GEOLOGY OF POSEY COUNTY.

Posey county is the extreme southwestern part of Indiana. The seat of justice, Mt. Vernon, is 198 miles, and the farthest point, at the mouth of the Wabash, over 200 miles southwest from Indianapolis.

It was organized in 1814, contains 420 square miles, or 268,000 acres, and is bounded on the north by Gibson, east by Gibson and Vanderburg, south by the Ohio River and State of Kentucky, and west by the Wabash and State of Illinois.

These boundary streams are stately rivers, of nearly equal size at low water. The Wabash comes from the rich alluvial loams and clays of Northern Indiana, and the prairies of Illinois, loaded with manurial sediment; the Ohio, at overflow, brings the calcareous washings of its tributary streams, and is red with angry waves. At ordinary stages the latter is the "Belle riviere" of the French—the beautiful river of the early traveler; bright and blue in its clear almost crystal waves and royally crowned by a swan-like fleet of steamers trailing their smoky banners against the clear sky, it is attractive. From the hill tops it is a scene of active beauty, clearer, brighter and fuller of progressive energy than even the "Silver Rhine." Each of these rivers is belted with broad, alluvial plains, ranging from a narrow strip to five or more miles wide, with a soil of unrivaled fertility, excelling the boasted granaries of Egypt by the diversity of its productions. Corn, wheat and oats are cultivated, and produce crops never elsewhere equalled. All the fruits of a temperate clime are abundant, and textile plants have been and may be successfully grown. 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.

The drainage of the northern parts is by Black River. This stream, almost insignificant in its present volume, shows evidence that once it was a mighty river, broad alluvial bottoms bordering its sides, so much wider than a stream of its volume required, that it is plain at some early time—probably about the close of the Lacustral period, Patoka, or creeks(?) tributary to Pigeon, were discharged by this way. Big Creek drains the central parts and was formerly a mill stream of importance. Small streams flow from the southern areas to the Ohio. Many of these creeks flow through flat level plains, and have the muddy beds characteristic of the Loess soils.

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 100 to 200 feet, and average a height of 125 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, imported by fluviatile 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, and 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 peroxide of iron	2.80
Chlorine	.12
Loss and alkalies	1.55
	100.00

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 presence 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 "meadow lands," bordering the rivers and streams are due to causes now in action. Solid rocks, laminated or crystalline, compose the rock-ribbed crust of the earth. These, on exposure to frost, air and water, decompose or disintegrate, or, broken from their beds, are rounded, rolled, and, by the mills of nature, ground into clays, sands and pebbles by rushing water and waves. The finer particles, as clay and sand, combined with rich organic matter, form here the productive alluvial bottoms of a delta outrivaling the famous delta of Africa. This deposit is always found above or against the sides or excavated edges of older beds.

In deep shafts at Evansville, and at Henderson, Kentucky, a bed of fluviatile shells was found, at a depth of forty to seventy feet from the surface, so deposited as to indicate an era when the Ohio flowed at a bed that much below its present level; but, more wondrous, it showed an early period in the river's existence, reaching back to tell the story of life, and climate and time. These mollusks, then abundant here, were such as now are common in streams bordering the northern shore of the Gulf of Mexico; and as they could only exist in a sub-tropic climate, they prove that such climate prevailed here. They may be intimately connected with the following epoch.

LUCUSTRAL EPOCH.

The Loess or lacustral loams succeed in age. It was the epoch of great lakes or slow-flowing lagoons, with a warm climate succeeding the glacial time. These loams are an ash gray or brownish buff color, exhibiting, principally, an impalpable sand, with a small amount of clay. Sir Chas. Lyell, on his visit to this county, identified this deposit as the equivalent to the Loess of the Rhine, and he was enabled to know of the thermal conditions by the shells found abundantly at New Harmony as equivalent to that of Cuba or Mexico. These shells are listed in my report for 1870, on

Sullivan county, but here repeated for the benefit of those not having that report, viz.: *Macrocyclas concava*, Say; *Zonites arboreus*, Say; *Hyalina indentata*, Say; *Patula perspectiva*, Say; *Helicodiscus lineatus*, Say; *Pupa armifera*, Say; *P. fallax*, Say; *Strobila labyrinthica*, Say; *Stenotrema hirsuta*, Say; *S. monodon*, Rack.; *S. monodon var. fraterna*, Say; *Vallonia pulchella*, Muell.; *Succinea avara*, Say; *Valvata tricarinata*, Say; *Pomatiopsis lapidaria*, Say; *Helicina occulta*, Say.

Of these shells, *H. occulta* is of tropic life, and belongs to the latitude of Cuba and Mexico. Prof. Swallow remarks: "These lacustrine fluviatile and land species of mollusca indicate a deposit formed in a fresh-water lake, surrounded by land and fed by rivers; and refer back to a time when a large portion of this valley was covered by a vast lake, into which flowed various rivers and streams." The climate was tropic or subtropic.

The low, rounded hill-tops, constantly recurring, appear like tumuli, and are occasionally shaped by the Mound Builders for funeral purposes. The red, marshy clay, fat with shells of that epoch, forms a fertile soil along the shore line of the lagoon-like lake, characterized by a heavy growth of poplar, walnut, sugar tree, ash and post-oaks of giant size; the lower and more sandy member of the Loess, impervious to air and moisture, bears a growth of oak, hickory, gum, beach, dogwood, symbolic of the cold, close soil.

