by gray shale, full of kidney iron stones, enclosing plants and fruits.

Coal L, No. 31 of section, offers the characteristic physical form and qualities usually presented throughout the Indiana coal field. It is a laminated semi-caking or free-burning coal, rich in carbon, and yielding a gray or white ash, with little or no cinder. It is the most persistent coal of the Wabash basin in thickness, regularity and good qualities. In this vicinity it has been pierced by three bores, showing an average thickness of only about two feet, which may be regarded as the probable thickness of the seam along the southern and western part of the county. This will hardly justify mining at present. The seam, from indications in Pike and Gibson, will be found well developed in the northeastern half of the county, and, when facilities for transportation promised by proposed railways exist, will add materially to the available wealth. It is admirably suited for rolling mill, locomotive and stove use. Below coal L a hard ferruginous, laminated sandstone, passing into siliceous shales, has been pierced by bores, and occurs at adjoining regions in outcrops, filling a space of from 90 to 120 feet, at the base of which the limestone superimposing coal K is found; sometimes flinty, but on the Kentucky side of the river carrying the usual fossils as *Productus costatus*, *P. longispinus*, *Lophophyllum proliferum*, *Spirifer cameratus*, *S. lineatus*, *Athyris subtilita*, *Chonetes mesoloba*, *C. sp.?*, and *Crinoid* stems.

Coal K is not seen in the county. In bores along the Ohio river it never develops a thickness of two feet and



is generally thinner or barren. Typically it is a strong caking coal, containing some sulphur, and burns to red or brown ash. K is magnificently exhibited in the adjoining parts of Pike county, and we may reasonably expect that it underruns, with workable thickness, about one-third of the northeastern part of the county, gradually, but regularly, thinning and scattering toward and at the deep centre of the coal basin to the west. A short distance below the horizon of K, beds of black shale occur, which are often in bores, reported as coal. No thick or workable seams may be expected at this depth. The space usually presenting the block coals is here barren, as it is generally in the southern part of the State. It seems probable that at the central extreme depths of the basin the vegetable material, which if preserved pure would suffice for a coal seam, was largely intermixed with clay and argillaceous matter, and thus diffused and scattered, is represented by a black shale, and the ironstone, No. 38. The conglomerate sandrock, No. 39, forms the bottom rock or bed of the Coal measures. It is a coarse, red sandstone, heavy bedded or massive, containing, often, a few red and white quartz pebbles, conglomerated, but the latter are generally absent in the Indiana coal field. This sandrock is only pierced by the Crescent City Park bore in this county, and in neighboring wells, but is typically exhibited in adjoining regions to the northeast and south.

The sub-conglomerate coal A, is only known by report. Its existence in this region is, to say the least, problematical, and certainly of no economic importance. The deepest bores report beds of limestone and sandstone, which are referred to the Chester beds of the subcarboniferous period. These bores were put down during the oil excitement, and are not very reliable for minor details, but their steady concurrence, as to the underlying limestone, is regarded reliable. The foregoing gives a connected view of the surface phenomenon and rocky structure of the county. Details will be added for local information.

## LOCAL DETAILS.

Near Evansville the surface rocks are the soft blue, buff and gray sandstones passing into argillaceous shales, No. 14 of general section. In this bed the "Ingleside" shaft in the west suburb of Evansville was begun, piercing in its depth the lower rash coal and shales, and N, M and L in succession. Thanks are returned to Mr. John Ingle for the following items :

## SECTION IN INGLESIDE SHAFT.

(FORMERLY BODIAM.)

## Fractional Section 26, Township 16, Range 11.

	Ft.	In.
1. Clay and alluvial sand.....	29	00
2. Clay and shale.....	61	00
3. Slaty coal and fire-clay.....	3	00
4. Sandrock.....	4	06
5. Siliceous clay shales.....	12	09
6. Shale and iron stones.....	5	08
Fire-clay.....		10
7. Ferriferous sandstone.....	7	09
8. Fire-clay with sand and iron.....	12	03
9. Sandstone (ferriferous).....	12	01
10. Shale.....	1	00
11. Sandstone.....	7	05
12. Coal N ("Little Newburg").....	2	11
13. Fire-clay with iron balls.....	5	08
14. Limestone.....	5	00
15. Fire-clay parting.....	2	06
16. Limestone.....	4	06
17. Gray shale black at bottom.....	83	10
18. Coal M., "Main Newburg".....	4	02
19. Fire-clay.....	4	00
20. Fire-clay with pyrite.....	3	08
21. Siliceous shale.....	11	09
22. Argillaceous sandstone.....	5	00
23. Gray shale (Soapstone).....	64	05
24. Soapstone (fern bed).....		03
25. COAL L: Impure cannel, 1 ft. 6 in.; pyritous argillite, 1 ft. 4 in.; slaty cannel, 1 ft. 2 in.; semi- coking coal, 1 ft. 3 in.....	5	03
26. Fire-clay.....	2	06
	<u>362</u>	<u>08</u>

The foregoing is the pioneer exploration of this vicinity and corresponds generally with out-crops seen nearer the margin of the basin, excepting only, the unusual depression of the rash coal (No. 3 from top). In fact, in sections previously published and those which have heretofore come to my view, the occurrence of this coal at so low a level is not noted. The "Ingleside Mining Co.," John Ingle & Co., proprietors, have an establishment which, for intelligent direction and sufficiency of equipments, is rarely excelled. The shaft is arranged for double cages, ascending and descending at the same time, with third compartment for "air," thus securing good ventilation. The fixtures are driven by a steam engine of 90 horse power. The screens and dumps are ample and well arranged, with facilities for delivering coal on rail, river, or wagon for city use. These fixtures have an output capacity of 2,400,000 bushels per annum, or 200,000 per month. Largest output for one month, October 1875, was 91,000 bushels of lump; the least output was in June, 24,000 bushels.

Total output for 1875:

Lump coal.....	720,000 bushels.
Nut and screenings.....	80,000 bushels.
	<hr/> 800,000 bushels.

Making an average of 66,600 bushels per month.

Average price  $6\frac{1}{2}$  cents per bushel aboard car or boat.

Their principal market is for mills, factories and house use in the city, and for steamers on the Ohio river. Considerable shipments are also made by the Evansville & Chicago, and St. Louis & Southeastern railways. The mine, although situated immediately on the bank of the Ohio and to a small extent driven to the edge of it, is almost entirely free from water. There is none in the "workings," and the surface seep is hoisted in a half hour run, daily. In the black shale which forms the roof, are some fine fossils, including *Productus*, three species, *Bellerophon*, two species, *Aviculopecten*, two species, *Pleurotomaria*, two species, *Macrocheilus*, two species, and

a *Goniatite*, which I saw in the cabinet of Dr. Stinson. In the gray argillite a few feet above this coal, in the Henderson shaft, (Ky.), one of the proprietors obtained a *Conularia*, closely allied or identical with the one found in the subcarboniferous beds. The coal in the mine and accompanying rocks are as follows:

## INGLESIDE MINE.

Argillaceous limestone, pyritous....		1 ft. 4 in.
Black slate (shale).....		1 ft. 4 in.
Laminated coal .....	1 ft. 3 in.	
Parting .....	2 in.	
Solid caking coal .....	2 ft. 11 in.	4 ft. 2 in.
		<u>6 ft. 10 in.</u>

This coal ranges from three feet eight inches to four feet four inches, and averages nearly four feet at this mine, as, also, at Newburg, Henderson, Green river, etc. As before hinted, it is remarkably uniform in thickness and persistence; in fact, the single bore at the Crescent City artesian springs is the only exception, so far developed. In other regions of our basin, the coals are not so regular. Large barren areas intervene, or the seams narrow and are unworkable. One uninterrupted seam is equal in avails to several unreliable coals, and gives more certain returns. We may, therefore, feel confident that this single seam will assure great prosperity to this region, for the quality is good and the supply, practically, unlimited.

When coals become scarce, as in England, the upper two feet seam, (N), may and will be worked. Within Ingleside mine, a test bore was put down, under directions of Mr. William Adams, to whom I am indebted for the section. At the bottom, it was supposed from the borings that a five foot coal existed. A shaft was sunk, which developed the fact that part of the seam was impure or slaty, with only fifteen inches of good coal—not sufficient to justify working. The quality was good, as may be seen from analysis of coal L, in chemist's report. The specimen was obtained from Mr. Ingle. The dip of lower coals, L, M and N, from

Newburg via Evansville, along the center of the trough which gives direction to the lower Ohio valley, is eighteen feet nine inches per mile, with many irregularities or rolls. Dip to south, from the northern line of the county, is about twenty feet per mile, decreasing to eight or ten feet, until it passes the central synclinal, where the dip is reversed, ascending to the south.

A short distance east of the Ingleside mine, is the location of the proposed railway bridge, as a link in the nation's commerce, so necessary to the prosperity of Indiana and Kentucky. Test bores were put down under direction of Mr. W. Adams, who kindly furnished the following exhibit, which proves that good stony foundations are at hand, thus reducing the cost nearly one-half, as compared with the St. Louis bridge, etc.:

## SECTION AT INTER-STATE R. R. BRIDGE.

## (INDIANA SHORE).

	Ft.	In.
Clay.....	8	00
Sand .....	44	00
Blue clay.....	1	00
Marl, (shell bed?).....	7	06
Shale.....	14	06
Total.....	75	06

## (KENTUCKY SHORE).

	Ft.	In.
Sand and loam.....	67	06
Carbonaceous matter.....		06
Marl, (shells?).....	7	06
Shale.....	15	00
Total.....	90	06

The "Crescent City Park" and pleasure grounds are situated on the east bank of Pigeon creek, southeast quarter of section 24, township 6, range 11. The grounds are well arranged, beautifully ornamented, and easily accessible by street railway. Hon. Wm. Heilman is proprietor. One of the most interesting attractions is a flowing artesian well, which furnishes a saline, sulphurous water of well attested medical properties. The bore, four and a quarter inches in

diameter, was commenced December, 1868, for oil. In the upper part, a strong flow of burning gas, (carbureted hydrogen), escaped. This was continued until salt water was struck, at less than three hundred feet, which overpowered and drove back the gas.

## SECTION IN CRESCENT CITY ARTESIAN WELL.

	Ft.	In.
Soapstone .....	31	00
Gray sandstone.....	2	06
Soapstone and shale.....	37	06
Very hard gray sandstone.....	1	00
Slaty coal.....	1	06
Shale.....	6	00
Gray.....	44	06
Soft shale.....	11	00
Soft gray sandstone.....	18	00
Hard dark sandstone.....	5	00
Gray flint?.....	2	00
Dark gray sandstone.....	62	00
Salt water.		
Hard black shale, (Coal?).....	73	00
Gray sandstone.....	65	00
Flint.....	6	00
Hard gray shale.....	5	00
Hard argillaceous sandstone.....	34	00
Gray shales, (Soapstone).....	55	00
COAL (L?).....	1	06
Gray shale and sandstone.....	134	00
Dark sandstone, with salt water flowing seven gallons per minute, 3° Baume.....	5	00
Hard pure sandstone conglomerate.....	50	00
Coal and slate.....	0	06
Soapstone .....	10	00
Coal (A?) and slate.....	1	06
Fire clay.....		06
	682	00
Surface.....	17	00
Total .....	709	00

This bore seems to show irregularities in the rocky strata, and differs from all others put down to a corresponding depth, at the several points explored in this region. It is possible that during the "oil fever" less attention was

paid to what was then esteemed a minor matter, as coal, etc., then we can now wish. However this may be, the section is given for future comparison.

At Avondale, a northern suburb of the city, a bore was put down in April, 1875, with the following results, kindly furnished by H. E. Reed, Esq.:

## SECTION IN AVONDALE BORE.

	Ft.	In.
Surface .....	9	06
Blue clay .....	30	06
Gray sand.....	2	06
Blue mud, (quicksand) .....	22	03
Gravel, sand and shells.....	6	00
Fire-clay and sand.....	28	03
Gravel and sand.....	1	00
Sandstone.....	2	00
Fire-clay .....	2	09
Sandstone.....	11	00
Fire-clay .....	7	09
Sandstone .....	7	00
Fire-clay, with pebbles.....	2	08
Siliceous clay.....	1	00
Sandstone, with iron balls .....	72	00
Concretion .....	1	10
Sandstone.....	36	10
Rock slate.....	6	00
Black slate .....	2	10
Coal.....	4	00
	256	09

A company was formed which at once commenced sinking a shaft with engine and fixtures of the most approved power and plan. The enterprise was being prosecuted, at the time of my visit, with energy and skill, and had passed the quicksand, overcoming obstacles which required patience, foresight and nerve. Just below the quicksand a wonderful bed of fresh water shells was found, including ten species of muscles, *Paludinum*, *Melania*, etc., a large majority of which now have their habitat in the States that border upon the Gulf of Mexico, and prove conclusively that at an early day, soon after or at the close of the lacustral period, a climate prevailed in southern Indiana similar to that enjoyed by our Southern brethren. This

subject has been herein more fully discussed under head of "Recent Geology." It has since been announced in the newspapers that the company struck the main coal, four feet thick, on the 10th of March, 1876, at a depth of 260 feet.

An account of strata met in the new shaft at Henderson, Ky., ten miles south of Evansville, reported by H. E. Yingst, foreman, and taken with the assistance of G. M. Alves, Esq., John Reichert and George W. Fallen, the latter two, of the company who originated and prosecuted the "People's Mine" enterprise:

## SECTION IN "PEOPLE'S MINE" SHAFT.

(HENDERSON, KY.)

	Ft.	In
Yellow clay and sand.....	10	00
Black peaty soil.....	4	00
Blue clay.....	3	00
Yellow clay and quicksand.....	10	00
Clay and sand, with boulders 1 to 6 inches in diameter, and a great variety of sub-tropical fresh water mussels and univalves.....	10	00
Porous limestone.....	1	00
Fire clay parting.....		03
Blue limestone.....	2	06
Slate and coal.....		10
Solid limestone, weathering yellow, fossils.....	2	06
Fire clay.....		06
Soft soapstone.....	4	10
Black slate.....		02
Soapstone, with limestone boulders.....	1	06
Shaly sandstone.....	5	02
Shaly sandstone.....	30	00
Gray shale.....	13	00
Black slate.....	4	00
Coal parting.....	0	04
Hard stony fire clay.....	3	00
Siliceous shale, with ironstones.....	27	00
Black slate with fossil shells, and <i>Stigmara</i> , <i>Lepidodendra</i> and <i>Cordaites</i> .....	1	08
COAL—worked.....	4	00
Fire clay.....	3	00
Hard fine blue limestone to bottom of shaft.....	3	00

172 03



The top of "People's mine" shaft is twenty-one feet above high water, and sixty-five above low water in the Ohio. According to surveys made by Mr. Alves, and results in the short entries of this mine, the dip is reversed, and strata rise to south and southwest at the rate of from twenty to a hundred and ten feet per mile. The last may be only a local roll. It is possible that Holloway's bore, put down four miles east of Henderson, to a depth of one thousand and twenty-four feet, pierced successively the coal measures, the upper beds, including St. Louis, of the sub-carboniferous, and rested in the sandstone member of the knobstone groups. A six foot coal, reported one hundred and fifty feet above the bottom, is a black slate, sometimes occurring at that horizon.

Going northwest from Evansville, the rocks pierced at the beginning of Ingleside shaft, are found partly exposed in the bed of Pigeon, and in the sides of the bold bluff which bounds the alluvial valley on the north. The crest of the bluff shows the double limestone, which usually, in counties to the north and west, separated by a space of from ten to forty-four feet, are here brought in contact, by absence of the material generally intervening. They also mark the horizon of the first and second rash coals, here also barren. Above them is the third or local rash coal, and the Merom sandstone. The following exposure was noted at Babytown hill and Phil Koch's quarry:

## SECTION AT BABYTOWN.

	Ft.	In.
Soil .....	10	00
Merom sandstone, (soft) .....	45	00
Coal, 3d rash, local .....	1	05
Siliceous shale .....	3	00
Laminated, sandstone ripple marked; some good quarry stone .....	19	00
Blue limestone .....	2	00
Conglomerate, siliceous and feriferous—place of flint .....	2	00
Yellow ferruginous limestone .....	7	00
Siliceous shale to brook .....	35	00
Total .....	<u>114</u>	<u>05</u>

Some stone for rough masonry and flags has been quarried on Phil. Koch, Senr's land. The coal is of limited area, but is reported to burn well. The same seam of coal has been worked to a limited extent on land of Phil. Koch, Sen., southwest quarter section 14, township 6, range 1, and D. S. Lytle, same section.

The limestone in foregoing section, and on land of W. H. Law, southeast quarter section 23, township 6, range 4, contains large and small crinoid stems, *Spirifer lineatus*, *Spirifer Kentuckensis*, *Athyris subtilita*, *Terebratula bovidens*, *Productus longispinus*, *Rhynchonella osagensis*, *Lophophyllum proliferum*, *Hemipronites crassus*, *Campophyllum torquium*, ? etc., in fact, is composed almost wholly of marine animal remains, generally so compressed and broken as to be undistinguishable.

From the top of Babytown hill, nearly 200 feet above low water in the river, a splendid view is enjoyed of the city and its teeming life, and the beautiful river bearing on its bosom graceful, life-like steamers, laden with the commerce of the Valley States. In the village, on land of J. F. Schaeffer, northwest quarter of section 23, township 6, range 11, a spring flows from the base of a decomposing mass of limestone, somewhat acidulous, and holding iron and sulphur in solution. It has been used medicinally with success, and will doubtless have good effects in febrile cases.

On Andrew Koch's land, southwest quarter section 14, township 6, range 11, the massive bed of the Merom rock is well exposed, exhibiting one of its typical features. The rock is 20 to 40 feet thick, and is composed of sharp, angular grains of sand, with small partings or veins of soft, hematite, and a few trunks and stems of plants. The sand is but slightly agglutinated, or disintegrating from ancient exposure, is soft and incoherent, and may be removed with a shovel, scarcely requiring the aid of a pick or blast. On exposure, the iron is removed by rain and dew or by washing. The sand is white, clean, excellent for plastering, etc., and may be used for the manufacture of glass. All these

strata dip 60 feet per mile to west, northwest. Absence of the third rash coal in a well, on the same land, proves its area extremely limited.

#### BABYTOWN WELL.

(A. Koch's land.)

	Ft.	In.
Soil.....	10	00
Soft, incoherent sandstone.....	2	00
Soft Merom sandstone, massive bed.....	43	00
Siliceous shale, no coal.....	16	00
	<u>71</u>	<u>00</u>

Adjoining, on land of Charles Rodenberg, southwest quarter section 15, township 6, range 11,  $4\frac{1}{2}$  miles west of Evansville, a large amount of stone has been quarried and burned, making a strong, dark lime.

#### SECTION AT RODENBURG'S QUARRY.

	Ft.	In.
Clay and loess.....	40	00
Merom rock and siliceous shale.....	20	00
Blue clinky limestone.....	2	04
Conglomerate, with argillaceous and flinty material, fossils .....	3	00
Gray limestone, weathering yellow, brecciated, with crushed fossils.....	5	00
Parting of fossils.....	0	to 0 02
Gray laminated limestone.....	4	00
Siliceous shale, ironstone nodules and plates of sand- stone .....	25	00
	<u>101</u>	<u>06</u>

This bed of stone is probably at or about the horizon of the top of the Ingleside shaft. The strata dip rapidly to the west, consequently springs are not found on the eastern, but burst out on the western exposures or hill sides. Continuing southwest on the land of J. W. G. Stinson, the rocks afford the following:

## SECTION AT STINSON'S SPRING.

(FOUR MILES WEST OF EVANSVILLE.)

Southwest quarter section 28, township 6, range 11.

	Ft.	In.
Loess and soil.....	3	00
Merom rock.....14 feet to	6	00
Siliceous shale with nodules.....	13	00
Upper hard blue limestone.....	3	02
Parting slate and fire clay, place of second rash coal	04	
Yellow limestone with crinoid stems, <i>Spirifer lineatus</i> , <i>Natica</i> , etc.....11 feet to	3	09
Shales and sandstones to brook.....	22	00
	<u>51</u>	<u>03</u>

Strata locally dip west 60 feet per mile. The Merom sandstone is ferruginous and very coarse, indicating a shore or estuary deposit transported by strong currents or thrown up by breakers. In short spaces the beds are nearly horizontal or sinking with regular dip, but frequent masses of false or diagonal bedding with a slope of  $10^{\circ}$  to  $35^{\circ}$ , faced directly to the west, showing that the deep ocean, whose waves gave direction to this deposit, was in that course.

At Michael Gluck's lime kiln, southwest quarter section 32, township 6, range 11, stone has long been burned, making a good strong lime for local demand. The following out-crop was noted:

	F.	In.
Loess, soil.....	20	00
Red sand, loess.....	4	00
Soft Merom sandstone.....	26	00
Shaly sandstone.....	12	00
Blue limestone.....3 feet to	1	00
Calcareous argillite with plates of chert of 2 inches to 8 inches, and containing <i>Spirifer lineatus</i> , <i>S.</i> <i>Kentuckensis</i> , <i>Bellerophon</i> , <i>Athyris</i> , <i>Productus</i> , and crinoid stems and arms.....	3	00
Gray and buff limestone crowded with a crushed mass of above fossils.....	8	00
Gray shale in brook.....	2	00
	<u>76</u>	<u>00</u>

Another outcrop of this flinty (hornstone) limerock, was seen further on in the West Franklin road, which has been a noted curiosity with geologists who have made this region famous by their labors. At this point, although not well exposed, it would seem from the sloping outcrops, that the whole thickness of this limestone had passed into clinky hornstone (flint). At southeast quarter section 6, township 7, range 11, the Merom sandstone is seen along the top of the hill, indicating a thickness of twenty to thirty feet.

On the slope of the hill, near the residence of F. Finney, are three sink holes, such as are so common in the region of the subcarboniferous limestone, from ten to thirty feet in diameter. Their size indicates an unusual development of limestone of this locality. These are the only sinks seen in our coal measures. A large spring discharges the water collected by them. At the southwest corner of the county, about a mile east of West Franklin, the bluffs expose a bold precipitous face to the river. The limestones here parted by a slight layer of slate and thin plates of the second rash coal, are elevated with the Merom sandstone by a local anticlinal ridge, with strike from northeast to southwest, and dipping slightly to the east, but rapidly, for a short distance, in the normal western direction. Much stone was formerly burned here, and at the village below, for shipment to the southern market, but this lime contained so much color and foreign ingredients that it could not successfully compete with the purer article from subcarboniferous. At this bluff, Mr. Geo. M. Priest (to whom I am indebted for section in bore, and other favors), in November, 1859, put down a test well, which, with the outcrops gives a good exhibit of strata, viz:

## PRIEST'S BLUFF SECTION.

West half section 19, township 7, range 11.

## OUTCROP.

	Ft.	In.
Covered.....	22	00
Yellow ferriferous Merom rock.....	15	00
Pyritous clay shale, with plates of sandstone.....	19	00
Black carbonaceous slate.....1 ft. to	0	00
Blue limestone.....1 ft. to	4	00
Parting, 2d rash coal.....		06
Buff clinky limestone.....	5	06
Blue and black shale, 1st rash coal.....1 ft. to	0	00
Siliceous shales with iron nodules.....	27	00
Bore—high-water mark.		
Siliceous shale, with good iron ore in bands and nodules.....	36	06
Siliceous shales, with nodules.....	30	00
Hard concretions.....	2	00
Sandstone.....	44	03
Laminated sandstone and shale.....	13	00
Blue shales.....	27	00
Very dark shales.....	3	06
Coal, (N?).....	3	06
Fire clay.....	1	06
Total.....	254	03

By this it is seen that a coal of workable thickness exists at a depth of 157 feet below high water mark. Just across the line, in Posey county, the rash coals are better exhibited, although of no great importance. They are, at no locality in the State, of workable extent. Near this point, and below, the tops of the hills, 130 feet above the valley, afford a magnificent view, embracing a large extent of river and bottom fields, and have been employed as "look-outs," or residences, by the Mound Builders and other pre-historic races.

Going north along the county line, the Merom sandstone was noted at several localities, generally in Posey county, rising to the northeast and dipping to west southwest. Much diagonal or false bedding was observed with wave faces to west. At Andrew Keck's quarry, northwest

quarter section 36, township 7, range 12, half a mile west of the county line; the massive member of the Merom sandstone is well exposed, and yields an excellent quarry stone, in large blocks, one of the best quarries in the vicinity. In the lower strata *Calamites* and worn trunks of coal plants were seen. Below the quarry is a band of black shale with locally a thin seam of coal from six to ten inches thick.

The same sandstone outcrops on the farms of Charles Keck, Lewis Hauschild and George Roseman, sections 30 and 31, township 6, range 11; soft and incoherent at the top, but presenting massive ledges ten to twenty feet thick, in the ravines. A short distance east of this locality the sandrock ascends to the summit of the hills, and the double limestone and rash coals are exposed in the valleys. Massive beds of sandstone are seen along the southern bluffs of Big creek, some of which have been quarried for rough masonry. At Wm. Fauquher's, and vicinity, section 6, township 6, range 11, the Merom sandstone caps the tops of the hills and a band of black carbonaceous shale, twelve to eighteen inches thick, is seen in the ravines, representatives of the second rash coal of general section, the limestones apparently being absent, or having passed into a calcareous shale. A thin coal was formerly worked, for blacksmiths' use, on the Dow farm, northwest quarter section 1, township 6, range 12.

On the dividing ridge between east and west branches of Big creek, on the farm of Henry Schiff,  $2\frac{1}{2}$  miles southwest from St. Wendell, the Merom sandstone has not been eroded, and crowns an almost knob-like elevation. The lower strata is soft, micaceous and readily yields to the action of the atmosphere and running water, the middle or massive member, more compact, often stands out 10 to 15 feet, overhanging the brook which rushes past its base, forming "rock houses" like those so often seen in the conglomerate hills. These have been used for shelter in storms by Indians, as well as wild animals. St. Wendell is a German village (section 7, township 5, range 11), and

presents many characteristics of the fatherland, novel to Americans. The industry, thrift and prosperity of the citizens is proverbial. Well appointed farms, good gardens and comfortable or luxurious houses, filled with means for social comfort, enables them to enjoy life somewhat independent of the outside world. Coal has been stripped to a very small extent at several openings near the village, but it is impure, thin, and will not justify expensive work. On the farm of John Tenbarger, west half section 6, township 5, range 11, the second rash coal is found 11 inches thick, of fair quality. At George Helfert's, southwest quarter section 7, township 5, range 11, several loads have been mined; for quality, see chemist's report.

## SECTION AT HELFERT'S—ST. WENDELL.

	Ft.	In..
Slope, Merom sandstone.....	70	00
Calcareous shale (limestone).....	1	06
Black sheety shale.....	2	00
Coal, second rash.....	1	06
Laminated fire clay, in brook.....	1	00
	<u>74</u>	<u>06</u>

In the black slate covering this coal was seen dermal tubercles and spines of *Petrodus occidentalis*, *Nucula inflata*, *Cardiamorpha Missouriensis*, etc. The fish specimens above are probably termed "comb-like teeth of sharks" in former reports.

The northwest part of the county, near the residence of Hon. Leroy Calvert, is a prime agricultural region; perhaps, considering all the surroundings, the best in the country. The table land is a broad, gently undulating or nearly level plateau, and offers the characteristics of a prairie opening. The soil produces good crops of grass, wheat, and a fair yield of corn in its natural condition; but many farms have been enriched by under-draining, which assures good crops in spite of unpropitious seasons by fortifying plant life against flood or drought. In this vicinity the valley of Big creek proper is from two to three miles wide, and several of



its branches have valley plains from one to two miles wide, with only brooks or wet weather streams flowing through them, in no way commensurate with the erosion necessary to excavate such water-ways, all pointing back to the time when temporary sluice-ways, discharging floods of ice-water from the northern and northeastern glaciers, swept across here to the Wabash by way of Big creek, now an insignificant stream. The rocks are deeply covered, and the only outcrop noted is a quarry of Merom sandstone on the farm of John Klaser, northwest quarter section 23, township 4, range 11. Well improved farms, comfortable houses and a thrifty people characterize this vicinity.

Returning south towards the city, many vineyards and profitable orchards were noted in the broken and hilly region which borders the ravines. On the farm of Mr. George Graff, northeast quarter, section 22, township 5, range 11, much ill-advised search has been made for silver, and an expensive shaft put down through the solid Merom rock. It is unnecessary to say that there is not the least probability of finding such ore in this county. The following shows the outcrops:

## SECTION AT GEORGE GRAFF'S.

	Ft.	In.
Covered and variegated shale.....	30	00
Soft Merom sandstone.....	8	00
Laminated Merom sandstone.....	20	00
Massive Merom sandstone.....	12	00
Shale and sandstone.....	3	00
Blue sandstone and shale.....	7	00
Black slate .....		08
Coal, rash.....	1	02
Siliceous shale.....	4	00
	<u>85</u>	<u>10</u>

The character of the under bed indicates the irregular and unreliable nature of the coal noted in the above section. Although appearing at the horizon of the second rash coal, it is probably a local deposit of no great extent.

On John Kohler's land, southeast quarter, section 3, township 6, range 11, coal was formerly worked at a good deal of expense. The fixtures are not in use, and gone to decay. A specimen of the coal for analysis was not obtained. The following section is nearly correct, viz:

## SECTION AT KOHLER'S OLD MINE.

	Ft.	In.
Soil and loess.....	10	00
Merom rock.....	25	00
Gray shale.....	4	00
Coal, rash.....	1	06
Laminated fire clay.....	2	00
	<u>42</u>	<u>06</u>

Before the opening of Ingleside shaft, the coal mined here was hauled in wagons to partially supply a light local demand in the city. It is not probable that this coal will pay for working. In Big creek region and along the county line, judging from outcrops seen in Posey county, the space between the first and second rash coals is widened up to from 10 to 40 feet, in some cases to a still greater extent, and the limestone superimposing them, passes into calcareous shales or fossiliferous argilites. No closely connected section was taken showing this feature in the county.

North of Evansville, near the crossing of the Princeton pike over Pidgeon, a sandstone in regular layers is quarried. It is fair stone for foundations and underground work, and easily shaped by reason of its planes of stratification. The following section reaches from the bed of the creek up to and including the double Permo-carboniferous limestone which is seen as boulders or residual red clays along the crest of the hill, but becoming persistent where not exposed to the air:

## MECHANICSVILLE—PIGEON SECTION.

## Southwest quarter section 8, township 6, range 10.

	Ft.	In.
Clay soil .....	26	00
Yellow clay .....	8	00
Blue shale—decomposing shale.....	8	00
Place of Permo-carboniferous double limestone.....	5	00
Covered slope, (shale) .....	40	00
Gray shale .....	10	00
Banded sandstone, passing into shale.....	1	06
Gray shale.....	15	00
Sandstone passing with wedge-shape terminals into shale.....	11	00
Silicious shale with iron stone nodules.....	15	00
	114	06

Mechanicsville is a thrifty suburb, elevated 150 feet above the city, and 520 feet above tide-water. The pure air and sunshine is apparent in the ruddy faces and elastic forms of its citizens.

From the top of the hill a wide view is spread out, embracing the city and its spires and factories, the rich, broad valley alive with railway trains, and the river quivering beneath the tread of stately steamers. Across the river in Kentucky, hills twelve to fifteen miles away pierce the blue sky with cones and peaks, apparently 80 to 100 feet higher than this spot, guarding the southern wall of the Ohio valley. A short distance east of the north end of the long narrow village, on northwest quarter section 5, township 6, range 10, the double limestone persistently outcrops in the shallow ravines, and is worked at two quarries. The product is used for curbing and stoning the streets of Evansville. This stratum rises to the northeast at about fifteen feet per mile, and is seen a surface rock two miles northeast of Mechanicsville, and at Andrew Palmer's on the pike. Near Anton Schmitt's, northwest quarter section 20, township 5, range 10, it shows a face of seven or eight feet, and in cavities beneath its disturbed edges, rattlesnakes\*

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\*Col. Hornbrook tells of a fight between two large serpents, one a rattlesnake, the other a blacksnake, witnessed by himself on this farm. It was a fight to the death. The reptiles rearing up nearly erect, maneuvered their heads with swift-winged motion for advantage, and filled the air with sickening smell. The rattler

and other serpents gather every season from an acre of miles, to hibernate. One of the former was said to have been ornamented with 26 rattles.

