THE NATURAL RESOURCES OF THE STATE OF INDIANA.

BY W. S. BLATCHLEY.

The main province of the Department of Geology is, in the writer's opinion, the advertising of the natural resources of Indiana. This advertising is accomplished in two ways. First: By annual reports, of which the present volume is the twenty-fourth in the series and the fifth issued under the auspices of the writer. Second: By the Department serving as a bureau of information or a medium between the owners or lessees of the lands on which the natural resources are located and the prospective user or producer of such resources. For example, a certain person or company desires information as to where he or they can find glass sand, fire-clay or undeveloped coal lands within the State. A letter is addressed to the Department, making inquiry concerning the resource desired. An answer is at once written giving full information as to where such deposits are located, name of owner and such other information as is at hand. This information is wholly gratis, no fees whatever being charged either party. In this way hundreds of letters are annually answered and much capital directed to sources of investment which it is believed will prove remunerative. On the other hand many people are warned against investing money in trying to develop certain resources which do not occur in a locality where they are thought to be.

To give a general idea of the main resources of the State and their location the present paper has been prepared. While it contains, in part, information which was published in the Twentieth and Twenty-first Annual Reports, it gives in addition much which has been gathered since their publication.

Ranking in area of square miles but thirty-fourth among the forty-five states of the Union, Indiana, on January 1, 1899, stood sixth in the production of coal, fourth in the production of petroleum, second in the production of natural gas, seventh in the production of build-

ing stone and sixth in the value of her clay products. According to careful computations, the value of each of the five leading mineral resources produced in Indiana in 1898 was as follows:

Petroleum	$2,228,276
Coal	5,177,044
Natural gas	5,060,969
Stone	1,731,914
Clay products	3,211,512
Total	$17,409,715

The capitalist seeking profitable investment, whether it be of a commercial or manufacturing nature, must ever take into consideration a number of elements upon the presence or absence of which the success of his enterprise will largely depend. The first and greatest of these is the law of supply and demand. If he is dealing in or producing an article for which a demand exists or can be readily created —equal to or in excess of the supply—his success is well-nigh assured. If, on the other hand, he buys or begins the manufacture of an article which is already largely in stock, or for which the demand has begun to decrease, his future is apt to be a stormy one. He should, therefore, previous to making his investment, give long and careful study to all the conditions relative to the future supply and demand of the article in which he proposes to deal or which he intends to make. If his investment is for manufacturing or productive purposes—as most likely it will be—the elements, in addition to the one of supply and demand, which should be noted are:

1. Transportation facilities.
2. Fuel supply.
3. Quantity and quality of raw material.

Transportation Facilities in Indiana.

Lying, as she does, between the Great Lakes on the north and the rugged or mountainous regions of Kentucky and Tennessee on the south, the State of Indiana furnishes a comparatively level plain, 240 miles in length and 145 miles in width, across which must pass all the main arteries of travel between the east and the west. No less than nineteen great through trunk lines of railway, carrying the passengers and freight of a mighty nation, cross all or a portion of her width, while seven important north and south systems run the full length of the State. Adding to these the numerous branches running diagonally and connecting the main lines, we have a most complex system of railways, whose branches permeate almost every nook and corner of our commonwealth. Moreover, electric railways, which in

the future will furnish cheap and rapid means of transportation, are fast being constructed throughout the State. From the main lines of steam or electric railways, switches can be readily and cheaply constructed to the site of any resource lying within the State which promises to yield a fair amount of freight for the future. When to these facilities we add those of the waterways of Lake Michigan on the north and the Ohio on the south, we have avenues of transportation unexcelled by any State in the Union.

In the following pages it will be shown that the other two elements —*fuel* and *raw material*—so necessary to a great manufacturing community, are abundant in Indiana.

FUELS.

The natural fuels of Indiana are three in number, viz., petroleum, natural gas and coal. These fuels are the most valuable resources of our State to-day. They are all stored products which have been formed in ages past, and no one of them is now being produced beneath the surface of our State. Taking them up in the order named, we find that their locations and statistics of production are as follows:

PETROLEUM.

Petroleum in Trenton Limestone.

Crude petroleum occurs in Indiana in commercial quantities in two distinct geological formations. The principal one of these is the Trenton limestone, which underlies the whole State, but which, up to the present, has produced oil in paying quantities only in an area of about 500 square miles. This area is divided into a main portion, or main field, and several minor areas. The main field is located in the counties of Adams, Jay, Blackford, Wells, Grant and Huntington. This field extends from the Ohio State line to Marion, Grant County, and averages about twelve miles in width. Full details concerning the topography of this area, together with a map and account of the oil industry therein, were published in the report of this Department for 1896.

Outside of this main field, isolated pools or small areas of Trenton rock productive of oil are found at Peru, Miami County, and near Keller's Station, Wabash County; Alexandria, Madison County, and Broad Ripple, Marion County.

The oil in the Trenton rock is a dark, ill-smelling liquid, with a specific gravity of .853, or 35° Beaume. It is found only in the uppermost sixty feet of the Trenton, and is usually in two porous strata or

"pay streaks," which are separated by a non-porous stratum 15 to 25 feet in thickness. Over the larger part of the State these porous strata are wholly lacking in the Trenton rock, and hence no gas or oil is found when the drill pierces that formation.

The cost of operating a lease in any of the Indiana Trenton rock fields is as low or lower than elsewhere in the eastern United States for the following reasons: (a) The wells are comparatively shallow, the Trenton limestone in most instances being struck at less than 1,000 feet. (b) It is seldom that more than 150 feet of drive pipe and 400 feet of casing are necessary. (c) On account of a comparatively level surface a large number of wells can be connected to and pumped with one power. (d) Gas for fuel or for running gas engines is usually plentiful. (e) Transportation facilities are excellent, a system of pipe lines permeating all parts of the main field.

Petroleum in the Corniferous Formation

The second rock formation productive of oil in Indiana is the Corniferous, the lowermost division of the Devonian system found in the State. This formation occurs only in the western half of Indiana, where it is represented either by sandstones 10 to 20 feet in thickness or by limestones 5 to 65 feet thick—sometimes by both. Oil has been found in the Corniferous limestone at Terre Haute, Vigo County; Petersburg, Pike County, and near Medaryville, Jasper County, and in a corresponding sandstone at Loogootee, Martin County. This oil has probably, in all the above mentioned localities, been derived from the overlying black or brown Genesee shale, which is from 95 to 160 feet in thickness, and very rich in bitumens.* These bitumens have, by natural processes, often been separated from the shale, and in the form of gas or petroleum have been collected in porous reservoirs either in the shale itself or in the underlying Corniferous limestone or sandstone. The shale or original source of the oil or gas is much thinner than the Trenton limestone, and hence the amount of oil or gas formed from the distillation of organic bodies therein must have been correspondingly less. Moreover, the shale lies nearer the surface, and a greater loss of the volatile products of distillation must have taken place. For these two reasons the supply of gas or oil in the Corniferous will never equal that found in the Trenton limestone, and the life of any field or area in which it is discovered will be relatively shorter. The oil of the Corniferous is darker colored, more ill smelling and of a greater density and weight than that found in the Trenton limestone.

*A paper treating of the bitumens of this shale was published in the report of this Department for 1896, pp. 108–119.