DRIFT.

Next in order of time succeeds the great ice age; a stratum of sand and gravel resting below the Loess, but upon or against the sides of older formations. It represents the sorting and sifting power of water in motion, each deposit being placed where the velocity of the current could no farther carry it; thus a ripple deposited gravel and bowlders, a slower current left banks of coarse sand, and, finally, slow eddy-currents made banks of clay and fine sand. At the base of the hills at New Harmony are beds of glacial material, indicating the sorting powers of the Wabash in its youthful vigor.

GENERAL GEOLOGY OF POSEY COUNTY.

The rocky formations of this county are classed as of the Upper Coal Measures. The surface outcrops exhibit two or three coal seams, with intercalated beds of limestone; above is the Merom sandstone, which, unconformable with the Coal Measure rocks, lies above them, and its coarse material demands a shore line of a mighty, surging sea for its formation. This rock is of later date and apparently of different conditions, and, perhaps, indicates that future students may find evidence to connect it with

Mesozoic times and possibly with the Triassic period. Cretaceous beds occur in adjoining regions of Kentucky and Missouri. Outliers are to be expected, and should be sought for, in Indiana.

GENERAL SECTION OF POSEY COUNTY.

The following general section is combined from the shafts, bores and explorations made from outcrops in eastern and northern parts or adjoining regions, and probably gives the unexplored strata of this county:

		Ft.		Ft.	In.
1.	Buff, brown, red and mottled shales	2	to	0	00
2.	Merom sandstone, soft, shaly, upper div.	20	to	25	00
3.	Merom sandstone, massive in quarry beds	10	to	30	00
3½.	Dark gray or buff shales and flaggy sandstones, with clay iron stones	10	to	20	00
4.	BROWN IMPURE COAL, 3d rash coal	1¼	to	00	00
4½.	Flaggy or 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
6.	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 alluminous, arenaceous or shaly, 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 *Chætetes*	8	to	5	00
21.	Gray or white shale, with nodules of ironstone and bands of sandstone	30	to	40	00
22.	Siliceous shale, passing to massive sandrock to south and west; Anvil rock? of Lesquereux and Owen	60	to	71	00
23.	Black slate and clod, with many animal 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			1	06
32.	Fire clay			2	06
34.	Siliceous shales and coarse massive ferruginous sandstone	90	to 120	00	
35.	Bituminous 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 nodular 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 Lower Carboniferous limestone.				
				833	11

PALEOZOIC TIME.

CARBONIFEROUS AGE.

Upper Coal Measures.

The following remarks (made after a careful and protracted study of the mines, outcrops, bores and shafts of Vanderburg county) are given here as the fullest show the writer has of the deep strata of Posey county, where, from the depth of the coal seams, extensive explorations have not been made. The section and deductions apply with full force to Posey county.

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 in thickness, occupy the hill-tops in the eastern 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 southeastern 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*, *Syntrielasma*, 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 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, often crowded or almost wholly composed of fossils, as *Athyris*, *Spirifer lineatus* and *Lophophyllum proliferum*, offer many and 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 unctous 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 eastern parts.

The yellow and gray sandstone (No. 15) is found well down in the Evansville shafts, and is not exposed in the county.

The black shale or clod (No. 17) is pretty constant, and differs from the slate usually found covering coals in 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. 18 of the general section) is a choice, gassy coal, of excellent quality. 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 Stevens' land, northwest quarter section 7, township 6, range 9.† It is also pierced by Priest's bore, at West Franklin, in

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

* In Vanderburg county.

the extreme southwest corner of Vanderburg county, and by the Kentucky shafts at Henderson—in fact at every point at which this horizon has been explored. These facts indicate a general 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. 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 *Chætetes 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 can be 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 inhabilis*, *M. fusiformis*, *M.* (sp?) *Pleurotomaria carbonaria*, *P. sphærulata*, *P. Grayvillensis*, *Orthoceras Rushensis*, *Nautilus decoratus*, *Aviculopecten rectilateraria*, *A.* (sp?) *Nuculana bellistriata*, *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; while bones and corprolites are frequent, though crushed and fragmentary.

The Ingleside coal M., locally known as "Main Newburg" (No. 24 of the general section), is the probable 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 the city of Evansville. From absence of faults or barren places, indicated by bores conducted up to this time, we may infer

* In Vanderburg county.

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.

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 below 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 eastern part of the county. This will hardly justify mining at present.

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 mesaloba*, *C.* (sp. ?) and *Crinoid* stems.

Coal K. is not seen in this region. 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. 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 Vanderburg 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 Sub-Carboniferous 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, as before stated almost wholly studied from out-crops, bores and shafts in Vanderburg and Pike counties, and in the Greene River regions of Kentucky. Details will be added for local information.

LOCAL DETAILS.

With low water in the Wabash, the following section was observed, following down the cut-off:

SECTION AT NEW HARMONY CUT-OFF.