At the residence of J. W. Knowles, Esq., disturbed fragments of Merom sandstone are seen at and on the surface, and the limestone 5 to 9 feet thick on the sides of the hill. His well gives the following:

## SECTION IN KNOWLES' WELL.

	Ft.	In.
Soil and red clay.....	12	00
Merom sandstone.....	14	00
Soapstone and shale.....	9	00
Siliceous shale.....	2	00
Limestone.....	2	00
	39	00
Add limestone in outcrop.....	8	00
	47	00

At the southwest corner of Knowles' farm, southwest quarter section 17, township 5, range 10, the massive Merom sandstone overhangs the brook which flows by its base, forming a rock house, which was a favorite resort of Indians seeking protection from storms. Mr. Knowles' fruit trees are a surer source of income than field crops. He carefully cultivates or preserves some of the native fruits, as persimmon, pecan, etc. At the neighboring residence of Mr. G. Potts, an interesting and well arranged cabinet of fossils, relics, etc., was visited, some of which were of much scientific interest.

Inglefield is situated at the southern edge of the high dividing ridge of table-land, from which the water-shed is to the northwest to the Wabash, and south to the Ohio. It is well up to the summit level of the county. A cut by the railroad, south of the village, exposed strata full of interest. First shales with bands and boulders of siliceous iron stone are seen dipping to the southwest. As they pass from view, their upper surface roughly distorted and water

gave the first blow, but in coiling back for another stroke, exposed his flank. The blacksnake, seeing his opportunity, like lightning, seized his adversary by the back of the neck, and throwing him with thumping sound upon the ground, wound his coil around, boa-constrictor like, and crushed and choked him dead.]

worn, the massive member of the Merom rock superimposes the shales resting on their eroded surface, but unconformably as if of more recent date, perhaps establishing a line between older and more recent geological formations, between the Triassic? and Permo-carboniferous periods.

The Merom rock is itself very irregular, with much false bedding and alternately compact or of friable texture.

No fossils were seen. A bore put down by W. Adams, for the proprietors of Browning's mill of this village, discovered the following extraordinary strata, indicating a prevalence of limestone on this anti-clinal similar to the calcareous beds found in deep bores reported in geology of Gibson county, viz :

#### INGLEFIELD BORE SECTION.

	Ft.	In.
Surface clay.....	10	00
Red Merom sandstone.....	36	00
Carbonaceous parting, coal.....		04
Hard flinty limestone.....	4	00
Clay parting, second rash coal.....	1	08
Flinty gray limestone.....	6	00
Light gray sandstone.....	20	00
Soft white limestone.....	8	00
Soapstone, first rash coal.....	16	03
Shale.....	20	00
Gray flinty limestone.....	3	02
Soapstone.....	26	00
White limestone.....	30	00
Gray shale.....	20	00
Fire clay.....	10	00
Coal N ?.....	1	06
Fire clay.....	4	00
Gray shale.....	10	00
Soapstone .....	28	00
Sandstone.....	3	00
Black slate.....	2	00
Sandstone.....	17	00
	<u>276</u>	<u>05</u>

Two and a half miles northeast of Inglefield, near McCutchen school house, section 2, township 5, range 10, and section 34, township 4, range 10, an interesting cluster of pre-historic earthworks exist, which will be more fully noted under the head of antiquities. The double limestone is found in wells, etc., on the table-land in this vicinity, from 20 to 40 feet below the surface. It is seen along hill-sides on the Thomas McCutchen farm, northwest quarter section 25, township 4, range 10, where stone has been burned for lime, and where another winter resort for snakes has been discovered and destroyed.

The top of a bald peak on the McCutchen farm, northwest quarter section 25, commands one of the finest outlooks in the State, embracing the hills and knobs beyond Newburg, 18 miles to the south, Dittany hill, 6 miles to the northeast, the range of wall-like hills along the west line of Pike county, as McGregor's hill, etc., and Kennedy knob, 15 miles to the north, in Gibson county. At each of the last two stations, and at Snake knob, sections were taken and given in reports on Pike and Gibson counties, which are by this survey and by stratifications here noted, connected with the survey of Vanderburg; for the double limestone which caps the top of each of these hills is seen ascending to the northeast, and as it approaches the intervening valley of Pidgeon, passes out above the surface two and a quarter miles east southeast of Eberfield, in Warrick county. At Dittany hill, in Warrick county, interesting phenomena are observable, some accounts of which are given under the head of recent geology.

Passing down Pidgeon creek, the rocks were concealed by float materials. At Millersburg, in Warrick county, coal of superior quality (for analysis see chemist's report), was worked during the short life of the canal, and is still used for local fuel. This coal is apparently our nearest approach to Pittsburg coal. The following section was taken near Mischke's mill:

## SECTION AT MILLERSBURG.

(WARRICK COUNTY).

		Ft.	In.
Slope and argillaceous shale.....		12	00
Pyritous argillite.....		1	00
Black clod fossils.....		1	00
COAL N:			
Laminated good coal.....	1	04	
Choice cubic coal.....	1	06	
Rash pyritous coal.....		06	
			3 04
Argillite, with pockets of impure coal .....		5	00
Gray shale .....		2	00
Blue limestone, very hard and ferruginous.....		5	00
Total .....		29	04

In the black clod over coal N, were noticed some beautiful pyritized specimens of *Myalina*, *Aviculopecten*, *Productus*, *Chonetes*, *Macrocheilus*, *Rhynchonella*, *Spirifer* and *Nautilus*, with *Neuropteris*, *Pecopteris*, *Alethopteris*, *Cordaites*, *Sigillaria*, etc. In the limestone a few crushed specimens of *Spirifer*, *Productus*, *Athyris*, with crinoid stems, were observed. In the village, a number of ancient mounds were visited.

At Chandler station, on the Boonville railway, a new shaft had just been put in successful operation by the proprietors, Pattison & Williams. The fixtures are first-class, driven by an engine of forty horse power. They were mining 50 to 60 tons a day, and as soon as the entries, which were in progress, could be finished, the capacity would be equal to an output of 200 tons a day. The company carefully select and reject the pyrite and other impurities, desiring to sell only a good article, and furnish a good coal for steam and grate use; for analysis see chemist's report. I am indebted to Mr. H. E. Williams, superintendent, for the following sections, and other favors.

## CHANDLER SHAFT.

(WARRICK COUNTY.)

	Ft.	In.
Clay soil .....	16	00
Coal N. Millersburg and "Little Newburg" .....	2	00
Fire clay .....	2	06
Blue dark limestone with <i>Spirifer cameratus</i> , <i>S. lineatus</i> , <i>Athyris</i> , <i>Chonetes</i> and crinoid stems .....	9	05
Soapstone, (indurated shale) .....	4	00
Hard sandstone .....	3	00
Light soapstone .....		08
Siliceous shale .....	11	10
Sandstone .....	5	03
Gray shale .....	10	05
Dark soapstone .....	2	01
Gray shale with plates of sandrock .....	34	00
Black slate .....	1	00
Slaty clod, with large boulders .....		08
COAL M.		
Fair coal .....	1	04
Pyrite parting .....	0 to	02
Good coal .....	1	04
Laminated coal .....	1	04
	4	02
Fire clay .....	4	00
Siliceous shale, iron nodules .....	5	00
	116	00

This is an excellent, strong coal. Care should be used to reject the band of pyrite, when the product will command a ready market.

The following section was taken at Newburg near the southeast corner of the county. Most of the strata are seen in out-crops. Thanks are returned to Mr. Love, proprietor, for a report of strata in shaft. The small seam, N, is 80 feet above low water in the Ohio, 30 feet above high water and 10 feet above the top of the shaft.

## SECTION AT NEWBURG SHAFT.

	Ft.	In.
Massive yellow sandstone .....	18	00
Gray shale .....	16	00
Black slate and fire clay .....	2	00



COAL N. "Little Newburg" .....	1	04
Fire clay.....	5	00
(TOP OF SHAFT.)		
Gray and buff limestone.....	8	00
Gray shale with plates of sandstone.....	88	00
Hard slate, pyritous fossils.....	1	00
COAL M.		
Fair coal.....	1	10
Pyritous parting.....		02
Good coal.....	2	00
		<hr/>
	4	00
Fire clay .....	2	00
Siliceous shale, pyrite pebbles.....	3	00
		<hr/>
	148	04

The limestone under coal N is rich in the coral, *Chaetetes*, and contains a few specimens of *Lophophyllum* of exaggerated size, in some individuals, the diameter of the calices would range from three-fourths to an inch and a quarter. According to the Cypress creek bore, a short distance east of the shaft, coal L is 123 feet below M, K 60 feet below L, and the conglomerate ? sandstone 112 feet below K.

On the land of Silas Stevens, northwest quarter section 7, township 6, range 9, seven miles northeast from Evansville, a shaft was put down to coal N and formerly operated. The coal, too thin to be worked in competition with the thicker seams, was reported to be of superior quality—a rich, fat caking coal, full of gas. The shaft was abandoned and could not be entered without help. The following is the reported section, and neighboring outcrops confirm the report :

## SECTION AT STEVEN'S SHAFT.

	Ft.	In.
Covered soil.....	8	00
Choice yellow sandstone.....	22	00
Siliceous shale with iron shells.....	10	00
(Top of shaft.)		
Gray and buff, siliceous and also shales, with thin shells and plates of iron stone.....	19	00
Black slaty clod. ....	1	00
Coal N.....	2	03
Fire clay in brook.....	2	06
	<hr/>	<hr/>
	54	09

This coal is very like the Millersburg coal; for analysis see that coal. In the brook, shelly or concretionary iron ore in fragments was abundant, equivalent to similar outcrops seen at Millersburg and 130 feet below the top at Dittany hill, marking the horizon of coal N. The yellow sandstone in section has here been worked. The stone is a superior article of sandstone, regularly bedded, and may be readily and cheaply split or broken to "dimensions." Natural exposures show that it is durable and valuable.

#### ECONOMIC GEOLOGY.

Evansville, the county seat, is one of the principal cities of the State, and commercially, takes the first rank. It is situated on the north bank of the Ohio river, in latitude  $38^{\circ} 8'$  north, and longitude  $10^{\circ} 30'$  west from Washington. The altitude of the Ohio at low water is 320 feet above the ocean. The elevation of Main street is 50 feet above low water, and consequently, the average altitude of the city above tide-water is 370 feet.

As early as 1812, a few settlers gathered about the wilderness site of the city, and in 1820, there were only 100 inhabitants. About 1830 it took new life, when the rich Wabash valley, then just settled, sent down its wonderful productions to glut the New Orleans market. In 1840, the population was 2,121; in 1850, 3,235; in 1860, it had reached 11,468; in 1870, 28,715; and now, 1876, is fairly estimated at 42,000. Such figures signalize not only the growth of the city, but also, wealth, for investments, increasing with population, have consequently averaged more than 100 per centum advance in each decade. This growth is due to a variety of causes which will be briefly hinted at. The citizens, with a heritage of pioneer spirit, have bravely overcome natural drawbacks—averted the malarious exhalations natural to their alluvial situation, by a magnificent system of sewerage, in health worth twice its cost, have rejected the impure and unhealthy surface-water, and secured pure water by first-class works, have conquered nature by dredging flint gravel from the bed of

the river, and making first class streets and pikes radiating to every point of the compass, have encouraged and sustained the manufacture, at home, of every native production, and finally, urged by their favorable situation on the Ohio, below interrupting rapids and ice, and near the outlet of the Wabash, Green and Tennessee rivers, combining a navigation of more than 2,000 miles, have, by their skill and energy, seized upon the boating transportation, and "made commerce king." By facilities for trade, a large area of southwestern Indiana, southern Illinois, western Kentucky and some portions of nine other States to the south and west, are rendered tributary to her trade; prospering and receiving benefits in return.

The latest (1874) statistical compilations\* available, although not as full as desirable, gives an illustration of manufactures and vigorous commerce, amounting in the aggregate to over \$50,000,000 per annum:

#### MANUFACTURE AND TRADE OF EVANSVILLE.

Agricultural Implements and Seeds.....	\$500,000
Ale, Bottled.....	71,000
Architectural Castings.....	40,000
Auction and Commission.....	608,723
Beer and Malt Liquors.....	690,000
Books and Stationery.....	135,000
Boots and Shoes.....	1,500,000
Bottled Sauces, Table Notions, etc.....	8,000
Brass Manufactures.....	125,000
Bricks.....	200,000
Brooms.....	15,000
Building Improvements.....	3,000,000
Carpets, Oil Cloths, etc.....	200,000
Carriages.....	130,000
China and Queensware.....	500,000
Clothing.....	1,250,000
Coach Trimmings and Horse Goods.....	100,000
Coal—Its Local Trade.....	173,845
Confectionery.....	400,000
Cooperage, Staves, Shingles, etc.....	150,000
Cotton Fabrics, manufactured.....	150,000

\*Roberts' "Evansville, her Commerce," etc., 554 pages. Octavo.

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Dry Goods and Notions.....	\$5,100,000
Drugs and Chemicals.....	1,100,000
Engines, Boilers and Machinery.....	1,091,000
Enameled Grates and Mantels.....	10,000
Edge Tools and Cutlery.....	40,000
Furniture and Chairs.....	825,000
Grain and Flour.....	5,075,000
Groceries.....	6,000,000
Galvanized Iron Cornice.....	60,000
Hair Goods.....	15,000
Hardware, Jobbing.....	600,000
Hats, Caps, Furs and Straw Goods.....	600,000
Hogs and Provisions.....	500,000
Hosiery.....	13,000
Ice.....	140,000
Iron, Merchant and Heavy hardware.....	350,000
Iron Pumps.....	3,500
Iron Railing and Jail Work.....	15,000
Iron Safes and Bedsteads.....	11,500
Jewelry, Watches, Silverware, etc.....	200,000
Leather, Hides and Oil.....	500,000
Lightning Rods.....	5,000
Liquors and Wines.....	3,500,000
Marble and Building Stone.....	135,000
Millinery.....	40,000
Music and Musical Instruments.....	100,000
Paper, Blank Books, Binding, etc.....	260,000
Paper Wrapping.....	5,000
Plows.....	145,000
Produce—Wool, Feathers, etc.....	300,000
Realty Sales.....	2,307,562
Saddlery and Saddlery Hardware.....	500,000
Salt, Lime, Cement and Plaster.....	200,000
Sewing Machines.....	170,000
Ship Chandlery, Boat Stores, etc.....	150,000
Soap and Candles.....	60,000
Steam, Gas and Water Fixtures.....	45,000
Stoves and Hollow-ware.....	640,000
Sugar Cane Machinery.....	30,000
Terra Cotta and Stoneware.....	30,000
Tin, Copper and Sheet-Iron Ware.....	500,000
Tobacco and Cigars.....	3,545,000
Toys, Fancy Goods and Fire Work.....	50,000
Trunks.....	30,000
Wagons, Wheels, Hubs, etc.....	75,000
Wall Paper, Window Shades, etc.....	100,000
Wood, Lumber, etc.....	3,000,000

Woolen Fabrics, manufactured.....	\$125,000
Miscellaneous Retail Trade Estimate.....	2,000,000
Various Manufactures not specially detailed.....	2,225,000
Total .....	<u>\$52,477,180</u>

Banking facilities are already at hand equal to this business. The churches are numerous, chaste and substantial. Her public schools are equal to the best; her street railways are extensive; her hotels and opera house scarcely equaled by any city of the same size, and with over 300 extensive and prosperous manufacturing establishments, her growth has only begun. The present is but an indication of the grand future when Evansville shall be queen of the lower Ohio. The total bonded debt of this city is reported at \$1,600,000, for which she has property and public improvements worth double their cost, but fairly valued at \$2,800,000.

In addition to all these, a great need invites the citizens to new enterprise. A railway bridge, crossing the Ohio, is a necessity long felt that will almost double the present prosperity of the people, and must be at once built here or at some wiser rival city.

#### COAL.

The mineral resources of the county are apparent from the foregoing geological sections—little more need be added. It may be repeated that the main coal seam, M, is of great and almost uninterrupted persistence throughout the county wherever sought. Barren places may be found, but from present indications such a case will be exceptional to the general rule—i. e., a four foot seam of strong, workable coal underruns nearly the whole area of the county. In other regions faults and “barrens” are large and expensive elements in the cost of coal. Nature has generously, and with full hand, taken off this tax and assures cheap fuel. Coal is the source of England’s pre-eminence, and of Belgium’s wealth; it is the food of steam, the great slave of humanity. Here the offering is unlimited, cheaply accessible, and quality good, elements of prosperity granted to few of the great

manufacturing cities of the world, and which earnestly invite skilled laborers to this harvest. In addition to the 300 prosperous and profitable manufacturing enterprises already established in the city, it may be suggested that a "plant" for *grinding, working and coking* the nut and other coals is desirable. Coke is urgently demanded by many trades. In fact, the future prosperity of every manufactory, directly or indirectly, depends on cheap coke, and no greater benefaction can be conferred on our region, than a successful demonstration of that quality in our coals. Coke is also wanted in unlimited quantities in the mineral regions of the West. A thousand carloads per month are carried by our doors to the gold and silver works of Eldorado. The precious metals should pay tribute to our black diamonds, and acknowledge the superior value of the latter.

Coal N is thin, not averaging much over two feet, but superior as a grate or coking coal, rich in volatile matter, and contains but little sulphur. It is found desirable for family use, by tidy housekeepers, and, with extended deodorizing surfaces, may and will be used for gas. Tests made when the Millersburg coal was accessible by canal, were favorable.

#### STONE.

The sandstones of this county are mentioned at several localities. It is generally found in masses or layers of suitable thickness for work. It is well adapted for foundations, etc., and extensive quarries may be profitably opened in the hills, six to seven miles northeast of the city. The Merom sandstone, as a rule, is not a good stone, as it readily disintegrates. The upper limestones have been used for curbing, and will be needed for rip-raps and flood guards. The beautiful cream-colored stone fronts and trimmings, which add so much to the architectural appearance of the public buildings, stores, churches and private residences, are from the thick beds of St. Louis limestone, of the sub-carboniferous group, found abundantly in adjoining regions in this State and Kentucky. This stone is cut by saw, works well under the chisel, and is tough and durable. It is here

a cheap building material. Clay for bricks is found abundantly throughout the county; the quality is good. Modified clays are found in several of the valley lands, and are of superior quality for crocks and jars. The under clays of the coals will furnish an article suitable for terra cotta work and stoneware, which will rival the coals in value.

#### METALS.

Iron ores are found throughout the coal measures. Nodular ore of good quality occurs just above and below the horizon of coal N. In the present state of affairs, it will not pay to work. The largest deposit seen, was at Priest's bluff, in southwestern corner of the county, where several car loads are exposed at low water. Very minute scales of gold and nuggets of copper are sometimes found, imported with the modified detritus of the glacial drift. It is scarcely necessary to say, that there is no probability and scarcely any possibility that ores of copper, lead or silver exist in this county, certainly not in economic quantities.

#### SAND.

Sand is abundant on the bars of the creeks and river. It is easily and cheaply "elevated" from the bottom of the latter, by steam. From the decomposition of the Merom rock, a sharp angular sand is obtained, desirable for strong masonry, plastering, etc., which may be economically used for making glass.

#### ROAD MATERIALS.

There are no gravel beds in the county like those so common in the drift regions in the central and northern parts of the State, but in the bed of the Ohio river and generally below low water, are extensive deposits of ferruginous chert, broken in "nut" fragments, torn from the chert beds of the sub-carboniferous higher up the river and carried and rolled here by floods. This is one of the best stones known for metalling pikes and streets. The surface, when compressed by use, is soon re-cemented by the iron it

contains, making a compact, smooth surface, nearly impervious to air and moisture, and slightly elastic. It is extensively used in the city, and conjointly by the city and county authorities. Free pikes radiate in every direction leading to and from Evansville. These are the best public works in the county, for, civilization, social refinement and intelligence dwell only on good roads, avoiding inaccessible or impassable regions. This is proven by the concentration of homes and population along highways even to the neglect of many fertile regions.

#### WATER.

Mention has already been made of some deleterious minerals liable to be found after seasons of drought in wells on the lacustral clays and sands, creating a predisposition to inflammatory diseases. Citizens can not be too earnestly urged to secure pure water for culinary as well as drinking purposes, and for their stock. Assurances have been given that a filtering cistern, holding and collecting rain water, will often save its cost in a single year, at the expense of the doctors and pill venders.

#### HEALTH.

The health of Evansville, since a general system of drainage and sewerage was adopted, is good, and compares favorably with other large cities. The low lands, river bottoms, etc., are liable to malarial diseases. Experience shows that the cause of such disease while readily circulating in, is heavier and floats only in the lower stratum of air, and is most active at night; consequently, the evil effects of malaria, even in the low lands, may in a measure be avoided by arranging sleeping rooms at an elevation of ten to twenty feet from the ground.

#### TIMBER.

The forests of this county have been noted in the general description. They afford one of the great sources of income. Ornamental woods, as walnut, oak, maple, beach, ash, etc.,



are common, and several of the most prosperous manufacturing establishments are engaged converting this home material into useful and ornamental furniture. Other kinds of timber are used for building purposes, the manufacture of wagons, carriages, plows, implements and machines. The sales, direct and indirect, credited to the forests amount annually to over \$4,000,000.

#### AGRICULTURE.

Although overshadowed by the grand achievements of commerce and manufactures, the farmer finds agriculture an honorable and profitable avocation. The skilled husbandman is sure of fair crops, and located at a central distributing point, he is certain of satisfactory prices. Market gardening on land well underdrained is highly profitable, and never equal to the home demand. The progressive farmers in the "flat" areas, are making their uplands equal to river bottoms by tiling.

#### FRUIT.

The natural advantages in soil, warm climate and command of an unfilled market are neglected—perhaps for the reason that other pursuits are more quickly remunerative. The "bluff" soil of this region is the American equivalent to the Loess of the Rhine which produces the generous wines of France, and with the same care will as richly reward. The climate is in the neutral zone, between uncomfortable warmth and cold, not subject to the extreme changes which renders the business hazardous in more exposed regions. Hence, the tender fruits, as peach, apricot and grape may be grown to perfection along with the sturdier apple and quince. The market is unfilled—east, west, north and south—and with daily means of access. Under the control of those who know how to use them, these advantages ought to make Vanderburg county a "pomological paradise."

Some attention has been given to the subject, and a few very profitable orchards and vineyards were observed. Wines from the latter were rich in boquet and spirit. Trees and vines should be mulched with sawdust, etc.; to

protect the roots from the hot sun of summer, and to retain moisture. Numerous native fruits invite attention. Walnuts and hickory nuts command a ready market, and the pecan flourishes and may be easily and profitably cultivated. Wild grapes, plums, etc., crown the hill tops or cluster in the valleys, but the luscious persimmon, "*God's fruit*," is the plentiest and best. The last presents two varieties—the late and the early—which contains generally but one seed, and is large, sweet and palatable. It is believed that selection by cultivation would produce persimmons rivaling the date. Before drying, the fruit should be slightly scalded in an alkaline solution.

#### TRANSPORTATION.

The system of commercial intercourse is almost complete. The Evansville & Chicago railway furnishes direct connection with the north, northeast and northwest, 500 to 800 miles away; Evansville & Nashville railway connects with the extreme gulf States, 300 to 400 miles to the south; the Evansville & St. Louis points directly to the grand treasures of the west, and the Boonville and Newburg roads are intended to open a close connection with the east. These railways, with their mighty traffic, would seem sufficient, but to these must be added a fleet of steamers, which "walk the waters like a thing of life," 64 in number, with 18 barges, having a total tonnage of 14,240 tons, owned by citizens of the county, and subsidiary to its interests. These, with as many others from neighboring cities, explore our great system of river navigation, 10,000 miles in extent, exchanging the manufactures and goods of Evansville for the crude products of their neighbors.

#### ANTIQUITIES.

Several earthworks exist in this county—isolated or clustered mounds and pits, which require for their excavation the persistent labor of a people with a combined purpose under intelligent direction. In their location, embracing healthy and picturesque stations, convenient to

water, generally to river transportation, fertile lands, and a wide outlook to the east; characteristics so constant as to indicate a design, and indistinctly to reveal the religion, government and habits of a mysterious, unknown race. Of these remains the savages knew nothing. Their nomadic life and restless habits forbid such works.

Several isolated mounds were noted on the bluffs, 130 to 170 feet above the Ohio, at the southwest corner of the county, near West Franklin. Implements of stone and pottery found here, were of artistic execution. A celt, (hand axe), of flint was polished like the Danish celts, (unusual in America, if not unique), also a granitic hand axe with beveled edges. A cluster of mounds of great interest was observed near McCutchen school house, two and a half miles northeast of Inglefield, twelve miles from Evansville, on northeast quarter of section 2 and 3, township 5, range 10, and south half of section 34, township 4, range 10, about twenty-five in number. They were scattered over fifty or more acres, and covered with forest and bush. Fifteen were counted, measuring from 2 to 6 feet in height, and 20 to 60 feet in diameter. On the adjoining Hillyard farm are two pits or excavations, now partially filled. One of them was 60 feet in diameter, and, at first settlement, 20 feet deep, now only ten feet deep. The second was 15 feet in diameter and four feet deep, apparently for underground homes, or for water. A constant spring—rare in this vicinity—seems to have invited the mound builders to this elevated and commanding point, which is a promontory of the dividing ridge which separates the watershed of the Wabash from that of the Ohio. The outlook embraces the wide flat valley of Blue Grass creek, and the distant mound-capped knobs in the horizon. The excavations probably existed first as sink holes through the underlying limestone, and afterward were shaped for human use. An examination can alone definitely settle this question. One of the mounds has been opened. It contained, near the base, ashes, shells, bones and pottery, indicating a mound of habitation. Many relics, well wrought in stone, are reported to have been found in this vicinity.

The extreme northeastern corner of the county was a favorite resort of the pre-historic races. Mr. Jno. B. Locke has collected some interesting stone relics on his farm, northeast quarter section 24, township 4, range 10, found on a knoll in a small mound, including a sandstone pipe or calumet, in shape of "bear's head," ears erect, mouth distinct and claws folded as if hibernating; also, a "medicine" tube of Alabama talc, three and one-half inches long, three-fourths of an inch in diameter at the "mouthpiece," nearly two inches at the opposite end, with a constriction above the middle, the bottom edge was serrate; also, flattened discs of sandstone. On visiting the locality, a bed of whitish clay was seen at the western extremity of a ridge 600 feet long by 200 from north to south. In front of this to east was an area, the surface level and apparently paved with plastic clay 500 by 200 feet, probably a "Chungke play-ground," with council chamber, where the relics were obtained. On this "play-ground" a set of six "Chungke" stones were found from three to four inches in diameter, two inches thick, with a concavity in each side like the quoit or discus of the Olympian games. Surrounding or at the edges, spear and arrow points and "flint chips" have been noticed. This "Chungke" ground is now a field in cultivation. At an early day it was covered with a growth of trees, none over 400 years of age—youngsters compared with the surrounding forests—indicating that this area had been used within 1000 years. At an arrow factory on T. B. McCutcheon's land adjoining, flint "chips" in quantity are reported, also flint "splinters" two to three inches long and perfect as if cut with a knife, instead of by cleavage.

Some interesting mounds were noticed in and adjoining the village of Millersburg. They were composed in part of sand.

At the extreme southeastern corner of the county, extending across the line into Warrick, is one of the most interesting earthworks seen. Angell's mound, on farm of Ham. Angell, southeast quarter section 31, township 6, range 9, is a wonder. A symmetrical cone rising up from the level plain to

a height of 50 feet, and only 300 feet in diameter. It is almost too grand to be attributed to the puny arm of man. Many smaller mounds, but larger than the general average, are located on the Gen. Lane farm, adjoining the Angell on the east. In this neighborhood are found vases, jars, jugs, implement handles, images of duck and owl heads, human faces and hands, spindle whorls, pipes and buttons, made in pottery; also buttons of cannel coal, and axes, hoes, spades, pestles, grinders, celts, arrow and spear points of stone. Graves of savage Indians are discovered throughout the county, sometimes intruders upon the mounds, but shallow and carelessly made.

*Ossuaries* or bone vaults have been discovered a few miles west of Evansville. They are isolated or often intrusive on the mounds. They contain the bones of all a nation's dead for a certain length of time, generally seven years, collected from temporary places of deposit at the mid-summer season of cheerless fasting and mourning, cleaned, bleached and deposited in walled vaults covered with flat stones and earth. Older than the Indian period, and later than the mound builders, they belong to an intermediate littoral or riparian race, who retained some of the religion and art of their dispossessed predecessors, but their coarse, crude implements and pottery show that they were far lower in the scale of progress than the latter. They are closely allied to the Natches and Choctaws of DeSoto's expedition.

Thanks are returned to the citizens generally for information and assistance. Acknowledgements for special favors are due to the following gentlemen: Col. Philip Hornbrook, John Ingle, Ingle Bros., Dr. Stinson, Capt. H. E. Leed, Hon. J. D. Riggs, Hon. H. C. Gooding, Sebastian Henrichs, Joseph Hennel, Wm. Fauquher, James W. Knowles, H. E. Williams, of Vanderburg and Warrick; to John Reichert, G. M. Alves, of Henderson, and to the President and Directors of the E. & C. and E. T. H. & C. railroad companies.

# OWEN COUNTY.

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BY JOHN COLLETT.

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Owen county contains 396 square miles, and is bounded north by Putnam, east by Morgan and Monroe, south by Green, and west by Clay county. Spencer, on the west bank of White river, is the county seat, and is 53 miles southwest from Indianapolis. White river is the chief water course. It enters the county from the northeast, near the middle of the east line, where also it forms the division between the counties of Morgan and Monroe, thence it flows southwest with many windings that result in a valley line nearly direct. The bluff walls of this valley are as a rule precipitous, built up with massive strata of stone from 80 to 110 feet. Raccoon, Mills and McCormack creeks flow through narrow rocky chasms into the river from the south, and Indian, Limestone, Mill, Rattlesnake and Fish creeks flow into it on the west side, generally with course directly from the north, the first taking their direction from the general dip of the rocky formations, while the second set of streams owe their origin to causes which will be noted under the head of Glacial drift. Eel river takes rise near Alaska, in the extreme northeastern part of the county, flows west with no deep cuts through a broad level plain largely built up with recent fluvial or lacustral sediment to Cataract. Here, plunging down the successive falls, it has hewn a passway through a very narrow channel, surmounted by steep or perpendicular sides. This river flows across or around three sides of the county, in more than a great semicircle. Its affluents are Jordan, Six-mile and Fish creeks.

Many springs break out in great volume on the east side of the valleys, conveyed by impervious strata which, dipping generally to the west, account for their position. The water is pure, cold and sparkling, and invites the attention of dairymen and butter makers. It is apparent that this region is well watered, and that the supply is more reliable than in the drift areas. The surface features are agreeably diversified. Rich alluvial bottoms from one-fourth to one-half of a mile wide are found on either side of White river; the small creeks have valleys of no great extent. Near Alaska and Quincy, in the northeastern parts, a rolling or gently undulating area slopes off to the broad, level valley plain of Eel river to the west and north, a fine body of land, producing fair crops of corn and wheat, and an excellent growth of grass.

A similar area about Patrickburg and the extreme west line of the county, slopes gently to the west, and comprises some choice black lands, which produce excellent crops of corn, wheat, oats and grass.

From the northwestern corner of the county to the southeastern, a broad belt of from six to ten miles wide, embraces a hilly, almost mountainous region, in which high hills and deep valleys alternate in close succession. It presents many extensive views full of wild and picturesque beauty. From a point on the divide some distance northeast of Patrickburg, an illusion having an important bearing on the past geologic history of the county, was noticed. Thence the surface of the elevated areas and ridge tops sloped gently to every point of the compass. The deep ravines were hidden by the wall-like ridges with their mantles of tree and bush, leaving no hint of the profound valleys 180 to 250 feet deep, which largely occupy this area.

From that standpoint was revealed the ancient rocky surface of the county as it came from the hand of nature, modeled in the bosom of the ocean, a great plain sloping gently to the west, northwest and southwest, before the currents of ice water, in the glacial age, demanding egress

to the south, had eroded their deep valleys. The scene was not less remarkable for the extensive view enjoyed. Sheriff Moffett, who was familiar with the whole region, pointed out the highlands near Gosport in the northeast part of the county, Cantwell's hill near Santa Fe, Spangler's hill at Cataract, the elevated plateau near Atkinsonville, the ridge east of White river, southeast from Spencer and two knobs like clouds in the blue distance, one just south of Freedom, the other 18 miles away in Greene county.