The year 1899 was not characterized by any great strikes or new developments of importance in the oil fields of Indiana. During the first half of the year the rapid rise of price in iron pipe and most other supplies used in oil production deterred many prospective wildcatters and even old operators from putting down new bores. The price of Indiana crude oil remained almost stationary (74 to 76 cents) until June, when it began slowly to creep upward. By July it had reached 82 cents, and by September 1, 90 cents. On the 15th of September it had advanced to 99 cents, and soon thereafter climbed above the dollar mark. On January 1, 1900, it was selling at $1.12 per barrel.

This advance in price in the latter half of the year caused a corresponding increase in activity among the operators. Wildcatters, too, began to be more restive, and cast a longing eye on territory which promised a chance, however remote, for a return of their money. As a result, a number of bores were put down in various localities a few miles outside the limits of the main field as shown in the map in the 1896 report; while in a number of places territory which, from the data available, was then shown as "light oil territory," and which had been considered comparatively valueless, was proven by new bores to be highly productive. Good examples of such bores are on section 32, Chester Township, Wells County, and in a number of sections in Jackson Township of the same county. In fact, this latter township developed in 1899 more new wells which proved excellent producers than any other similar area in the main field.

The Main Indiana Oil Field in 1899.

It was predicted in my report of 1896 that the Indiana oil field is connected with that of Ohio, and that the line of connection would be found to be in northeastern Jay, or southeastern Adams County, perhaps both. The results of the drilling in 1899 in part fulfilled this prediction. In September a well was drilled in on the Dudgeon farm in section 27, Blue Creek Township, Adams County, and only 300 feet west of the State line, which had an initial production of 75 barrels. In November another good well was drilled in on the Hoblet farm in the same section. Two small producing wells were also located two miles west in section 29, and two or three just east across the Ohio line. On December 20, the field contained seven wells with a total daily production of about 90 barrels. The southernmost well in this field is several miles north of all former bores put down to find the connecting link between the two States.

On January 10, a well which started at 250 barrels was drilled in on the Storms lease in section 19, Washington Township, Blackford County, thus extending the known field three miles to the southwest.

A number of other good producing wells were afterward located in the same and adjoining sections, so that the main field now extends to the western limit of Blackford County.

Other fair producing wells just outside the main field, as mapped in 1896, were located during the year in sections 10 and 16, Center Township, Grant County, and a good one was finished, in December, in section 19, Salamonie Township, Huntington County.

A wildcat bore which produced a good showing of oil and much salt water was put down near Lafontaine, Liberty Township, Wabash County. Another well, which filled up with 300 feet of oil, and would produce 15 barrels daily, was finished in wildcat territory near Hagerstown, Wayne County, 50 miles south of the heart of the main field and 40 miles southeast of Alexandria. The nearest producing wells are at Parker, Randolph County.

The Peru Oil Field in 1899.

Progression in the Peru field was wholly backward during the year. But three productive wells were drilled in and these had a total initial production of only 40 barrels, or an average of 13 barrels each. Four dry holes were put down during the year, and 37 wells, formerly productive, were abandoned. The total production of the field was 250,297 barrels, as against 446,672 in 1898. The first productive bore south of the Wabash River was drilled in on the Snyder farm in August. Its output was, however, small, and one or two dry holes in its vicinity stopped further drilling in that direction.

At Keller's Station or Rich Valley, Noble Township, Wabash County, fifteen bores were put down during the year. Of these six were dry, while nine had a total initial output of but 55 barrels daily. In Erie Township, Miami County, just west of the Rich Valley field, the results were much better. Here, also, 15 wells were drilled in, of which but four were dry. The producing ones had an average initial production of 24 barrels.

The Broad Ripple Field in 1899.

The area of the Broad Ripple field was not materially increased during 1899. But 11 wells were completed. Of these, 10 were productive and one dry. The total initial product was 265 barrels, or an average of 26.5 barrels per well. The total production was 51,000 barrels, as against 102,087 in 1898, a loss of just 50 per cent.

On account of the anti-gas waste law, no oil was produced in the Alexandria field during 1899. An appeal from the decision of the Indiana Supreme Court was taken by the oil operators and was argued before the United States Supreme Court the latter part of December. The chances are that, as soon as the gas supply fails, not only the

Alexandria field but a large part of the other territory now producing gas will yield oil in quantity.

Two small oil fields were developed during the year 1899 at quite a distance from the main field. The oil in both was found in the Corniferous limestone or a correlative sandstone, this being the same stone in which oil was discovered at Terre Haute in 1889. The original source of the oil in each—as at Terre Haute—is undoubtedly the New Albany or Genesee shale.

The Loogootee Oil Field.

One of the new fields was near Loogootee, on the B. & O. S. W. Ry., in Martin County. Five bores were put down by a local company. The first was drilled just south of the town to a depth of 1,682 feet and produced only a slight showing of oil. A second and third well were sunk—each a quarter of a mile farther eastward than the preceding—but only to a depth of about 530 feet, when gas was struck. In October these wells showed a rock pressure of 200 pounds per square inch and yielded about 400,000 cubic feet of gas each per day.

The fourth well was put down about 90 rods east of the third and at that point showed the sand stratum to be 16 feet in thickness. This well yielded both gas and oil—the latter flowing at the rate of about 20 barrels daily. The oil is dark in color and has a specific gravity of 32° Beaume. A fifth well, only 700 feet east of the fourth, was a dry hole. This was the sum total of the developments to January 1, 1900. Loogootee is 532 feet above sea level and the depth to Trenton rock is about 1,900 feet.

The other prospective field was in Gillam Township, Jasper County, about six miles west of Medaryville. Oil in small quantity was found in eight wells at a depth of only 105 to 110 feet below the surface. Little or no gas was found, the oil-bearing limestone being so near to the surface that all volatile portions had escaped. The oil is very dark and heavy, the specific gravity being but about 24° Beaume, and is sold mainly for lubricating purposes. On January 1, 1900, the total yield from the eight wells was about 40 barrels daily.

The Terre Haute Oil Wells.

Eleven thousand barrels of oil were produced from the Phoenix well in the city of Terre Haute during the year 1899. This well was drilled in on the night of May 6, 1889, and for more than ten years has yielded an average of 1,000 barrels or more per month. The oil is found in the Corniferous limestone which underlies the black Genesee shale, at a depth of 1,630 feet from the surface.

When the drill first struck this oil-bearing stratum, on the date above mentioned, the flow was so great that quite a lake of oil ac-

cumulated around the derrick, and there was some alarm lest a destructive fire should result. The drills were then pulled out of the well, and as soon as the end of the drill left the mouth of the drive pipe, a solid stream of oil four and a half inches in diameter shot into the air a distance of forty or fifty feet. While running at this rate there was probably a little over a barrel a minute pouring from the well, and when the pressure decreased from the first spurt, which lasted only fifteen minutes, the flow steadied down to a four and a half inch stream spurting about three feet above the mouth of the well. A tank with a capacity of twenty barrels was put under the pipe, and it was filled to overflowing in just twenty-two minutes.

This great flow soon began to decrease, and in a few months had reached an average of 35 barrels per day, which it has since maintained. However, it is by far, the best oil well ever drilled in Indiana, since no other has kept up so high a production for more than five years.

The result of this strike was like that of every other similar one in the history of the petroleum industry. Hundreds of oil operators from far and near flocked to Terre Haute. Real estate almost doubled in price. Twenty-four new companies were formed, eighteen of which made locations. A dozen or more bores were put down to the required depth within three miles radius of the first gusher, struck the proper stratum, and for the most part found—nothing. Two, within a short distance of the original well, yielded oil in small quantity. The yield of one was soon overcome by salt water. The other continued to produce for five or six years, but was finally abandoned.