		Ft.		Ft.	In.
1.	Alluvium (river bottoms)	30	to	10	00
2.	Loess	20	to	10	00
3.	Clay, sand, gravel, etc., sorted from glacial drift . . .	30	to	13	00

4.	Merom sandstone; massive in eastern parts, to the west laminated	50	to	20	00
5.	Limestone, with fossils	4	to	12	00
6.	Black shale				
7.	Upper Rash Coal	10	to	0	00
8.	Shaly sandstone	10	to	40	00
9.	Concretionary iron balls	1	to	2	00
10.	Calcareous shale, with fossils	1	to	2	00
11.	Black, sheety shale, with coprolites and fossil remains.	1	to	2	00
12.	Lower Rash Coal	0	to	1	06
13.	Gray shales, with plant remains to low water in river	2	to	4	00
				116	06

The lower sandstones of this locality present fossil casts of strong growing plants of the Permo-Carboniferous age, *Calamites*, *Sigillaria* and numerous beautiful ferns. A *Sigillaria* preserved by Mr. Sampson was of wondrous size. A part of the fossils seen in his collection were: *Lophophyllum proliferum*, *Bryozoans*, *Productus longispinus*, *P. punctatus*, *P. costatus*, *Orthis Pecosi*, *S. lineatus*, *Athyris subtilita*, *Myalina Missouriensis*, *Entolium aviculatum*, *Bellerophon carbonarius*, *B. percarinatus*, *B. Montfortianus*, *Peurotomaria carbonaria*, *P. tabulata*, *P. spherulata*, *P. Grayvillensis*, *Orthoceras Rushensis*, etc., etc.

This section does not reach down to the bottom of the Upper Coal Measures, and indicates that the horizon of the workable coals M., L. and K. are from 200 to 500 feet below.

Continued rains directed attention to the eastern part of the county. A section was taken near the county line, at M. Gluck's, southwest quarter section 32, township 6, range 11, where the upper limestones were well developed.

SECTION AT GLUCK'S.

	Ft.	In.
Loess loam	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 *Spirifer Lineatus*, *Orthis Pecosi*, *Bellerophon*, *Athyris*, *Productus*, 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
	76	00

An 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 southeast 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. George 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 the 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 Schift, 2½ 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, enable 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 Tenbarge (west half section 6, township 5, range 11), the second rash coal is found, eleven inches thick, of fair quality. At George Helfert's (southwest quarter section 7, township 5, range 11), several loads have been mined.

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
	76	00

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

The northeast part of the county is a prime agricultural region; perhaps, considering all the surroundings, the best in the country. The tableland 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.

Continued rains and overflows concealed the beds of the stream, justifying the recall, condensed, of some of such sections, by Dr. D. D. and Prof. Richard Owen, given in their Reports.

Six miles north of New Harmony, near the residence of Jos. Calvin, a coal seam is exposed, about nine inches thick.

CALVIN SECTION.

	Ft.	In.
Covered top of hills	70	00
Limestone, without fossils	2	00
Shaly sandstone	5	00
Soft shales, with plants and shells	21	00
Coal	0	09
Fire clay	2	00
	100	09

On Mackadoo Creek, eight miles northeast of New Harmony, two thin seams of coal are seen.

On Big Creek, near the road from New Harmony to Mt. Vernon, a bed of coal eight, to ten inches thick, is exposed, and was worked for burning lime. The roof shales contain plant and fish remains, as well as fossil mollusca.

At the mouth of Rush Creek there is a thin bed of coal, ten to eighteen inches thick, overlaid by a bank of sandstone, four to six feet thick; and on the border of the Wabash, at low water, a bed of soft shales is exposed, containing a great abundance of plants. The black, slaty shales, here, contain many fossils.

SECTION AT BLAIRSVILLE.

		Ft.	In.
1.	Alluvial soil and Loess	5	00
2.	Shales and shaly sandstone	15	00
3.	Coal—rash	0	03
4.	Fire clay, with broken plants	6	00
5.	Sandstone	6	00
6.	Fire clay and trace of coal	0	03
7.	Shales and shaly sandstone, to Creek	0	00
		32	06

In the sandstone (No. 5 of this section), remarkable fossil remains of standing trees were discovered by Dr. D. D. Owen. One of the largest specimens, preserved in the cabinet of this distinguished geologist (afterward destroyed at the fire of the State University), was two feet three inches high, perfectly cylindrical, and thirteen inches in diameter at the top, where it was broken off. A similar specimen was secured, and sent to the State Museum by the writer, in 1875.

Graysville, Illinois, opposite the northwest corner of the county, gives the following expose of the limestone and first rash coal:

SECTION AT GRAYSVILLE.

	Ft.	In.
Covered space	8	00
Bituminous fossiliferous shales	4	00
Fossiliferous limestone	1	00
Black, bituminous shales	0	03

Rash coal—plant remains	0	03
Slaty coals	0	03
Fire clay	1	00
Shaly sandstone—plant remains	12	00
	26	09

Many fine fossils have been found in the calcareous beds here, and some described by Norwood and Pratten.

The State Geologist is indebted to kindness of Prof. E. T. Cox, his able and meritorious predecessor, for the following facts on the "Geological Features of Posey County." Prof. Cox's long study of this vicinity, aided by the corps of distinguished laborers in this science, who rallied at New Harmony as the central home of geology, gives them high value.

LOCAL GEOLOGICAL FEATURES OF POSEY COUNTY.

The geological features of Posey county, though presenting many points of extreme interest to the paleontologist, are correspondingly uninteresting to the peterographic geologist, on account of the very uniform character of the rocks which present themselves to the view of the explorer.