Although level areas in this belt are not of great extent, several large farms were observed, which, under wise direction, were yielding good returns. The hilly region is better adapted to special pursuits than to general farming. When plowed, the loose soil is inclined to "run" with every shower, and so managed, will, in time, strip off the soil and expose the underlying rocks. This course is destructive. On the other hand, if the attention of the citizens was turned to wool growing and dairying, the soil would not deteriorate, but, according to the Spanish axiom, "The sheep treads with a golden hoof the soil," it may be indefinitely improved. In part of this region, farmers complain that blue-grass and timothy fail, and that clover injures the soil by increasing its liability to "run." It is suggested that orchard grass is a sufficient substitute for the first, and Chilian clover (true Alfalfa) will furnish a substitute for the latter and a perennial forage plant. The red soils of this district are rich in calcareous matter and very fertile in their original (natural) condition. This is proven by the magnificent forests which once prevailed—nearly gone. Some giants of this royal race were observed and measured. Poplars from 5 to seven feet, white oaks from 4 to 6 feet in diameter, with trunks carrying their size well from 50 to 80 feet in length; walnut and other valuable trees of good size were seen, and sassafras trees, generally known as a shrub or bush, having the wonderful diameter of over 3 feet. Such indications should not be neglected. They are a hopeful indication that the old fertility may be



restored by shading the ground from the hot sun by pasturage grasses.

#### RECENT GEOLOGY.

Recollecting the fact, mentioned in the foregoing general description, that the original surface presentation of this county, as it emerged from the mother carboniferous ocean, was a great plain, sloping gently to the west, with two slight ridges guarding to the north and south, the depression or gulf-like basin, 3 or four miles wide, about and west of Patricksburg, in which the block coals were prepared and deposited, the question naturally occurs, to what causes may the well developed system of hills and valleys be attributed. There is no evidence of volcanic energy; little or none of earthquake action, except the slow, gentle oscillations, by which the crust of the earth is continuously raised or depressed over large areas, continentally. Close observation will at once discover agencies, in the long past, of adequate power. The elements are nature's great agents—water, air and heat: ice her great plow, water her graver, and air and heat her moulder. With them and time, she has accomplished the denudation and erosion of mountain, plain and valley. We have but little knowledge of the long period which followed the emergence of this region, till the Glacial age. We know that it was long enough for the Permian, Triassic, Jurassic, Cretaceous and Tertiary seas, in the great valley of the continent, to the west, to develop and sustain their wondrous life under a tropic<sup>2</sup> clime. This was followed by a period of intense cold, which has left many records of existence, graven with a pen of ice, "on the rocks forever."

#### THE GLACIAL EPOCH.

This epoch on our continent is divided into two periods—the first, in which a deep massive river of solid ice flowed up the St. Lawrence valley, plowed out the beds of Lake Ontario and Erie, resting its ice foot along a ridge still seen in northern Ohio and northeastern Indiana, and discharging

a flood of ice-water, melted by the warmth of each recurring summer's sun, by sluice-ways (present river valleys) into the Ohio and Wabash rivers. Last summer I had the pleasure of studying some of the most interesting phenomena of this period, under the guidance of Dr. Newberry, the accomplished chief of the Ohio geological survey. At Put-in-Bay and Kelley's islands, vast surfaces are planed off smooth as a floor, others grooved and striated, each mark indexing the course and initial point of the mighty ice machine, and recording a mysterious chapter of the book of nature. The general course of this flood was along the axis of these two lakes, and an average of the observations made was, that its direction was south  $80^{\circ}$  west. Of this period we have only fragmentary evidence in this State, a single nugget of magnetite from the Adirondacks, a few flat, oval pebbles apparently from the Medina sandstone, some well-defined sluice-ways in Ohio and Indiana; but we may add that many of the actual streams—more of the old river beds and valleys of the State have the general direction of the first flow. In this county, an ancient river flowing west has crossed the top of the conglomerate ridge a mile west of Cataract, scalping clean the surface material, it has left exposed as a clean floor the quartzite under coal A. Going west, we find fragments of this hard stone with identifying fossils, and extensive beds of sand, as if the high-water line of a stream on the high lands north of Jordan. The latter and Six-mile creeks have great valley plains within their high bluffs, far beyond the usitude of the actual streams, even many times wider than the valley of White river below Spencer, and the bed of Six-mile, as shown by bores, was excavated to a depth of from 50 to 80 feet below its own and the level of the chief water courses surrounding. It is suggested that these phenomena may be referred to the first glacial period.

Of the second glacial period, the evidence is apparent to the careless observer. The records are easily read. It was subsequent to the St. Lawrence flow, for on the Bay islands, the southern shore of Lake Erie and where else observed,

its striæ over-ride, and its debris obliterate, the marks and channels of the latter. It come from the extreme north, loaded with Arctic granites. Crossing Lake Superior, it took up iron ore, copper, greenstone and pudding stones from Keweenaw Point and the Manitouline islands. Divided by the peninsula of Michigan, the larger stream flowed solidly up lake Michigan, hewing out its bed, and thence pushed by congelation in the rear or drawn by the ice vacuum in front, poured its rigid current over the northern half of Indiana and Illinois. Probably of extreme thickness at the north, the ice sheet did not have a hight of over 200 to 400 feet in central Indiana, as measured by the Glaciometer\* in Brown county. For a probably short time the ice sheet extended over nearly the entire area of the county. Glacial striæ, cut in conglomerate, were seen in the barn-yard of John Haxton, Esq., in southeast quarter section 20, township 9, range 5, the striæ having a confused direction of south  $18^{\circ}$  east to south  $46^{\circ}$  east. This southern limit is extreme. But little glacial debris was seen south of Atkinsonville and Santa Fe. It is probable that the foot of the ice flow for a long time lodged, and was heaped up against the ridge running east and west through Spangler's hill just south of Cataract, where the wintry accumulation was melted and discharged down Mill, Rattlesnake, Fish and Lick creek valleys. The ice-water of summer, in flood like torrents, following the direct path marked by the ice, flowed directly south to and sometimes across the present valley of White river. Confirming the conclusion, an interesting set of north-south "passes" were observed, cutting at right angles, and checkering the ridges between those more ancient sluice-ways of the ice age, Jordan and Six-mile valleys, and leading thence to the head waters of Fish and Lick creeks. Very minute quartz pebbles and other comminuted relics of the imported rocks were seen on the head waters of these streams, on Rattlesnake creek, and on the ridge near Atkinsonville, showing conclusively that these valleys were ice-water sluice-ways, and that their

origin is due to the violent floods which swept from the foot of the glaciers. To-day a cut of less than 70 feet would carry the water of Eel river, above the falls, through the the pass east of Spangler's hill, into Rattlesnake, its old channel. Near the mouth of that creek and in the town of Spencer, fragments of quartzite under clay of coal A were observed, which had undoubtedly been torn from the dividing ridge near Cataract, and carried thence by the ice waters via Rattlesnake creek. At the same time, White river, following the course of the soft Chester sandstone, at an elevation of 130 feet above its present channel, flowed up McCormack creek, through the "Flat woods," and down Raccoon to the wide channel below. Glacial pebbles sustaining this view were noticed along the banks of the latter stream, as also some fossils peculiar to the knobstone beds of Brown county, which seem to indicate that Beanblossom had once crossed from near Ellettsville to the "Flat woods," and found discharge also by Raccoon creek.

That the valleys of Eel, below the cataracts, and of White river, below the mouth of McCormack creek, are recent, much more recent than that above, is obvious. They are at once contracted to from one-fourth to one-twentieth their former width, that is, the width of the ancient channel higher up stream. The question at once arises, how was the new channel obtained? During the evident long period that the foot of the glacier rested against cataract ridge and the highlands in the north part of Monroe county, the continuous retreating and advancing process of the ice scooped out a deep, wide basin in White river, east of Gosport, and north and east of Cataract, just as the basins of the lakes were excavated, far below the river and outlet. As the ice by climatic change withdrew to the north, these basins became sluggish streams, or filled by the excessive precipitation common in cold regions, temporary lakes. Now this region is underlaid with limestone, stratified and checkered with partings. Rainwater is its solvent. The water would find these partings, and seek discharge by the line of dip of the rocks.

At first, a single drop would find its way, to be followed by others, each enlarging the orifice, until underground brooks were established, wide caverns were opened, and when these became too wide to support the overlying rocks, the roof would fall in and expose the hitherto "lost river." The same process is at work to under-cut the lower fall at Cataract. Wells dug in the valley plain, between Quincy and Cataract, in the old river bed leading to the "flat woods," and in the wide bottoms above Gosport, indicate beds of laminated sand and muck of lacustral character.

The foregoing presumption, referring the deeply excavated valleys of Fish, Lick and Rattlesnake creeks, and the "flat woods" channel of White river to the agency of glacial ice water, is reasonable and founded upon the facts incidentally mentioned, but fully confirmed by the trail of small, white, quartz pebbles, black sand (magnetite), and gold dust found along these streams. Objects which here, can only be attributed to the imported rocks of the

#### ALLUVIUM.

The alluvial bottoms bordering the streams are due to causes now in action. As rocks are pulverized by action of the atmosphere, by the frost or heat of the sun, or by the abrasion, pounding and rolling of the brooks and streams, the fine residuum is seized by currents and thrown down by the still water on their flood plains. Combining all the minerals utilized by plants, they are very fertile, rivaling the stories of Egypt in the perfection and abundance of their products. Common crops are grown to advantage—the yield of corn is simply enormous.

#### PALEOZOIC GEOLOGY.

The rocky formations of Owen county belong wholly to the Carboniferous age, and comprise that part of the coal measures beginning at Coal K, reaching down to the bottom of that group, and through the upper part of the Sub-carboniferous to the top of the Knobstone beds. The highest geologically of these strata are found at

the western line of the county, near Coal City; the lowest in the bed of White river above Gosport, the whole tabulated from isolated outcrops, gives the following exhibit:

## GENERAL SECTION OF OWEN COUNTY.

## CARBONIFEROUS AGE, CARBONIFEROUS PERIOD.

*Coal Measure Group.*

	Ft.	Ft.	In.
1. Surface drift and soil.....	0	to 110	00
2. Brown ferruginous sandstone.....	12	to 4	00
3. Black sheety slate and sandstone.....		3	06
4. COAL K.....	1	to 2	06
5. Fire clay.....		3	00
6. Gray shale and slaty limestone.....	12	to 19	00
7. COAL J, (part block).....	1	to 4	02
8. Laminated under clay.....	2	to 6	00
9. Clay shale and shaly sandstone.....	18	to 12	00
10. COAL I, block .....	2	to 6	07
11. Laminated under-clay.....	2	to 7	00
12. Siliceous shale, locally rich in nodular iron ore, passing into sandstone.....	14	to 8	00
13. COAL B, part splinty cannel.....	$\frac{1}{2}$	to 3	02
14. Fire clay.....	2	to 4	00
15. Clay shale or sandstone.....	8	to 13	00
16. Coarse soft sandstone, glass stone .....	15	to 4	00
17. Massive conglomerate, grit stones .....	60	to 90	00
18. Black aluminous, pyritous shale, locally with bands and nodules of clay iron- stones .....	0	to 20	00
19. Black shale.....	2	to 00	00
20. COAL A, caking, impure.....	0	to 1	06
21. Fire clay.....	4	to 2	00
22. Dark pyritous shale, with ironstone nodules passing into sandstone.....	40	to 10	00

## SUB-CARBONIFEROUS PERIOD.

*Chester Group.*

	Ft.	Ft.	In.
23. Kaskaskia limestone.....	15	to 22	05
24. Dark silicious shale .....	10	to 5	00
25. Chester sandstone, laminated, ferrugi- ous, with locally white quarry and grit beds.....	60	to 80	00

*St. Louis Group.*

26. St. Louis limestone, laminated, concretionary, or in heavy strata.....	90 to 70	00
27. "White quarry stone," Warsaw?.....	2 to 30	00
27a. Gray limestone interchanging with sandstone.....	12 to 6	00

*Keokuk Group.*

28. Keokuk beds—hard gray or buff limestone—with intercalations of indurated clay, containing geodes.....	50 to 46	00
29. Blue shale and aluminous limestone ( <i>Burlington beds?</i> ).....	10 to 5	00

*Knobstone Group.*

30. Coarse ferruginous sandstone.....	5 to 10	00
31. Gray shale and argillaceous sandstone, disintegrating .....	40 to 25	00
Total exposure of rocks .....	682	00

## DESCRIPTION OF THE GENERAL SECTION.

## COAL MEASURE PERIOD.

*Coal Measures.*

The coal measures, including the conglomerate sandstone, occupy a large area in the western and southern part of the county. The conglomerate is well developed on each side of Eel river, in the northwest part of the county, (although the floor and the foot bluffs of the river are of subcarboniferous limestone), it trends east to Fender hill, south of Cataract, then bending west and south, it is the surface rock on the west bluff of Rattlesnake, crosses White river near Freedom, and is found covering the hills and elevated areas in the southeastern part of the county. They are designated by Nos. 1 to 22 inclusive, in the section. Outliers, of small extent, (their companion beds eroded during the glacial period), are found east of the line above indicated, and considerable exposures of the Chester beds, especially the Kaskaskia limestone, are found in the deeply cut valleys to the west of this line.

Coal K, number 4 of the section, is generally absent,

two outcrops only being noted, one north of Coal City, near the county line, the other southeast of the same place on the farm of White, section 14, township 9, range 6. The seam is irregular and unreliable, varying from a few inches to two feet. The coal is fat, sulphurous, coking, and burns with much cinder to a red ash. In the black, sheety slate roof were noted fish remains, as bones, coprolites, and spines and plated scales of *Petrodus occidentalis*. The overlying limestone is argillaceous and bituminous, consequently not of much economic importance; it contains *Spirifer cameratus*, *Spirifer lineatus*, *Athyris subtilita*, *Productus costatus*, *P. semireticulatus*, *P. longispinus*, *P. cora* and *Lophophyllum proliferum*. Coals J and I, Nos. 7 and 10 of section, are of a laminated or splinty structure, characteristic of our block coal, with, at localities in the western parts, one or more partings of fat, resinous, splinty cannel. They occupy an area of about 45 square miles in townships 9 and 10, in ranges 5 and 6. This area was a great depression in the bed of the carboniferous ocean, walled by a shore or bluff line of conglomerate sandstone to the north and south, a bay or gulph opening into the grand carboniferous sea to the west. In this quiet bay or lagoon, protected from wind and wave by bold promontories to the north and south, was macerated and pulpified (a process necessary to manufacture block and cannel coals), the vegetable material which now constitutes J and I; block coals, from their nature are not persistent over large areas, but here they are fortunately more regular than in the most favored fields.

When the surface is uneven or hilly, a very considerable amount of these coals has been removed by denudation and erosion.

The underclays of J and I, as far as seen, are laminated or shaly, indicating a subaqueous deposit, rather than the soil which produced the plants to form the coal.

Coal J, although laminated, contains so much volatile matter, as splinty cannel, etc., that in the mere local market it is neglected, and but few opportunities of investigation



afforded. The upper coals north, south and west of Coal City are referred to this seam.

Coal I is generally developed around Patricksburg and thence west, south and southwest, to within two miles of that corner of the county. It is a splendid block coal, burning with little smoke or cinder, like hickory wood, to a white ash. It varies from three to nearly seven feet in thickness, and although at a few localities it contains partings of splinty cannel, it is eminently a free burning block coal, generally free from sulphur and other impurities, and believed to be well suited for the blast furnace, in the natural state. It is an excellent fuel for steam, rolling mill, glass factory, household and locomotive use.

Coal B, No. 13 of section, lies from 12 to 20 feet below coal I, and is seen in outcrops all around the northern, eastern and southern rim of the latter. It is also found at intermediate valley stations where coal I has been eroded and washed away. B is typically a fat, gassy coal, but generally comprises one or more divisions of resinous, splinty cannel, almost as rich and pure as Albertite. The best developed view of this seam is at the Arney and the Needy mines, section 9, township 9, range 5. At other points, north and northeast of Patricksburg, this coal, although thin, is remarkably pure, pure enough for gas making, and at a few stations presents a rare article of cannel coal.

No. 16, the upper coarse, soft member of the conglomerate, is incoherent or readily disintegrates, becoming a mass of coarse sand. On exposure, the iron it contains is dissolved and carried away by rainwater, leaving the leached residue clean and white, suitable for glass making. A fine deposit was noticed southeast of Patricksburg, on the Vandalia road.

#### CONGLOMERATE SANDSTONE.

The massive Conglomerate, No. 17 of section, develops a broad band from three to six miles, reaching across the county from northwest to southeast corners. Although eroded and cut through by the streams, so as to expose the underlying limestones, etc., in many of the creek valleys, it

is the general surface rock, the valleys excepted, in all the region north and west of Cataract, in the space between Rattlesnake and Fish creek, and in a strip from two to three miles wide along the southern boundary of the county. This stone is either heavy-bedded or massive, splits readily, dresses well for hammered masonry, hardens on exposure, is fire and water-proof, and is a superior and desirable material for abutments, foundation and fire-proof edifices. Generally ferruginous and consequently buff or brown in color, at several stations, as at the Moffet farm at the head of Six-mile, at Evans', south of Atkinsonville, and at King's "Buzzard Gulch," section 6, township 10, range 4, good white stone, and superior grits were observed. With facilities for transportation, this stone would be demanded for masonry, and perhaps to an equal amount in value for grindstones and grits.

Coal A, number 20 of section, is a rough, caking coal. It generally contains pyrite, burning with much offensive smoke and yellow flame to a red ash full of clinkers. Besides it is very irregular and inconstant, no where attaining a thickness of over two feet in the rare pockets, the average for the whole area would not probably exceed five inches. The returns gathered in mining A will not likely exceed twenty cents on the dollar expended.

The dark or black aluminous shales Nos. 18 and 22 are pretty constant companions to coal A, in fact, more certainly persistent than the coal itself. At several points they carry considerable bands and beds of clay ironstone, but are more notable for the amount of pyrites generally contained. This decomposes on exposure to air, undermining the superimposed conglomerate, and forming cavities and "rock houses."

The life of the carboniferous age was peculiar. A curious vegetation prevailed, so exuberant as to amass vast beds which stored the sunlight and heat of the past for to-day's use. A majority of these remains are referred to in the books as land plants: *Ferns*, *Lepidodendrons*, *Sigillaria*, *Stigmaria*,

*Calamites*, etc. Many algæ are seen as *Chondrites*, *Cauler-pites*, and a tender vermiform fucoid, not sufficiently preserved for determination. The animal life is wholly marine, ranging in habitat from the shore zone of 50 to 100 feet down, to the shell fishes, etc., whose home was in the vast depths of the mighty sea. Air breathers are rare or entirely absent, no evidence of such were seen in this county.

#### SUB-CARBONIFEROUS PERIOD.

##### *Chester Group.*

The Kaskaskia limestone, No. 23 of section, is the upper member of the Chester group. It heralds a great change in the conditions, life and results of the earth's existence. Here a line is drawn by the fossils, sharp and distinct. In this bed and below, a peculiar marine life, animal and vegetable, flourished in profusion, with but few evidences of any dry land. Most of this life perishes and becomes extinct. A few survivors, a meagre minority, live over in the coal measure epoch. They were replaced with new forms. A new life was introduced, anticipating the needs of to-day.

The Kaskaskia only exhibits a thickness of from five to twenty-two feet, is a marked horizon, easily recognized, drawing the exact line above which coal may be found and below which it is not found in workable deposits, hence its significance and economic importance as a geologic index.

This stratum is found well developed high up in the sides of the hill at Jackson's bluff, near Arcola, section 33, township 9, range 4, is just caught in the tops of the hills about Freedom, whence its eastern outcrop bends west on the top of the conglomerate spur near Middletown and Steubenville, when it turns sharply east to Fender's hill near Vandalia, thence north and west to Cataract and the northwest corner of the county. In this rock are found *Pentremites Godonii*, *P. pyriformis*, *P. obesus*, stems of crinoids, probably *Zeacrinus* and *Actinocrinus*, fronds of *Archimedes*, *Zaphrentis spinulosa?*, *Spirifer striatus*, *S. Kentuckensis*, *Athyris ambigua*, *Productus punctatus*, *P. semireticulatus*,

*Retzia vera?*, *Rhynchonella Osagensis*, *Pinna* (?), *Hemipronites crenistria*, and teeth of fishes. Generally these fossils are fragmentary, or in poor preservation, but distinct enough for identification. The stone breaks irregularly, containing some argillaceous matter, weathers brown or buff, and is only tolerably durable, though hard to work. It is used for rough foundations and for burning. It yields a dark, strong, "cold" lime. When highly ferruginous it decomposes, forming extensive beds of red and yellow ochre, as at Stiltz farm, north of Middletown, and at Sloo's, section 19, township 9, range 5.

The Chester sandstone, No. 25, succeeds below. It is from 60 to 80 feet thick, generally ferruginous and closely laminated; at several stations it affords good quarry stone, easily wrought. The fossils are rare, comprising a few plants, as *Lepidodrendon*, *Sigillaria*, *Cordaites* and *Fucoides*.

#### ST. LOUIS LIMESTONE.

The St. Louis limestone, No. 26 of section, lies immediately below the Chester sandstone and outcrops in a broad belt from two to four miles wide, with axis extending from Quincy, southeast by Mill creek and McCormack creek, to the eastern boundary of the county. It is typically a thin, heavy bedded limestone, often concretionary or argillaceous, sometimes dark colored from disseminated iron, with partings of indurated clay containing a small amount of magnesia. The upper division at several stations is in thin laminae, and affords paving stones as at Fletcher's quarry, near the mouth of Rattlesnake and Mill's quarry on Mill creek, or where the layers are thicker, excellent rubble stone as at Schweitzer's quarry, near Spencer. In the same beds is found a fair lithographic stone, which can be furnished by the car load, and has been used by lithographers for "transfers" with good results. Large quantities may be obtained at the last mentioned locality, as at many other stations. Just outside, or last of the axial line of this bed is the "White quarry stone," division No. 27 of the St. Louis limestones, sometimes known as the Warsaw limestone.

It is an mass of crushed shells and other animal remains, deposited in a trough or depression in the floor of the ancient ocean, from a half to one and a half miles wide, which may be traced in south and southeasterly directions almost continuously, by Ellettsville, Bloomington, Bedford to Salem, in Washington county, and perhaps further. At favorable exposures, the Keokuk beds are seen depressed beneath this trough, rising above, (notwithstanding the dip), at the west as well as eastern margin, thus forming a depression in which the light shells, etc., would be drifted by slight currents. Here are entombed the remains of billions of individuals to the acre. The animals are small, some microscopic. The stone is compact, fine grained and pure, in proportion to the degree of comminution to which these remains were subjected. The quarry stone is a white or gray neutral tint, may be quarried in blocks of any size demanded, saws well, is tough under the chisel, capable of resisting great weight, resists the action of the elements well and, in fact, combines all the points of a superior building stone. It has been used in many of the public edifices of our western cities, and is everywhere favorably known. This division (quarry stone) is irregular, varying from 2 to 30 feet in thickness, and sometimes thins out to a mere parting. The animal life of the St. Louis limestone was wholly marine, and consisted generally of animals that occupied the zone of cool or temperate pure water, from about 600 to several thousand feet in depth. The characteristic fossil is *Lithostrotion*, but three specimens *L. Canadense* were seen; *L. Proliferum* was common, sometimes in open clusters, the calyces were generally solitary and of extraordinary size. Some specimens from 5 to 9 inches in length, and from one half inch to one and a quarter inches in diameter, also, *Productus punctatus*, *P. cora*, *Athyris ambigua*, *Spirifer striatus*, *S. Keokuk?* *S. Leidii*, fronds of *Archimedes Owenena*, *Aulopora gigas*, *Pentremites conoides*, and fragments of *P. Woodmani*, stems of crinoids but no heads. Spines of *Archæocidaris*, *Rhynchonella sub-cuneata*,

*Retzia vera*, *R* (Sp.?). *Terebratula hastata*, *Hemipronites crenistria*, *Platyceras acutirostris*, *Bellerophon*, *Straparollus*, *Conularia*, and *Rotalia Baileyi*. Teeth of the great sharks *Helodus*, *Cochliodus*, *Deltodus* and *Cladodus* were rarely seen. A good fossil bed was noted at stone-cut, near Cave-Spring station, on the New Albany & Chicago railway.

#### KEOKUK GROUPS.

The Keokuk beds, No. 28, succeed next in age and inferior position. They are first seen near high-water line at the foot of the hill at the pork-house near Spencer; above town they descend to low water, passing under the quarry depression of the St. Louis limestone, from thence they continually ascend to the northeast, passing well up on the hillside as Gosport and out at the surface in the northeast corner of the county. They consist of heavy bedded, dark or gray colored, hard, rough limestone, with intercalated beds of clay, often filled with geodes or partings of chert. The geodes are characteristic and an interesting feature. Rough and uncouth outwardly, they are filled with nature's brightest, purest gems, and freshly broken, sparkle with the imprisoned light of past ages.

This limestone is used for foundations, steps, curbing, rip-raps and walls exposed to rapid currents of water. It is sometimes burned for lime, but is generally too ferruginous. A farm wall of this stone was neat, effective and permanent. Life was abundant. Crinoid stems crowd the rocks, and although heads of these animals were rare, it was evident that they filled the sea with their singular forms. Close investigation will yet discover good crinoid beds. Stems and broken fragments were seen of *Actinocrinus* and *Goniasteroidocrinus*, spines of *Archæocidaris*, plates of *Melonites* with *Pentremites Worthenii*, *Platyceras fissurella*, *Spirifer Keokuk*, *Spirifer striatus*, *S. cuspidatus*, *S. neglectus*, *S. lineatus*, *S. pseudolineatus*, *Retzia Verneuillana*, *Rhynchonella subcuneata*, *Terebratula trinuclea*, *Bellerophon sub-lævis*, *Dentalium primevum*, *Hemipronites*

*crenistria*, *Zaphrentis Dalyi*, *Archimides Owenana*, and *Aulopora gigas*.

In the blue argillaceous stone below No. 29, which may possibly represent the Burlington beds, were noticed in the railroad cut at Gosport, *Spirifer plenus?*, *S. striatus*, *Productus semi-reticulatus*, *Chonetes planumbonum*, *Aviculopecten amplus*, *Hemipronites crenistria* and *Fucoides*.

The life of this period is still marine. No sign of aerial life or dry land was seen. The animals required tolerably pure water, and a depth of from about 500 to 3000 feet. At adjoining stations are found *Spirifera*, *Athyris* and *Producti*, of a type heralding the approaching age of coal.

#### THE KNOBSTONE GROUP.

This bed, No. 30 of section, is seen below the New Albany railroad, and thence ascends to near the top of the hills in the northeast corner of the county, and gives character and shape to some of the sharp, mound-like knobs in that region. The impure water and muddy bottom of the sea at this period was not favorable for the life of water-breathing animals, nor for the preservation of their remains. No sign of life was seen, except a vermiform fucoid, which was common.

The upper division generally affords quarry sandstone of fair quality, but here none was seen of economic importance. The shales contain much pyrites, which, decomposing on exposure, give cause for chalybeate and sulphur springs.

#### LOCAL DETAILS.

The rocks of Owen county have a general dip, varied locally, of from 30 to 50 feet to the mile, and averaging in the sub-carboniferous about 33 feet per mile, in a direction west southwest. This explains the continuous disappearance of strata going west, and the occupancy of the surface by rocks of a higher position geologically, and more recent age, but actually at a lower level. The outcrops, in view from the west side to the northeast corner of the county,

are equivalent to a bore or shaft put down, in the valley west of Patricksburg to a depth of nearly 700 feet.

The occurrence of Knob sandstone and shales near Alaska, in the northeast corner of the county, is already mentioned. Here the ridges and tops of the hills are capped with limestone of the Keokuk group, which is soon carried by the dip to the bluffs and beds of the ravines and brooks.

Quincy is situated in an extensive valley known as the "flat woods," which dates back to the glacial age, and extends from Cataract in a northeasterly direction to Morgan county, and beyond. Here the ice foot rested for a long time against high ridges of limestone to the south, and melting, sent their waters to the south and west by Rattlesnake and Jordan. The pounding, washing, grinding process, resulted in an excavation much lower than the then outlet, and as the ice retired north, the excavation for a time became one of our ancient lakes. Wells to the number of 8 or ten in the village, at a depth of 25 or 30 feet, pierce a black, mucky soil, containing brush, trees, leaves, grass, etc. This unctuous clay is characteristically lacustral. It is underlaid with quicksand, and fine glacial gravel. The valley plain produces fair crops of corn and wheat, but is better suited for meadow grasses, of which good returns are received. The soil of the surrounding ridges is a rich yellow limestone clay, admirably adapted for the growth of wheat, clover and blue grass. It was originally clothed with a grand forest of sugar, poplar and walnut trees. One of the wells in the village gave the following exhibit:

## SECTION IN QUINCY WELL.

	Ft.	In.
Black soil .....	1	08
White and gray clay, with crawfish pipes, with little sand—no pebbles .....	10	00
Blue clay, with pebbles .....	3	00
Black mucky clay, with brush and plant remains....	3	00
Hard pan and fine pebbles.....	3	00
Coarse gravel and boulders, (depth unknown).....	3	00
	23	08



The trunks found in the above were of trees 4 to 5 inches in diameter, generally crushed or broken to pieces. The insertion of the branches was opposite and alternate, like fir or ash, and the rings of growth were compressed and fine, as if subject to a cold climate.

"Stone cut," on L. N. A. and C. R. R., a mile north of Cave Spring station, exposes an outlier of the lower division of the St. Louis, rich in characteristic fossils, and worthy the attention of students. The bottom of the cut contained Keokuk fossils.

The soil in this vicinity, formed from decomposition of limestone, is rich and productive. It was covered with a magnificent growth of walnut, poplar, oak, beech and sugar trees. Some giant specimens still survive. A poplar was measured 20 feet and 8 inches in circumference, with trunk 65 feet long. The farmers are prosperous and thrifty, as indicated by good houses and barns, and well appointed farms. Much attention is given to grazing and the cultivation of blue grass. "Sink holes" abound, showing the cavernous nature of the rock below. These funnels collect the rainfall which is carried by underground streams to a favorable outlet.

Cave Spring, on the farm of Jesse Rogers, near old Middletown, is an example. The spring flows from an open cavern 30 x 40 and 6 feet high, and plunges down a narrow chasm worn in the rock, some 40 feet. It was formerly utilized, driving three buhrs and a carding machine. The water discharge, with a head of three feet, is from 36 to 200 cubic inches, and although now unused, has an estimated capacity, with a turbine wheel, of at least 40 horses for eight months of each year. The temperature of the external air, July 23d, was 92° Fah.; of the cave 71°, in the gulch below the fall the air was oppressively chilly.

## SECTION AT CAVE SPRING.

	Ft.	In.
1. Keokuk limestone crowded with crinoid stems...	20	00
2. Argillaceous limestone (Burlington?) with suture partings at fossil beds.....	22	00
3. Hard blue limestone in beds of 1 to 2 feet, with fossils, outlet of spring.....	7	00
4. Argillaceous sandstone, geodes and thin plates of limestone.....	11	00
5. Knob sandstone, etc.....	25	00
	<u>85</u>	<u>00</u>

Partings between strata were covered with fossils. Some of extra size, as *Hemipronites crenistria*, from 3 to 4½ inches long; *Productus costatus* with spines two inches long; also nearly all the characteristic fossils of the group. Eroded spirifers exhibited well their internal structure and spiral appendages. Suture joints—"devil's toe-nails"—were distinct, and showed well their origin from beds of fossils. The cave is 1½ miles east of the station on the railway.