No further prospecting was done until 1899, when two bores were completed. One of these, about two miles north and one-half mile west of the Phoenix, was a dry hole. In the other, about 40 rods northeast of the Phoenix, oil was found, which partially filled the bore. The well was probably good for ten barrels per day, but litigation was begun against the owners, and up to January 1, 1900, it was not producing.

Previous to the sinking of the Phoenix well, three or four bores had been put down, one to a depth of 2,400 feet. In two of these oil in small quantity had been found.

There is little doubt but that a large quantity of oil underlies the city of Terre Haute and vicinity, else the yield of the Phoenix well could not have been so long continued. The porous area or reservoir containing it must, however, be narrow, and this bore probably struck it at just the right point to get the best results. As noted on a previous page, there is little chance of ever developing an oil output from

the Corniferous limestone, in any way comparing to that from the Trenton rock, on account of the much greater area and thickness of the latter formation.

The total production of petroleum in Indiana in the year 1899 was 3,818,713 barrels,* which, at the average price of 87½ cents per barrel, amounted to $3,341,374. Compared with 1898, this was an increase in production of 67,406 barrels, or 1.7 per cent. Owing, however, to the much higher average price, the amount received was $1,113,098, or, approximately, 50 per cent. more than in 1898, and $341,374 more than in any year since oil was discovered in the State. The greatest production, heretofore, was 4,680,732 barrels, in 1896. This, at 63 cents—the average price for that year—amounted to $2,954,411.

The following is a complete record of the monthly production of petroleum in the Indiana fields, beginning in January, 1891, and closing with December, 1899:

* This includes 11,000 barrels produced at Terre Haute but does not include the amount used for fuel and other purposes in the field.

TOTAL PRODUCTION OF PETROLEUM IN INDIANA FROM 1891 TO 1899 BY MONTHS.

[Barrels.]

MONTH.	1891.	1892.	1893.	1894.	1895.	1896.	1897.	1898.	1899.
January	6,171	15,841	111,824	259,000	300,568	365,582	290,746	317,014	298,207
February	5,981	18,946	96,025	232,107	230,559	241,743	309,922	272,780	221,356
March	5,159	24,794	134,549	282,376	310,303	386,586	341,961	325,301	291,173
April	4,973	26,184	146,493	287,330	352,077	395,032	328,779	310,034	326,690
May	5,757	31,033	186,939	321,502	397,001	417,963	340,023	311,208	345,755
June	8,136	40,888	209,616	333,479	403,569	434,167	369,803	320,477	335,198
July	10,809	49,203	221,666	327,349	434,376	422,968	375,249	314,861	330,002
August	11,603	56,109	248,353	345,031	420,132	407,238	371,921	332,777	348,537
September	16,500	66,034	245,615	319,588	409,169	415,675	362,528	326,264	333,199
October	19,029	95,699	252,568	339,424	393,153	394,283	408,179	319,490	327,697
November	20,801	129,270	245,607	304,030	373,789	337,331	430,958	200,644	327,718
December	21,715	144,067	236,038	337,450	361,436	362,164	423,069	300,457	333,182
Total	136,634	698,068	2,335,293	3,688,666	4,386,132	4,680,732	4,353,138	3,751,307	3,818,713

PRODUCTION OF PETROLEUM IN INDIANA FROM 1889 TO 1899.

	1889.	1890.	1891.	1892.	1893.	1894.	1895.	1896.	1897.	1898.	1899.
Total production (barrels of 42 gallons)	33,375	63,496	136,634	698,068	2,335,293	3,688,666	4,386,132	4,680,732	4,353,138	3,751,307	3,818,713
Total value at wells of all oils produced, excluding pipeage	$10,881	$32,462	$54,787	$260,620	$1,050,882	$1,774,260	$2,807,124	$2,954,411	$1,871,849	$2,228,276	$3,341,374
Value per barrel	$0 32⅝	$0 51½	$0 40	$0 37	$0 45	$0 48	$0 64	$0 63	$0 43	$0 59⅜	$0 87½

In the following table there is shown the number of wells put down in Indiana for petroleum in each month since June, 1891:

NUMBER OF WELLS COMPLETED IN THE INDIANA OIL FIELDS FROM 1891 TO 1899, BY MONTHS.

YEAR.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1891.....	.....	.....	.....	.....	.....	.....	6	6	15	15	15	8	65
1892.....	11	13	18	13	17	19	17	30	25	52	33	47	295
1893.....	20	30	31	36	45	47	47	55	27	72	56	76	542
1894.....	90	103	103	80	110	107	84	123	100	107	97	85	1,189
1895.....	61	45	81	111	122	153	132	140	129	106	102	85	1,267
1896.....	76	90	86	136	148	150	113	121	70	58	66	66	1,180
1897.....	41	35	40	47	49	52	60	45	55	89	119	54	686
1898.....	41	23	29	43	38	55	53	80	72	82	92	86	694
1899.....	75	48	68	64	87	99	77	104	106	120	106	106	1,060
Total....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	6,978

From the above table we learn that there was greater activity in oil operations in Indiana in 1899 than in any year since 1896. On January 1, 1900, there were 4,336 wells producing oil in the State, as against 3,628 on January 1, 1899—a gain of 708 for the year. The table also shows that 6,978 wells have been sunk within the State for petroleum, so that 2,642 of those completed have either proven dry or were abandoned previous to January 1, 1900. The number abandoned in 1899 was 247; while the number of dry holes drilled during the year was 105. This was but a fraction less than 10 per cent. of the total bores put down.

Comparing the following table with the one above, we learn that this was the smallest percentage of dry holes put down in any year since oil was discovered in the State.

TOTAL NUMBER OF DRY HOLES DRILLED IN INDIANA OIL FIELDS FROM 1891 TO 1899, BY MONTHS.

YEAR.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1891.....	.....	.....	.....	.....	.....	.....	0	2	5	4	3	1	15
1892.....	2	6	6	2	3	4	2	3	3	18	6	21	76
1893..... ..	7	10	10	6	14	6	11	9	5	14	10	9	111
1894.....	19	14	24	14	13	13	9	21	15	14	8	17	181
1895.....	7	4	13	16	22	20	15	23	12	12	9	13	166
1896.....	10	13	6	28	26	20	14	19	4	4	6	8	158
1897.....	8	9	7	12	5	16	11	9	16	11	18	8	130
1898.....	14	4	2	13	9	6	7	10	12	8	13	16	114
1899.....	5	9	14	5	5	7	12	9	12	14	8	5	105

Taking into consideration the large number of bores put down, the small number of dry holes resulting, and the high average price received for the oil produced, the year 1899 was one of the best in the history of the Indiana petroleum industry. The prospects for 1900 are, at the present writing, very bright. While new territory of importance may not be opened up, the high price of the liquid, if maintained, will stimulate the sinking of many new bores in territory already productive. The average yield per well may not be so great, for the days of the gusher are probably ended. But it should be remembered that one large well will not make any man a fortune; twenty small ones may in time. The yield of the large one will quickly grow much less; that of the twenty small ones will hold out for a long time. There is yet room for thousands of wells in the territory known to contain oil. At present prices, ten wells pumped by one power, and yielding on an average but three barrels each per day, will prove a paying investment.

NATURAL GAS.

Natural gas, the cleanest and best natural fuel known to man, occurs in greater or less quantity in an area approximating 2,800 square miles in the eastern-central part of the State. It is found in the uppermost 50 feet of the Trenton limestone—a great rock formation which underlies the entire State, with an average thickness of about 500 feet. This limestone does not outcrop within the State, and its closest known proximity to the surface is near Lawrenceburgh, Dearborn County, where it is 348 feet below.