We find the sandstone, which caps the hills in the northern part of the county and extending into Gibson and Vanderburg counties, spreading over the whole county where the land is elevated enough to catch it. This sandstone is sometimes thin-bedded, but is generally massive, has a reddish-brown color and coarse, granular structure, and is most probably a portion of the great sandstone so well pronounced in the Bluffs at Merom, Sullivan county, Hanging Rock, above Mt. Carmel, on the Wabash River at the latter city, and at Carnie's Bluff, below Mt. Carmel, on the Wabash. It is also seen as a massive rock, but not so thick, as found in the above mentioned localities, in the hills that border the western bottoms of Fox River, in Illinois, six miles west and almost opposite New Harmony, Indiana. A portion of this rock forms the Grand Chain, in the Wabash River, nine miles by land and twenty-two miles by water below New Harmony. The lower part of this sandstone also crosses the river at the Little Chain. At the latter locality, the reef across the stream is formed of a thin-bedded, bluish-gray, highly micaceous sandstone, with here and there impressions of stems of coal plants.

At the time of my visit the United States River Improvement engineers, under the direction of Major J. A. Smith, were engaged in dredging up this sandstone and building a breakwater or cribbed wall of rock, jetting down the stream for a distance of 4,000 feet or more. This dangerous obstruction had been removed for a width of fifty feet, which is as wide as the excavation could be made by once going over, it being the intention, next season, to take out fifty feet more and to make the channel one hundred

feet wide, with a depth of six feet of water at the lowest stage. Captain Huston was in charge of this important work, and entertained us most hospitably on his dredge boat, the "Kwasind." I was surprised to see the lower Wabash River, from Mt. Carmel down, such a large and important stream. At New Harmony it is twelve hundred feet wide, and increases this width to the mouth, where, according to the engineer's report, this river discharges more water in time of drought than is found in the Ohio at its embouchere, ten miles above Shawneetown.

SECTION OF FORMATIONS AT NEW HARMONY.

	Ft.		Ft.	In.
Soil and sub-soil	1	to	6	00
Loess	6	to	30	00
Drift, yellow clay, with small crystalline bowlders	10	to	20	00
Hard, blue clay (hard-pan)	½	to	1	00
Merom sandstone; sometimes thick-bedded, yellowish red color and spotted with iron stains; often friable, and seldom suitable for building purposes	10	to	50	00
Argillaceous and siliceous shales	5	to	10	00
Coal	½	to	1	00
Fire clay	1	to	3	00
Limestone; earthy, and of accretionary structure, and without fossils	0	to	2	00
Argillaceous, jointed, bluish-gray shale	20	to	30	00
Thin-bedded and schistose sandstone, highly micaceous, and carrying stems and trunks of *Sigillaria Oweni* and *Asterophycus Coxii*	3	to	6	00
Banded limestone, with *Palæophycus Milleri*	0	to	0	02
Calcareous shale and limestone, full of fossils (West Franklin limestone)	2	to	25	00
Argillaceous shales, with some coal plants, black, bituminous, sheety shales, with fish teeth and *Coprolites*	0	to	2	00
Coal	0	to	0	06
Bluish underclay, full of fossil plants	0	to	3	00
Low water, Wabash River.				

Underneath the sandstone (which I have traced from Merom to the Ohio River, and which, for the purpose of convenience, and fixing the continuity in the mind of the reader, has been designated as the Merom sandstone), there is a massive bed of siliceous and argillaceous shales, with intercalated beds of fossiliferous, calcareous shales and earthy limestones. At West Franklin, opposite Diamond Island, the limestone is of very great thickness.

Prof. E. T. Cox is of the opinion that the West Franklin limestone has its counterpart in the Carthage limestone, which crops in the bank of the Ohio River, about one mile below Uniontown, Union county, Ky. On Big Creek, near the road from New Harmony to Mt. Vernon, this limestone is not so thick, and is of a black color, very close grained, breaks

with irregular fracture, and has a strong fœtid odor. It contains a few characteristic Coal Measure fossils, very perfectly preserved, but difficult to procure on account of the hardness of the rock. The fossils are white and, when the rock is polished, they show white on a black background. If the stone could be had in dimensions free from cracks, it would be valuable as a marble for mantles, table tops and other decorative purposes.

At the Lower Hills, in Bethel township, the limestone seen in the shales above alluded to, is of an earthy, accretionary character, not at all resembling the West Franklin, and is without fossils. On the road from New Harmony to Evansville, and about five miles east of the Posey county line, the West Franklin limestone is seen in great force, cut through by the drainage ravines, and is extensively quarried for lime.

At the cut-off, in the edge of New Harmony, there is a beautiful exposure of the lower part of the Merom sandstone and the upper portion of the underlying shales. About ten feet of the sandstone, of a coarse-grained, friable nature, and reddish-brown color, has under it five or six feet of argillaceous shale, containing a seam of poor coal, eight inches thick, underlaid by a bed of fire clay that will answer well for coarse pottery; and, beneath the latter, is an earthy accretionary limestone of a reddish-brown color, and wholly barren of fossils. Under this limestone is a massive bed of bluish-gray, jointed, argillaceous shale, improperly called soapstone. Under this shale, there is a bed of sandstone, about thirty feet thick, in layers from two inches to twelve inches thick. The total thickness of this bed varies, and is best seen at the mouth of the cut-off, where it was quarried by the Old Harmony society for the foundations of its hall, and for the ornamental doorway, the lintels and other portions of the building. This doorway was carved by Frederick Rapp. It can not be considered a durable stone, though the blocks for the above purpose appear, so far, to have withstood the test of fifty-one years. Under this sandstone, at the site of the lower dam, in the cut-off, there is exposed, in the bed of the river and along its shores, another mass of shales, containing a band of flat ironstones, rich with remarkable fossilized ferns that are in bold relief. Some of the most remarkable have been figured and described by Prof. Leo Lesquereux, in the Report for 1875. The best preserved specimen was found on Brouillet's Creek, in Vermillion county, and obtained from the cabinet of Mr. J. F. Miller, Superintendent of the Pan-Handle Railroad, Richmond, Indiana. While on a visit to this place with Mr. James Sampson, of New Harmony, he found and gave to the State Museum some of the very best and most interesting specimens that have yet been discovered. The name given by Prof. Leo Lesquereux is *Palæophycus Milleri.*