Miller's cave, a mile and a half northeast from the latter, on section 33, township 12, range 2, is surrounded by wild, canyon-like scenery, romantic and interesting. The spring here has a fall of 40 feet, and by a turbine drives a boulder "corncracker" mill. The cavern is 40 feet wide and 4½ to 5 feet high for 100 yards, where there is a long room 7 feet wide and 15 feet high; beyond, the water is deep and the roof descends to within a foot or two of the water. It has been traced, as Mr. Chas. Dow states, more than half a mile to its source in two "sinks," one in Morgan, the other in Owen county. In wet weather the cavern is sometimes filled to its utmost capacity, and the water in the pool is then 25 feet deep. The exposures give the following stratigraphic exhibit:

## SECTION AT MILLER'S CAVE.

	Ft.	In.
Keokuk limestone.....	20	00
Argillaceous limestone, crinoid stems.....	18	00
Indurated clay, with geodes and long crinoid stems.....	8	00
Sandstone parting .....	1	00
Red limestone with <i>Spirifer striatus</i> .....	2	00
Laminated calcareous argillite, with <i>Spirifer</i> , <i>Producta</i> and <i>Hemeporonites</i> .....	6	00
Argillaceous limestone, with geodes.....	8	00
Knobstone shales and sandstone.....	10	00
	<u>74</u>	<u>00</u>

On the dividing ridges between and around the sources of these caves, "sinks" from ten to thirty feet deep are very abundant, at some localities averaging one to an acre.

Gosport is a thriving town of considerable commercial importance. It is surrounded by wide alluvial bottoms and fertile uplands, and has the advantage of two railways. The hill, over 100 feet high, on which the town is located, commands a wide view east, southeast and southwest, across and along White river and Bean Blossom valleys. Here White river makes a short bend to the south. A bed of fluviatile sand in the north and west parts of town from 10 to 20 feet in depth, marks the flood plain or high water line of the ancient White river, then flowing 120 feet higher than now. The fair grounds south of town are well situated, and are ornamented with a number of "look-out" mounds 100, 200, 300 and 400 feet in diameter, and 10, 25, 30 and 40 feet high. Their well defined symmetry is striking, no evidence of artificial origin seen except that several quoits and "chungke" rollers were found here. The high conical mound within the enclosure affords a fine view of horse races, etc., at fairs.

The wells in the west part of town pierce sand and red clay, to a white limestone, which becomes shaly or fissile on exposure, in the following order:

## SECTION IN GOSPORT WELLS.

	Ft.	Ft.
Fluviatile sand.....	10	to 20
Red calcareous clay.....	20	to 10
White fissile limestone.....	25	to 6
	<hr/>	
	36	

The area covered with sand comprises about 500 acres, shaded by the foliage of trees, etc., it acts like a sponge absorbing and holding the rainfall, the wells are never failing, especially when so protected by vegetation. The top of the ridges and hills west of town are capped with compact gray and white St. Louis limestone, which, when burned, makes a good strong lime; beneath is seen blue Keokuk stone and geodes. The following section, from the top of the hill in town to White river, is full of interest.

## SECTION AT GOSPORT.

	Ft.	Ft.	Ft.
Slope, sand and red clay.....	20	to 10	00
White or gray St. Louis limestone.....		8	00
Green or yellow mudstone, with <i>Spirifera</i> and <i>Hemipronites</i> .....		4	00
Brown Keokuk limestone full of crinoid stems, geodes and fragments of crin- oidea.....		20	06
Clay mudstone.....	1	to 4	06
Gray laminated Keokuk limestone, with geodes small containing calcite, small fossils and many crinoid stems.....		4	00
Blue argillite (calcareous) with mudstone partings containing large Zaphrentes, Conchifers and Brachiopods.....	15	to 18	00
Knob sandstone.....	5	to 12	00
Knobstone shale.....	30	to 23	00
	<hr/>		
	104 00		

The Knobstone group passes from sight under the Keokuk beds at the foot; the latter pass under the St. Louis at the top of the hill, and the last disappears beneath a covering of Chester sandstone from two to three miles west of Gosport. The blue argillite at the base of the Keokuk beds is possibly "Burlington." It is peppered with minute

geodes, and contains large, broad winged *Spirifers*, *Aviculopecten amplus*, *Hemipronites crenistria*, *Productus semireticulatus*, *P. Cora*, etc. Every marked strata on the hillside signalizes a change in the conditions of the sea, destructive of life, as the partings and beds are universally covered with fossils so perfect that they must have lived and died on the spot. This is often characteristic of the Keokuk beds in this vicinity. The Keokuk limestone is crowded with crinoid stems, but a single head in tolerable preservation was seen, (*Goniasteroidocrinus*). Dip of strata 30 feet per mile to southwest.

A stone fence on the farm of Dr. Smith, one and a half miles north of town, is a novelty in this region. It presents a handsome appearance, cost \$2.25 per lineal rod, "is pig tight, horse high, bull strong," and good for 1000 years.

Mr. Fred Goss, a pioneer of 1817, says that on a small hillock or mound, a few hundred yards east of the railway crossing, north of Gosport, a roving band of Shawnee Indians had buried a dead child of the tribe. Shortly after the settlement of Gosport, when the same band was in this region, their chief, "Big Fire," died. They brought his body in a canoe ten miles by river, thence it was carried, by four elders of the tribe, on a bier made of two poles interlaced with bark, to the grave, where it was painted, dressed in his best blanket and beaded moccasins and buried along with his ornaments and war weapons. The grave was three feet deep, lined with rough boards and bark. Over it was planted an oak post, five feet high, eight inches square, tapering to a point at the top, which was painted red. The monument was often visited and long revered by the band. It has disappeared within a few years.

After the departure of the Indians some medical students, who have since become distinguished citizens of our State, determined to resurrect the great Shawnee. Meeting at the mound they proceeded to partially open the grave, when suddenly the report of fire arms and the "war-whoop," given by some festive friends, precipitated an inglorious

departure. Neither darkness, swamp or river, retarded their race, until protected by the Buskirk homestead. They told their story of peril to the great delight of their young friends.

Gosport was founded in 1817. Abram Alexander and Ephraim Goss were proprietors, and with their families were the first settlers in a wilderness surrounded by savages; their nearest neighbor was John Dunn, nearly 10 miles away at Spencer. Among the notables seen in town was Capt. D. V. Buskirk, a representative citizen of our great young State. The captain volunteered for the union during the late rebellion, bore gallantly the march, the battle strife and the the keen tortures of Salisbury prison pens. He is six feet ten inches high, weighs 360 pounds, is active, amiable and kind. He is said to be the largest man in the State—his neighbors emphatically declare that he is the “bigges hearted” man in the world.

Passing south the railway soon enters and cuts across the great belt of “*White quarry limestone*,” here enlarged to a width of about two miles; and of which Mill creek is the axis. This bed is a treasure. “There are millions in it.” Immediately on the railway line, easy of access, a stone of the best quality promises to enterprise and labor surer and better returns than Eldorado.

The “white limestone” comes soft from the quarry, work easy and tough, may be quarried in blocks of great size, and combines nearly every good quality of a perfect building material. Some variety is presented passing from soft to hard. The medium compact stone is the best, as it will better bear a burden, and resist atmospheric wear; and at the same time closer in texture, it does not stain as the soft, porous stone will in a smoky atmosphere. The following list comprises a part of the actual or prospective quarries on Mill creek, at Mundy’s station, and extending well towards Spencer. They are prepared to fill orders to any amount for rough and sawed building stone, also caps, sills, columns, ashlar, flagging, monument bases, etc., etc.

Rockwell & Co., for the "Eagle Stone works," have opened a massive bed of fine stone just north of Mill creek, and with a short siding, are well prepared to load cars directly from the quarry bed. The stone is compact, well grained and good; and is formed wholly of moderately comminuted shells, Bryozoans, etc. The stratum is fifteen feet thick. Blocks may be obtained of the full thickness of the quarry and thirty or more feet long. They have facilities for shipping from three to five car loads per day.

Adjoining on the south, Smith Johnson has a good deep quarry of similar stone; some beds of light color. Less than one-quarter of a mile northeast, the "quarry bed" thins out and is replaced with argillaceous limerock, underlaid with Keokuk stone.

The "Gosport Stone and Lime Company" have a valuable lease covering the southern bluff of Mill creek, south half, south half, section 3, township 10, range 3. The stone is compact and excellent for chisel work. The quarry was opened in 1874, and a great number of car-loads was shipped for the base of the \$250,000 court house at Vincennes. Their switch siding is convenient for loading with the quarry derrick. Higher up the creek is a choice bed of soft white limestone, where at least 5,000 car-loads of stone, quarried by erosion, lies naked. These blocks and masses have been exposed to the elements during the ages since the glacial drift, and thus tested are durable without doubt.

Walter Ring, on southeast quarter of section 33, and southwest quarter of section 34, township 11, range 3, has opened a bed of a peculiar variety of this stone. The bed is 18 feet thick, the lower member compact and close-grained, while the middle and upper strata are soft and chalky white. A chisel, driven by an ordinary mallet, cuts from one-half to three-fourths of an inch at each blow. It is easy of approach by rail along the creek valley, with plenty of sand for sawing and polishing.

M. Hays, on southeast quarter of section 3, and northwest quarter of section 10, town 10, range 3, has an immense

bed of compact stone, of a ruddy or delicate chocolate tint. Exposed by erosion, it is now protected by a slight covering of loose dirt, and to the east presents a mural face, which still retains in bold mouldings the ancient river marks, not obliterated by ages of aerial exposure. This ability to resist disintegration and wear, is conclusive, and is a sufficient indication. With a switch along the face of the bluff, this stone can be quarried with very little expense in unlimited quantities. It is especially recommended for rough building stone in which cheapness is a ruling element. The "White River Lime and Stone Company," Simpson & Archer, proprietors, of Spencer, have a well appointed quarry on southeast quarter, northwest quarter, section 10, township 10, range 3, at Mundy's Station. They are prepared to fill wholesale or retail orders in sawed or dimension stone; monumental bases, spirals, lime, etc. Their quarry face gave the following exhibit :

## SECTION IN WHITE RIVER CO.'S QUARRY.

	Ft.	In.
Soil .....	1	06
Laminated stone, for burning.....	10	00
Gray rubble and bridge stone.....	4	02
Upper sawing band, for bases, etc.....	3	09
White sawing stone.....	16	03
Total quarry bed.....	34	08

The upper stratum has been burnt for lime with profit. It yields a snow white lime, slakes slow, does not set too quick, and works cool. All refuse of the quarry may be burned, so that no waste of stone or labor is necessary. The quarry bed may be broken with wedges to any shape desired, and so true that little or no dressing is required for foundations. As large blocks can be furnished as may be transported by rail; and, in fact, larger, for columns can be had 4 x 6 feet, 20 or more feet long. Slabs were seen on the yard with face  $9\frac{1}{2}$  x 6 feet and 5 inches thick, sawed true and correctly. It works tough under hammer and chisel, and is desired for capitals, mouldings and ornamental



work. Specimens may be seen at the Court House, Pennsylvania street hotel, etc., at Indianapolis, and many of the finest buildings in the west. The stone weighs 150 pounds per cubic foot; capacity of derrick, 150 feet, or one car load. The works are driven by a steam engine of 40-horses with power of pushing eight gangs of from one to ten saws, with a dimension capacity of 15 x 42 face, and 2 to 8 inches in thickness; daily cut of saws, 24 inches, or 2 inches per hour. Sales amount to \$1000 per month—expense for labor, \$450, leaving for wear, tear, interest and profit, \$550 per month. They began in 1870 with a capital of \$500; have since exhausted one-fifth of an acre, and sold products amounting to over \$40,000. Their switch receives stone from the mill and quarry derrick, and delivers coal at the furnace door. To supply the mill a well was put down in the valley, which proved that this narrow chasm, unconnected with any extensive water-shed, had in glacial times been eroded as low as the present bed of White river.

Along the Indianapolis & Vincennes railroad track, immediately south, Messrs. Ellis, Judge W. M. Franklin, R. M. Beem and B. Schweitzer have each quarries varying but little in quality, but each having some special point in its favor. They are all well situated, and have first-class facilities for mining and shipping excellent stone. The hill at Beem's and generally the highest ridge is capped with Chester sandstone.

Spencer, the county seat, is pleasantly situated upon a slight terrace, overlooking the alluvial bottoms of White river. It is noted for its solid prosperity, fine school house, orderly children, and the universal love and cultivation of flowers. The citizens are justly proud of their neat, substantial and even elegant graded school building. The edifice will bear favorable comparison with any in our cities, and although crowded with children of all ages, its walls did not show one mark of defacement. The teachers certainly deserve much credit—the children more. Superintendents throughout the State could well strive to copy the model here offered. The grounds are tastefully adorned

with shrubs, flowers, etc., planted and cultivated by willing boys and girls, who are joint owners.

The hills north, west and south of town are built up with St. Louis limestone, generally argillaceous, and capped with Chester sandstone. The pork-house, a mile west of town, is a large stone building, with the best modern fixtures for the preparation and cure of meat. The establishment was neat, clean, and in model condition. A bold bluff to the south gives the following :

## SECTION AT SPENCER PORK-HOUSE.

	Ft.	Ft.	In.
Chester sandstone.....	20	to	0 00
Slope on ridge.....			40 00
Soil, stripped.....			5 00
Rubble stone, laminated argillaceous limestone, part lithographic.....			38 00
Siliceous fine stone, passing into cherty limestone.....			14 00
Fossil limestone.....			5 00
Siliceous mud stone.....			6 00
White limestone, used for burning.....	4	to	10 00
Concretionary limestone, with flints and sandstone.....	18	to	7 00
Covered Keokuk beds to river.....			31 00
			<u>156 00</u>

Bernhardt Schweitzer's stone and lime quarry is on adjoining land northwest quarter section 29, township 10, range 3. The quarry stone is an argillaceous limestone, in layers 2, 4, 6, 8, 10, 12 and 14 inches thick. A film of clay allows the rock to come up freely presenting smooth faces; the layers are usually persistent; but with sledges are easily broken in square or oblong blocks of dimensions suited for the purpose intended. With skill the fracture is nearly at right angles to the plane of stratification. Fixtures are adequate to the loading of 6 to 12 cars a day. Shipments in 1873 were 600 car loads at \$10.00; in 1874, 400 car loads at \$8.00 per load. This material known to the trade as Schweitzer's "*Rubble stone*," is used for foundations, water tables, etc., at Indianapolis, Vincennes, etc., being

ready for use without expense of dressing, it commands favor and a ready market.

Lithographic stone is present in the same quarry, in layers from 2 to 4 inches thick. For certain work it answers a good purpose, but the demand is limited, about \$400 worth have been sold for this use. In the quarry are found a few fossils common at the junction of the St. Louis with the Chester, viz: *Productus cora*, *Zaphrentis spinulosa*, *Athyris sub-quadrata*, *Hemipronites crenistria*, *Bellerophon laevis*, etc. On the same tract is a bed of gray limestone, which Mr. S. burns, 6 to 10 feet thick. He uses a "perpetual kiln," 35 feet high, 12 feet in diameter, with capacity for one car load per day, or 1800 bushels per week. The stone burns readily and even, slacks complete, works cool, and without "specks or blister." The lime business is profitable, and the excellent material in the county ought to be marketed with good returns. Mr. S. has experimented with hydraulic cement, mixing refuse lime with argillaceous material abundantly at hand. Results offer him encouragement. In the same hill, is an outcrop of refractory siliceous stone closely laminated, known as "Fire stone," it resists the action of heat, and is sought for lining furnaces, fire-places, etc.

On the farm of J. W. Archer, southeast quarter section 18, township 10, range 3, northwest of town, is a bed of creamy white St. Louis limestone, somewhat laminated, but would doubtless prove an excellent material for doorsteps and other uses subject to wear. A polished specimen showed a close grained, compact texture. It would probably burn to a very white lime. On this farm and along the ridge west of town are seen outcrops of Chester sandstone, while the deep valleys are built up with St. Louis limestone.

On the bluff north of town and in the road half a mile above the narrows, slabs were seen covered with long, slender, solitary calyces of *Lithostrotion proliferum*, etc. Black sand at this locality, seen in the wet weather washes, is a foot mark of the glacial age, black magnetite, imported from the extreme north, and which, by reason of nearly

equal specific gravity, is so constantly associated with gold dust brought hither in the boulders, etc., on the glaciers.

Four miles south of Spencer, and east of the river, the valley suddenly widens from a half to about two miles. Within are two interesting island mounds, around and between which, in former ages, the river has evidently had channel, while from the east, sand and gravel more than 100 feet upon the hills, indicate a former discharge of water from that direction by a wide valley, which now guards a little brook. This is an interesting specimen of erosive action. A detached mass of stone on the west of the mound is known as "Big Rock." Thirty years ago it was the location of a floating grist mill, which when anchored, was driven by the passing current of the river.

At McCormack and Rocky creek, a few miles above Spencer, on the east side of White river, are well developed and extensive beds of "White quarry limestone." The latter locality has been well tested by Prindle & Hays, who exhibited some specimens highly polished and of marked beauty from a "marble" ledge at the top. This stone is fine and close-grained, of a creamy white color, and compares favorably with any in the State. Their quarry, northeast quarter, northwest quarter, section 22, township 10, range 3, gives the following structure:

#### SECTION AT PRINDLE & HAY'S QUARRY.

	Ft.	In.
Slope.....		
White foundation stone.....	6	00
White "marble" stone.....	4	00
Choice white, extra good.....	6	01
White sawing stone.....	4	06
Good gray sawing stone.....	3	10
Base, sometimes coarse and ruddy, for dimension work.....	4	07
	<u>29</u>	<u>00</u>

This stone is believed to be fully equal to that at the quarries on the opposite side of the river, as there, it is composed wholly of the remains of marine animals, broken,

crushed and ground to dust—the coral dust of the sea, and re-cemented by nature. In proportion to the degree of comminution, the stone is fine, close-grained and white. When the shells are broken and only partly crushed, the stone is apt to be colored and porous. Soft and tough from the quarry, it hardens in the air, and bleaches to an agreeable neutral tint. The rounded face of the bluff, corrugated by water-lines of ages, show its enduring quality. There are more than 1000 car loads stripped by nature, inviting attention, which could be split and loaded with little expense if a track-way was laid across the river and up the creek valley. A short distance above the mouth the stone is thickened up to 32 feet. It soon thins again, and within a mile is lost and replaced with argillaceous, concretionary limestone, in heavy strata. Plant remains are seen in the “quarry beds.” Occasionally a cone or leaf of *Lepidodrendron* is uncovered and wakes from its stony trance to tell a single word of the dry land which overlooked the silent, sub-carboniferous sea.

In northeast quarter, section 23, township 10, range 3, the creek passes through a gorge only 100 feet wide, and impinging against the northern bank, affords the following exposure:

SECTION AT HIGH BLUFFS, McCORMACK CREEK.

	Ft.	In.
Heavy bedded buff limestone, with <i>L. proliferum</i> , <i>Syringapora</i> , and <i>Sponges</i> .....	25	00
Laminated argillaceous stone .....	20	00
Hydraulic stone, concretionary, argillaceous	27	00
Massive limestone.....	9	00
Blue shale .....	4	00
Banded concretionary limestone.....	14	00
Flaggy limestone, in bed of creek.....	10 to 2	00
	101	00

Springs seeping from crevices in the rock, or springing from the summit, cool the air and reach the bottom in a cloud of spray, the wild, romantic scenery, reverberating roar of falling water, cool air breathed by the cavernous

rocks, renders the valley a favorite picnic ground, while disciples of Walton are greeted by their finny friends. Still ascending the creek; a wild, rattling roar, intensified by quick, sharp echoes, shakes the air, confusing the mind by its overwhelming ubiquity. The falls would be insignificant in a wider valley, but in this narrow canyon it is full of never tiring interest. The following section is exposed:

## SECTION AT FALLS AT M'CORMACK CREEK.

	Ft.	In.
Hard thick bedded limestone, to slope.....	8	00
Cherty argillaceous limestone, with <i>Lithostrotion</i> .....	5	00
Argillaceous limestone, with chert balls .....	14	00
Hydraulic clay stone.. .....	7	00
	34	00

On slabs worn by the hurried current, were noticed solitary specimens of *Lithostrotion proliferum*, generally one-quarter to one-third of an inch in diameter, and 2 to 4 inches long, two specimens were seen 8 to 11 inches long and three-quarters to one and a quarter in diameter. They were giants of their race.

Above the mouth of McCormack creek, the bottoms of White river are from one to two miles wide with bluffs, rounded or gently sloping to the plain, but a short distance below the mouth of the "narrows," the bluffs 150 to 180 feet high, suddenly approach with precipitous or overhanging faces and reduce the valley to a mere gorge, indicating a recent cut not yet widened and rounded by water and time. Terraces are discovered on either side of the upper river, 140 to 150 feet above its present bed, fluvial drift. Where did this water flow before the chasm at the narrows was opened? Proceeding up McCormack creek, the mystery is solved. Beyond the falls, a broad valley from one to two miles wide, 130 feet above the present channel of White river is found, walled with rounded or sloping ancient bluffs, and passing near the west line of the county, returns by Raccoon creek to the wide river valley below Freedom. No intervening ridge exists having a summit

level of more than 140 feet above the river. Along this ancient river bed imported glacial gravel was seen, and on Raccoon some fossils peculiar to Brown county, indicating that for a time Bean Blossom had discharge by a depression said to exist in the rim of the basin, directly from Ellettsville through this trough known as the "Flat woods." The soil of this valley-flat is a yellow loam, evidently made by a sluggish stream, or lake. The underground quicksand and black silt seems to be lacustral. Mr. W. J. Walden gives a statement of material found in a well on his farm, southeast quarter of section 26, township 10, range 3, showing the nature of the Flat woods subsoil.

## SECTION IN "FLAT WOODS."

	Ft.	In.
Black mucky soil.....	8	00
Sand and fine gravel.....	6	00
Jelly-like, blue, sticky quicksand, with logs, sticks, leaves, etc., no bottom found with iron rod.....	8	00
	<u>22</u>	<u>00</u>

Going south down this valley, on a bluff hill 250 feet above White river and 120 feet higher than this basin, rough boulders, and beds of Chester sandstone in place were seen. Southwest quarter of section 12, township 9, range 3, near this, a "silver mine" was attempted by clearing out an old sink, (used as a cache by the Indians), and blasting down into the St. Louis limestone; it is jocularly known as "Schweitzer's folly." No silver or other valuable metal can be found here.

Paving stones apparently of fair quality were noticed at Mill's quarry on Wyatt creek, and on Little Raccoon, west of White Hall. They are siliceous, seemingly abundant, and will prove valuable.

## SECTION ON RACCOON.

	PAVING STONES.		Ft.	In.
Slope.				
Dark cherty limestone.....	22	00		
Fire-proof paving stones, flags.....	18	00		
Argillaceous L. S. to brook.....	35	00		
	<u>75</u>	<u>00</u>		

White Hall is a quiet village nestled in a valley. St. Louis limestone is seen in the deepest ravines, the sides of the hills are built up with Chester sandstone, and the knobs are capped with conglomerate. In the valley basin northwest of town, in the neighborhood of J. Rone and W. Coffey, are many "sink-holes," some of which are known as "breathers," giving discharge to water and currents of cold air; others are called "drinkers," receiving the rain-fall. On Coffey's farm, section 22, township 9, range 3, several of the latter were seen, and rippling brooks could be heard in their dark course in the cavernous earth. Small specimens of kaolin clay have been found near to the west of Coffey's; also choice specimens of oolitic limestone.

At Green's mill, on Big Raccoon, the stream has cut a deep, narrow channel. The cliff opposite is beautifully clothed with evergreen hemlocks and cedars. The following section was observed:

## SECTION OF GREEN'S MILL.

	Ft.	In.
Chester sandstone, with diagonal false bedding.....	47	00
Slaty pudding stone.....	4	00
Fossil lithographic stone.....	16	00
Flaggy firestone, (siliceous).....	10	00
	77	00

Some interesting stone cooking vessels were found hid in a cavity of this bluff, including a pot having a capacity of three gallons, and a skillet for baking tortillas, (hoe-cakes). Some time and money has been unwisely spent here in search of silver; it was found to be a very "barren ideality." The precious metals cannot be found here. A mile and a half northwest from Green's mill, a small brook, tributary to Raccoon, has undercut a ledge of stone, forming a natural bridge, reported to be 22 feet long, 18 feet high and 10 feet wide. The elevated region for miles north towards Spencer, exhibits a good soil, and most favorable location for fruit. Several profitable orchards were noticed. W. Y. Mills has an orchard in successful bearing which comprises 500 trees of choice varieties.



At Arcola coal A has been opened one foot thick—it is not worth working. The Kaskaskia limestone is seen in the creek north of the village. R. H. Gentry found near here, buried in the ground, edges up, five new sharp stone axes, grooved for handles, laid away for future use and buried, perhaps, to retain the tough elasticity of the stone.

At "Jackson's Bluff," land of J. and D. Prewet, the Kaskaskia limestone was formerly burned for shipment by boats on White river. In a thin outcrop of coal A specimens of choice cannel coal were found, it is thin, and of little economic value. The limestone is well developed and contains well preserved characteristic fossils.

#### SECTION AT DYER'S HILL.

(Southeast quarter, section 33, township 9, range 4.)

	Ft.	In.
Conglomerate sandstone.....	25	00
Coal and shale.....		04
Kaskaskia limestone.....	19	00
Shale and Chester limestone.....	55	00
	<u>99</u>	<u>04</u>

#### SECTION AT JACKSON'S BLUFF.

(Southwest quarter section 33, township 9, range 4.)

	Ft.	In.
Slope .....	40 to 20	00
Laminated conglomerate.....	8	00
Coal parting.....		04
Massive conglomerate .....	12	00
Shale and cannel coal.....	1	08
Kaskaskia limestone.....	18	00
Shale and Chester sandstone .....	70	00
	<u>130</u>	<u>00</u>

Mt. Pisgah is a prominent outlook commanding the great valleys which radiate from it. Houses across the valley on the conglomerate hills to the south, shrink to mere specks in the distance.

Interesting to the geologist is the trip by rail from Spencer by Freedom to Schweitzer's shaft, two miles beyond

the line, in Greene county. The railroad track at Spencer pork-house rests on the upper strata of the Keokuk group, which thence south is no more seen. The hill is built up 97 feet with St. Louis formation, and Chester sandstone is just caught in the top of the hill. Going down the river, the road is down grade; we actually descend, but geologically, rapidly ascend to higher rocks. The dip to southwest carries the St. Louis under the track half a mile below the crossing of Rattlesnake, and the Chester beds from the bluff, presenting some good quarry sandstone, with the Kaskaskia limestone at the summit.

#### SECTION AT FREEDOM.

(Ritter's Hill, southeast quarter section 20, township 9, range 4.)

	Ft.	In.
Surface soil etc.....	10 ft to	30 00
Soft conglomerate.....	25	00
Massive conglomerate.....	30	00
Place of coal A.....	1	00
Kaskaskia limestone .....	22	00
Chester ferruginous sandstone.....	60	00
Chester sandstone, massive in river.....	19	00
	<u>186</u>	<u>00</u>

A short distance west and south of town, conglomerate sandstone forms the tops of the hills, and several quarries were noted of superior white sandrock and grit stone. That on Mrs. Devore's land, northeast quarter, section 17, township 9, range 4, was visited. The upper beds of the Chester group rapidly dip to southwest, soon approach the railroad level, giving a slight outcrop of coal A, rise again for a short distance and finally disappear a mile and a half below Farmer's Station, where the bluffs are all conglomerate. Here coal A, has been worked by adit and shaft, one to two feet thick, and comparatively good. Thus, descending grade all the trip, one has geologically risen from the Keokuk through St. Louis and Chester beds to near the top of the Conglomerate, more than 300 feet.

Good quarry beds of conglomerate sandstone are found

here (Greene county), convenient to the railroad. Coal A in the vicinity of Freedom is irregular, non-persistent and deceitful. Money and time spent in its exploration will meet little or no returns.

The Chester group superimposes the St. Louis limestone in the areas which we have been just describing, and is found in regions immediately to the west of the latter. The sandstone member does not often afford stone of superior quality, but at a few locations it has been utilized for foundations, etc. The upper member of the Chester, the Kaskaskia limestone, fixes the top of the sub-carboniferous, and is easily recognized. Its outcrops have already been described, and are marked by the K'k. L. on the accompanying map.

Rattlesnake valley is a narrow cut from north to south, 100 to 250 feet deep. The bed of the valley is in the St. Louis limestone, containing but few fossils, generally argillaceous, and at the bridge leading west from Spencer, presenting some beds of clay-stone well suited for mixing with lime in the manufacture of cement. Here also some large specimens of drift quartzose fire-clay were noted, which undoubtedly had been torn from the top of Jones' hill, near Cataract and brought hither by ice. The eastern bluff of the valley is as a rule capped with Chester sandstone, the western by the conglomerate sandrock and the horizon of coal A, as at Fender's hill, Criss' hill, etc. One outlier of conglomerate and coal A occurs on Cantwell's hill, near Santa Fe. All these strata dip to the west, consequently permanent springs of great volume flow out from the eastern bluff.

The upper valley contains terraces of glacial drift, pebbles and blue clay, and just east of Spangler's hill, near Cataract, is a low gap by which the glacial current with Eel river once found doorway to Rattlesnake; a cut of 60 or 70 feet, 80 rods long, would return the former stream to its old channel.

## SECTION AT SPANGLER'S HILL.

	Ft.	In.
Soil and drift.....	20	00
Conglomerate sandstone.....	25	00
Coal A, parting and iron ore.....	2	00
Bituminous shale.....	15	00
Kaskaskia limestone, with characteristic fossils .....	14	00
Chester sandstone, shaly.....	55	00
Gray shale.....	15	00
Argillaceous limestone of St. Louis group to top of falls.....	20	00
	<u>166</u>	<u>00</u>

The dip of the rocks west from this point to Jordan, is locally 120 feet to the mile, the Kaskaskia limestone being seen on Dr. Jones' land, northwest quarter section 2, township 11, range 4, in the bottom of a very deep ravine.

Cataract village takes name from the double falls of Eel, and derives support from the mills, etc., here situate. It was once the milling and mercantile center for a large area of country, before the day of railways. The river, within a distance of three-fourths of a mile, by two plunges, falls 81 feet, passing through a deep, narrow channel cut in St. Louis limestone.

The falls are owned by Burton, Shoemaker & Co., of Indianapolis, with several hundred acres of adjacent timber land. The upper falls are reinforced by a low dam. The water is carried by a box race to a wrought iron flume, 26 feet perpendicular length, and of 42 inches diameter, driving two central discharge wheels 30 inches in diameter, with force of 18-horse power. The force is sufficient to drive two buhrs and their machinery for an average of nine months. For three months the stream averages fifty times, and for five months ten times more water than is used.

At the time of my visit the river was full, and the scene one of interest and grandeur. From a floor of limestone, the river, with rapid plunges and bounds, descends 25 feet, and then at a single leap thunders in a stream of white foam and spray to the abyss; a beautiful rainbow spangles the spray which rises from the boiling cauldron. The best

view is from an unpleasant stand-point among the machinery under the mill. The descent from the top of the lower falls is 45 feet. Less than a mile below, the river, flowing with sluggish current, is suddenly seized with new life and impulses. Hurrying along a short rapid it makes clean the splendid leap of 30 feet, breaking in masses of foam and clouds of spray, and passes off in a dark stream flecked with frothy islands of floating silver. Below the second falls is a large amphitheater, with precipitous or overhanging sides of limestone, which is filled with sharp echoes and continual roar of the ever resounding cataract. Niches and recesses in the walls were festooned with drooping shrubs and plants, even behind the airy sheet of water ferns and trailing creepers are modestly nestled away, contrasting their emerald hues with the foam and spray, each frond and leaf tipped with a sparkling drop of crystal purity.

The cataracts of Eel are the grandest falls in this region of the west. They are favorably known to pic-nic parties and tourists, and in combination with the deep canyon-like valley at the narrows, the gap above the falls, the wide view from Spangler's Hill, comprise scenes of romantic beauty and wildness, full of enjoyment and interest, and worth the attention of pleasure seekers.

Sixty feet below the second fall, a strong stream of water gushes out of the northern wall of the amphitheater. It indicates the mode by which nature has cut a way through and under the beds of limestone and formed within a recent period the present channel of the river. In the course of time this underflow will undermine this fall, or remove it further back.

Just below the upper falls is an overhanging cliff 50 feet high. The crest is fringed with shrubs and flowering plants. Two children playing here, the boy of 12 years, straining to gather flowers, fell over; the little sister, seeking her lost brother, slipped and likewise made the terrible fall to the rocky floor. Insensible when found, they soon recovered, owing their lives to the bushes and shrubs which

slightly retarded their descent. This is known as the "Child's Leap." A pet deer, attempting to cross above the upper falls, was caught by the current at high-water, it made the fearful plunge, and rising from the boiling basin swam out.