It is only in such parts of this limestone as have, by natural agencies in the remote past, become porous that the gas is stored. It

was generated or formed thousands of years ago by the destructive distillation of the animals or plants buried in this limestone, and in time found its way into the uppermost porous strata, which have served as a storehouse or reservoir for its keeping. When the overlying Utica shale, a very dense and close cover which the gas can not pass through, is pierced by the drill the gas escapes or passes upward into the iron pipes which carry it wherever needed. Whenever the drill passes through the Utica shale and strikes the Trenton limestone where it is not porous, no gas or oil is found. Over the greater portion of the State the limestone is non-porous, and hence both oil and gas are lacking. The oil, as well as the gas, was formed from the animal and plant life buried in the Trenton limestone, the gas being only the lighter or more volatile product, which has arisen into the highest stratum of the porous reservoir, or into the apex of the arch or anticlinal in which the stored products are found.

It is now almost universally admitted that the rock pressure in any oil or gas field is nothing more nor less than water pressure, as in artesian wells, the water entering the porous stratum at some point where the latter outcrops and so forming a head or source. Hence, the deeper the well the greater the head of water and the higher the rock pressure. The porous rock contains a limited amount of gas, held in place by the overlying shale. The salt water is below this gas, ever pressing it upward into the vent furnished by the drill hole. As the supply of gas is gradually exhausted, the water rises to fill the pores, and the rock pressure is lowered. The pressure does not tell us anything about the volume or amount of gas stored in the rock; but the rate of diminution of pressure furnishes an excellent index of the rapidity with which that amount is being lessened. The salt water usually overcomes the gas pressure and drowns out or shuts off a well long before the rock pressure has been reduced to zero. In the Indiana field the average pressure in 1890 was 325 pounds. On the first of January, 1900, it was 155 pounds. The average well is drowned out, i. e., the supply of gas is shut off, at about 130 pounds. From this it will be seen that the future of natural gas in the State is not a promising one.

The highest use to which natural gas can be put is that of household consumption. With no kindling, no replenishing, no ashes, no soot, the duties of the housewife are decreased many fold. On account of the near failure of the supply, all new factories which are thinking of using gaseous fuel should be warned against locating in the Indiana gas field, instead of being attracted thither by promises of free gas. The coal bearing counties of Indiana will furnish cheap and plenteous

fuel for many years to come, and to those counties we would recommend all capitalists seeking sites for factories, when fuel is the principal factor to be considered in the choosing of the site.

In view of the rapid failure of the supply of natural gas, many manufacturers are turning their attention to "producer gas," or gas made by forcing air into an incandescent mass of coal or coke. The coal from many veins in western Indiana is shown by analysis to be well suited for the making of producer gas, and one of the largest rolling mills in the city of Terre Haute has been using such gas made from Vigo county coal for ten years. This company claim that they can make a ton of iron with the gas produced from 800 pounds of coal. Dr. W. A. Noyes, of the Rose Polytechnic Institute, who has made many coal analyses for this Department, has written as follows concerning this subject: "The heating power and the value for making producer gas of the Indiana coals is practically identical with that of the Pittsburgh coals, so far as the combustible matter which they contain is concerned. The Indiana coals differ from the eastern bituminous coals chiefly in that they contain more moisture and more sulphur. These reduce their heating power and their value for making producer gas as compared with the Pittsburgh coals, *but only by five to ten per cent. on the average.* The heating value and the gas producing value of coals from either region will be very nearly in proportion to the per cent. of combustible matter, that is, to the sum of the 'volatile combustible matter' and 'fixed carbon' which they contain."*

There is little doubt, therefore, but that, on the failure of the supply of natural gas for manufacturing purposes, the factories now in the gas belt will be able to use petroleum, or producer or other gas made from Indiana coal, where the coal itself can not be directly used, on account of the nature of the wares produced. Indeed, it will be the housewife, and not the factory owner, who will suffer the most inconvenience when the supply of the gaseous fuel shall have completely failed.

For full details concerning the condition of the Indiana gas field at the close of the year 1899, the reader is referred to the report of the State Supervisor of Natural Gas, in another part of the present volume.

In the following table will be found a statement of the value of the natural gas produced in Indiana from 1886 to 1898, inclusive:

*For tables of complete analyses of Indiana coals see pp. 105 and 106 of the 21st (1896) Annual Report of this Department; also pp. 1569 and 1570 of the 23d (1898) Report.

VALUE OF NATURAL GAS PRODUCED IN INDIANA FROM 1886 TO 1898.

Year.	Value.	Year.	Value.
1886	$300,000	1893	$5,718,000
1887	600,000	1894	5,437,000
1888	1,320,000	1895	5,203,200
1889	2,075,702	1896	5,043,635
1890	2,302,500	1897	5,009,208
1891	3,942,500	1898	5,060,969
1892	4,716,000	Total	$46,728,714

COAL.

During the year 1899 there was a great increase of activity in the coal regions of Indiana. The output from the mines was far greater than in any previous year. Many hundreds of acres of the best coal deposits changed hands, having been secured by parties having large capital to invest. Much of this land will be held for future development, but in a number of places extensive mines are being established, and the coal output bids fair to be doubled within the next three years.

This increased activity in the coal industry was due to several reasons. Chief among these was the great wave of prosperity which our country, as a whole, experienced, and which has caused such an activity in manufacturing interests as to greatly enhance the demand for fuel. A second reason was the growing of the belief, now general, that the life of natural gas in Indiana, for both manufacturing and household purposes, is a very short one, and that when such fuel fails the value of the coal lands will increase to a great extent. A third reason was that, for the first time in recent years, accurate data relative to and maps showing the exact location of all coal deposits in the State became available on the issuing of the Twenty-third Report of this Department.

This volume, containing 1741 pages and seven large maps, is devoted wholly to the coal interests of the State. It shows that the coal deposits of Indiana cover about 7,500 square miles, of which between 6,000 and 7,000 square miles are underlain by coal. They are confined exclusively to the southwestern part of the State, and lie west of a line passing through Williamsport, Greencastle, Paoli and a little to the east of Cannelton. There are between 20 and 30 horizons at which coal occurs, of which five contain workable coal over large areas, and not less than seven others contain workable coal over

small areas. The workable coal runs from 3 feet to 10 feet in thickness. The upper beds or "bituminous" coals average between 4 and 5 feet thick, while the lower or "block or semi-block" beds average 3 feet 1 inch. The upper beds occur in large basins, often hundreds of square miles in area, through which they often maintain great uniformity of thickness and minor detail. The lower beds are characteristically in small basins, often of only a few acres, but some with an area of several square miles. The coal in these basins is thick in the center and thins toward the edges.

The Indiana coal field is part of the eastern edge of the Illinois coal field, so that all the coal and other rocky beds tend to dip or get deeper toward a point in southern Illinois. The result of this is that along the eastern edge of the Indiana field only the lowest coal bed is found. Going westward this descends at the rate of about 24 feet to the mile, and gradually the other beds set in, until, along the Wabash River, the lowest bed may be 700 or 800 feet below the surface, and as high as 16 other beds have been found above it in a single drilling, the total thickness of the coals in this case being over 32 feet. As a rule not more than one or two workable beds will be found at any locality, and at many points, constituting together perhaps one-fourth of the field, none of the underlying beds are workable. In a few cases three or more beds are workable at a single point.