These shales and schistose rocks are found throughout the county, and may be seen in most of the streams in times of drought or extreme low water. On Macadoo Creek, near the road leading from New Harmony

to the Hume settlement, they are quite siliceous, and contain casts of many fossil shells, conspicuous among which is seen *Monopteria longispina*, Cox.

At Blairsville, on Big Creek, they contain upright trunks of trees, *Sigillaria Oweni*, Lesq. From this famous locality Dr. David Dale Owen obtained many specimens, from six inches to a foot and more in diameter and three feet high from the branching roots to the top of the broken body. Sir Charles Lyell, when on his second visit to this country, accompanied by Dr. Owen, made a careful examination of this locality. Not only has it been examined by the above mentioned parties, but during the years before it had received the attention of William Maclure, Thomas Say, C. A. Leseuer and Dr. Troost; subsequently by Norwood, Shumard, Pratten, Worthen, Lesquereux, Cox, and many others. Below the roots of these standing trees is a bed of argillaceous shales, containing some fossil ferns, and other coal plants, and a thin seam of coal.

The calcareous beds which underlie this member of the general section were best exposed on the bank of the Wabash, just above the mouth of Rush Creek, but they had been so extensively worked for fossils by the very many geologists who congregated at New Harmony, that the subsequent freshets of the Wabash have filled up the excavation to such a depth that it would be a vast and expensive undertaking to excavate it so as to again expose the fossil bed. At the cut-off the fossil bed is not so thick; but it was crowded with fossils that have gone to enrich the cabinets of the country.

I should have stated that the two massive blocks of limestone, above alluded to, in the cut-off and the Rush Creek locality, furnished the fossils for the excellent monograph on carboniferous fossils published by Norwood and Pratten, also a subsequent publication by J. H. McChesney.

Any one wishing to study the fossils of these famous localities must visit the extensive collection made and owned by Mr. James Sampson, of New Harmony. Every available part of his residence contains cabinets that are filled with fossils and other objects of natural history. But it is when you enter what he calls his "sanctum sanctorum" that one is bewildered with the vastness of his labors in bringing together the natural history of this renowned region of the State. There are two rooms to this temple of science. The first one you enter contains his work bench, around which is to be found a multitude of tools suitable for all kinds of work. In the center is a round table for books, papers, etc. The ends are filled with cabinets and shelves, crowded to their utmost capacity with choice specimens. The ceiling overhead is completely covered with prepared specimens of fishes, cheloniæ, snakes, etc., etc. The next room has its sides and ends filled with cabinets from top to bottom, and in the central space, leaving a narrow walk on each side, is also a string of cabinets. Here are to be seen Indian relics of all kinds, among which are a great many that are rare and precious. In others are the prepared

skulls of all the birds and quadrupeds of the district, feet of birds, etc. There are rows of bottles filled with reptiles. Here, again, every available spot on the ceiling is covered with heads and skins of animals.

When you have finished looking through this vast museum, you will not fail to be impressed with the amount of labor required, through the single exertions of one man, to hunt them up and clean the fossils from their rock matrix, more or less difficult to remove, and place everything away in admirable order. Mr. Sampson is now 77 years old, and is still a hale and hardy man, and just as full of enthusiasm for collecting as in his younger days. He walked with me to visit many localities and, on returning in the evening, showed no signs of the least fatigue—in fact, was not nearly so tired as I found myself.

Mr. Sampson is not the only collector and naturalist at New Harmony, for this is also the home of Prof. Richard Owen, the former State Geologist of Indiana, and for many years Professor of Geology and Natural History in the State University, at Bloomington. At the time of my visit, this distinguished scientist and author was absent, with his wife, on a visit to the Southern Exposition, at Louisville. I met him on the cars as they were returning home, but, being on the way to Griffith Station, I was sorry that I could not accept his kind invitation to pay him a visit.

I found that Mr. John Chappelsmith had, on the death of his wife, returned to England. He lived for many years in New Harmony, and drew all of the fossils that were described by Prof. E. T. Cox, and figured in the 3d Kentucky Report. He was a skilled artist and engraver. I spent an afternoon at Mrs. Thomas', looking over several scrap books that contained specimens of drawings and steel-plate engravings. They were admirably drawn and showed great skill.

The calcareous shales of the cut-off and Rush Creek are also seen in the bank of the Wabash River, at Grayville, Illinois, twelve miles above New Harmony. At the latter locality, it is highly fossiliferous, and there is a band of ironstone just above it, which has furnished a large number of remarkable *Cephalopoda*, *Lamellibranchiata*, *Brachiopoda*, *Gasteropoda*, *Pteropoda*, *Bryozoa*, and corals. Like Rush Creek and the cut-off, this also has been a place of great resort for the New Harmony naturalists, and has furnished specimens that were new to science.