In winter the cataracts put on their festal robes. The trickling springs flute and corrugate the sides of the chasm with mouldings, columns and pilasters of ice. The trailing bushes and limbs of trees are coated by the ever rising spray, and every terminal twig is gemmed with lustrous crystals, which, in the sunshine, blaze with a thousand tiny rainbows. This vicinity may be visited from Cloverdale or Gosport, on the Louisville and Chicago Railway, respectively 8 and 10 miles distant.

The sharp dip of strata south and west from Cataract, gives within a space of two miles, a very extensive geological view and of some interest, although but few fossils are found in good condition.

## SECTION NEAR CATARACT.

(Connected.)

	Ft.	Ft.	In.
Conglomerate sandstone .....	20	to	60 00
Coal A.....	00		2 00
Aluminous shale.....	20	to	10 00
Kaskaskia limestone.....	10	to	20 00
Chester sandstone.....	60	to	90 00
St. Louis limestone .....			85 00
Keokuk group ? .....			11 00
			<hr/>
			281 00

A very narrow ridge southwest of Fender's hill, separates Eel valley from the head of Jordan, between which and Six Mile creek by Jordan village, low gaps already mentioned present an available approach to the block coals from Indianapolis, worthy the attention of engineers.

The outlines of the conglomerate sandstone are mentioned in the description of the general section. It occupies a belt two to three miles wide, from north to south across

the county near or a little west of the meridian, between ranges three and four, but with formations boldly extended westwardly at the northwest and southwest corners. From a number of sections taken, two will be given, to show the general structure of this deposit:

#### SECTION AT EVANS'.

(Northeast quarter, section 28, township 11, range 4.)

	Ft.	In.
Soil and surface .....	16	00
Yellow sandstone.....	8	00
Blue shale with ironstone.....	10	00
Black slate. Coal B.....		08
Fire-clay .....	2	00
Coarse sandrock .....	28	00
Massive conglomerate, white and yellow—good grit	30	00
Soft white sandstone.....	3	06
Blue pyritous shale.....	12	00
Carbonate of iron, band and kidneys .....		08
Black clod .....	1	10
Coal A, bright .....	1	08
Blue shale with iron ore .....	12	00
Kaskaskia limestone in creek.....	11	00
	<u>137</u>	<u>04</u>

In this sandrock many beautiful specimens of *Lepidodendron*, *Sigillaria*, *Stigmara* and *Calamites*, have been found by Mr. Evans. Several small outcrops of Coal A were reported in the neighborhood, among others at William's bank, southwest quarter section 28, township 11, range 4.

At Matthew King's, southeast quarter, section 6, township 10, range 4, the top of the conglomerate is eroded. The following section is seen in a romantic amphitheater with overhanging sides:

## SECTION AT "BUZZARD GULCH."

	Ft.	In.
Soil .....	20	00
White conglomerate gritstone .....	15	00
Massive white stone—grindstone grit .....	8	00
Heavy bedded conglomerate.....	12	00
Coal A.....	1	00
Fissile sandstone. ....	15	00
Blue pyritous shale with excellent nodular iron ore	20	00
Kaskaskia limestone.....	20	00
	<u>111</u>	<u>00</u>

Some giant oaks were seen and measured on the Evans and Kings farms; the latter was carefully laid down to grass from which good returns were received.

The outcrops of coal A, near Cataract, Needmore, Jordantown, Atkinsonville and Vandalia, are marked on the map accompanying this report. The coal is generally sulphurous and impure, and of no great value, although a few openings give a fair to good coal, a further list is not necessary. The workings only show a thickness of 12 to 18 inches. At an outcrop on the farm of John and Rolla Wright, on the west half of section 23, township 10, range 5, the Kaskaskia limestone is well developed with characteristic fossils, including *Pentremites Godoni*, plates of *Cyathocrinus*, etc., and if the limestone is persistent in level, it superimposes coal A. The connection of the strata could not well be seen.

Middletown is situated in the midst of a level or gently rolling plateau. The soil is more than ordinary and produces good crops of wheat, corn and grass. Some forests of excellent timber were noticed. A large amount of lumber, staves, headings, etc., is prepared and shipped. The warm loamy soil is well adapted for the growth of fruit. The orchards were thrifty, prolific, and rarely fail. Notwithstanding the universal failure throughout our country, of tender fruits, some peach trees were in bearing. Jacob Long has 2000 Concord vines in model order, with an orchard of fine apple and peach trees. The vines were



hanging full of grapes, in fact an arbor was shaded as much by the rich clusters overhead, as by the leaves. The vines are only four years old, but the crop of 1874 was seven tons. Besides marketing wagon loads, he manufactured 400 gallons of wine, which was of good body and finely flavored with fruity bouquet.

The surface rock about the village is the lower member of the conglomerate sandstone, with cuts in ravines to the limestone member of the Chester group. Coal A is developed at several openings, yielding some good fat coal, and at two localities an excellent band of cannel of small thickness. A single outcrop of coal B is reported on section 14, township 9, range 5. These coals have been tested for local use, but are thin and will not pay for expensive work. Two miles northwest of town are the favorably known banks of L. C. & F. Arney and Joseph Needy, respectively, in the northwest and southwest quarter of section 9, township 9, range 5. These banks have been worked for about 25 years for local use, yielding nearly a million bushels. The following section was taken at Arney's:

## SECTION AT ARNEY'S BANK.

	Ft.	In.
Slope .....	74	00
Gray shale and soapstone.....	7	00
Pyritous band.....	2	00
Coal I, block.....	3	00
Indurated clay.....	1	00
Gray shale, with Kidney ore.....	11	00
Coal B:		
Laminated rough.....	06	
Laminated good.....	06	
Splinty cannel.....	04	
Choice caking.....	1	06
Rough coal.....	02	3 02
		<hr/>
		101 02

Arney and Needy's coal is of excellent quality, compares favorably with the best coking coal in the country and burns with a brilliant sheet of white flame to a white ash without clinker. Coke from this bank was formerly used at Seward's

foundry at Bloomington, and was found equal, if not superior to that of Pittsburg; softening instead of hardening the metal. It is superior for blacksmith's use, and sought for burning in grates on account of the brilliant illumination of the flame. Where known it is reported as selling for four cents a bushel more than block or other western coal for household purposes.

The area of coal B at this locality is limited, and generally found on elevated knolls and ridges, the base of which is of conglomerate. Openings have been made in sections 21, 17 and 8, but were not in work.

On the well-improved grazing farm of John Haxton, southeast quarter section 29, township 9, range 5, an assortment of the best blooded cattle and hogs was seen. He reports the following bore :

## SECTION IN HAXTON'S BORE.

	Ft.	In.
Clay soil.....	9	00
Coal.....		04
Conglomerate sandstone, with glacial striæ.....	32	00
Chester limestone.....	18	00
Sandstone.....	3	00
	<u>64</u>	<u>00</u>

On Hubbell's and Dillon's farm at Mt. Good, chalybeate springs were noted, charged with iron from the pyritous shales at the base of the coal measures. Near the latter, on land of J. K. Wells', southwest quarter, section 16, township 9, range 5, occurs an outcrop of typical pebbly conglomerate, which has been locally used for "millstone grit."

Red and yellow ochre is found in a bed said to be six feet thick on the Sloo land, northwest quarter of southeast quarter of section 20, township 9, range 5. Three openings have been made. Its origin is probably due to the decomposition of ferruginous shales, and the deposit of iron and clay therefrom. The paint is of good quality, but on full experiment a demand for the article could not be found.

At Isaac Needy's, southeast quarter of section 17, township 9, range 5, the following section is reported :

## SECTION AT NEEDY'S WELL.

	Ft.	In.
Clay and soil.....	12	00
Coal I.. ..	2	00
Stony clay.....	3	00
Siliceous shale.....	14	00
Coal B, choice.....	4	09
Plastic fire-clay.....	4	00
	<u>39</u>	<u>09</u>

Many other outcrops of coal I and B were reported in this vicinity and the localities visited. Generally they were not in work, and the thickness of the seams could not be measured. The following connected section, taken on sections 17 and 20, township 9, range 5, gives a general view of the stratification:

## NEEDY—HUBBELL SECTION.

	Ft.	In.
Soil.....	20	00
Coal I.....	2	06
Shaly sandstone.....	17	00
Coal B.....	3 to 4	09
Conglomerate .....	75	00
Coal A.....	1	08
Sandstone.....	43	00
Chester beds, Kaskaskia limestone.....	17	00
	<u>180</u>	<u>11</u>

I am indebted to the kindness of Niblock, Zimmerman & Co. for a record of the following bores, viz:

## BORES ON WARNER FARM.

(Southeast quarter, section 24, township 9, range 6.)

## FIRST HOLE.

	F.	In.
Surface clay.....	7	00
Gray sandstone.....	2	06
Blue sandy shale.....	3	08
Black shale.....	1	04
Blue sandstone.....	4	06
Siliceous shale.....	3	00
Coal .....	1	00

Clay .....	5	04
Blue shale.....	6	00
Iron ore.....		06
Sandy shale.....	13	11
Blue shale.....	4	03
Coal and shale.....	3	00
Fire clay.....	1	06
	<u>57</u>	<u>06</u>

## SECOND HOLE.

	Ft.	In.
Surface clay.....	4	00
Slaty fire clay.....	4	08
Gray siliceous shale.....	26	04
White sandstone.....	4	06
Gray siliceous shale.....	21	02
	<u>60</u>	<u>08</u>

## THIRD HOLE.

	Ft.	In.
Surface clay.....	5	06
Yellow sandstone.....	14	00
Blue sandstone.....	1	00
Gray shale.....	2	04
Gray sandstone.....	40	02
White sandstone.....	1	00
	<u>65</u>	<u>00</u>

## FOURTH HOLE.

	Ft.	In.
Surface clay.....	4	00
Gray siliceous shale .....	23	06
Blue shale.....	3	00
Coal (B ?).....	3	04
Fire clay .....	3	02
Iron ore.....		07
White shale—Iron stone.....	1	00
White sandstone, with iron balls.....	8	11
Gray sandstone .....	14	06
Blue siliceous shale.....	20	03
Conglomerate sandstone.....	23	09
	<u>104</u>	<u>00</u>

Also, by the same parties, the following bores:

## SECTION IN BORES ON WINTER'S FARM.

(Northeast quarter, section 23, township 9, range 6.)

## FIRST HOLE.

	Ft.	In.
Surface clay.....	4	06
Sandstone.....	5	02
Coal .....		04
Fire clay .....	5	00
Blue siliceous shale.....	19	05
Coal.....	2	10
Fire clay.....	4	03
Siliceous shale.....	45	04
	<u>86</u>	<u>10</u>

## SECOND HOLE.

Surface clay.....	17	06
Hardpan .....	10	06
Sandstone.....	1	00
Rotten coal.....		08
Fire clay .....	7	06
Blue siliceous shale.....	8	08
Blue shale.....	3	00
Fire clay.....	2	00
	<u>50</u>	<u>10</u>

## THIRD HOLE.

	Ft.	In.
Surface clay.....	3	06
Blue shale .....	21	01
Coal.....	3	06
Fire clay.....		06
	<u>28</u>	<u>07</u>

## LOVE'S FARM.

Southeast quarter, section 23, township 9, range 6.

Surface clay.....	30	06
Hard pan.....	12	00
White sandstone.....	4	08
Fire clay.....	2	00
	<u>49</u>	<u>02</u>

Thanks are due to A. Grim and R. E. Winnett, for the record of the following tabulated bores in south half of

section 11, and the north half of section 14, township 9, range 6. Each locality is brought to the datum line of the railroad grade by addition to or subtraction from the first space; that is, the amount that the surface at any bore is below grade is added to the first column of spaces, or, if above grade, is taken from the same. The bores are located on plat of said land attached to the map of Owen county.

The bores given above and heretofore vary greatly, and show that important irregularities exist, which forbid the sinking of shafts without first proving the territory. The tabulated bores terminated as a rule in or at the limestone member of the Chester group, and show that the ground was fully proven.

West of Lick creek the land becomes nearly level, sloping gradually to the "bottoms" of Eel river. The soil is alluvial, and produces good crops of cereals and grasses. The forests were once unequalled, and the surviving timber is of extra size and value.

Stockton is in the midst of this productive land, and is a thrifty village. Coal is mined only for local use, and none of the banks were in work. Several openings and outcrops of coals I and B are carefully noted on the map, all ranging from two to three and a half feet, and averaging about three feet.

Jesse Reagan works a strip bank with three openings on northeast section 13, township 9, range 6. This coal has a good reputation for steam and grate use, but is rather splinty for blacksmith use.

## SECTION AT REAGAN'S BANK.

	● Ft.	In.
Clay and gray shale.....	5	00
Soft, black shale.....		04
Coal B:		
Semi block coal.....	09	
Lustrous cubic coal.....	03	
Block coal.....	1 06	3 06
Semi block coal.....	1	00
Stony clay.....	2	00
	<u>10</u>	<u>00</u>



TABLE No. 2.

*Location, etc., of Bores on south half section 11, and north half section 14, township 9, range 6. (Owen county.)*

Bore No.	Course from Shaft.	Distance from Shaft	Above datum.	Below datum.	Actual depth from Surface.
			Subtracted in No. 1.	Added in No. 1.	
		Feet.			Ft. In.
1	S., 11° E.	321	Grade.	.....	164 02
2	S., 51½° E.	1531	.....	12.00	103 11
3	N., 87½° E.	2020	.....	65.00	60 06
4	S., 45° E.	2400	.....	15.00	85 00
5	N., 2° E.	1996	3.00	.....	98 02
6	S., 65° W.	152	Grade.	.....	121 09
7	N., 20° W.	153	Grade.	.....	105 00
8	N., 59° E.	164	Grade.	.....	112 02
9	N., 59° E.	314	Grade.	.....	105 02
10	S., 59° E.	310	.....	3.00	101 03
11	S., 15° E.	618	.....	2.00	111 10
12	N., 86° E.	930	.....	30.00	68 10
13	North.	387	3.00	.....	117 08
14	N., 53° W.	432	.....	4.00	108 08
15	S., 10° E.	1000	.....	2.00	108 06
16	S., 79° E.	1607	.....	55.00	48 04
17	North.	1250	4.00	.....	99 06
18	West.	1650	.....	20.00	85 06
19	S., 62° E.	1676	.....	45.00	56 00
20	S., 54° E.	1200	.....	8.00	93 06
21	S., 35° E.	1650	.....	4.00	104 09
22	N., 35° W.	1150	.....	5.00	97 06
23	N., 35° W.	1150	.....	5.00	92 02
24	N., 25° W.	2400	2.00	.....	88 05
25	N., 80° W.	1250	.....	8.00	93 06
26	S., 60° E.	650	Grade.	.....	106 11



Denmark is on a valley plain, surrounded by magnificent forests. The vicinity is settled by Dutchmen and Dunkards, whose industry and thrift are well known. The alluvial soil deeply covers the rocks, allowing but few exposures of coals I and J, which are located on the map. The seams are from three to three and a half feet thick; composed of block coal, with layers of splinty cannel of great purity and value. The last melts to a pasty mass in combustion, leaves but little ash, and is nearly as pure as Albertite. The Burger, Croft, Goshorn and Rowe banks, have long been worked, and deservedly bear a good reputation. J. R. Merrell, an experienced blacksmith, says the Croft coal is far preferable to that from Pittsburg for smiths use.

George Croft works his strip bank on northwest quarter section 23, township 10, range 6. It is an excellent coal. The following section occurs:

#### SECTION AT CROFT'S MINE.

	Ft.	In.
Clay and drift .....	5	00
Gray shale soapstone .....	3	00
COAL I? .....		
Semi-caking coal .....	0	06
Choice block .....	2	00
Pasty cannel, "Albertite" .....	0	08
Clay .....	3	02
	2	00
	<u>12</u>	<u>02</u>

It may be seen that going west from Patrickburg the coals become less dry, contain more volatile matter, and although superior as fuel, are less suited, without coking, to bear the burden of a blast furnace. In quality they are very similar to coal B.

Patrickburg is an unique village. The inhabitants are generally skilled mechanics, industrious, progressive, able and willing to supply local demands, and compete in outside markets. It is on the axis of the great eastern protrusion of the coal measures. The conglomerate is depressed below the surface sufficiently to allow coal B to under-run the vicinage and coal I to be found in all the hills and ridges.

The latter is grandly developed, showing a thickness of from three and a half to over six feet of pure choice block coal, equal to the best in this or any State. No district can boast such a combination of thick seams, and at the same time so many varieties, comprising choice block, choice caking and extra cannel coal. A mere list of the mines, outcrops and openings marked upon the map would occupy too much space, consequently we must refer to it and merely mention a few representative banks which happened to be in work :

## SECTION AT PATRICKSBURG.

	(Connected.)	Ft.	Ft.	In.
Soil, clay.....		50	to	10 00
Gray shale.....		10	to	1 00
Coal I, block.....		4	to	7 00
Gray shale, iron balls.....				10 00
Indurated clay .....		20	to	4 00
Coal B, caking.....		1	to	2 00
Fire clay.....				2 00
Gray siliceous shale and sandstone.....				20 00
Massive conglomerate.....		20	to	40 00
Coal A, caking or cannel.....		0	to	1 06
Shale or sandrock.....		5	to	15 00
Kaskaskia limestone, Chester.....				12 00
				<u>124 06</u>

On Wm. S. Norris' land, southeast quarter, section 21 township 10, range 5, coal I is found five feet thick in well. Coal B is worked in the brook. A considerable amount of good iron ore, pure and in large concretions, is found in the shale over B, in quantity to justify mining :

## SECTION AT NORRIS'.

	Ft.		Ft.	In.
Soil.....	4	to	10	00
Gray shale.....			4	00
Coal I, block.....	3	to	5	00
Shale and iron ore.....			30	00
Coal B .....			2	02
			<hr/>	<hr/>
			51	02

## SECTION AT FLETCHER'S BANK.

(Northeast quarter section 10, township 10, range 5.)

	Ft.		Ft.	In.
Soil, clay.....	30	to	5	00
Gray shale.....	5	to	8	00
COAL I, block.				
Semi-block coal.....	1		08	
Choice block coal.....	3		04	
Splinty cannel.....			07	5 07
Shaly Clay.....				5 00
			<u>23</u>	<u>07</u>

## SECTION AT ROYER'S MINE.

(Northwest quarter, section 11, township 10, range 5.)

	Ft.		Ft.	In.
Soil, clay.....	30	to	5	00
Gray shale.....	4	to	10	00
COAL I, block.				
Semi-block coal.....	1		08	
Choice block .....	3		06	
Splinty cannel.....			10	6 00
Shaly clay.....				4 00
			<u>25</u>	<u>00</u>

These banks are adjoining the village on the northeast. Some good caking coal was seen on the Chambers farm, southwest quarter of section 3, township 10, range 5, which is excellent for smiths use, and is so free from sulphur that it bears stocking well. It is thin and worked by stripping. A singular horseback, which divides the coal into two seams, was noticed at southeast corner of the southwest quarter, section 3, township 10, range 5. It was composed of gray fire clay, and contained worn *Stigmara* and rootlets of coal plants.

Near the residence of J. Frantz, southwest corner of section 1, township 10, range 6, from a well 4 feet square, a ton of superior iron ore was obtained in passing the shale bed, five feet thick, which overlies coal B. Many wells have met the same bed of ore, and it is believed the

quantity and quality would justify examination and probably mining.

The Overholzer bank is worked by stripping, the coal is irregular in thickness, but at the mine presented a face of six feet one inch. It is good block, with partings of fat caking coal. In the vicinity of Overholzer's and thence north coal I is generally eroded, but coal B may be found just below the ore bed.

#### SECTION AT BRAMMER'S.

(Southeast quarter, northwest quarter, section 1, township 10, range 5).

	Ft.	In.
Slope .....	30	00
Coal I, impure.....	1	08
Gray shale—covered.....	27	00
Coal B, caking.....	1	06
Shale and conglomerate.....	58	00
Coal A.....	1	00
	<u>118</u>	<u>08</u>

Another outcrop on the northwest quarter, northwest quarter of same section gives the following:

#### SECTION AT BRAMMER'S CANNEL COAL BANK.

	Ft.	In.
Slope.....	40	00
Blue and gray shale.....	4	00
Quartzose sandstone.....	1	02
Choice cannel coal.....		08
Resinous coal.....	1 to 2	00
Blue and gray bituminous shale.....	8	00
Massive sandrock—conglomerate.....	12	00
	<u>67</u>	<u>10</u>

Brammer's cannel coal, although thin, is the best I have ever seen. See analysis. Similar coal is found at other outcrops in the neighborhood.

Special thanks must be returned to sheriff Ham. Moffett, for the numbers of the lands throughout the coal regions, by which outcrops, etc., are located on the map, and for guidance to points which otherwise could not have been

visited. It is believed that every opening and outcrop in the county was visited, and as many are marked on the map as was possible upon so limited a scale.

#### ARCHÆOLOGY.

Religious mounds and mounds of habitation, structures peculiar to our most ancient predecessors, were not found in the county, yet trophies in stone similar to those known to be of that age are not uncommon, viz: a copper needle, an iron ore plumb bob, stone axes, chisels, spear and arrow points, striped slate ornaments, tubes and gorgets. Still there are many mounds which, from their structure and contents, are referred to the intermediate riparian race, who succeeded the Mound Builders, and who yielded in turn to the savages. They were probably closely allied to the Southern Indians, visited by De Soto, and of whom the "Natches" were representatives.

The residence of J. A. Coffey is on a bluff west of and 40 feet above Spencer. A hillock obstructed the view, and in leveling which, it was found to be a sepulchral mound, 60 feet in diameter and 19 feet high. In the center was collected a promiscuous mass of human bones, soft from the decay of ages, amounting to 150 bushels, or three cords, and estimated to represent 150 persons—a mass 6 feet high and 15 in diameter, in a sharp, conical heap. This was covered, 1st, with a two-foot layer of white sand, carried nearly a mile from the nearest bar in the river, a part of which had sifted down among the bones put away dry and clean at some stated occasion; 2d, the soft shroud of sand was enclosed in a sheet of clay 18 inches thick, red as if burned, and still above, the mound was built up with common loam. In this upper deposit was found two intrusive graves of the late savages, in which the bones were but little decayed. With the latter were flint arrow points and coarsely polished stones.

A quarter of a mile south of Freedom, Dr. A. J. Minnich opened a mound four feet high and thirty feet in diameter. Within was a vault which required at least two or

three wagon loads of stone for its construction. Some of this material was in slabs 4 feet square, and had been carried from the bluff 300 yards distant. The vault contained about thirty skeletons, the bones promiscuously mixed and evidently disjoined before their deposit. The bones were soft and porous, and crumbled to dust on exposure. They were shrouded in soft river sand, and plastered over with red (burned) clay.

Less than a mile north of Freedom a mound was partly removed to grade the railway. It contained more than 100 skeletons. The vault was made by placing flat stones over the head, lapping toward the center, to prevent removal by animals, and then covering with loam.

On the McBride farm, adjoining the last, is a mound 12 feet high and 150 feet in diameter, with two smaller ones attached at the southwest. On top of the large mound was a circle of stone vaults 6 feet long, 2 wide and deep, covering the whole top, each grave containing two or more skeletons, with heads toward the center and bodies radiating out like the spokes of a wheel. The bones indicated persons from four feet ten inches to five feet and a half high. No ornaments or utensils were found in the vaults. Another charnel vault had contained a low heap of bones, and the flat stones which covered it were placed the inverse of shingle work, commencing at the top and finishing at the bottom, consequently it was with difficulty opened.

Mr. J. W. Archer saw an interesting funeral in California, at which the bodies were first consumed by fire, and over the ashes a very respectable mound was built in commemoration. Did space allow, a description would give a clue to the origin of some of our more common mounds.

#### ECONOMIC GEOLOGY.

The characteristic soil in different parts of the county has been already noted. It is known that any soil will deteriorate unless managed with care, and supported by rest and fertilization. Continued cropping is exhaustive to the best,

but on thin soils, is death. We can not too earnestly suggest that in the hilly regions the grounds could be profitably seeded to orchard and similar grasses, and that such a course would restore and maintain the soil. Cool springs in great volume invite attention to cheese and butter making.

#### TIMBER.

Mention has been made of choice forests in different parts. These comprise all the best varieties found in the State. The growth is exceptional. Specimens of oak were measured, at several stations, 4, 5 and 6 feet in diameter, with trunks straight as an arrow, without limbs or fault, 50 to 80 feet long. Some poplar trees were still larger, all of perfect growth, without shake or knot. Such timber is valuable and should be used only by skilful workmen for mechanical objects.

#### CLAY.

Bricks are made throughout the county. Clay for this purpose is common and abundant. The under-clays of the coals furnishes good material for fire brick, pottery and terra-cotta ware. Some modified clays were seen on Six Mile, etc., which were superior for potters use.

#### "KAOLIN."

Specimens of porcelain clay (*Silicate of Alumina*), were found on Jordan, Rattlesnake and the head waters of Raccoon creeks. Explorations have been made by Messrs. Allison who report the discovery of a bed several feet thick.

At a subsequent visit, a shaft had been put down twelve feet, ten of which contained nuggets, pockets and masses of Kaolin in a matrix of fine, pure plastic yellow clay, and a bore found that the bed was equally developed fifteen feet below, making a total depth of twenty-five feet, of which about 20 per cent. was Kaolin. From the irregular and diagonal bedding it owes its origin to fluvatile action, and indicates a large and pure deposit in the vicinity; it is at the horizon below the base of the Conglomerate at which

such clays are found in Parke and Lawrence and may be expected in Greene, Monroe, Martin, Pike and Dubois counties. The opening was made on the land of Henry Ritter, northwest quarter, section 7, township 9, range 3. Another promising outcrop, as yet undeveloped, occurs seven miles west of Spencer, on the land of Richard Keene, northeast and southeast quarter, section 27, township 11, range 4. The specimens selected are of excellent quality, as pure as the best, and promise a grand enlargement of our home industries. Prof. Cox has suggested the name *Indianaite* for this valuable mineral.

#### STONE.

From the preceding report it will be readily seen that stone is abundant, of good quality, and in great variety, comprising sawing limestone, compact limestone, stone for burning, lithographic and rubble stone, grit, glass and polishing stone, with clays suitable for the manufacture of hydraulic cement. The rocky strata are a vast treasure with "*millions in it.*" Enterprise and labor will transmute the very hills into current gold.

#### COAL.

The coals of this county are fully equal to the best, and are in great variety. The block coals are suited to the use of the blast furnace. Coal B is, at certain stations, almost pure, burning with great flame and but little ash. If found free from disseminated sulphur, etc., it would seem that the splinty cannel, B, is worthy the attention of gas makers.

#### MEDICINAL SPRINGS.

Chalybeate water has well attested curative properties. The springs mentioned in local details merit and will command the attention of invalids.



### PAINT.

The paint beds near Middletown, on section 20, township 9, range 5, and near Commissioner Stutz's farm, are extensive and of good quality. The ochre needs washing, when it will compete in the markets. A sufficient demand can hardly be found for car loads of paint.

### FRUIT.

The high hills and divides are admirably suited for fruit growing. Immunity is thus secured against the effects of sudden changes in temperature\*. No more inviting field can be found, nor is it a matter of hazard. The missionary experiments of Long, at Arney, and Criss, near Vandalia, are demonstrative, proving that the calling is sure, profitable and pleasant.

In conclusion, thanks are returned to the citizens of Owen county for kind co-operation and assistance. Every aid was tendered and freely given. Special acknowledgements are due to Ham. Moffet, J. W. Archer, J. C. Simpson, Hon. W. M. Franklin, J. N. Allison, J. N. Merrill, Samuel Ray, J. A. Coffey, A. J. Tipton, Jacob Long, Jno. Haxton, J. L. Stoots, Wm. Winters, C. Acuff, Hon. J. C. Robinson, Hon. W. E. Dittmore, R. H. Gentry, J. S. Meek, H. Richards, O. E. Foster, W. Coffey, Calvin Fletcher, R. H. Gouty, Henry Dyer, Dr. Minnich, S. F. Evans, Dr. J. M. Jones, T. D. Stillwell, James Beaman, Hon. W. A. Montgomery, T. C. Bailey, L. M. Hays, Fred. Goss, D. B. Buskirk, Jesse Rogers and Dr. McDonald.

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\*For additional facts on this point, see reports of Knox, Gibson and Lawrence counties, 1874.

# MONTGOMERY COUNTY.

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BY JOHN COLLETT.

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Montgomery county is bounded north by Tippecanoe, east by Clinton, Boone and Hendricks, south by Putnam and Parke, and west by Parke and Fountain, and contains 504 square miles or 322,560 acres. Crawfordsville, the seat of Justice, is situate near the geographic center and is 48 miles northwest from Indianapolis. The principal villages are Pleasant Hill, Linden, Darlington, Shannondale, Valley City, Lynnsburg, Whitesville, Ladoga, Ashby, Parkersburg, Waveland, Alamo, Yountsville and Waynetown.

The drainage takes direction from the dip of the underlying rocks, generally a little west of southwest. The main stream is Rock river or Sugar creek, which enters south of the northeast corner and traversing the central areas, passes out six miles north of the southwest corner of the county. Its affluents from the north are Lye and Black creeks; from the south, Walnut, Offield and Indian creeks. The southern and southeastern parts are drained by Big and Little Raccoon creeks, and at the northwest by Coal creek, which flows directly into the Wabash. These streams, with their numerous tributaries, are fed by springs that flow out of the the great sponge-like mass of clay and gravel at its junction with the rocky frame work of the earth. They are, therefore, reliable streams, and furnish an abundance of water for agricultural and mechanical needs.

The surface of the country is pleasantly diversified, combining in the highest degree the useful with the agreeable. The western part, near the principal streams, is hilly and broken; in the north and center it is gently undulating, and at the east and southeast flat and level. The latter regions were originally clothed with a heavy growth of fine forest trees. In the north, extensive prairies prevailed, surrounded by glades, "openings" and groves of timber. The soil is everywhere fertile, and produces remunerative crops of corn, wheat, oats, grass, fruit, etc. It is especially adapted to the growth of blue grass the "gold finder" of Indiana. The health of the region is proverbial.

The following table of altitudes, deduced from uncompensated barometric observations with Stansberry and Williams' tables for a basis, are only approximate, but indicate such an elevation as insures exemption from some of the worst forms of malaria.

TABLE OF ALTITUDES.

(Above the Ocean).

	Feet.
Crawfordsville.....	749
Linden .....	763
Divide, seven miles north of Crawfordsville.....	799
Darlington.....	752
Mace—Frederick ...	788
Valley City—New Ross.....	838
Ladoga .....	820
Ashby.....	837
Waveland .....	694
Bodine's Mill—Sugar Creek.....	598
Alamo .....	839
Glacial moraines—near Alamo.....	870
Waynetown .....	735
Indianapolis .....	698
Terre Haute.....	494
Lafayette.....	538

## GEOLOGY.

## (Recent Geology.)

The surface deposits are due to three separate epochs of the Quaternary period, and are classified as follows :

## QUATERNARY PERIOD.

	Ft.	Ft.
Alluvium.....	0	to 20
Fluviatile drift and terraces.....	0	to 80
Lacustral beds .....	0	to 50
Glacial drift .....	10	to 120

During the long period in which the Triassic, Jurassic, Cretaceous and Tertiary seas successively came into existence, lived their age, and prepared the way for the life and time to follow in regions to the south and west of the Mississippi, it is probable that this part of central Indiana was elevated and continually rising above the level of the ocean, presenting the bare, rocky structure of the earth to the elements, for we find no evidence of these ages *in place*, except the erosive phenomena, and the deep cut river channels, now filled with the debris of later times.

## THE GLACIAL EPOCH.

The Glacial epoch succeeds this hiatus, leveling down former inequalities, filling up old valleys, and covering the hitherto bare surface with deep beds of clay, gravel, sand and boulders. In a practical view, this is one of the most interesting studies of the geologist. The surface deposits and resulting soil determine the value and kind of productions of a country, and give life and mental character to its inhabitants. A clay must be devoted to the grasses and grazing, the addition of siliceous material makes a loam capable of a wider productive range, but combining and properly mingling with these the alkalies and usual minerals, gives a still greater breadth of production, and that competency which insures comfort and leisure for mutual improvement.