The eastern edge of the field, including eastern Fountain and Parke, Putnam, Owen, eastern four-fifths of Greene, Martin, Dubois, Orange, Crawford, Spencer and Perry, contains but limited quantities of workable coal. Most of this area is hilly. The lower, pockety coals are nearing outcrop, so that most of the mines are small and worked by drifting. These coals tend to be block or semi-block.

West of this belt is another from 10 to 20 miles broad where the coals are still shallow, the mines seldom reaching a depth of 100 feet. The coals are block or semi-block, and, though in pockets, are largely workable. This belt is flat or rolling. It crosses western Fountain, central Parke and Clay, western Greene, central Daviess, eastern Pike and Warrick counties.

Still west of this is a third belt 10 to 20 miles wide, where the upper coals are near outcrop and extensively mined. The coals in belt two are here deeper, and, as a rule, not workable. Most of the mines of the State are in this and the preceding belt. This third belt covers Vermillion, southwestern Parke, Vigo and western Clay, eastern Sullivan and Knox, western Daviess, Pike and Warrick counties.

Gibson, Vanderburgh and Posey and western Sullivan and Knox counties comprise a fourth belt or area, where the upper coals are

generally workable but deep; the mines, as a rule, being 250 feet or more in depth. The lower coals are here usually thin. On account of the surface rocks in this area showing little or no coal, the impression is general that there is but little coal in this belt. The data at hand lead to the conclusion, however, that not only is this view erroneous, but that this area will some day prove the richest part of the Indiana field.

The most active mining regions at present are in Clay and Vigo, southern Parke and Vermillion, and eastern Sullivan and western Greene counties. The quantity of coal in Clay and Greene is not great, but will yet last for many years. Parke and Vermillion counties have somewhat larger quantities. The coal of Vigo and Sullivan counties, though long and extensively mined, has hardly as yet been touched. This is still more true of Knox, Gibson and Vanderburgh counties. Pike county has a bed of unusual thickness outcropping or very near the surface, but as yet hardly touched. The same bed is present in Warrick County, though not covering as large an area. Daviess County still has much workable coal but in thin beds. Limited areas of unmined block coal exist in southeastern Parke and western Clay counties and near Patricksburg, Owen County.

This block coal is the most valuable coal in the State. It is as pure as splint coal, is almost free from sulphur or phosphorus, and has the softness and combustibility of wood. In burning, it swells so little that its expansion is scarcely perceptible, does not change form, and never cakes or runs together; hence, it is a most valuable fuel for the blast furnace and the cupola of the iron founder.

For steam and household purposes it has an unrivaled reputation. It burns under boilers with a uniform blaze that spreads evenly over the exposed surface, thus securing a more uniform expansion of the boiler plates. Its lack of sulphur also causes it to have but little detrimental effect upon the boiler, grates or fireboxes. In household grates it burns with a bright, cheerful blaze, like hickory wood, making a very hot fire, which, for comfort and economy, can not be surpassed by any fuel except an abundant supply of natural gas.

All told, there is estimated to be 40 billions of tons of coal in Indiana, of which one-fifth, or 8 billions, are estimated to be workable under present conditions. It is estimated that 100 million tons, 1-400 of the total amount, or 1-80 of the workable amount, have been mined out. Assuming that the past rate of increase of production be maintained, it is estimated that the field will last not less than 300 years.

The use of coke for domestic fuel is largely on the increase in south-

ern Indiana and Illinois. It is gradually taking the place of anthracite coal, as the price of the latter advances year by year.

Coke From Indiana Coal.

Coke weighs but about 40 pounds per bushel, so that the bulk of a ton is twice as great as that of anthracite, whereas the heating power per bushel is two-thirds as great. Coke is, at present, made in Indiana only at Ayrshire, Pike County, where David Ingle has 24 ovens in operation. These are the old-fashioned "bee-hive" ovens, in which all the gases, ammonia and other by-products set free from the coal during the process of coking are allowed to escape. It is estimated that each ton of Indiana coal contains 25 pounds of sulphate of ammonia and 60 to 70 pounds of tar, besides one-third or more of its weight in volatile combustible matter. In the "bee-hive" oven these are wholly lost. In weight the amount of coke realized is about 49 per cent. that of the coal used. In other words it takes two tons of coal to produce one ton of coke. The latter, however, is of excellent quality and the demand for it is constantly increasing. It brings about $2.10 per ton at the ovens, and retails for domestic use at St. Louis and elsewhere at $5.00. The freight rate to St. Louis is 75 to 80 cents per ton.

The coals from veins V, VI and VII (1898 Report), are well suited for coking, and much of the pea and slack coal hitherto wasted or sold for a low price could, when washed, be used to advantage for coke making. Especially would this be true if improved ovens, utilizing or saving all by-products, were erected.

Report of the Mine Inspector.

The report of the State Mine Inspector, Mr. James Epperson, shows that 5,865,123 tons of coal were mined in Indiana in 1899. This was an increase of 688,079 tons over the output of 1898, which was the largest in the history of the State.

This increase was due to the absence of the usual strikes on the part of the miners in the leading coal districts in the State, and to a largely increased demand for Indiana coal during the last three months of the year. This demand was in part brought about by the shortness of the supply of natural gas and a consequent storage of coal for winter use. There is no doubt but that the demand for Indiana coal will gradually increase as the supply of gas grows less, and the chances are that the output will reach 10,000,000 tons per annum before the year 1910.

According to the report of Mr. Epperson, the following is the relative rank of the fifteen coal producing counties for the year 1898, together with the output of each, the total number of miners employed in mines working ten or more men, and the amount of wages paid:

		Tons.	Number of Men.	Amount of Wages Paid.
1	Clay	1,104,254	2,055	$947,424 34
2	Vigo	1,041,491	1,019	584,792 57
3	Sullivan	790,609	742	398,926 09
4	Parke	784,433	982	614,163 69
5	Vermillion	659,842	541	368,818 29
6	Greene	659,161	824	367,500 52
7	Pike	173,905	437	105,831 69
8	Daviess	167,209	423	110,674 21
9	Vanderburgh	152,833	209	118,028 09
10	Warrick	99,572	138	44,976 20
11	Gibson	71,634	120	41,851 23
12	Fountain	55,102	66	39,603 09
13	Knox	47,881	119	32,762 05
14	Perry	25,139	42	21,217 26
15	Martin	6,798	12	4,402 85
	Total	5,839,863	7,739	$3,800,972 39

But few of the mines operating less than ten men made a report to the State Inspector, as they are not required by law to do so. The tonnage given by those which reported was only 25,260, bringing the full amount reported up to 5,865,123 tons. This was probably 100,000 tons less than the actual output of coal for the year.

It is my opinion that the law should be so changed as to require the examination, at least once a year, of every mine operating in the State, regardless of the number of men employed. A monthly report of the output of each of these smaller mines should also be made, so that *exact* statistics relative to the coal industry would be available. Many mines employ from six to eight men, and the aggregate amounts to a large number. The life of any one of these men is as valuable as that of a man working in the larger mines, yet under the present law they receive no protection whatever. The air where they work is often extremely foul, man-shafts are more often lacking than present, and too little attention is given to the condition of the roof. Some of these abuses could at least be ameliorated by the occasional visits of an inspector invested with power to better the conditions where possible.

Owing largely to the efficiency of the supervision of the Mine Inspector and his deputy, the number of fatal accidents during 1899 was but 15, or less than any year since 1891.

RESOURCES OTHER THAN FUELS.

LIMESTONES.