William Maclure, who purchased one-half of the town of New Harmony from Robert Owen, in 1825, for the purpose of promoting a love for natural history, was, himself, one of the earliest workers in geology, and, indeed, might properly be classed as one of the founders of the science. He crossed the Alleghany Mountains many times on foot, to study their rocky structure, and lived long enough to see his conclusions, which were published in book form, verified by the research of modern students. Associated with him at New Harmony was Thomas Say, styled the great American naturalist; C. A. Leseuer, the great artist and ichthyologist of

the expedition of La Peruse, fitted out under the auspices of Napoleon I, to explore Australia; D. Troost, the eminent geologist and mineralogist, who afterwards moved to Nashville, where he died, leaving a cabinet of great scientific value. These eminent men were followed by the late David Dale Owen, M. D., and his brother, Prof. Richard Owen, who came to New Harmony in 1832, fresh from the schools of Europe. Dr. D. D. Owen commenced at once to arrange a chemical laboratory and museum of natural history on a scale that, in those days, had no superior in this country. William Maclure turned over to him his vast collection of rocks and minerals that had been made in Italy, Spain, Portugal, West Indies, Mexico and France, at a great cost. So vast was this valuable collection that many boxes remained unopened up to the time of their removal to the State University at Bloomington. In 1837, D. D. Owen was appointed United States Geologist, with headquarters at New Harmony. He was instructed to make a reconnoisance of what was then the Great Northwest, now Minnesota, Wisconsin, Iowa, and the northern part of Illinois, in order to point out, for preservation by the Government, the salt springs, lead and other mineral-bearing rocks, previous to offering the lands for sale. This herculean task was accomplished in two months, and the report laid before Congress at the opening of the next session. Several hundred men were employed in making the survey. They were divided into companies, having an intelligent head to look after the work, and each company was allotted a district, in which every section was to be visited and samples of the rocks collected. At stated points, Dr. Owen would meet each camp, and study the work accomplished. The country was almost without settlements, and each camp had to be supplied with hunters, whose duty it was to furnish game for subsistence.

In looking over Dr. Owen's report, one can not fail to appreciate the skill and fidelity with which this great geologist performed this survey under immense difficulties and in such a short time. He carried with him on the trip up the Mississippi a suite of rocks and minerals, which were exposed on a table in the cabin of the steamboat, and he would daily give his men instruction in geology and point out the characteristic rocks of the leading formations and the minerals that it was likely would be found in them. In this way, by the time they reached the place to disembark, they had been made acquainted with the first principles of geology. In after years, this great region was more systematically surveyed by Dr. Owen.

The headquarters of the United States Geological Survey continued at New Harmony up to 1856. Among the geologists connected with these surveys, who spent more or less time at New Harmony, were Dr. J. G. Norwood, B. F. Shumard, Dr. Litton, Col. Charles Whittlesy, the veteran geologist, Dr. Locke, F. B. Meek, the eminent paleontologist, and others.

After the completion of the Smithsonian Institution building at Washington, the headquarters of the Government surveys were established in that city.

Dr. Owen was placed in charge of the Kentucky survey and the Arkansas survey, with Dr. J. G. Norwood in charge of the Illinois survey, and Prof. Richard Owen in charge of the Indiana survey, all of whom had headquarters at New Harmony, where the advantages of comparison could be found in the extensive cabinets of the Owen collection. New Harmony, then, became the resort of a great many geologists, some of whom made it their home. I may mention among these, as connected with the Kentucky survey, Maj. Sidney Lyon, Prof. E. T. Cox, Leo Lesquereux, Mr. Nicholson, civil engineer and topographist. In the Arkansas survey, E. T. Cox, Leo Lesquereux, Dr. Elderhorst (author of "Elderhorst on the Blowpipe"), and Joseph Lesley; on the Illinois survey, J. G. Norwood, chief; Henry Pratten, J. H. Wolfers, Dr. Varner, A. H. Worthen and J. H. McChesney. In the Indiana survey, Richard Owen and Leo Lesquereux. From this, it will be understood why New Harmony became a kind of Mecca for geologists and naturalists. Subsequently, A. H. Worthen became State Geologist of Illinois, and the headquarters was moved to Springfield. Prof. E. T. Cox was appointed State Geologist of Indiana in 1869, and the headquarters of the survey was established at Indianapolis.

ECONOMIC GEOLOGY.

The survey is indebted to the favor of Gen. Alvin P. Hovey for the following paper on the common sense interests of Posey county, and it is so reliable and pointed that it is given verbatim:

Posey county was organized in 1814 and named in honor of one of our Territorial Governors, Gen. Thomas Posey.

It lies in the extreme southwestern part of the State, and is bounded, on the south and west, by the Ohio and Wabash Rivers, for the distance, by their sinuosities, of at least one hundred and forty miles.

The topography of this part of the State is but very imperfectly known abroad. The great body of the county is gently undulating. Large tracts of rich black soil are found in level lands or flats of Black River, Big Creek and Point townships, which are above all overflows of the Ohio and Wabash Rivers.