To the phenomena of the glacial epoch we are indebted

to a great degree for results that make this region desirable for man. A period of intense cold prevailed. A mighty river of solid ice, with its sources away off toward the pole, its southern foot terminating at about  $39^{\circ} 10'$  north latitude, many hundred miles in width, slowly crept to the south. Its surface was covered with a large amount of angular fragments of rocks from overhanging cliffs at the north, and with gravel, sand, etc. Such material absorbing warmth from the short Arctic summer, would gradually sink in their matrix, or falling through numerous crevasses and water-ways, would reach the bed rock over which the glacier was advancing, the softer material would be ground in this giant mill to powdered clay and sand, while the more obdurate rocks would be rounded, polished and striated and survive as gravel and boulders which we find so plentiful in this region. The imported rocks are generally crystalline, with a reasonable percentage from the Silurian and Devonian beds, which, in combination with the native shales, lime and sandstone, thoroughly comminuted and mingled, constituted a perfect soil, because it comprises in available form the constituent materials of all the paleozoic strata.

The boulder drift may be described as a vast bed of gray clay or hard-pan, sand, gravel and boulders mixed "pell mell" or obscurely and irregularly stratified with slight partings of sand and gravel, at wide intervals, impervious to air and holding water with tenacity, it acts as a great sponge, grasping the rain-falls to feed the numerous springs which flow from its base, and maintains such an equilibrium of moisture as averts drought, and insures the perfect growth of blue grass and other plants that do not penetrate the ground to a great depth.

The earliest glacial flow in America was from the northeast ( $N. 80^{\circ} E.$ ), which passed up the St. Lawrence valley, hewing out the basins of lakes Ontario and Erie, and finding discharge by sluice-ways into the Ohio, Wabash and Mississippi. In the region of the lakes named, the records of this period are well preserved and easily interpreted.

Judged by the results, the work was long continued, and of great energy. Hitherto any facts indicating the extension of this flow to Indiana, have escaped attention. But a flow of such magnitude can not be supposed to have spent its force and material at the western end of lake Erie and suddenly ceased. Even then it was exhibited in great force. The natural conclusion would be that the evidence of its existence would be partially or wholly obliterated by the later flow from the north, passing directly across the vacated track of the former. Some facts have come under observation in the last year, which, although obscure, seem to throw light on a subject hitherto unsolved.

A system of canyon-like valleys were discovered in Owen and Clay counties, having the direction of the first flow, which can not be explained by any circumstances connected with the second cross-flow, and which, from the great depth of the erosion and subsequent building up with silt, dates its origin to an earlier period in the Glacial epoch. In Putnam county, and other parts of the State, are many valleys, once of great depth, although now profoundly built up, or entirely obstructed, have the direction of the axial line of the eastern lakes S. 80° W. In this county it will be observed that the trend of the ancient valleys, now occupied by the present streams, but generally more or less obliterated or obstructed, also have an east-west course varying slightly to the south. Thus the prairie depression near Linden connects directly in the northwest corner of the county with Coal creek, which is continued for some distance in this primal course. Lye creek enters near the extreme northeastern corner of the county, and after flowing in a westerly direction for six miles, suddenly turns to south, the ancient valley is plainly continued through Lye creek and Black creek swamps and Black creek valley. The obstructing agent, a vast bed of modified clay and water-washed sands are at once detected at the head of Black creek, between Linden and Crawfordsville. The discharge of water thus denied, the flow from the east would first be confined, and after reaching the maximum

capacity of the basin, be compelled to find a new line of exit to the south by Sugar creek. The obstructing dam of modified materials is the termination of a north-south ridge, and its modified nature demands the sifting and sorting process of flowing water. A lake, now known as Lye, and Black-creek swamps succeeded, originally six miles long and from one to three miles wide. The deepest wells in the basin do not find the bottom of the Lacustral silt, quick-sand and muck; and, although now drained and brought under cultivation, within the past fifty years it was covered with water. In opening ditches, drains, etc., many canoe paddles, spears and fishing implements have been found, proving that in modern times it was a constant body of water and a favorite resort for the Indian fisherman. The present channel of Lye creek, from the point where the southern bend commences, to its mouth, is by a deep, narrow valley, with steep, precipitous bluffs, which facts indicate the recent origin of this out-let.

The facts observed in relation to Sugar creek are of interest, and point more definitely to the early Glacial epoch for a solution of the phenomena observed. This stream east of Crawfordsville has a general trend of south  $70^{\circ}$  to  $80^{\circ}$  west. A few miles west of the city, and a short distance north of Yountsville, it is suddenly deflected directly to the south and southwest. Above this point, the valley bottoms are from one to two miles wide with well rounded bluffs supported by great beds of gravel and modified drift, which have been subjected to the sorting action of swift currents of water. Below Yountsville the valley is compressed, rarely exceeding a few hundred yards in width. Its precipitous or overhanging bluffs are often bare and naked cliffs of stone, indicating conclusively the recent origin of the chasm through which the stream flows, and the short period during which the bluffs have been exposed to the modifying influences of the elements, for a long exposure is nature's cure for wounds, by disintegration, wearing away exposed surfaces, removing asperities,

reducing precipices to gentle slopes, and covering their sides with fine sand and clays wrested from superior strata.

These facts, without doubt, demanded another and older outlet for Sugar creek, and if the primal direction of the stream was due to the action or results of the first ice flow, it ought to be found continuing in the original course west from Crawfordsville. Beneath that city, and in an area of several hundred acres west and southwest of it, are beds of coarse gravel and sand, having a thickness of 40 to 90 feet, of drift origin, but sorted and re-deposited by fluvial action. The stream to whose currents its origin was due, at one time must have had its low water level as high as a terrace on which Crawfordsville is situated. This was accepted as a hint toward a solution. Starting with this level registered as a datum line on the barometer, it was found that allowing a range of less than 40 feet, between high and low water in the ancient river, at least two outlets existed, one leading more directly to Coal creek, the other trending gently southwest to Sugar Mill creek. The latter is a broad well defined valley, now somewhat of a swampy nature, and, as far as pierced by wells, say 30 to 40 feet, built up with mucky silt and quick-sand, with beds of fine gravel. It seemed evident that the ancient river not only could but actually did find egress by this way. This presumption is further sustained by the fact that deep wells and bores in search of coal have discovered a great system of deeply eroded river channels in the great level plateau in the south part of Fountain county, now entirely filled up with silt and glacial drift, and which are on the produced line in which a river of the early glacial period, would be compelled to seek the Wabash and western drainage. To these deductions we may add that a few fragmentary rocks which seem to be like the Medina sandstone of Ontario, and two nuggets of nearly a pound each, of course octahedral Champlain iron ore, were found near the present mouth of Coal creek, in the bed of "Old" Sugar creek, if our theory is correct. These facts, separately, are of little value. Combined, they hint at the solution of an obscure



chapter of nature's history, and are briefly thrown together to invite full investigation, rather than a complete solution of the enigma.

From the nature of the case, as well as from the foregoing facts, the early glacial epoch was a system complete in itself, with a cold Arctic source, a regular and exact course of flow, and with sufficient channels for the discharge of ice water at its southern and western foot, continuing through ages, in the latter period of its existence, until climatic or atmospheric reasons, its propelling force had declined, it was met at the western end of lake Erie by the northern flow, full of energy and power, and which, sweeping down along the axial lines of lakes Huron, Michigan, and the Mississippi river, overpowered the former.

To the second ice-flow we are indebted for nearly all the rocks, sands, gravel, clays, etc., of the boulder drift. As it gradually approached, crossing the track of the first, the advance water discharge would probably tear up and remove, in a greater or less degree, the surface deposits, using the valley channels already prepared; but at length, when the glacier itself, in solid mass, supported by a great cushion of plastic material crossed this region, advancing with an alternating motion, proportioned as the long arctic winters exceeded its short summers. Under such circumstances the first result would be to fill up and bridge over all former chasms and valleys, and interesting exhibits of this process were discovered in excavating the roadbed of the Louisville and Chicago railway in Putnam county. The surface rocks on the northern side were found planed off and striated, but preserving a square edge with no scars or marks on that side of the chasm; the southern side always scarred with a worn and rounded cap, as if for a time the ice had grounded against the latter and then rose over it. The case just mentioned pretty fully explains the phenomena presented here. The ice sheet, with clay, gravel and boulders in great volume, invading the ancient valley, for a time exhausted its energy in filling up and bridging the

depressions until by an inclined plane it could ascend the high lands to the south. A dyke of such material with continued accretions of ice was built up until the water-way was entirely obliterated, and a vast lake covered all the central parts of the county. A new outlet was sought and found when the water reached the maximum capacity of the basin, across the easily eroded conglomerate sandstone at the southeastern corner of the county. On the extreme highlands just south of Alamo the surface is marked by a succession of small knolls and basins disconnected, yet indicating obscurely parallel ridges, which are believed to be terminal mud moraines; the spaces between, of 80 to 190 yards, recording the annual advance and recession of the ice foot.

During some part of this period it seems that a branch glacier was deflected to the east by the highlands seven or eight miles north of Crawfordsville, near Mt. Pleasant Chapel, passing between this point and Romney, thence southeast by Darlington towards Fredericksburg, leaving a trail or dyke of immense boulders along its track, filling up some of the depressions and floating over others, by this time partly filled with water.

The resulting Lake existed a very considerable period—long enough to hew out by its waste water the present rock-walled chasm, through which Sugar creek now flows, in the southwestern part of the county. During this time all the old river beds were more or less filled up with glacial clay or gravel and lacustral muck and silt, through which the stream had afterwards to renew its valley, removing the finer material and depositing gravel and boulders in vast beds as terraces. Beds of the latter are common about Crawfordsville but rare below Yountsville. The lacustral silt, a black, mucky mass, containing trunks and branches of trees, is seen below the terrace gravels, or is pierced in deep wells at and near the city. As the main lake was reduced by drainage, smaller isolated lakelets survived, as Black and Lye creek swamps. East of Sugar creek and south of Crawfordsville was an extensive body of

water, covering nearly 100 square miles, the silt and shore line which is so plainly lacustral and marked that its existence could not have terminated more than a few thousand years ago. The phenomena of this basin has long been noticed and studied by Col. James H. Harney, to whom I am indebted for much information, etc., and in whose honor as the discoverer I have given it the name of *Ancient Lake Harney*.

The boulder drift deeply covers the eastern, northern and northwestern parts of the county, bearing internal evidence of its origin, as polished, striated and rounded pebbles and rocks imported from the Laurentian beds north of lake Superior. When long concentrated by currents of water some notable deposits of gold dust and magnetite occur, associated on account of their approximate specific gravity, on the bars and riffles of the water courses.

#### GLACIAL STRIÆ.

At two localities, direct, positive evidences of the ice flow, recorded by the glacier itself, were observed. Near the residence and on the farm of Jesse Winters, a band of hard, compact, oolitic limestone occurs, which, exposed by denudation at points nearly a mile distant, showed that over that area, and probably a much larger one, the glacier had, in its motion, leveled the surface, planing and polishing the solid rocks. The well marked striæ in a right line indicate the direction of this local flow to south 8° east

On the north bank of Coal creek, three miles west of Waynetown, the massive conglomerate forms the low banks of the stream, and is quarried for building purposes; the surface exposed for about half a mile on the Brant farm has been leveled and planed by the same agency, cutting across the lines of deposition. The direction of the striæ is more nearly in accordance with the great glacial movement down the valley of the Wabash and its tributaries, and is to south 18° east, with an apparently greater easting at other localities.

## LACUSTRAL AND FLUVIATILE DRIFT.

The central, western and southern parts, as indicated from facts already mentioned, are as a rule covered with modified Glacial, Lacustral or Fluvial drift, with true boulder clay at intervals. As might be expected from the mode of its origin and deposition, it contains a large amount of calcareous material from the underlying shales and local limestones. Water draining through this soil and gravel is highly charged with minerals. The great springs which flow out at the foot of the terrace gravel beds, deposit masses of calcareous tufa (honey comb limestone). A film precipitated each day soon covers exposed objects, and a never-ending variety of leaves, grasses, twigs and mosses are preserved as casts. In proportion to the quantity of lime thus added the soil is enriched. The surface gently undulating is carpeted, with shrubs and blue grass. The oak and elm forests which prevail on the cold tenaceous clays are replaced with a thrifty growth of ash, beech, walnut, poplar, sassafras and sugar trees of superior size. In autumn, when the frost just touches the ripening foliage of the latter, as if by magic, they are at once arrayed in festive robes of glory. The forest becomes a giant parterre, brilliant with a thousand vivid tints of purple, gold and crimson, relieved by a setting of russet and azure, while the emerald carpet is flecked and strewn with drifting leaves ripened to the deepest hues of orange, brown and vermillion. We may well suppose that the citizens of this county rejoice in this thanksgiving scene painted by God's own hand; and absorbing transfused inspiration, her theologians and orators have spoken words that have deeply molded human character; that her poets in *alt* and *bass* have sung songs that have touched responsive chords wherever the English language is spoken.

## GENERAL GEOLOGY.

The rocky exposures of this county belong to the Carboniferous age, and comprise the lower or conglomerate

member of the coal measures and the whole of the Sub-carboniferous period. Bores and wells of a 100 feet in depth have pierced the black slate or upper member of the Devonian age. Brought together in connected section from isolated and widely separated outcrops, they give the following stratigraphic exhibit:

### CONNECTED SECTION, MONTGOMERY COUNTY.

#### QUATERNARY PERIOD.

	Ft.	Ft.	In.
1. Alluvium.....	0	to	20 00
2. Fluvatile drift and terraces.....	0	to	80 00
3. Lacustral beds.....	0	to	50 00
4. Glacial drift.....	10	to	120 00

#### CARBONIFEROUS AGE.

##### CARBONIFEROUS PERIOD.

##### *Coal Measure Group.*

5. Conglomerate sand rock, heavy bedded or massive.....	10	to	80 00
6. Shaly sandstone, with much false bedding, containing trunks, branches and prints of coal plants .....	2	to	8 00
7. COAL A, rash and impure, changing to a black slate from 4 to 20 feet thick...	8 in to		0 00
8. Shaly sandstone and pyritous shales....	7 ft. to		4 00

##### SUB-CARBONIFEROUS PERIOD.

##### *Chester Group.*

9. Chester limestone.....	4	to	20 00
10. Chester sandstone and shale.....	40	to	10 00

##### *St. Louis Group.*

11. St. Louis limestone.....	12	to	0 00
12. Yellow ferriferous sandstone.....	15	to	2 00

##### *Keokuk Group.*

13. Keokuk sandstone.....	20	to	10 00
14. Shales, with dykes and irregular pockets of limestone, rich in fossils. ....	20	to	40 00

##### *Knobstone Group.*

15. Knobstone shales and sandstone, without fossils.....	30	to	20 00
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## DEVONIAN AGE.

*Hamilton Group.*

16. Black slate in wells and bores .....	110 00
	<u>574 00</u>

The oldest strata out-crop at the extreme northeastern corner of the county, and are deposited with much regularity, dipping gently to the southwest. Following the line of dip along the valley of Sugar creek, the latter and higher beds are met successively, capped by the conglomerate member of the coal measures, near the county line, in the extreme southwestern corner. Hence, commencing at the lowest geological beds, we constantly ascend to superior and more recent strata, although, by actual levels, we are descending along the great inclined plane which gently slopes west to the Mississippi, the axis of the great valley of the continent. Reference is made to the general section by the marginal numbers.

## DEVONIAN AGE.

## BLACK SLATE.

The rocks of this age were not seen in place. They out-crop in localities immediately adjoining to the north and east, where their characteristics are well exhibited. Many fragments of the Black slate, No. 16, were seen in the drift near Darlington, and it is pierced in wells. A bore put down at Stover's mill, northeast quarter, section 29, township 19, range 4, found the black slate rich in bitumen, and almost carbonaceous, with a thickness at neighboring localities of one hundred and ten feet. This bed is distinctly and regularly laminated, is of dark, almost black color, when fresh from the quarry, but upon exposure, weathers to a brown or light gray. With partings and traces of asphalt, is associated much pyrite in sharp or obtuse crystals, known as "fools' gold." In adjoining regions this bed contains many minute marine fossils, as *Lingula*, *Discina*, *Leiorhyncus* etc., with bones and teeth of monster fishes, especially sharks.

## SUB-CARBONIFEROUS PERIOD.

## KNOBSTONE SHALES.

The Knobstone beds, No. 15, are determined from stratigraphic reasons alone. They consist of thinly laminated shales and shaly sandstones, seen in the bluffs of Sugar creek where it enters the county. They are of little or no economic importance, although crystals and pockets of pyrites have often given illusory hopes of gold to the unskilled. No fossils were seen; the nature of the deposit indicates a shore line with inflowing streams, discharging impure water, which, with a muddy bottom, was not suited to the life of marine animals, or the preservation of their remains after death.

## KEOKUK GROUP.

With the exception of the very small territory already described, and the portions hereafter to be noted, the rocks of the Keokuk group occupy the central area, extending in a broad belt from north to south across the county, covered in places by out-liers of the later rocks, which have, as a rule, been removed by glacial or fluvial action. These beds are generally deeply covered with drift, and consequently exposures are only seen in the beds and bluffs of the water courses. They consist of dark and gray shales and soft sandstones containing pyrite and clays. The lamination is regular and generally thin, the intervals of quiet being marked by homogeneous or massive beds. Such periods of stable quietude seem to have been regularly broken. Dykes of limestone, probably deposited upon or thrown against the sides of bluffs which must have existed in the bottom of an ocean of great depth, traverse the softer beds from northwest to south, southeast, parallel with the strike of the rim to the northeast. These limestone dykes and pockets, although of no great extent, are extremely significant. As a rule they are followed, for a space of one-fourth to half a mile, or more, with a rapid accumulation of sea silt with disturbed false bedding, the faces of which indicate

a great open ocean to the southwest, followed by periods of tranquility and new disturbances.

These phenomena, taken as a whole, seem to indicate a gradual upheaval of the shore line, parallel with what is termed the Cincinnati dome, continued at irregular intervals, which resulted in a continued silting up of the areas under consideration. A full connected view of the facts can only be obtained by following Sugar creek in detail; and such a trip will convince the watchful student that the apparent irregularities of the dip are unreal, and may, in a great measure, be explained by reference to slight oscillation and consequent silt beddings. The sedimentary clays and shales near, but not immediately above the limestone pockets, are rich in fossils. At favorite localities the bottom of the sea was crowded with life. Armies of Crinoids with strong stems 1 to 20 feet long, yet pliant with life and safely anchored to the solid bottom, lived in great communities in the deep dark waters. Their heads, a wonder of artistic beauty and ingenious mechanism, were supported and surrounded by strong arms divided into fringed fingers, which, elastic with vitality, served at once for defense, and at the same time, with prehensile instinct, grasped and sorted the food which sustained their strange and complicated being. Other animals of artistic structure and wondrous symmetry prevailed; minute coral insects, gasteropods intimately connected as food or otherwise with the reigning crinoids; brachiopods reached out their spiral arms loaded with tentacles; curled ophiurians twisted their snaky fingers about the crinoid bases, and star fishes lent their subdued rays to enliven the gloom of that watery night.

The beds comprise several families, many genera and species, and billions of individuals. For their determination some of the prominent American and European paleontologists have devoted years of time and much treasure.

The authorities of New York, Ohio and Illinois and different scientific associations, have, in the kindest spirit, expended large sums of money in the discovery and study



of this chapter of the globe's ancient history, and have published more than one hundred costly figures and a thousand pages of letter-press, in illustrating and illuminating this remarkably interesting and rich field of research. Coming with the taste of the "tree of knowledge" on their lips, they have boldly demanded of nature an explanation of her laws and rules, and stripping bare one of her mysteries, have opened a new book for the information of man.

Fossils from the crinoid beds of Crawfordsville now enrich the cabinets of most of the colleges and geological associations of the scientific world. Every year discovers new forms and reveals new secrets.

The following list, made out with the assistance of that veteran student and scientist, Prof. E. O. Hovey, and the most extensive worker, L. H. Cory, kindly revised as to arrangement and detail by Prof. A. H. Worthen of the Illinois and Prof. R. P. Whitfield of the New York survey, is given as a full if not complete enumeration of the fossils. It may be observed that there are many species and several genera as yet inedited, a duty which Indiana owes to science, and which it is hoped she will shortly fulfill by full paleontological reports sufficiently illustrated.

## LIST OF FOSSILS

FOUND IN THE KEOKUK GROUP AT CRAWFORDSVILLE,  
INDIANA.

### PLANTÆ.

#### ALGÆ.

Genus CAULERPITES, Sternberg.

**Caulerpites**, (Sp ?) resembles **marginatus** ..... Lesquereux.

Genus CHRONDRITES, Sternberg.

**Chondrites Colletti** ..... Lesquereux.

#### LYCOPODIACEA.

Genus STIGMARIA ? Brongniart.

**Stigmaria Hightoweri** ..... Krout.

**ANIMALIA.****RADIATA.****CCELEENTERATA.**Genus **AULOPORA**, Goldfuss.**Aulopora gigas**.....Rominger.Genus **SYRINGOPORA**, Goldfuss.**Syringopora**, (Sp.?).....Genus **ZAPHRENTIS**, Rafinesque.**Zaphrentis Dalii**.....Edwards and Haime.Genus **AMPLEXUS**, Sowerby.**Amplexus fragilis**.....White and St. John.**ECHINODERMATA.****CRINOIDEA.****PLATYCRINIDÆ.**Genus **PLATYCRINUS**, Miller.**Platycrinus hemisphericus**.....Meek and Worthen.— **Yandelli**.....Owen and Shumard.  
— (inedited.)Genus **DICHOCRINUS**, Munster.**Dichocrinus expansus**.....Meek and Worthen.— **ficus**.....Lyon and Casseday.**ACTINOCRINIDÆ.**Genus **ACTINOCRINUS**, Miller.**Actinocrinus Humboldti**.....Troost.— **jugosus**.....Hall.Genus **ALLOPROSALLOCRINUS**, Lyon and Casseday.**Alloprosallocrinus conicus**.....Troost.Genus **BATOCRINUS**, Casseday.**Batocrinus Agassizi**.....Troost.— **calyculus**.....Hall.— **Coreyi**.....Lyon and Casseday.Genus **ERETMOCRINUS**, Lyon and Casseday.**Eretmocrinus magnificus**.....L. and C.Genus **AGARICOCRINUS**, Troost.**Agaricocrinus tuberosus**.....Troost.— **Americanus**, Rominger (=tuberosus.....Troost.)**CYATHOCRINIDÆ.**Genus **CYATHOCRINUS**, Miller.**Cyathocrinus poterium**.....Meek and Worthen.— **inspiratus**.....L. and C.

Genus **BARYCRINUS**, Wachsmuth.

<b>Barycrinus</b>	<b>herculeus</b> .....	M. and W.
—	<b>Hoveyi</b> .....	Hall
—	<b>arboreus</b> .....	M. and W.
—	<b>Lyoni</b> .....	Hall.
—	<b>multibrachiatus</b> .....	L. and C.
—	<b>stellatus</b> .....	Troost.
—	<b>magnificus</b> .....	M. and W.

Genus **POTERIOCRINUS**, Miller.

<b>Poteriocrinus</b>	<b>Indianensis</b> .....	L. and C.
—	<b>Coreyi</b> .....	M. and W.
—	<b>Hoveyi</b> .....	M. and W.

Genus **SCAPHIOCRINUS**, Hall.

<b>Scaphiocrinus</b>	<b>æqualis</b> .....	Hall.
—	<b>decadactylus</b> .....	L. and C.
—	<b>depressus</b> .....	M. and W.
—	<b>nodobrachiatus</b> .....	Hall.
—	<b>robustus</b> .....	Hall.
—	<b>unicus</b> .....	Hall.
—	<b>Coreyi</b> .....	M. and W.
—	(sp. ined.)	

Genus **ZEACRINUS**, Troost.

<b>Zeacrinus</b>	<b>concinus</b> .....	Meek and Worthen.
—	(sp. inedt.)	

Genus **SYNBATHOCRINUS**, Phillips.

<b>Synbathocrinus</b>	<b>Swallov</b> .....	Hall.
—	<b>robustus</b> ?.....	Shumard.

Genus **GONIASTEROIDOCRINUS**, L. & C. =? **GILBERTSOCRINUS**, Phillips.

<b>Goniasteroidocrinus</b>	<b>tuberosus</b> .....	L. and C.
—	(sp. inedt.)	

Genus **FORBESEOCRINUS**, DeKay and LeHon.

<b>Forbeseocrinus</b>	<b>Meeki</b> .....	Hall.
—	<b>Wortheni</b> .....	Hall.
—	<b>Saffordi</b> .....	Hall.
—	? <b>ramulosus</b> .....	L. and C.

Genus **ONYCHOCRINUS**, Lyon and Casseday.

<b>Onychocrinus</b>	<b>exsculptus</b> .....	L. and C.
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Genus **TAXOCRINUS**?, Lyon and Casseday.

? <b>Taxocrinus</b>	<b>ramulosus</b> .....	L. and C.
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(Family uncertain.)

Genus **CATILLOCRINUS**, Troost.

<b>Catillocrinus</b>	<b>Bradleyi</b> .....	M. and W.
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Genus **CALCEOCRINUS**, Hall.

<b>Calceocrinus</b>	<b>Bradleyi</b> .....	M. and W.
—	<b>nodosus</b> .....	Hall.

*BLASTOIDEA.*Genus *PENTREMITES*, Say.

- Pentremites Wortheni* ..... Hall.  
 — *conoideus* ? ..... Hall.

Genus *GRANATOCRINUS*, (Troost,) Hall.

- Granatocrinus granulatus* ? .....

*ECHINOIDEA.**PERISCHOECHINIDÆ.*Genus *LEPIDESTHES*, Meek and Worthen.

- Lepidesthes Coreyi* ..... M. and W.

Genus *ARCHÆOCIDARIS*, McCoy.

- Archæocidaris* (sp. inedit.) .....

Genus *MELONITES*, Owen and Shumard.

- Melonites* (sp. inedit.) .....

*ASTEROIDEA.*Genus *ONYCHASTER*, Meek and Worthen.

- Onychaster flexilis* ..... M. and W.

Genus *PROTASTER*, Forbes.

- Protaster gregarius* ..... M. and W.

*EDRIOASTERIDÆ.*Genus *AGELACRINITES*, Vanuxem.

- Agelacrinites squamosus* ..... M. and W.

*MOLLUSCA**MULLUSCOIDEA.**BRYOZOA.*Genus *ARCHIMEDES*, Le Sueur.

- Archimedes Owenana*.

Genus *FENESTELLA*, Miller.

- Fenestella* (sp. inedit.)

Genus *TREMATOPORA*, Hall.

- Trematopora* (2 sp. inedit.)

*BRACHIOPODA.*Genus *STREPTORHYNCHUS*, King.

- Streptorhynchus crenistria* =

- Hemipronites crenistria*\* ..... Phillips

\*In a letter in reply to questions asked Prof. R. P. Whitfield, the distinguished Paleontologist, at Albany, New York, says: "The genus *HEMIPRONITES*, Pander, as typified by *Orthis hemipronites* and *O. adspetus* is as yet unknown in America, and is distinct from *STREPTORHYNCHUS*, King, as recognized in *S. crenistria*."

## GENUS CHONETES, Fischer.

- Chonetes planumbona*.....M. and W.  
 — (sp. inedt.)

## GENUS PRODUCTUS, Sowerby.

- Productus magnus* .....M. and W.  
 — (*tenuicostus*) *cora*.....D'Orbigny.  
 — *punctatus*.....Sowerby.  
 — *vittatus*.....Hall.  
 — *alternatus*.....Norwood and Pratten.  
 — *semi-reticulatus*.....Martin.

## GENUS SPIRIFER, Sowerby.

- Spirifer striatus*.....Miller.  
 — *Keokuk*.....Hall.  
 — *fastigatus*.....M. and W.  
 — *sub-orbicularis*.....Hall.  
 — *sub-cuspidatus* .....Hall.  
 — (sp. inedt.)

## GENUS ATHYRIS, McCoy.

- Athyris Royissi*.....L'Eveille.  
 — ? *sub-lamellosa* .....Hall.

## GENUS RETZIA, King.

- Retzia Verneuilanum* .....Hall.

## GENUS RHYNCHONELLA, Fischer.

- Rhynchonella sub-cuneata*.....Hall.

## GENUS TEREBRATULA, Lihwyd.

- Terebratula hastata*.....Sowerby.  
 — (sp.?)

## MOLLUSCA VERA.

## LAMELLIBRANCHIATA.

## GENUS AVICULOPECTEN, McCoy.

- Aviculopecten Indianensis*.....M. and W.  
 — (n. s.).....Whitfield.

## GENUS MYALINA, De Koninck.

- Mayalina Keokuk*.....M. and W.

## GENUS PINNA, Linnæus.

- Pinna sub-spatulata*.....M. and W.

## GENUS LITHOPHAGA, Lamarck.

- Lithophaga lingualis* .....Phillips.

## GENUS ALLORISMA, King.

- Allorisma* (sp. inedt.).

**GASTEROPODA.**Genus **PLATYCERAS**, Conrad.

- Platyceras fissurella**.....Hall.  
 — **infundibulum**.....M. and W.  
 — **uncum**.....M. and W.  
 — **equilatera**.....Hall.

Genus **EUOMPHALUS**, Sowerby, or **STRAPAROLLUS**, Montfort.**Euomphalus** (sp. inedt.)Genus **LOXONEMA**, Phillips.**Loxonema** (interior cast, inedt.)Genus **DENTALIUM**, Linnaeus.**Dentalium primarium**.....Hall.Genus **CHITON**, Linnaeus.**Chiton** (sp.?)Genus **BELLEROPHON**, Montfort.**Bellerophon** (sp.?)**PTEROPODA.**Genus **CONULARIA**, Miller.

- Conularia sub-carbonaria**.....M. and W.  
 — **Crawfordsvillensis**.....R. Owen.

**CEPHALOPODA.**Genus **ORTHOCERAS**, Breynius.**Orthoceras** (sp. inedt.)Genus **NAUTILUS**, Linnaeus.**Nautilus Coxi** .....M. and W.Genus **GONIATITES**, DeHaan.**Goniatites** (sp. inedt.)**ARTICULATA.****CRUSTACEA.**Genus **PHILLIPSIA**, Portlock.

- Phillipsia** (Griffithides) **bufo**.....M. and W.  
 — **seminifera** ?.....Morrison.  
 — **Portlockii** ?.....M. and W.

The principal fossil localities are at Corey's Bluff on the northwest bank of Sugar creek, a mile north of Crawfordsville, from which a majority of these fossils were obtained, at and near Troutman's mill, at and near the mouth of Lye creek, at Mrs. Dice's on Walnut creek, at and near the mouth of Offield and Indian creeks and on Black creek,

all within a radius of seven miles of the city; and the best localities are within three miles.

#### ST. LOUIS GROUP.

The St. Louis beds succeed in order of superiority. In the southern part of the State they present a heavy laminated or massive limestone, sometimes concretionary and full of fossils, from 100 to 200 feet thick, with slight beds of sandstone. Going north, the limestones become thinner and are more or less replaced with arenaceous material. Here the group is greatly reduced or entirely absent, and the usual fossils are extremely rare. A few weathered specimens of *Lithostrotion Canadense* are reported with *Pentremites conoideus*, *P. Woodmani*, *Zaphrentis spinulosa*, *Retzia Verneuillanum*, *Rhynchonella mutata*, *R. subcuneata*, *Euomphalus* sp.? *Waldheimia* sp.? *Spirifer incrassatus*, *Productus punctatus*, *P. (tenuicostus) cora*, with dismembered plates and stems of crinoids and sharks teeth. The above fossils were found at three different localities; one at the county line southwest of Parkersburg, at Oldshoes quarry west of Waveland, and at Coal creek quarry a mile west of Waynetown.

At places, if not generally, the rocks of the St. Louis group are absent or replaced by a sandstone, without fossils and from the scanty evidence at hand, we may almost conclude that the conditions necessary: clear, pure, cold water, was episodal, subject to interruptions by and perhaps a recurrence of circumstances again suited to Keokuk life.

#### CHESTER GROUP.

The rocks of the Chester group exhibited a thickness of about 50 feet to the north, in Warren county, and of nearly 100 feet in the southern part of the State. Here they are greatly narrowed, ranging from 4 to 50 feet thick. They consist of non-persistent bands, dykes and pockets of gray argillaceous limestone, underlaid by a gray or yellow sandstone, well laminated, and gray and dark siliceous shales. The whole series is generally arenaceous and furnishes good

quarry stone at several localities northwest and west of Crawfordsville.