For its output of ornamental and building limestone, Indiana is the most important State in the Union. The Indiana oölitic stone has long been known among architects for its strength and durability. Within the past decade the demand for it has been rapidly increasing, and it is now in use in 27 states, one territory and one foreign country. Four State capitol buildings, those of Indiana, Illinois, Georgia and New Jersey, have been constructed wholly or partly from it, as have also 27 court houses in Indiana, and numerous custom houses, postoffices, hotels and other public buildings throughout the United States. The Soldiers' Monument at Indianapolis, with its magnificent carved groups of statuary, is composed wholly of it. In New York and other eastern cities it has also been used in the construction of the private residences of many of the richer citizens. Its wide reputation is due to its general usefulness in masonry, ornamentation and monuments; its abundance; the ease with which it can be quarried and dressed, and its pleasing color and durability.

The Indiana Oölitic Stone.

This stone is found in a strip of territory from two to fourteen miles in width which extends from Greencastle, Putnam County, to the Ohio River. It occurs in a stratum varying from a few feet to nearly 100 feet in thickness. This stratum is massive, often without an interruption from top to bottom, and the size of the blocks which may be quarried is limited only by the capacity of the quarry machinery and transportation facilities.

The principal quarries of this stone are located near Romona, Owen County; Stinesville, Ellettsville, Bloomington and Sanders, Monroe County; Oölitic, Dark Hollow and Bedford, Lawrence County; Salem, Washington County, and Corydon, Harrison County.

Few building stones are more accessible than the Indiana oölitic limestone. Occurring as it does in an almost horizontal position, it outcrops over a comparatively large area, with either no covering at all or one so light that it can profitably be removed. The map of the area prepared for the Twenty-first Report of this Department, shows the total length of the outcrop in Owen, Monroe and Lawrence counties to be not less than 1,600 miles. The Monon Railway traverses the area from north to south over all the productive part, and there are also three east-west railroads and a short line known as the Belt, which serves to connect many quarries around Bedford with the other roads. There are also short branch roads, making switch connections with one or more of these roads, running into each of the quarries.

The oölitic stone is a granular limestone, or calcareous sand rock in which both grains and cementing principle are carbonate of lime. In the common sandstones of the State the grains are hard and nearly angular. In the oölitic stone they are always soft and either round or rounded, and the cement is harder than the grains. In color the stone is either buff or blue. Its specific gravity is about 2.47, and its weight about 152 pounds per cubic foot. In chemical composition it is nearly pure carbonate of lime, the *average* of eight analyses of specimens from the eight leading quarries showing the following percentage composition: Calcium carbonate, 97.62; magnesium carbonate, .61; iron oxide and alumina, .36; insoluble residue, .91. The crushing strength of 50 specimens ranged between 4,500 and 13,200, with an average of 7,000 pounds per square inch.

The fire resisting properties of the oölitic stone are also very great, as a series of experiments on one-inch cubes by this Department has proven. Heated to 1,000° F. and plunged into cold water, the cubes were not affected. Heated to 1,200° F. and plunged into cold water, the cube crumbled slightly along the lower edges. Heated to 1,500° F. and cooled in air, the cubes retained their forms intact but were calcined in a marked degree. This shows that the stone will withstand the effects of fire to the point of calcination.

On account of its softness when first quarried, the oölitic stone can be readily sawed or carved into any form desired. The saws in use at the various mills are almost entirely the common gang saw with long iron blades made to swing to and fro across the stone, sand and water being fed under each saw automatically.

The larger part of the stone shipped is used for fine dimension stone for buildings, both for face work and trimming. It is also largely used for monumental purposes, either as bases for monuments or for the shafts, or both. Large quantities are used for pavements, curbing, sewer piers, abutments, etc. It makes a strong and durable pavement, and does not wear slippery. Its use for curbing for cement walks is increasing year by year in many of the larger towns of Indiana and adjoining states. Large quantities of the spalls and waste pieces from the quarries are also annually used for railway ballast, or are crushed into macadam for country roads.

It is by far the most valuable stone in Indiana, and many good deposits are as yet undeveloped. For a detailed account and maps of the area containing the oölitic stone, and also full data relative to its production for the market, the reader is referred to the paper by Messrs. Hopkins and Siebenthal in the Twenty-first (1896) Annual Report of this Department.

In the vicinity of Osgood, Ripley County; Westport, New Point and St. Paul, Decatur County, and Laurel, Franklin County, are extensive beds of Niagara limestone, which for many years have been extensively quarried. This is known as the Laurel limestone, since the stone is typically exposed and has been longer worked near the town of that name.

Niagara Limestone.

This stone can be quarried more easily and at less expense than any other stone of a similar nature in the State; the natural seams and even bedding doing away largely with the necessity for drilling and blasting. The stone occurs in natural slabs of a uniform thickness—two to twenty inches—and with the upper and lower surfaces very even, so that for many purposes tool dressing after quarrying is not necessary. It is of a handsome color, very hard and durable, and is used extensively for flagging and curbing, and to a less extent for window sills, window caps, range stone, ashlar, doorsteps, foundations, street crossings, gutter stone, pier footings, bridge abutments, etc. For many of these uses it is better suited and can be furnished more cheaply than either the Indiana oölitic limestone or the Berea (Ohio) sandstone, the two materials with which it comes in closest competition.

The railway facilities, especially about Laurel, have been recently improved, switches having been laid to some of the best deposits. This stone can therefore be put on the market for a lower price, and yet with a greater profit than in the past, when it was hauled to the cars on wagons. Its superior quality will doubtless soon lead to its more extensive adoption for those purposes, above enumerated, for which it is so well adapted.

A somewhat similar stone, well fitted for curbing, flagging and paving, and occurring, as does the Laurel limestone, in layers of variable thickness, has been quarried in the immediate vicinity of Wabash, Wabash County. The deposits are large, easily and cheaply quarried, and worthy of much more extensive development.

Limestones for macadam, concrete and other purposes for roads and streets occur in many localities in central and southern Indiana. One of the most extensively worked deposits is at the Kenneth quarries, three miles west of Logansport on the State Line Division of the Pennsylvania Railway. Thousands of tons of crushed stone are shipped from there to Chicago for street purposes. The Illinois Steel Company draws on this quarry for much of the limestone used for fluxes in their enormous steel plant.

Macadam Stone.

Two crushing plants have been recently established at Monon, White County, and are doing a large business in making macadam of the Lower Helderberg stone outcropping in abundance at that point.

At Kokomo, J. B. Carter & Son crush and ship enormous quantities of hard, bluish limestone, which has proven very durable and excellently suited for concrete work. An analysis of an average sample of their output shows it to be composed of calcium carbonate, 89.32 per cent.; magnesium carbonate, 5.27 per cent.; silica, 3.37 per cent.; iron oxide, etc., 1.63 per cent.

Other large plants for crushing macadam material are in operation at Greencastle, Putnam County; Romona, Owen County; Mitchell, Lawrence County, and Milltown and Marengo, Crawford County.

The use of crushed stone for macadam and concrete work is constantly growing, and the business of preparing the stone for such uses will, in the near future, become a most important industry in many localities of the State. The Niagara, Lower Helderberg, Oölitic and Mitchell limestones are in general well suited for macadam, and there are many localities where these stones outcrop in quantity close to a railway, which offer excellent sites for the investment of capital.

Stone for Lime.

In the vicinity of Huntington, Huntington County; Delphi, Carroll County, and Logansport, Cass County, deposits of Niagara limestone are found which are especially suited for the production of lime for building purposes. At Huntington and Delphi the manufacture of lime is carried on on an extensive scale, the value of the yearly output at the two points approximating $250,000. The product is noted through the eastern United States for the excellence of its quality, and is much sought after by builders and contractors.