There is a general misapprehension as to the "bottom land" of the rivers. Commencing where the southeastern line strikes the Ohio River, following it down to the Wabash, and, thence, up the Wabash, to the northwestern corner of the county, near Grayville, Illinois, a strip of land on the margins, not exceeding a half a mile in general width, forms the celebrated "bottoms," or corn lands, of Posey. These bottoms have given

the travelers on the river the general idea that the whole of the county is a level swamp. Commencing at Mt. Vernon, and running north to Cynthiana, it can be safely said, that no finer or better land can be found in this State, or any other part of the United States. The best of water is found in every locality, and a failure of any crop is unknown to the oldest inhabitant. There are many fine fields of wheat which have been cultivated for fifty years, and producing more now than they did in former years. It has a rejuvenating subsoil, that seems to be exhaustless and improves on continued cultivation. In wheat, it is the banner county of Indiana, the "Banner State," and produces over 4,000,000 bushels of corn, or maize, with a capacity, when fully developed, of almost doubling its present productions. Below is given an abstract taken from the office of the Auditor, for 1883—that for 1884 is not yet complete, and may be increased by at least ten per cent.

1883.

Acres of wheat	60,693
Acres of corn, up-land	79,641
Acres of corn, bottom land	13,372
Acres of oats	3,615
Acres of barley	101
Acres of rye	104
Acres of Irish potatoes	760
Acres of sweet potatoes	99
Acres of timothy hay	5,042
Acres of clover	12,087
Acres of blue grass	1,234
Drain tile, rods	89,346

I will only observe that our wheat averaged about eighteen bushels per acre, which would amount to about 95,000 bushels; corn land at least forty-five bushels per acre, or over 4,000,000 bushels; besides other grain. There are probably about 20,000 acres of good land held by their owners out of cultivation as timber land, which is of the best quality.

There are outcroppings at West Franklin, ten miles above Mt. Vernon, and on the Grand Chain, on the Wabash, of sandstone and bastard limerocks, but of no considerable quantities. There can be but little doubt that the whole county is made land, with the usual coal formation in this locality; and vein M., worked at Evansville, Shawneetown, Henderson, and other surrounding localities, clearly prove the existence of the same formations here. There are eight or more spots in the county, at different points, where coal, in the upper or thinner veins, crop out. The working vein at Mt. Vernon will, probably, be found at about 200 feet below the surface, and a company is about to be formed to sink a shaft on the Ohio, near Mt. Vernon. The highlands, commencing at the upper part of the city of Mt. Vernon, and extending about eight miles below, are above the

highest water of the Ohio River, and are destined, at no distant day, to be covered with manufacturing establishments. There is no other locality on all the banks of the Ohio River, from Pittsburgh to its mouth, where eight continuous miles of high banks, above all high water, can be found. It will be the foundation for a future great city; for as the drainage of all the table lands of the Ohio valley are speedily thrown into the river, by the hundreds of thousands of miles of tiling and artificial ditches, the river will be annually subject to increasing overflows, until manufacturers will be compelled to abandon all overflowed localities and seek positions above the swelling waters.

Without doubt, there is a bright future for Posey. No other county of the same number of square miles has the same agricultural advantages. Every part of her one hundred and forty miles of river, and her eighty miles of railroad running through her lands, offer to the agriculturist markets for the vast quantities of grain grown upon her soil. The rivers compete with the rail, and the rail with the rivers, for low freights, and the agriculturist, instead of being at the mercy of one kind of transit for his produce, has his option to select another.

ARCHÆOLOGY.

Posey county was the center of mechanical skill in the time of the Mound-Builders. Copper was beaten into thin plates, for buttons, gorgets and tiny bells; obdurate flint was polished as are Danish flints; shells from the ocean were pierced and polished for ornaments; beautiful vases and vessels were made in perfect symmetry; and the native pearls of the Wabash were prepared and pierced to serve as beads.

Several good-sized mounds were seen on the bluff, one hundred and seventy feet above the Ohio, at West Franklin, giving a wide out-look over the beautiful river and its rich valley lands.

A clump of mounds on the bluff overlooking New Harmony attracted the attention of our early scientists. One was opened and described by Leseuer. At the same town the old German burial ground is dotted with mounds, showing the taste of our predecessors for beauty in aspect and situation.

TABLE OF ALTITUDES AND DISTANCES,

With Elevation at Low Water above the Level of the Sea, on Wabash River between Terre Haute and Mt. Carmel, and on White River between its mouth and Hazelton. Distances taken in steamboat channel at low water from maps made from recent surveys.

WABASH RIVER.