The line on the map indicating the "eastern line of the Chester beds" includes the most easterly outliers, and at the same time large areas in which such rocks have been eroded, exposing the underlying St. Louis and Keokuk strata.

The most abundant fossils are survivors from the Keokuk beds, which afterward give character and culminate in the coal measure epoch, as *Productus punctatus* (*vittatus*), *P. semireticulatus*, *P. (tenuicostus) cora*, *Hemipronites crenistria*, *H. crassus?*, *Spirifer striatus*, *S. lineatus*, *Athyris ambigua*, *A. subtilita*, *Terebratula bovidens*, *Retzia vera*, *Rhynchonella Osagensis?*, *Pinna Sp.?*, *Allorisma Sp.?*, *Aviculopecten* (*n. s.*), *Orthis resupinata*, *Dentalium primarium*, *Pentremites pyri-formis*, *P. obesus?*, *Zaphrentis spinulosa*, *Syringopora* and *Archimides Owenana*.

The rocks of this bed both lime and sandstone are quarried, and at several localities furnish excellent material for foundations, cellar walls, piers and other hammered masonry. The limestone has been burned, yielding a strong "hot" lime.

#### CARBONIFEROUS PERIOD.

##### COAL MEASURES.

The coal measure rocks comprise a narrow belt along the western boundary; just touching the northwest corner, the area is much widened to the south of Alamo and along the bluffs of Sugar creek, and again reduced by denudation in Raccoon valley.

Coal A is here a thin, inconstant, impure seam of no value. For analysis see chemist's report. The coal varies in thickness from a mere trace to three or four inches; is generally absent, or at other localities diffused by maceration through from six to twenty-one feet of black argillaceous shale.

At this horizon several poorly preserved trunks of *Lepidodendra*, *Stigmara* and *Calamites* were observed with



broad striated leaves of *Cordaitea borassifolia*, with the fruits or nuts *Trigonocarpum olivæformis*, *T. ornatum*, *T. tricuspidatum*. and the berry like nuclei of *Trigonocarpum* and *Cardiocarpum*, some of which are probably new to science.

#### MILLSTONE GRIT.

The conglomerate sandrock superimposes the horizon of coal A, and is the highest, geologically, and most recent rocky bed in the county. It is a coarse, reddish brown sandstone, generally ferruginous, and at very rare localities containing white and red quartz pebbles. It is heavily laminated or massive, and exhibits a thickness from naught to 80 feet. It presents a valuable stone for heavy masonry, comes soft from the quarry but hardens on exposure to the air, and in the best beds is fire and water-proof.

To the foregoing description of the general section, details will now be added for local information.

#### LOCAL DETAILS.

Crawfordsville, the county seat, is located on a high bluff on the south side of Sugar creek, and because of its elevated position and natural drainage, effected by the underlying beds of sand and gravel, it is noted as a healthy city. The streets are wide, carefully graded and graveled, and shaded with native trees which render salubrity to the air as well as beauty to the city. The residences are neat and tasteful, and wear an air of thrift and comfort. Several manufacturing establishments, under judicious management, are prosperous and profitable. The city is also the commercial centre of the county.

The clayey nature of the soil rendered good roads both an economic and social necessity, resulting in the construction of nine first class gravel roads radiating from the common centre to the following places :

## GRAVEL ROADS.

To Alamo.....	8 miles.
To Waynetown.....	12 miles.
To Pleasant Hill .....	6 miles.
To Concord, northeast.....	5 miles.
To Darlington.....	6 miles.
To Fredricksburg .....	6 miles.
To Parkersbnrg.....	3 miles.
To Waveland .....	6 miles.
To Hill's Factory.....	3 miles.
To Ladoga and Ashby .....	4 miles.
	<u>59 miles.</u>

This makes a total of 59 miles of gravel roads in the county which has cost an average of \$1,500 a mile or \$88,500 for the whole, which were constructed by private corporations, under the gravel road laws of 1872. Many of these roads were found to be in excellent condition, and so remain the year round, especially that portion which is constructed of hard glacial pebbles with only enough sand to fill the interstices. It has been found here that small pebbles make the best road, and that a hard clay bottom requires much less gravel than other soils. In the absence of gravel beds, sand has been used for metalling some of the roads on a tough clay soil, under the impression that in time it would "pack" and become solid.

The beneficial influence of these roads is great and can be fairly appreciated by those only who remember the sloughs, morasses and "corduroy" in and on which the public were tortured in their travels thirty years ago. They open new sources of income and economy to the people, appreciate the adjacent property, and give vigorous impulse to social enjoyment and mental improvement.

## WABASH COLLEGE.

At an early date in the settlement of the west, when the pioneer had just entered the wild forests, still occupied by wilder savages, a band of young missionaries, hopeful for the future of this region, and foreseeing its moral and

educational needs, determined to found a school for collegiate education. Like knights of chivalry or standard bearers of a forlorn hope, they laid their plans, staked off the grounds, and kneeling on the snow that frosty November morning, consecrated themselves to the enterprise, and it to the God of Heaven. The vow then taken, with the enthusiasm of young manhood, has been fulfilled with signal devotion and untiring energy. Its founders taught and worked on a salary of six hundred dollars a year, but with the spirit of martyrs they returned one half to the treasury of the college, gave one hundred dollars to other charities, and reserved only the meager sum of two hundred dollars on which to feed and clothe themselves and families. In determination and self-denial "there were giants in those days."

With kindred feelings for *Alma Mater*, it is pardonable to make special mention of the writer's preceptor in geology, Prof. E. O. Hovey, as a christian gentleman, a hero in the educational cause, to whose prayerful faith and steadfast courage, which, like Sheridan's, could pluck victory from fiery disaster, this college owes its success if not its existence.

Wabash College was founded in November, 1832, and has been sustained entirely by private munificence. She has sent forth nearly 300 graduates, given high educational advantages to about 2,000 young men and her annual catalogue contains from 200 to 250 names. Her sons have gathered honors both in peaceful pursuits and in war. The last words to me of one of her bravest, Maj. David Shelby, who died for his country, in blessing his *Alma Mater* were: "I thank God I was reared in the land of the Yankee School Master."

The college edifices are situated on a beautiful campus of thirty acres covered with native forest trees. They consist of a chapel hall containing recitation, society, lecture, cabinet and library rooms; a dormitory with accommodations for one hundred young men; an academic hall for the

preparatory department and the military department, gymnasium and school of Technology.

"The course of study is full and thoroughly pursued, so that Wabash College has acquired high reputation and richly deserves, as it has, the confidence of the public."

In a great measure this county owes its mental, moral and pecuniary advancement to the unseen and hardly realized influences of the college which has, with full hand, thus blessed and rewarded its friends.

The terrace bluff, upon which Crawfordsville is situated, is composed of fluvatile gravel and sand, washed and sorted from the glacial drift and lacustral sands and silt, underlaid by some hummock-like masses of undisturbed boulder drift. These terrace beds contain a large admixture of the pyritous argillites from the Keokuk and Knobstone shales, which, on exposure, are decomposed, and becoming soluble, give origin to a number of chalybeate springs, locally known as sulphur springs, some of medicative repute. At freshly denuded beds, copperas, (sulphate of iron), may always be detected as a frost-like efflorescence. The ancient valley and river was probably in the extreme southern part of town, and, being obstructed in the direction of its discharge, formed a basin that was puddled and made capable of holding a vast body of water at a very early period; afterwards this basin was filled with pervious sand and gravel, still leaving a large capacity for water. Washes and ravines cutting the rim of the basin, drain off this water and afford discharge to the magnificent springs in Whitlock's hollow, which was the original attraction that caused this point to be settled by agents of the General Land Office. A few years since the rim of the basin was tapped by the wash in the bluff, between Washington and Vernon streets, giving outlet to a rushing, roaring torrent of water. Wells on the College Hill have pierced this terrace bed to a depth of nearly 100 feet, without reaching the bed rock, and show that the ancient valley was excavated to an equal or greater depth than the present channel of Sugar creek.

At the deep gorge in the north part of town the following strata were observed:

#### SECTION AT CRAWFORDSVILLE.

	Ft.	In.
Fluviatile and modified drift.....	18	00
Dark clay with boulders.....	8	00
Buff lacustral sandy clay, with fine pebbles and pockets of sand .....	9	00
Blue clay with striated and planished boulders, with pockets of clay and sand to Sugar creek.....	42	00
	<u>67</u>	<u>00</u>

The crinoid locality owes much of its notoriety to Prof. E. O. Hovey who has published articles describing the bed and its contents. Especial mention is due to O. W. Corey who justly claims the discovery of some of the best localities and who, with Mr. E. H. Corey, by their persistent explorations, have done so much for science. In honor of the former, his name is given to the bluff, southwest quarter, section 29, township 19, range 4, now owned by Prof. Bassett, where the best finds are met:

#### SECTION AT COREY'S BLUFF.

One and a half miles north of town, just below railroad bridge.

	Ft.	In.
Soft gray sandstone with crinoid stems and <i>Producti</i>	10	00
Shaly sandstone, without fossils.....	10	00
Ferruginous parting, <i>Pentremites</i> .....	0	06
Soft gray sandstone.....	5	06
Blue argillaceous sandstone.....	3	00
Blue siliceous clay shale, in places filled with crin- oids and many other fossils, crinoid bed.....	4	06
Gray feriferous sandstone.....	2	00
Blue shaly soapstone filled with fragmentary fossils, interrupted by an inclined dyke of limestone.....	25	00
	<u>60</u>	<u>06</u>

A majority of all the animal remains found in the list heretofore given, page 376, are found at this station, therefore a special list is unnecessary.

Similar fossil beds are found in the bed of Walnut creek, northeast quarter, section 11, township 18, range 4; at the

mouth of Black creek, southeast quarter, section 34, township 19, range 5; on a brook southeast from Troutman's mill, near the center of north half section 3, township 18, range 5; at the mouth of Offield creek, south half, section 16, township 18, range 5, and at the mouth of Indian creek, southeast quarter, section 2, township 17, range 6.

At each of these stations thin beds or dykes of limestone, generally steeply inclined, cross the creek valleys irregular as to thickness, but parallel with the line of strike of the rocks. The face or dip of such beds is toward the center of the basin, but an exception was seen where two such beds formed an anticlinal, capping the top of a former sub-marine bluff. These limestones contain remains of many shell-fish, disconnected crinoid joints, etc., but rarely or never crinoid heads or star fishes. It is probable that the stems were here anchored and remained, but at some tidal current, the heads being lighter, were swept away and buried with the sands and clays of the same specific gravity.

The different families of crinoids, with their companion parasites or dependents, seem to have lived somewhat in communities, although at roughly deposited stations, many species irregularly mingled are found.

From a condensed list of the specimens in the unrivaled collection of the college cabinet, and some private parties, the following gives an approximate estimate of the numerical ratio.

Actinocrinus Indianensis.....	6
Actinocrinus Humboldt.....	1
— jugosus.....	2
Agaricocrinus tuberosus .....	4
Alloprosallocrinus conicus.....	2
Batocrinus Agassizi .....	11
— calyculus .....	2
— Coreyi .....	1
Baryculus herculeus.....	2
— Hoveyi .....	2
— Lyoni .....	2
— arboreus.....	7
— stellatus.....	2
— magnificus.....	6
— multibrachiatus.....	5

Cyathocrinus poterium .....	2
— inspiratus .....	1
Catillocrinus Bradleyi .....	1
Calceocrinus Bradleyi .....	1
Dichocrinus ficus .....	5
— expansus .....	2
Eretmocrinus magnificus .....	3
Forbeseocrinus Meeki .....	19
— Wortheni .....	1
— Saffordi .....	2
— ramulosus .....	14
Goniasteroidocrinus tuberosus .....	5
Onychocrinus exsculptus .....	12
Poteriocrinus Coreyi .....	2
— Hoveyi .....	1
— Indianensis .....	2
Platycrinus hemisphericus .....	25
— Yandelli .....	1
Scaphiocrinus æqualis .....	23
— decadactylus .....	10
— depressus .....	1
— nodobrachiatus .....	1
— robustus .....	1
— unicus ..	9
— Coreyi ..	1
Synbathocrinus Swallovi .....	1
— robustus ? .....	1
Taxocrinus ramulosus .....	14
Zeacrinus concinnus .....	1

Just above the mouth of Walnut creek, a thick bed of dark shaly clay, homogenous and regularly laminated, seems to have been the result of quiet waters. No fossils were seen. Still ascending Walnut, on the farm of W. H. Durham, an interesting lot of fucoides and other fossils were seen.

#### SECTION AT DURHAMS'.

	Ft.	In.
Soil and gravel .....	30	00
Soft shaly sandstone .....	15	00
Blue shaly soapstone .....	6	00
Blue pyritous sandstone, with <i>Algae</i> , <i>Producti</i> , <i>Spirifera</i> , <i>Chonetes</i> , <i>Zaphrentes</i> , etc., geodized .....	3	00
Blue shale, with vermiform fucoides .....	7	00
	<u>61</u>	<u>00</u>

The *Zaphrentes* were strangely irregular in shape, strangled, and all the geodized fossils were largely magnified in the process of silicification. On the same land, near the abandoned saw mill and factory, is a perpendicular or overhanging rock known as Mt. Pisgah. Several well preserved fossils were seen, including *Spirifers*, *Chonetes*, *Producta*, *Phillipsia*, *Conularia*, and a single specimen of *Lithostrotion proliferum*.

At the "Devil's Backbone," a short distance above the confluence of Walnut with Sugar creek, the former closely approaches and is separated from the latter by a narrow foot-path. It is a favorite pic-nic ground. The local dip is to the northwest about 20 feet per mile.

#### SECTION AT DEVIL'S BACKBONE.

(Northeast quarter, section 29, township 19, range 4.)

	Ft.	In.
Clay and gravel.....	8	00
Gray shaly sandstone.....	4	00
Blue siliceous shale, with fucoides.....	4	06
Pyritous shale, place of upper crinoid bed.....	2	06
Blue shale with plates of sandstone, to creek.....	10	00
	<u>29</u>	<u>00</u>

A short distance above, is the old seat known as Stover's mill, northeast quarter, section 29, township 19, range 4. Here was formerly a deer lick, much frequented by wild animals. Many bones and horns of deer, buffalo, elk, etc., have been found, washed out by the creek which flows near by. The "lick" water comes from the base of a pyritous shale, and owes its saline-tonic qualities to the decomposition, by exposure, of the pyrite which sets free soluble iron and sulphur, the latter combining with the clay to form alum, sulphate of alumina.

About forty years ago, Major I. C. Elston put down a bore here for salt water to a depth of 75 feet. On reaching the black slate forty feet below the surface, it was found to be somewhat bituminous, and at the same time supposed to be coal, although full 140 feet below the horizon of the



lowest seam, A, and 210 feet below any workable coal. In 1867 another test bore was made which fully settled the question. No coal was or can be found at this level.

## SECTION AT STOVER'S MILL.

	Ft.	In.
Clay and loam.....	18	00
Terrace and drift.....	22	00
Gray sandstone and shale.....	24	00
Buff shale .....	14	00
Blue pyritous shale.....	14	00
Sandstone, shale and thin limestone in bore.....	70	00
Black slate in bore.....	10	00
	<u>172</u>	<u>00</u>

At the iron bridge one mile west of Crawfordsville, the top of the high bluff is built up with regularly laminated beds, but the limestone plates and pockets near the water level are irregular, dipping in every direction, indicating rather the result of a destructive storm wave than regular sedimentary deposits. This presumption is confirmed by the crushed, broken and disjointed condition of the crinoid stems and other fossils. The following section is seen:

## SECTION AT IRON BRIDGE.

	Ft.	In.
Covered soil and drift.....	11	00
Soft sandstone, with <i>Productus cora</i> , and <i>P. semireticulatus</i> .....	8	00
Gray shale and shaly sandstone.....	19	00
Blue and gray heavy bedded sandstone, with plates of limestone.....	11	00
Blue shale, with <i>Forbesocrinus</i> , <i>Platycrinus</i> , <i>Spirifer striatus</i> , <i>Producti</i> , etc.....	4	06
Red or blue ferruginous limestone, with crinoid stems, <i>Productus punctatus</i> , <i>Platyceras</i> , and <i>Chonetes planumbona</i> .....	1	06
Blue soapstone, to low water in creek, with crinoid plates and stems, <i>Producti</i> , <i>Spirifera</i> and <i>Athyris lamellosa</i> .....	4	00
	<u>59</u>	<u>00</u>

A short distance above the bridge, on the south side of

the creek, is seen the ancient erosion of the ice age crossing the present channel and valley of the creek with striæ corresponding in direction with those seen at the Horse shoe, (Durham's farm), on Walnut branch, viz: south  $22^{\circ}$  west; both places are now filled with a mass of boulders capped with lacustral silt. The violent washing process that sorted these huge boulders, ground and pulverized some of the crystalline rocks, and considerable quantities, more than fifty dollars worth, of gold dust and magnetite have been "panned" out by amateur collectors, on the ford bar. The lacustral silts at this place, below the foot of Washington street, and where the Green Spring gravel road crosses Dry branch, contain many trunks of large trees, vines, etc., indicating the warm subtropic climate that prevailed during this period. Fragmentary remains of tropical animals are preserved in the same beds, and teeth and bones of the *Elephas Americanus* (American Elephant) are not uncommon.

At Remly's Bluff, one and a half miles west of town, a perpendicular bluff of drift guards the south bank of the creek. It affords an interesting exhibit of the agencies at work during the Quaternary period. In the upper fluvialite drift was found some well preserved bones of the lately extinct monster, the Mastodon. At Remly's ford, on the north side of the creek, was seen an interesting fossil bed, though they were generally fragmentary. Planished rocks covered with striæ, that were uncovered by the floods of 1875, were seen on the south bank of Sugar creek, a half mile above the railroad bridge at Troutman station. Mammary knobs and protuberances finely striated record the direction of the flow to south  $8^{\circ}$  east, almost perpendicular to the present river valley.

Above and below Troutman station, many springs, of volume, sufficient to turn a mill, burst out from the side of the bluff. They demand for their origin a vast sponge of gravel and sand capable of absorbing and retaining for a time the rainfall, all contained in a vast trough or basin. We have already seen that the agencies, working in cross

direction at different periods of the glacial epoch, would necessarily produce the results here apparent. The water is heavily charged with lime in solution, which is precipitated on exposure to the air. Extensive beds of calcareous tufa are formed, in which are preserved casts of leaves, mosses, grasses, twigs, etc., in a film of lime, thickened by constant accretions.

Tufaceous deposits have, in some measure, been adopted for chronological purposes, in discussions on the antiquity of man and animals. By assuming a certain number of centuries as necessary for the formation of one inch of tufa and the acute use of multipliers, the age of man can be extended back indefinitely. Learned and labored arguments, founded on such uncertain assumptions, have been given to the world, hence definite facts throwing light upon the subject are of deep importance. Mann's (Winton's) mill erected at the early settlement of this county, was fed by the lime-water spring just north of Troutman's mill. The machinery was driven by an overshot wheel ten feet in diameter; its use was discontinued in 1835. In 1847 I saw the wheel imbedded in tufa up to the axle; now, 1875, the whole wheel is covered by this material. Supposing the accretion to have been continuous, irrespective of drought or floods, there has been a bed of tufa deposited on and about this water wheel, ten feet thick in a period of less than forty years, or three inches a year. A stalactite, formed against the exposed rocks by a wet weather seep, may be seen at the "stone cut" a short distance south of Bedford, Lawrence county, Indiana, on the line of the Louisville and Chicago railway. This deposit had attained a thickness of four inches in a period of twenty two years, requiring nearly six years to the inch.

Abram Troutman's mill utilizes the whole water of Sugar creek because of the solid limestone floor on which the dam is placed. It has three run of buhrs, two of which are driven, without fail, during the year. A short distance above, the bluff is composed of soft aluminous shale, which, a few hundred yards to the northeast, passes into a quarry

bed of sandstone. At the mill occurs a limestone reef nearly horizontal for a small space, composed almost wholly of crinoid stems and other relics of animal life.

## SECTION AT TROUTMAN'S MILL.

	Ft.	In.
Drift and terrace slope.		
Gray sandstone.....	20	00
Shaly sandstone.....	25	00
Pudding stone limerock.....	10	00
Blue shale.....	4	00
Crinoidal limestone, mass of animal remains.....	7	00
Blue soapstone in creek.....	4	00
	<u>70</u>	<u>00</u>

The above limestone contains, with a vast amount of stems and joints of crinoids, a great number of shells, as *Productus*, *Spirifer*, *Platyceras*, *Hemipronites* and *Chonetes*, the animals that seem to always congregate or to have been gathered at localities where the crinoid stems were anchored to the rocky bottom. This occurrence is too often repeated to be the result of accident. Doubtless their companionship was of mutual benefit, or possibly the limited area of stony bottom compelled the life of the sea to lead a congregational existence. Within a short distance, this limestone thins and passes to a soft argillaceous shale or mud stone, and reappears highly inclined, after an interval of shaly beds, half a mile wide. This discontinuance and recurrence of inclined bands is so often repeated as to form a law for these Keokuk beds, as was fully mentioned under the head of general geology.

At Cascade bridge, four miles southwest from town, a small brook leaps from an overhanging cliff twenty feet high and falls in a veil of foam. The water holds lime in solution, which precipitated, preserves in its stony film casts of leaves and moss. A tiny rainbow sometimes dances on the cloud of spray, and many a happy pair, after pic-nic visits here, have carried away bright images of that bow's promise on their hearts, forever.

## SECTION AT CASCADE BRIDGE.

(Southeast quarter, section 3, township 18, range 5.)

	Ft.	In.
Surface loam with limerock.....	10	00
Yellow ferriferous sandstone .....	2	00
Soft shaly sandstone.....	25	00
Brown or reddish limestone in plates and bands, crowded with fragmentary fossils .....	5	00
Blue soapstone, filled with crinoid plates and joints, "button mold" wash.....	8	00
Blue soapstone, faced with calcareous tufa.....	20	00
	<u>70</u>	<u>00</u>

Yountsville is the centre of a rich agricultural region. From the first settlement of the county it was a notable wool carding and milling locality. Spring creek was then the source of power, driving a saw mill, two grist mills and a woolen factory. Thirty five years ago Daniel Yount commenced the manufacture of woolen goods, and has since, by utilizing the whole water of Sugar creek, built up an extensive business favorably known over a wide extent of country. He employs three sets of carding machines, four spinning jacks, twenty looms and a full set of finishing machinery. Average product, \$75,000 per annum; during the war a single year's work amounted to \$170,000.

An irregular pocket of limestone was seen at Snyder's mill in the village. A conglomeration of well preserved fossils crowded upon and within each other, among which were observed *Spirifer striatus*, *Productus semireticulatus*, *P. punctatus*, *P. (tenuicostus) cora*, *Chonetes planumbona*, *Hemipronites crenistria*, *Phillipsia bufo*, etc.

This bed dips rapidly to the southwest, passing to a siliceous firestone, the partings marked with casts of Chondrites and other fucoides, and like the limestone before noted, constant only in inconstancy.

Bald hill, a mile north of Yountsville, is a picturesque spot, by barometer 110 feet higher than Crawfordsville and 190 feet above Sugar creek, which washes its base. A fine view is enjoyed up and down the valley of the creek and its

tributaries. Four miles away the steeples of Center church, the City school house and Wabash college are plainly seen in relief against the blue sky. The top of the hill and adjoining knolls are covered with well assorted fluviatile sand and fine gravel; plainly indicating the high water line of the ancient river which flowed by here to the west before its course was obstructed by the glacial flow and ice dam from the north.

At Hemlock bluff, less than half a mile below the village, there is a good exposure of strata, giving one of the best sections in the county.

## SECTION AT HEMLOCK BLUFF.

	Ft.	In.
Sandy loam with hemlocks.....	33	00
Siliceous limestone, with <i>Spirifera</i> and <i>Producta</i> .....	4	00
Blue carbonaceous shale.....	4	06
Red ferruginous limestone, with <i>Spirifera</i> , <i>Producta</i> , plates of crinoids, <i>Pentremites conoideus</i> , <i>Nautilus</i> <i>Coxi</i> ?, and <i>Trilobites n. s.</i> .....	2	06
Concretionary sandstone.....	6	00
Blue and gray shale, with plates of sandstone, the partings marked with vermiform fucoides.....	75	00
	<u>125</u>	<u>00</u>

Continuing to descend with the stream, the limestone, just noted, near the top of the bluff and 80 feet above the creek, at the mouth of Offield creek approaches low water and is seen as two pockets, the first is 60 feet wide and 5 feet thick in the middle with wedge shaped terminals to northeast and southwest; the second, 150 feet wide and 15 feet thick, similarly wedged out. Both are crowded with a conglomerated mass of crinoid stems; enough remains to have constituted millions of individuals. The stems were disjointed, and in many cases crushed as if a burial ground, on which their descendents lived, flourished and perished when some tidal wave swept away their plumed heads and feathery armatures, leaving the heavier stems with the *Producta*, *Spirifera*, *Platyceras*, etc., who clung to the superior race or nestled at their bases. The latter

shells, with bryozoans were but slightly injured or well preserved.

Clark's mill is driven by the whole power of Sugar creek. The dam is built upon a solid rock bottom and is completely effective. It comprises a saw and grist mill, the latter with two run of buhrs.

From Clark's to Bodine's mill a blue siliceous shale and sandstone forms the bluff of the valley and apparently dips to the southwest, in localities, at the rate of 30 to 40 feet to the mile; but this dip is local and unreal and is rather the result of false bedding built up against eroded banks and irregularities in the bottom of the subcarboniferous ocean. The siliceous shales are probably equivalent to the St. Louis beds, judging from stratigraphic reasons alone, as not a fossil was found in place except the vermiform impressions attributed to fucoides which are seen continually from the bottom of the Knobstone throughout the whole subcarboniferous period and in the coal measures. The muddy bottom of this ocean and the impure nature of the water were not suited for animal life or the preservation of the remains as fossils.

Commencing at the top of the Hemlock bluff a mere layer and increasing to the southwest to a thickness of 20 to 40 feet at the "Shades of Death," is a soft, yellow, heavy bedded sandstone, which, for reasons similar to those just stated, and from close resemblance to the same beds in Orange, Lawrence, Owen, Putnam and Warren counties, are referred to the Chester group. This stone is well and regularly laminated, except where the strata are tilted against and over humps and ridges in the floor of the sea. It is generally argillaceous, weathers buff or gray, and contains many nodules or hollow balls of ironstone. A great many bluffs on this division of the creek guard the narrow valley with precipitous sides covered with clustered wreaths of beautiful evergreens.

Half a mile above Bodine's Mill the west bank presents a nearly perpendicular face, along which pebbles came leaping and bounding as if from an ambuscade of boys.

## SECTION AT BODINE'S MILL.

	Ft.	In.
Yellow ferriferous sandstone, Conglomerate.....	30	00
Gray and buff laminated sandstone stained with iron, Chester and St. Louis.....	75	00
Silico-argillaceous shale, Keokuk.....	25	00
	<u>130</u>	<u>00</u>

On the Boo farm, half a mile north of the mill, pieces of float coal are washed out by the brook, and on the Ammerman farm adjoining, a small pocket of coal was opened, indicating the level of coal A. Descending with the stream, steep, rugged hills inclose the narrow valley, forming wild and romantic scenery.

Half a mile above the mouth of Indian creek, are the "Shades of Death." Clifty, a small brook, after turning upon itself, Sugar and Indian creeks at all points of the compass, flows into the latter forming a labyrinth of promontories, precipices and look-outs. The valley of the insignificant brook will not average over 100 feet in width, but is cut down into the soft, shaly sandstone to a depth of 140 feet. The sharp, narrow promontory is approached by a narrow causeway and ingress or egress is limited to a few favorable spots. On Indian creek the rocks are regularly laminated, but along the smaller brook the dip is quaquaversal. At the mouth of Clifty the upper rocks are heavy bedded or massive and ferruginous, weathering yellow or brown. The hard, ferruginous partings and concretions disintegrate more slowly than their rocky matrix and stand out in relief like magnified swallows and hornets nests, and are occupied in the nesting season by swarms of birds. The sides and slopes of these sharp hills and promontories are covered with a thick growth of evergreen hemlocks and cedars, and the tiptop hights with pines which lift their plumed foilage 200 feet above the brook, averting the sun's rays and filling the deep chasm with a gloom typical of the "valley of the shades."

Just below the mouth of Indian creek, the heavy bedded



sandstone comes down to the waters edge. A massive layer projects twelve feet, overhanging the deep channel 10 feet below. The sides retain the erosive moldings which record the ancient stand points of the stream. A symmetrically rounded buttress is a prominent feature and is known as the "pulpit rostrum."

Canine & Deer, on southeast quarter, section 2, township 17, range 9, secure the power of Sugar creek by a tight dam fitted to the solid rock bottom, to drive their saw and grist mill and woolen factory. The latter is supplied with the best new machinery and does a sale and custom business amounting to \$20,000 per annum.

#### SECTION AT CANINE AND DEER'S MILL.

	Ft.	In.
Soil and gravel.....	15	00
Coarse, heavy bedded, Conglomerate sandstone.....	15	00
Black, shaly soapstone, (place of coal A?).....	3	00
Ferruginous Chester sandstone, honey combed with pockets and recesses in which swallows, martins and pewees nest.....	8	00
Concretionary sandstone, with ironstone nodules....	45	00
	<u>86</u>	<u>00</u>

The Silver Cascade and Buzzard Rookery are a mile and a quarter below the mill, or five miles north of Waveland. Little Ranty, flowing from the south, approaches in a flume-like passway cut 50 feet deep in heavy sandstone, and thence rushes in a filmy sheet 45 feet down an almost perpendicular bank of dark shale, like an endless ribbon with warp of silver and woof of sparkling crystals. The cascade is nestled away in an amphitheater, 200 feet in diameter, crowded with shrubs, ferns and tenderest wild plants, here untrodden and unseen. Travelling ferns\* creep over and cling to the ragged masses of tufa, which guard the narrow entrance from the eye of the careless observer. More than a hundred feet above, tall oaks and pines,

\**Camptosorus rhizophyllus*, Link, erroneously designated by the writer as *Lygodium*, in Ind. Geo. Rep. 1874, p. 236.

encircling the rim, swing their branches together across the cove and chasm.

The scene is worthy a visit by the stereoscopist for a view, equalling, in spring and winter, the wildest beauty of the mountains. At the "rookery" all the buzzards living within 10 or 15 miles, meet each summer evening for information, converse and mutual assistance. The fact is mentioned as an evidence of the social instinct of this bird.

From this locality west, the conglomerate sandstone caps all the elevated region outside of the valleys and forms the surface rock. A few unimportant outcrops of coal A were visited. They are insignificant pockets, in no place exceeding a few inches in thickness. It is hopeless to expect this or any other seam of coal to present a workable thickness in a region, so near as the rim of the basin, where coals, as a rule, are always thin and barren.

A list of the carboniferous fruits found on Col. Budd's farm, four miles northwest of Waveland, is already given in the description of the general section. At and near Scott's mills a very ungeological confusion of coal measure and subcarboniferous strata is seen on the west side of the creek. As the station is extra-lital, discussion is unnecessary.

Alamo is the most elevated point visited in the western part of the county. The citizens bear evidence of the salubrity of their vicinage in their stalwart frames and energy of character. From this place the drainage is to every point of the compass, by Sugar, Mill and Coal creeks and their tributaries. South of the village, obscurely parallel lines of low knolls, extending in nearly an east-west course, were observed, with depressions and shallow crevices intervening with spaces of from 80 to 150 yards. They are referred to the glacial age, and seem to indicate the time when the retiring ice foot rested against the elevated spot; each winters expansion pushed up the little line of mounds before the ice, which, melting in the summer, would leave depressions in the muddy surface. In the decadence of the glacier, the recession of summer always exceeded the winter thrust, hence it is possible that these

insignificant knolls may record, by the intervening spaces, the rate at which the glacier foot was annually withdrawn.

Adjoining the village to the north and east, were noticed some conical cavities of large size which were, probably, the remains of waterways, entirely filled up at the same period, with the exceptions now mentioned. These phenomena are worthy of more time and study than could be spared in a hurried examination.