The oölitic limestone of southern Indiana has not proved itself fitted for the production of lime, but a formation immediately overlying the oölitic has been extensively used, and large kilns are now producing from it a good quality of lime at Mitchell, Lawrence County, and Romona, Owen County.

The following table shows the production of limestone in Indiana in 1898, and the uses to which it was put:

Building purposes	$1,083,571
Paving and road making	253,731
Riprap	16,046
Made into lime	195,040
Flux	138,184
Total	$1,686,572

SANDSTONES.

Sandstones of excellent quality and in commercial quantities occur at a number of localities in western and southwestern Indiana. These sandstones are classed under two heads. First, the *Mansfield Sandstone*, occupying a strip from two to ten miles or more in width, extending from the north part of Warren County 175 miles in an east of south direction to and beyond the Ohio River. While the Mansfield sandstone is soft, friable and easily worked, it hardens by exposure and becomes in time one of the most durable rocks in the State.

The Mansfield Sandstone.

In this sandstone the mass of the rock is made up of white or colorless quartz grains embedded in a matrix or cementing substance consisting almost wholly of iron oxide. When the percentage of this iron oxide is high the stone is a handsome *dark brown* in color and is especially suited for business blocks, and for the lintels and cornices of buildings whose fronts are constructed of pressed brick. The rain never discolors small portions of such stone, and the brick walls are therefore permanently free from those unsightly, mouldy-looking streaks which soon appear where limestone is used for finishings.

This brown variety of the Mansfield sandstone has been quarried at Hillsboro, Fountain County; near Green Hill, Warren County; Mansfield, Judson and Portland Mills, Parke County, and St. Anthony, Dubois County. Good brown stone in suitable position for quarrying, but not yet developed, occurs near Bloomfield, Greene County, and on Rocky Fork and Sugar Mill creeks in Parke County. Smaller outcrops of less importance occur elsewhere.

Specimens of this brown stone from six of the leading deposits in the State have been analyzed by this Department, and their *average* composition was found to be as follows:

	Per cent.
Insoluble residue—silica	90.39
Alumina	.49
Iron oxide	7.41
Lime	.08
Carbonic acid	.09

When the percentage of iron oxide in the cementing material is low and the iron is in the hydrous form, the color of the sandstone is *gray* or *buff*. Such stones are more common than the brown variety, and are well fitted for bridges, foundations, retaining walls, or, when of the best quality, for fronts of business blocks. These buff and gray varieties of the Mansfield sandstone have been quarried at and near Williamsport, Warren County; Attica, Rob Roy, Stone Bluff, Hills-

boro, Wallace, and elsewhere in Fountain County; Guion, Judson, and several different localities along Raccoon and Sugar creeks in Parke County, and at numerous small quarries throughout the area further south.

Coal Measure Sandstones.

In the upper coal measures, overlying or at a horizon above that of the Mansfield sandstone, are several beds of sandstone which are extensively quarried in the coal bearing counties of the State. In composition these coal measure sandstones are finer grained than the Mansfield sandstone, and the cementing matrix is more complex, being composed of a mixture of clay, silica, decaying feldspar and iron oxide. These stones are buff, blue or gray in color, and have proven durable wherever used. The largest quarries are at Worthy, Vermillion County; Riverside, Fountain County, and Cannelton, Perry County. The stone from Worthy has been used extensively in Chicago for sidewall fronts and trimmings, and with it public buildings in several towns of Illinois have also been built.

The stone at Riverside is very fine grained. It takes a smooth finish and is light blue or drab in color, and well adapted for delicate carving and ornamentation. It has a crushing strength of 6,000 pounds per square inch, and a chemical analysis shows the percentage of its composition to be: Silica, 93.16; alumina, 1.60; iron oxide, 2.69. It has been largely used at Lafayette and neighboring towns. A somewhat similar stone of the subcarboniferous formation, which has been used for bridges, foundations, etc., has been quarried near Attica, Fountain County; Raccoon and Bainbridge, Putnam County, and other points in the State.

The oldest and largest sandstone quarries in the State are those near Cannelton, Perry County. The stone varies in color from a lemon yellow to a light or dark gray. Its percentage composition is as follows: Silica, 96.18; iron oxide, 1.56; alumina, .54; lime, .15. It has proven very durable but its color is not an attractive one for fine buildings, owing to the iron oxide weathering to a rusty yellow tint. It has been extensively used for building purposes at Cannelton; in the locks on the canals at Louisville, Ky., and on the Green River, Kentucky; and for wharves, retaining walls, etc., at many places along the Ohio River.

Other deposits of sandstone which have been quarried on a small scale, occur near Rockport, West Baden, Paoli, Brazil, Coxville and Covington. Some of these, as well as many hitherto undeveloped deposits are sufficient in quantity, and in quality suitable to merit the careful attention of capitalists in search of good investments.

The following table gives the value of the sandstone output in Indiana for the years 1890 to 1898 inclusive:

1890	$43,983	1895	$60,000
1891	90,000	1896	32,847
1892	80,000	1897	35,561
1893	20,000	1898	45,342
1894	22,120		

CLAYS.

The clays of Indiana rank in value next to coal and building stone, among the natural resources of the State. It is only within the past five years, however, that capitalists have come to realize to some extent the vast possibilities which the clays and shales of western Indiana present for manufacturing purposes. Even yet but few of the main deposits are being worked, and there is room for twenty times as many factories as are now in operation. During the past two years all factories have had many more orders than they could fill, and, on account of the rapid advance in the price of lumber, the future of the clay industry is a most promising one.

At the present time Brazil, Terre Haute, Clinton, Veedersburg, Montezuma, Cayuga, Hobart and Porter are the principal seats of clay industries in the central west and northwestern parts, while important factories are located at New Albany, Huntingburg and Evansville in the southwest. In the eastern half of the State there are few, if any, clays suitable for other purposes than ordinary brick and drain tile.

The purest clay in Indiana is the kaolin of Lawrence and Martin counties. The best grades of it are pure white, and show a chemical analysis of 98.61 per cent. silicate of alumina, and but 1.47 per cent. of fluxes. The poorest grades are yellowish brown in color, but even they contain no more than 3 per cent. of iron oxide and but 5 or 6 per cent. of all impurities combined.

Kaolin of Lawrence and Martin Counties.

The great drawback to this koalin is its lack of plasticity. Otherwise it would be in every way suitable for the best grades of porcelain ware. It is, however, suitable in the highest degree for the manufacture of alum salts for the sizing of the finer grades of wall and letter paper. Its refractory properties are also very great, and for that reason, if mixed with a small percentage of the under-clays of the nearby coal measures to render it more plastic, it can be used for making the finer grades of refractory wares, such as retorts, glass pots, glass tanks, etc. Recent experiments have proven it also suitable for making a filler for furniture and buggies; for cosmetics and for ultramarine.

At the largest known deposit, four miles north of Huron, Lawrence County, thousands of tons of this purest of clays can be seen, comprising a stratum 5 to 11 feet in thickness; yet, since 1891 not a pound has been put to use. A great mineral resource of untold value —there it lies, unworked, unutilized, awaiting only the coming of energy and capital to make it up into many kinds of products which are now brought into our State from other lands.

Fire-Clay of Vermillion County.