LOCATIONS.	Miles from Wagon Bridge at Terre Haute.	Miles from Wagon Bridge at Vincennes.	Elevation of Low Water Above the Sea in Feet.
Main Street Bridge, Terre Haute	0.00	99.00	447.73
Foot of Island	1.60	88.40	446.32
Sugar Creek	2 50	87.50	445.88
Old Terre Haute, Ferry	4.55	85.45	445.41
Musgrave's Ripple (head) (Fall, 1.04 ft.)	7.20	82.80	444.12
Eight Mile Island (head)	7.80	82.20	442.93
Eight Mile Island (foot)	8.10	81.90	442.49
Hawk's Creek	10.95	79.05	442.11
Goose Nest Island (head)	12.70	77.30	441.92
State Line, Corner Stone	14.65	75.35	440.60
Strain's Ripple (head) (Fall, 1.20 ft.)	16 35	73.65	440.27
Turkey Reach, Ferry	18.10	71.90	438.71
Big Creek	18.70	71.30	437.70
Creek at Head of Aurora Bend	20.95	69.05	436.55
Foot of Aurora Ripple (Fall, 1.16 ft.)	21.70	68.30	434.75
Darwin Ferry	23.60	66.40	433.78
Darwin Landing	23.80	66.20	433.60
Bowen's Ripple (head) (Fall, 0.66 ft.)	25.50	64.50	432.68
Prevo's Landing (warehouse)	26 45	63.55	432.00
Little Sycamore Bend (head of bar)	27.90	62.10	431.57
Bridge Piers, Chenowith's Reach	29.15	60.85	431.26
Prairie Creek	30.40	59.60	430.95
Niles' Landing	32.10	57 90	430.15
Devil's Elbow Ripple (head) (Fall, 1.54 ft.)	35.40	54.60	429.56
Mill Creek, at York	36.40	53.60	427.71
Green's Ripple (head) (Fall, 0.66 ft.)	38.10	51.90	427.29
Raccoon Creek	39.35	50.65	426.46
High Water Cut-off, Hackberry Bend	41.10	48.90	425.84
Foot of same	43.20	46.80	424.69
Hutsonville Ferry	43.50	46.50	424.63
Hutson Creek	44.10	45.90	424.30
Head of Island	45.25	44.75	423.77
Turman's Creek	46.20	43.80	422.68
Harney's Landing	47.80	42.20	422.17
Merom Island (head)	50.05	39 95	420.88
Merom Ferry	51.00	39.00	420.81
Eagle Island (head)	53.00	37.00	419.41
Narrow Gauge Bridge	53.80	36.20	418.78
Greer's Ripple (head) (Fall, 1.08 ft.)	55.20	34.80	418.43
Palestine Landing	57.75	32.25	416.71
Turtle Creek	60.75	29.25	415.10
Hite's Ferry	61.85	28.15	414.71
McCutcheon's Slough	63.45	26.55	414.00
Shaw's Landing	65.70	24.30	412.70
Longtown Landing	67.70	22.30	411.42
Foot of Cut-off, Johnson's Ripple	70.30	19.70	409.49
Horse-shoe Cut-off (head)	71.20	18.80	409.79
Doe Creek	71.60	18.40	409.69
Swan Island	74.00	16.00	407.46
Goose Bar	75.15	14.85	406.75
Russellville Sawmill	77.20	12.80	405.28

WABASH RIVER--Continued.

LOCATIONS.	Miles from Wagon Bridge at Terre Haute.	Miles from Wagon Bridge at Vincennes.	Elevation of Low Water Above the Sea in Feet.
Belgrade Landing	81.50	8.50	403.42
Seven Mile Island (foot)	84.00	6.00	401.96
Massey's Bend Ripple (foot) (Fall, 0.35 ft.)	85.00	5.00	401.32
Fort Knox	86.30	3.70	401.09
Soap Creek	88.40	1.60	399.81
R. R. Bridge, Ohio & Mississippi	89.55	0.45	398.97
Wagon Bridge, Vincennes	90.00	0.00	398.81
Embarras River	95.75	5.75	394.85
Nine Mile Island (head)	98.45	8.45	394.61
Nine Mile Ripple (head) (Fall, 1.40 ft.)	98.85	8.85	394.45
R. R. Bridge	99.50	9.50	392.83
St. Francisville Landing	102.90	12.90	391.46
Raccoon Creek	106.90	16 90	389.91
River Deshee, Head of Cat-fish Bend	109.30	19.30	387.96
Little Rock Ripple (head) (Fall, 1.80 ft.)	112.00	22.00	387.66
Beadle's Dam Ripple (head) (Fall, 1.30 ft.)	114.75	24.75	385.40
Buchannan's Ferry	116.40	26.40	383.40
Hanging Rock (Fall of Ripple, 1.25 ft.)	118.75	28.75	382.55
Grand Rapids Dam (Fall of Ripple, 4.50 ft.)	121.10	31 10	378.68
Hurd's Ferry	121.50	31.50	376.76
White River, "The Point"	122.55	32.55	376.55
R. R. Bridge, Louisville, New Albany & St. Louis	123.70	33.70	. . . . .

WHITE RIVER.

LOCATIONS.	Miles from Mouth of White River.	Miles from Hazelton Ferry.	Elevation of Low Water Above the Sea in Feet.
Mouth	0.00	18.30	376.55
Ferry	2.95	15.35	376.73
Kelley's Ripple (foot)	3.30	15.00	378.07
Kelley's Ripple (head) (Fall, 1.80 ft.)	3.70	14.60	379.95
Bingham Place	5.05	13.25	379.46
Outlet Spring Lake	7.00	11.30	379.72
Slough, Foot of Bar	9.00	9.30	380.16
Field's Ferry	10.75	7.55	380.94
Ripple (foot) (Fall, 0.20 ft.)	14.00	4.30	383.34
Worth's Ripple (head) (Fall, 0.80 ft.)	16.00	2.30	385.69
Hazleton Ferry	18.30	0.00	387.05
R. R. Bridge, E. & T. H.	20.80?	. . . . .	388.82

NOTE—The first three of the low water elevations given above for White River, are taken from a survey made in 1879; the others from a survey made in 1880. Distance from mouth of White River to Mt. Carmel R. R. Bridge is 1.15 miles.

The above distances and elevations have been carefully compared and corrected by Jared A. Smith, Major of Engineers, U. S. Army, to whom thanks are returned.