In passing north from Alamo to Wesley, a remarkable set of valleys exist, evidently once the channel of a large stream, but now drained by small brooks. Some of these extend from the waters of Sugar creek across the divide, and connect with the branches of Mill and Coal creeks, while a great number suddenly terminate, obstructed or filled with boulder clay, covered with hard-pan silt. Barometric observations discovered two such outlets, which, the citizens inform me, were uninterrupted, and the highest elevation in which was not greater than the top of the terrace gravel on which Crawfordsville is built. Wells put down at several stations in these ancient valleys, pierced beds of sand, fine gravel and mucky clays, proving that formerly they were the channel of a rapid flowing river, now largely filled up. These valleys were formerly or are now morasses; one known as Wild Cat swamp is said to be an almost impassable quagmire. Another contains a lakelet of about 30 acres, known as Fruit's cranberry pond, in which wild cranberry vines still grow and yield good crops. The proprietor, Mr. George Fruits, was one of the pioneers in this region; he is now one hundred and nine years of age, and still retains his strength and faculties in a wonderful degree.

Waynetown is a thriving village situated on the south bank of Coal creek on the I., B. & W. railway. It is surrounded by a wide area of gently undulating land of loamy soil, rich in calcareous matter and remarkably fertile, producing extra crops of corn, wheat, oats and grasses. Clover makes unrivaled growth. The extraordinary condition of the soil is due to fluvial currents, which, in former ages,

had passage over this region, sorting and modifying the boulder drift and enriching the residual material with calcareous detritus eroded from the limestone outcropping to the east and northeast.

The forests of stately poplar, walnut, oak, sugar tree, beech, etc, which once covered this region have generally given way to the agriculturist, but some fine groves survive to tell of their former greatness.

Going west from the village down Coal creek, the following strata are seen in outcrop within a distance of two miles; the lower rocks successively dipping and passing from sight beneath the higher and more recent beds.

#### CONNECTED SECTION AT WAYNETOWN.

	Ft.	In.
Soil and drift.....	10 to 50	00
Conglomerate sandrock.....	25	00
Place of coal A—shale.....	8	00
Chester shale.....	12	00
St Louis limestone in bed of creek, near town.....	3	00
Siliceous shale.....	7	00
	<hr/> 105	<hr/> 00

The above limestone contains a few characteristic St. Louis fossils, as *Pentremites conoideus*, *P. Woodmani*, *Spirifer striatus*, *Rhynchonella mutata*, *Zaphrentis spinulosa*, *Aulopora gigas?*, *Euomphalus laevis*, a *Conularia* with disjointed stems and plates of Crinoids and a few shark's teeth.

The Conglomerate sandrock is well developed just beyond the county line. On the farm of C. Brant, two miles west of the village and a half mile south of the railway track, a bed has been opened which presents an excellent white, gray and buff sandstone, fire and weather proof, and worthy the attention of builders, for piers, foundations and strong hammered masonry. This bed ought to command a switch from the railway, as it would be advantageous in reconstructing the road, and probably add largely to its freight

trade. The top of this (Brant) quarry stone, for a quarter of a mile along the creek, has been planed to a level surface by glacial action, and presents one of the best examples of this grand phenomena, of the ice age, that may be seen in the State. The planished surface is marked with delicate striae, recording the direction of the flow.

The northern part of the county is notably a prairie region deeply covered with boulder drift; no rocky outcrops are visible. The prairies are level or gently rolling and are skirted by forests and dotted with island groves. In a state of nature the great plains, covered with rank waving grass and wreathed with vernal flowers of every hue, was a scene of grandure and beauty. Now the scene is changed and invested with higher practical interest. The whole expanse has been brought under cultivation or laid down in grass. With a soil that under forty years close cropping still exhibits no lack of fertility, the cereal productions rival those of the most favored localities. The soil is especially adapted to the growth of grasses and grazing, and the farmer of the future will give greater attention to this, the most profitable branch of agriculture. The neat towns and cross-road villages in the prairie region, indicate the thrift and prosperity of the inhabitants.

Linden, on the Louisville & Chicago railway, already puts on city airs in the completeness of its shops and residences. It is surrounded by beautiful, broad prairies, in which great corn and wheat fields, and meadows and grass lands, dotted with white cottages and stately mansions may be seen in every direction. In the western suburb is a chalybeate spring. The drainage water, in passing through beds containing pyrites, takes up the iron in solution, which on exposure to the air is deposited as flocculent sediment of brown and red ochre. The village is almost directly on the great trail or dyke of boulders which may be traced a long distance to the northwest, and is a constant feature in a southeasterly direction. On knolls and ridges the ground is covered with rounded masses, one to four feet in diameter, of black or red crystalline rocks, imported on the glacial

raft, from the extreme north. At depressions and valleys, the boulders are less numerous, although the trail is still plainly discerned, hinting the possibility that such depressions contained sufficient water to float the ice which dragged slowly and with much resistance over the higher knolls.

The phenomena observed in relation to Lye and Black creek swamps, are mentioned under the head of recent geology. It has been determined by a line of levels, that a cut of only eight feet would return the drainage of these swamps to their ancient channel, via Black creek. Wells put down in these swamps pierce the following lacustral beds without finding bottom :

## SECTION IN LYE CREEK SWAMP.

	Ft.	In.
Peat and muck.....	3	00
Yellow clay.....	2	00
Quick sand—silt.....	10	00
	<u>15</u>	<u>00</u>

Darlington is one of the most considerable villages in the county. It is located upon a gently rolling bluff on the south side of Sugar creek, and on the line of the Logansport and Southwestern railway. The citizens are intelligent, energetic, and noted as firm friends of education and progress.

The higher divides between the streams are composed of unmodified glacial drift. Such clays are cold, tenaceous, and require underdraining for profitable growth of the cereals, but are well adapted to meadows. The terrace plains along the streams and creek bottoms are very fertile. Large forests of valuable oak timber survive, which are prepared for market by the mills that abound on Sugar creek. They are an important source of income. The boulder trail, already mentioned, passes just west of the village. It is an interesting feature in the surface deposits of this region. Fragments of Devonian black slate are frequently met in drift, and in a well sunk on Dittemore's farm, it was reported found in place. On Asa Dittemore's

land, northeast quarter, section 7, township 19, range 3, a thin Keokuk limestone was quarried for the piers of the Darlington bridge. The following strata were observed:

#### SECTION NEAR DARLINGTON BRIDGE.

	Ft.	In.
Soil and drift.....	25	00
Limestone, hard, ferruginous.....	0	08
	<u>25</u>	<u>08</u>

Lye creek flows into Sugar creek a few miles below town. The bed of the stream is upon blue and gray shales and sandstones of the Keokuk age, in which a few interesting fossils have been found. Ascending Lye creek a short distance, the eastern bluff contains a thick band of laminated yellow and red limestone, which is quarried for foundations. The following strata were noted:

#### SECTION NEAR MOUTH OF LYE CREEK.

	Ft.	In.
Surface loam.....	6	00
Yellowish red limestone, containing <i>Productus cora</i> , <i>P. punctatus</i> , <i>P. muricatus</i> , <i>Spirifer striatus</i> , S. (indt.) crinoid stems and plates, disjointed, and fish teeth.....	9	00
Blue and green siliceous shale with <i>Zaphrentis</i> —, <i>Loxonema</i> , and <i>Euomphalus</i> .....	8	00
	<u>23</u>	<u>00</u>

Ascending Lye creek, on Isaac Rich's land, southwest quarter, section 1, township 19, range 4, is an outcrop of quarry limestone four to eight feet thick. Beneath it, some twelve feet, are a number of those pockets or dykes (here of sandstone) which were considered characteristic of the Keokuk beds, and as indicating the mode of their deposit. These dyke bands are from four to eight feet thick with strike from northwest to southeast, but only 30 to 60 feet wide, and are evidently the result of tidal waves sweeping up the shelving bottom of the ocean whose shore line was to the northeast and here, breaking on the bottom.

## SECTION ON LYE CREEK.

(Rich's Farm.)

	Ft.	In.
Soil, etc.....	5	00
Crinoidal limestone, ferruginous, laminated.....	8	00
Gray shaly sandstone.....	12	00
Dyke pockets of sandstone in blue shale, 0 feet to	8	00
Blue aluminous shale .....	4	00
	<u>37</u>	<u>00</u>

Just above, the creek passes over a floor of limestone inclined so as to partially dam the stream. Many crystalline rocks and boulders are seen in the channel at this point, and on the land of Mrs. J. Naylor, Mr. Edwin Cadwallader has collected several dollars worth of gold in flat scales, each pan showing "color." The shales in the low bank of the creek are crowded with fossils in nests, showing well preserved *Productus*, 3 sp., *Spirifer striatus*, valves of *Hemipromites crenistria*, three inches long, with *Chondrites*, *Caulerpites*, and vermiform fucoides.

On the farm of Jesse Winters, same section, the bed of Lye creek is strewn with a wonderful number of giant boulders; great, black, hornblendic monsters are heaped up with white granitic masses of crystalline rocks, which give in epitome the story of the glacial age, and explain the great thickness of the ice mass that could tear such rocks from their quarry-beds in the distant Arctic regions and transport them over a thousand miles to this spot, and the irresistible power which ground, planed and polished such obdurate materials, like mere trifles in the hands of a giant; for many of the boulders are from five to eleven feet in diameter. Still more explicit is the story told by the deeply covered native rocks. Wherever exposed by stripping, it is found that all the surface rocks over an area of miles, was plowed down, leveled and polished by the ice. Fine striæ, plain and delicate, as if the work of yesterday, point out accurately the direction, south 8° east, of the flow. Letters and words could not speak more intelligently. It is the finger of God recording on the



rocks forever, the wondrous story of nature's re-constructive and reparative agencies used in preparing a barren world of rocks for occupancy by animated nature.

The Keokuk limestone on this farm is oolitic, or composed of myriads of minute concretions like the roe of fishes and so compact as to perfectly preserve the evidence of the glacial phenomena. By the kindness of Mr. Winters and his son Jonathan, we were enabled to see these phenomena at widely separated stations and under favorable circumstances.

#### SECTION AT WINTER'S FARM.

(Oolitic limestone bed.)

	Ft.	In.
Soil and fluviatile drift.....	5	00
Glacial drift, with polished boulders and gravel.....	10	00
White Oolitic limestone, with many crinoid stems and plates, and <i>Athyris Royissi</i> , <i>Hemipronites crenistria</i> , <i>Productus punctatus</i> , <i>P. cora</i> , <i>Spirifer striatus</i> , <i>S. Wheeleri</i> ?, <i>Platycrinus Saffordi</i> , and <i>Synbathocrinus robustus</i> .....		06
Blue ferruginous limestone with same fossils and <i>Syringopora</i> .....		06
Siliceous limestone, red.....	1	06
Irregular yellow sandstone.....	4	06
Blue shale.....	2	00

The boulder trail already mentioned is a very prominent feature in the topography of this neighborhood; in some places the great rounded masses are thickly strewn, so as to almost cover the ground, in a band from a quarter to a half mile wide, and in many places show such uniformity in appearance as to suppose a common origin from the same quarry bed. At several stations wells have been put down in the trail, generally finding, at a depth of 10 to 20 feet below the surface, a bed of silted quicksand. This is especially the case at depressions in the surface, and seems to indicate that at such places the ice was floating as bergs in the water at the time the boulders were cast off.

According to the bores put down at Stover's mill, before mentioned, the Devonian black slate ought to be found

near the bed of the streams in this part of the county. In John Hewlet's well, on southeast quarter, section 8, township 19, range 3, several fragments of this rock were found and examined. The level clay lands between Lye and Sugar creeks were originally covered with a heavy growth of oak timber. The soil is compact and tenaceous, and may be greatly benefited by underdraining.

The valley of Walnut creek is wide and contains a large area of rich and highly productive land. It is a valley of erosion and owes its origin to the excessive precipitation which occurred about the close of the glacial epoch, when all our creeks were rivers. A tell-tale monument, of this time and the concurring phenomena, exists in the shape of a sharp conical mound, two miles west of Shannondale. It is situate on the Sutton farm, northwest quarter, section 34, township 19, range 3, in the midst of the broad valley plain of an insignificant brook, and is 90 by 100 feet in diameter and 40 feet high. It is symmetrical in shape and sharply conical. The boulders on the summit and sides, show that it once was part of the great glacial drift, which at one time covered the surrounding region, as deep or deeper than the mound is high, but since eroded, save this mass.

Beckville is situate on the flat, level summit of the glacial drift. The soil of this region is black and often mucky; the drainage is by the south branch of Walnut into Sugar creek. The village is on ground 95 feet higher than Crawfordsville.

Valley City, or New Ross, is a bright, gay village on the I., B. & W. railway, at the crossing of the proposed Anderson & Lebanon railroad, already graded. The eastern side of the county is generally level or slightly undulatory; the surface slopes gently, without bluff, to Walnut and Raccoon creeks. It was originally clothed with a magnificent growth of forest trees, including black walnut, poplar and oak of from three to six feet in diameter. Since the completion of the railway the timber from single acres has been sold at from 30 to 70 dollars. The most valuable trees are gone; some white and burr oaks survive, with much sugar,

beach, elm, linden, sycamore, cottonwood and willow. The soil is due to fluviatile action, and is generally enriched by a large admixture of lime from the underlying rocks, long since torn and ground up by water courses. It is fertile, and produces good crops of grain. The grasses delight in this soil and grow with unrivalled vigor.

At a cut on Squire Jessee's farm, exposed by the recent floods, the thread-like roots of blue grass were observed fringing the bank and which had penetrated the warm soil to a depth of two and even three feet. A short distance north of the village, on the land of J. B. Jessee, southwest quarter, section 36, township 18, range 3, the Keokuk limestones are exposed in the bed of Raccoon creek, and are quarried for foundations, etc. It is compact, almost wholly of crinoid shells, conglomerated together in wonderful profusion and confusion, with *Spirifer striatus*, in nests, and *Producta*, *Hemipronites* and *Platyceras*. Notwithstanding the immense number of crinoid stems, amounting to billions of individual crinoids in a single acre, the heads of the animals and the tiny light fingers and tentacles were almost wholly removed; but a single head of *Platycrinus Saffordi*, was found.

On the same farm, half a mile below, a lower bed of argillaceous limestone, about two feet thick, is quarried for building purposes. It contains the same fossils found in the upper bed, but in better preservation, indicating that the animals had lived and died on the spot, and had not been subject to the wear and tear of transporting agencies. A valuable bed of excellent gravel was here seen. It is a treasure for road making, and insures to the vicinity the social refinement, civilizing influences and prosperity, consequent upon good roads. Descending with the creek to the southwest, on the farm of Isaac Baker, northeast quarter, section 3, township 17, range 3, the upper crinoidal limestone was the low bluff of the creek. The stone is a mass of disjointed stems of crinoids slightly cemented together in a confused mass, from 6 to 9 feet thick. This innumerable host gives a hint of the vigorous life that thronged the

ancient sub-carboniferous ocean, below whose waves these rocks were formed. In the adjoining bed of the stream a blue argillaceous limestone is quarried, containing fine specimens of *Spirifer striatus*, *Hemipronites crenistria*, *Productus punctatus*, *P. cora*, *P. semireticulatus*, *P. costatus*, *Platyceras equilatera*, and *Aulopora gigas*. A short distance below, at the old mill dam, beds of shale and argillaceous sandstone replace and cover the foregoing limestones. All the rocks just mentioned and seen exposed in a space of two miles and a half along Raccoon, brought together in vertical section, give the following stratigraphic exhibit:

## SECTION AT VALLEY CITY.

	Ft.	Ft.	In.
Soil .....	20 to	10	00
Argillaceous sandstone.....	0 to	3	00
Crinoidal limestone.....	3 to	9	00
Blue argillaceous limestone.....	2 to	4	00
Blue shale, in creek.....		10	00
		<u>36</u>	<u>00</u>

The crinoid limestone is composed wholly of animal remains, and the possible presence of the phosphate of lime would suggest the use of this stone, after burning, for manure. The amount of phosphorus may be only a small per centage, but it is found that even homeopathic doses of this mineral have a powerful sanitary effect upon the soils.

Ladoga is one of the most prosperous villages in the county—the buildings are in good repair and well painted, and the gardens and grounds neat and tastefully adorned with shrubs and flowers, indicative of an orderly, intelligent and happy community. Several superior stone and other business houses indicate a well sustained trade, while churches and substantial school houses prove that the mental and moral training is not neglected. It also contains saw, grist and planing mills, shops for the manufacture and repair of wagons, carriages, agricultural implements, etc. The large woolen mills of Harney, Thomas & Co., are propelled by a steam engine of 80 horse power, with surplus steam

for dying and scouring. The machinery consists of two sets of wool carders, two spinning jacks and fifteen looms with the complementary apparatus for making flannels, jeans, cassimeres, blankets, broadcloths, etc. Their fabrics are honestly made and justly bear a good reputation. Their annual product is \$30,000 to \$40,000.

The country is still ahead of the town. The farms are well arranged and on every hill and knoll are seen white cottages or stately mansions which rival in comfortable appointments, our city residences. All these are but an index of the sure returns awarded to the industrious husbandman by the rich surroundings. The soil is a deep calcareous loam and produces, with certainty, good crops of wheat and corn but is especially suited to the growth of the grasses. The native blue grass is a mine of safe reliance; in a few years it forms a dense sward, and in product, equals the most favored region. This country was originally covered with a splendid growth of large walnut, poplar, ash, beach and sugar trees. The forests have been utilized or destroyed, giving place to productive fields and pastures. Some of these giants of the forest survive, crowned with the frost and glow of nearly a thousand years; and right royal do they appear in their massive strength and prominence that has so long defied time and storm; many groves of sugar, beach, poplar, etc., are preserved, and, at the time of my fall visit, no scene in fairy-land could exceed the brilliant beauty of their foliage, the leaves, ripened by the mellow warmth of autumn, had been just touched by frost, and blushing, wreathed the sober hues of nature in a quivering veil of colors borrowed from the rainbow. The scene was of enchanting interest, and the sight would fully pay the cost of a visit by European tourists who, in their own land, may not enjoy such specimens of nature's painting.

A short distance east of town is the first rocky outcrop exposed between that place and the old mill dam near Valley City. At the railroad bridge the following exposure is noticed.

## SECTION AT RAILROAD BRIDGE, LADOGA.

	Ft.	In.
Soil and drift.....	8	00
Gray shaly sandstone.....	18	00
Blue argillaceous sandstone in heavy beds..	4	00
	<u>30</u>	<u>00</u>

At the wagon road bridge, about ten rods west of the last mentioned locality, a strange and sudden change occurs in the stratification, indicating the versatile and inconstant nature of the ancient sea that deposited these rocks, and which, considering the regular lamination of the surrounding strata, may not be intelligently explained without calling in requisition a strong tidal wave of great velocity sweeping up against shore line shallows, or driving up an estuary or bay with current and force sufficient to carry coarse sand and pebbles. Intercalated with the ordinary rocks is a bed or dyke of pebbly conglomerate, eighteen inches thick, but which wedges to sharp edges within a width of thirty feet, crossing the valley from north to south with the strike of the rocks.

## CONGLOMERATE SECTION AT LADOGA.

	Ft.	In.
Soil and drift.....	6	00
Gray shaly sandstone.....	12	00
Pebbly conglomerate.....	0 to 1	06
Blue pyritous sandstone, with fucoides, in creek.....	4	00
	<u>23</u>	<u>06</u>

Similar beds of shaly sandstone were seen on the farm of Daniel Graybill, northeast quarter, section 27, township 17, range 4, five miles southwest of town. No fossils were seen except the common vermiform fucoid. The blue shales contain much pyrites, which on exposure decomposes and incrusts projecting rocks with an efflorescence of copperas (sulphate of iron). The same mineral, mixed with earth and gravel, produces chalybeate sulphur springs.

The site of the former Indian village, north half, north-east quarter, section 34, township 17, range 4, known as "Cornstalk town," was visited. In 1828 a remnant, some 20 families, of the great Miami nation dwelt here and cultivated in corn and pumpkins a field of 14 acres. On old maps the great war trail, from Vincennes to Thorntown and the Mississinewa, passed through this spot. Chief Cornstalk was a brave, faithful friend of the whites, and was respected and obeyed by his tribe. The kindest relations existed between the races. The white children were frequent and welcome visitors, enjoying the hospitality, sports and chase of the Indians, and were held in such kind remembrance that after an absence of 30 years they were at once recognized and hailed as brothers by their old friends in their new western home.

A dividing ridge from 100 to 150 feet higher than Ladoga, separates the water shed of Raccoon from that of Indian creek. The ridge is well marked, with often a sudden depression on either side. At several places mentioned by Col. J. H. Harney, the northern and eastern slope exhibits a shore line containing wave-washed sand and gravel. To the north and west, occupying an area of 40 or 50 square miles in the centre of the southern part of the county, is the level basin inclosed by the shore line ridge. The surface shows a black mucky soil, resembling that of the grand prairie of the western part of the State. It is level or very gently undulating, so that, in the first settlement of the county, it was, in parts, known as the "Black Swamp." Going northwest, toward the centre of the basin, several other shore lines of sand are reported, marking where the retiring water line was, for a period, stationary. The wells are shallow but penetrate beds of quicksand, fine gravel and mucky silt, containing trunks and branches of trees, all more or less laminated and so plainly the result of deposits from still or currentless water, that its lacustral origin seems obvious. Acknowledgements are due to Col. Harney, for much information and for facts in relation to these phenomena, who first

called attention to, and has investigated the subject with care. The containing ridge at the south, near Raccoon, is a sharp and narrow reef of limestone, which, during the later period of the drift, was sufficient to retain and deflect the rain fall of this basin by Indian creek to Sugar creek and the west.

Parkersburg, near the south line of the county, being without facilities for transportation, is a still and quiet village. The highest hills and ridges are capped with lime and sandstones of the Chester group. Near the water level in the brooks and creeks are plates and bands of some thickness containing a few characteristic fossils of the St. Louis limestone, while in the bed of the streams Keokuk rocks generally prevail. The limestones of each group are largely thickened up, compared with those in the northern part of the county, giving room to "sink-holes," so constant a feature in the southern part of the State, where these rocks are so grandly developed. They, in turn, receive and concentrate the rain-fall, giving rise to pure springs. An example is seen in the centre of the village, which supplies the citizens with pure, cold water.

The southern part of this and adjoining parts of Putnam county are specially adapted to the growth of blue grass. It is settled by an energetic class of Kentuckians, who have devoted large areas to the growth of this favorite grass. They delight to call their Indiana home "New Kentuck," and fondly hope to assure old associations by forming a new county with the familiar name of Bourbon, so full of pleasant memories.

The southwest part of the county is a broad valley plain, with gently undulating or rolling surface, drained by Big and Little Raccoon and their numerous tributaries. In the course of the long period in which these creeks have been engaged in excavating their thoroughfares in this water-shed, they have naturally traversed and modified nearly the whole surface deposits of this plateau; consequently the soil, a strong calcareous loam, is equal if not superior to any in



the most favored spots in the county, and rewards the farmer with full crops and sure returns. Waveland, on the Logansport, Crawfordsville and Southwestern railway, near the crossing of the proposed Lebanon, Anderson and St. Louis railway, is the trading centre of this district, and as might be expected, fully reflects the wealth and prosperity of its tributary district, in return. The village, with citizens strongly imbued with puritanic rectitude, has exerted a conservative moral influence, by example as well as precept, on the surrounding community. Good schools, good churches and general intelligence are characteristic. The Waveland Institute has given thorough academic instruction to many of our best college graduates. Temperance is absolute; for the title of town lots is guarded by wholesome covenants forbidding the traffic in intoxicants, under the penalty of forfeiture. Two miles southwest from the village is a thin outcrop of Chester and St. Louis rocks on the McIntire and Milligan farms. These beds are quarried by stripping, to supply the local demand for cellar walls, foundations, etc.

## SECTION NEAR WAVELAND.

(Connected.)

	Ft.	In.
Soil and glacial drift.....	25	00
Eroded fragments of conglomerate and quartzose fire-clay.....	4	00
Laminated limestone, with <i>Zaphrentis spinulosa</i> , <i>Pro-</i> <i>ductus cora</i> , <i>P. punctatus</i> , <i>Spirifer striatus</i> , <i>S. lineatus</i> , <i>Athyris ambigua</i> , <i>Hemipronites crenistria</i> , <i>Chonetes</i> , <i>Pleurotomaria</i> , <i>Syringopora</i> , crinoid stems and branches of ferns.....	3	00
Blue, hard limestone, with <i>Bellerophon levis</i> , <i>Retzia vera</i> , <i>Pentremites conoideus</i> , and a radiate, inedit.....	2	00
Blue shale.....	4	06
Sandstone at Jarvis'.....	2	06
Shale.....	7	00
	<hr/>	<hr/>
	48	00

The new radiate in the foregoing section was kindly presented to the writer by Mr. Z. M. Ball, druggist. It is

unique, and though not sufficiently cleaned for determination appears to be related to the genus *Melonites*, but more closely allied to *Oligoporus* or *Lepidesthes*, and is probably generically and specifically new. The state of preservation is unusual, for even the small spines or tentacles which cover the interambulacreal plates are well preserved.

Passing down Little Raccoon, the cherty limestone quarried at Milligan's is seen in the bank and bed of the stream. It is remarkable for frequent variations in its quality and physical constitution, changing first to siliceous limestone, then to sandstone and finally passing into heavy-bedded limestone, with intercalations of chert, as at Oldshoe's quarry.

#### SECTION AT ROBERT OLDSHOE'S QUARRY.

	Ft.	In.
Soil and drift .....	6	00
Blue and gray Chester limestone in laminae, with <i>Pentremites pyriformis</i> , <i>Productus cora</i> , <i>P. punctatus</i> , <i>Spirifer striatus</i> , <i>Zaphrentis spinulosa</i> , Bryozoans well preserved and many <i>Syringopora attenuata</i> .....	10	00
Soft buff calcareous sandstone passing into limestone .....	9	00
Heavy bedded, cherty, white and gray St. Louis limestone, with <i>Retzia vera</i> <i>Waldheimia</i> , <i>Rhynchonella mutata</i> , <i>Euomphalus laevis</i> , etc .....	5	00
Rumpled, blue, clinky limestone with <i>Syringopora</i> in reefs .....	3	00
	<u>33</u>	<u>00</u>

At the county line, on the farm of Capt. Jacob Oldshoe, is seen the junction of the conglomerate sandstone with the subcarboniferous rocks. The following outcrop was observed:

## SECTION AT CAPTAIN OLDSHOES'.

Southwest quarter, section 32, township 17, range 6.

	Ft.	In.
Soil .....	15	00
Gray, white, yellow and striped conglomerate .....	25	00
Irregular, false bedded conglomerate .....	5	00
Place of coal A .....		
Aluminous shale with pockets of <i>Kaolin</i> (Indi- anite) .....	0 to	1 06
Good hematite .....	0 to	2 00
Aluminous shale .....	3 to	0 00
Laminated limestone with partings of clay .....	15	00
Siliceous clay .....	2	00
Heavy bedded gray and white limestone with <i>Zaphrentis</i> .....	8	00
Laminated limestone in plates, to the brook .....	2	06
	<hr/> 74	<hr/> 00

Several beds of good iron ore (hematite) were visited on this farm and specimens secured for analysis. The Kaolin, on chemical test, proved equal to the best, and, although the bed seen is not considerable, further search for this valuable porcelain clay is invited by this presentation, as it is found in extensive deposits, at this horizon, in other parts of the State.

## ARCHÆOLOGY.

The general absence of earth-works in a productive region like this county is significant. It indicates that the social instincts of the Mound Builders located their permanent towns and villages only on streams susceptible of navigation by canoes, etc., and allows the presumption that in this remote period the chute at the canyon-like "Narrows of Sugar creek" was an obstacle too dangerous for this quiet and peaceful race to brave. One mound of doubtful origin was seen in the valley, in the west part of Waveland, and a cluster of low mounds was mentioned by J. M. Rice, Esq., on the north bluff of Sugar creek where it finally leaves the county. These, if true mounds, are only exceptions to the general rule—no mounds. Yet the

evidence of the presence and possession of this region by our earliest predecessors is full if not complete. In about every part of the county implements and ornaments wrought in stone are found, cut in good style by the most skillful artisans of the "Mound Builders age." In the cabinets of Rev. F. M. Symmes and Dr. T. D. Brown, were seen grooved stone axes with handle guards in relief, flint arrow and spear points and knives, gorgets, shuttles, pendants (plumb-bobs), spinerets, pipes, pestles, chisels, awls, five duck "totems" and one seal or Manatus "totem."

#### ECONOMIC GEOLOGY.

Lacustral and fluviatile drifts so largely prevail, that they give character to the soil of this district. These loams, enriched by admixture of local limestones, vary in constituents, and furnish soils well adapted to all the needs of a prosperous agricultural community, and which fully compensates for lack of mineral wealth. There are small areas of waste land that only require tile draining to render them immensely productive. Wheat is the principal cereal cultivated, but fair crops of corn and oats are produced, and the growth of forage plants may be equaled, but rarely excelled. After long years of cropping the original fertility of the soil may be restored in a few years by setting in clover. The apple, pear and quince are successfully grown and yield winter fruits in abundance. The small fruits, "native and to the manor born," are of superior quality and easy culture.

#### SCHOOLS.

Education has commanded the thoughtful consideration of some of the best minds of the county. Free schools are maintained in every neighborhood. All the towns and many of the villages have high schools and academies of good repute, affording facilities for a high grade of education, and Wabash College, with its extensive library, unrivalled geological and mineralogical cabinet, complete philosophical and chemical apparatus, years of experience

and large endowment fund, presents opportunity for a thorough collegiate course.

#### MANUFACTURES.

As yet the manufacturing industries are in their infancy, but a salubrious climate, cheap food, cheap homes, accessible coals and a ready market invite the attention of artisans.

#### WATER POWER.

The streams are fed by perpetual springs, and a fair supply of water may be relied upon, even in seasons of drought, with full supply for more than half the year. At least one half of this valuable power remains unused.

#### MEDICINAL SPRINGS.

Springs of great volume are not unfrequent. The chalybeate springs within the corporate limits of Crawfordsville have long been in use by the citizens, and their curative properties are well attested. They act as a laxative, febrifuge and tonic invigorator. Analysis by Dr. Thad. M. Stevens, of Indianapolis, found the following minerals in a pint of water :

##### *Vanderveer's Mineral Spring.*

	Grains.
Carbonate of potassa.....	0.018
Carbonate of soda.....	0.021
Carbonate of magnesia.....	0.478
Carbonate of iron. ....	0.077
Carbonate of lime.....	1.225
Chloride of sodium .....	0.088
Sulphate of soda.....	0.025
Sulphate of magnesia .....	0.915
Silicic acid.....	0.009
	<hr/>
	2.846

Carbonic acid and oxygen gases are held in solution which render the water agreeable to the taste.

## GRAVEL FOR ROADS.

Man is a social being, and the full enjoyment of these instincts demand facilities for intercommunication. There can be no full realization of civilization and Christianity without good highways, passable at all seasons of the year. The bond of union that sustained the Roman empire and civilized its subjects was its system of good roads that centered at the capital from every land. This county is supplied with vast beds of gravel, sorted by fluvial action from the glacial drift, and is the best material known for road making. It should be utilized.

## BUILDING STONE.

Limestone suitable for foundations and walls is found at irregular intervals; the quantity is limited and the quality inferior. The conglomerate sandstone, massive and heavy bedded, is grandly exhibited along the western side of the county. This stone comes soft from the quarry, but hardens on exposure; may be readily split or broken as desired by the workmen, and is fire and weather-proof. Blocks of any magnitude within the possibility of transportation may be obtained. Some of the beds south of Alamo and west of Waynetown contain good grits suitable for grindstones. A stone offering so many valuable qualities should be developed.

## CLAY.

Clay for bricks may be obtained in every neighborhood in the county. Other clays suitable for common crocks and jugs have been worked with satisfactory results, and examination has discovered deposits suitable for the manufacture of drain tile.

## TRANSPORTATION.

This county is favored with a pretty complete system of railways, which, crossing at Crawfordsville, radiate north, south, east, west, northeast and southwest. At least four other connecting lines are proposed, with some prospect for

their completion, one of which will place the city of Crawfordsville in direct communication with the coal fields of Fountain county, and give a decided impetus to manufacturing enterprise.

#### THANKS.

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