Next to the kaolin in purity is the fire-clay of Vermillion county, found just west of Montezuma and north of Hillsdale, in the hills bordering the Wabash River. It is a high grade, whitish silicious under-clay, showing 98.24 per cent. of clay-base and sand, and but 1.79 per cent. of fluxes. It is found in a stratum five to seven feet in thickness which underlies an area a mile wide and extends from Hillsdale almost to Newport. Coal of good quality both overlies and underlies the fire-clay, the latter outcropping on the sides of the ravines.

Fire-brick made from this clay have been used for years in the iron and steel furnaces at Birmingham, Alabama, and Atlanta, Georgia, and the Illinois Steel Company, at South Chicago, has recently begun the use of the unburned clay as a lining for their furnaces. Recent shipments in quantity have also been made to Milwaukee, New Orleans; Dayton, Ohio, and Old Mexico. The brick sell for $12.00 per thousand, and the ground clay for $1.50 per ton on board the cars at Hillsdale.

But two factories, working on a small scale, are at present engaged in making fire-brick and marketing this clay. Taking into consideration its quality and the facilities of fuel and transportation, there is room for an investment of large capital in its development, with the assurance of a handsome profit in the future.

Gannister.

"Gannister," or gannister rock, a peculiar mixture of fire-clay and sandstone, occurs in quantity on the farm of Geo. Galloway (Sec. 4, T. 20 N., R. 8 W.), near Fountain, Fountain County, Indiana. Samples of this deposit were tested by the Union Steel Company, of Alexandria, and found to be in every way suitable for the lining of Bessemer and other steel converters.

Potter's Clays.

Potter's clays of good quality are found in a number of localities in the coal bearing counties; notably near Huntingburg, Dubois County; Cannelton, Perry County; Loogootee and Shoals, Martin County; Clay City, Poland, and Brazil, Clay County; Coal Bluff, Vigo County, and Annapolis, Parke County. All of the deposits have been tested in a small way in manufacturing pottery for the local markets, and all have

given excellent satisfaction. The best known deposits and the ones heretofore most extensively worked are those at Huntingburg and Cannelton. The clays from these two points show the presence of 95.16 per cent. of clay base and sand, and 5.20 per cent. of fluxes. The average analyses of the clays used in the great potteries at Akron and Zanesville, Ohio, give 94.65 per cent. of clay base and sand, and 4.54 per cent. of fluxes. The potter's clays of Indiana are thus shown to be as good as those of Ohio, and the fuel supply and transportation facilities are, in many localities, better. A good slip clay for glazing pottery occurs in abundance along Rocky Run, four and one-half miles west of Rockville, Parke County.

Millions of tons of shales and underclays, well fitted for making the best grades of paving brick, sewer pipe and other vitrified products, exist in the coal bearing counties of Indiana. These clays lie in the closest proximity to the fuel necessary to burn them; the shales immediately overlying, and the under-clays, as their name denotes, underlying the veins of coal. No more durable material for the making of pavements can be used than vitrified brick, provided sufficient care be taken in the structure of the foundation upon which the brick are placed. Such a pavement comes nearer than any other to a typically perfect pavement; i. e., one which is reasonable in first cost; low in cost of maintenance, and easy of repair; durable under heavy traffic with reasonable freedom from noise and dust; free from decay, waterproof and non-absorptive; of low tractive resistance and furnishing a good foothold for horses.

Shales and Under-Clays for Vitrified Products.

The city of Chicago has recently let the contract for 66 miles of vitrified brick pavements, and a number of miles of brick roadways were constructed in 1899 in the country near Monmouth, Illinois. The making of paving brick is an industry yet in its infancy in Indiana, for the time will come, and that before many years, when not only the streets of every town of two thousand inhabitants within our State will be paved with brick, but also many of our country roadways in those regions devoid of gravel and other road material.

Numerous chemical analyses published in the Report of this Department for 1895, as well as the practical making of the products in many factories, have proven that the under-clays and shales of the coal regions can be made into the best of sewer pipe, roofing tile, terra cotta, hollow brick, stone pumps, conduits, pressed front brick, etc. Since 1891 thirteen large factories have been erected at Brazil, Terre Haute, Clinton, Veedersburg, Cayuga and Montezuma for utilizing these shales and under-clays. These factories have all been kept very

busy—even during the dull seasons of 1895 and 1896—the demand for their products being in many instances far greater than the possible supply. They have proven that the shales and under-clays of the coal measures are in every way fitted for manufacturing each of the products above mentioned. These factories are but the forerunners of others yet to come, for the raw material is there, the fuel necessary to burn it is there, railway facilities for bearing away the finished product are plentiful, and where these three necessary elements are present, capital is, in time, sure to come, to be invested and to make this section of the State a great clay industrial center.

The best deposits of unworked shales and under-clays for making vitrified products lie just east of Mecca, Parke County, west of Montezuma, Parke County, west of Terre Haute, Vigo County, and near Riley, Vigo County. In these localities railways are already constructed, coal is plentiful and the raw material can not be excelled in variety and quality. Other large deposits of shale which are as good in quality as those mentioned, but which at present lack railway facilities, are located on Coal Creek, one mile southeast of Veedersburg; on Brouillet's Creek, south of Clinton, Vermilion County; in section 6, Pierson Township, Vigo County, seven miles southeast of Terre Haute; near Patricksburg and Woodside, Owen County, and near Farnsworth, Sullivan County. A fine deposit of knobstone shale, whose analysis shows its fitness for vitrified products, lies alongside the B. & O. S. W. Railway six miles west of Seymour, Jackson County.

Clays for Terra Cotta Lumber.

In the northwestern part of the State, near Hobart, Lake County, Chesterton, Porter County, Michigan City and South Bend, are extensive deposits of silty clay, which is peculiarly fitted for the making of terra cotta lumber. This lumber is made by mixing one part of sawdust with three parts of clay, and then forming a hollow brick a foot square, and two, four or six inches in thickness. After burning, the ware is left very light and porous, but strong and wholly fire-proof. It can be sawed like a pine board, is penetrated easily by nails, and on it plaster can be spread without intervening laths, or to it wooden finishing can be readily united. It is coming into rapid demand for wall partitions in fire-proof buildings. Floor arching, wall furring, column and girder covering and under-roofing to which slate or roofing tile can be nailed, can also be made of this same porous material. One factory has been making these products at Hobart for ten years, and the average profits of the owner have been $20,000 per annum. He claimed to have the only deposit of clay in the State suitable for making the material, but investigations and chemical analyses made by this Department proved the presence of a great abundance of simi-

lar raw material, and capital invested at any of the points mentioned will realize a handsome profit in the making of porous fire-proof products, which will be extensively used in the next ten years.

Clays for Ordinary Brick and Drain Tile.

Clays suitable for burning ordinary building brick and drain tile occur in quantity in almost every county in Indiana. In the northern part of the State they are largely of drift origin, and some care has to be taken to choose those free from limestone pebbles. Within the past two years large factories have been erected near Martinsville, Montezuma and Brazil, for making ordinary brick from shale. These factories have been successful from the start, and in 1899 could not supply the demand for their output.

The following table shows the

CLAY PRODUCTS OF INDIANA FROM 1895 TO 1898, INCLUSIVE.*

	1895.	1896.	1897.	1898.
Brick:				
Common—				
Quantity	319,751,000	262,936,000	224,042,000	277,136,000
Value	$1,488,370	$1,207,247	$1,012,547	$1,359,596
Average per M	$4 65	$4 59	$4 52	$4 91
Pressed—				
Quantity	17,085,000	9,071,000	8,394,000	9,883,000
Value	$161,336	$99,954	$94,935	$101,935
Average per M	$9 44	$11 01	$11 31	$10 31
Vitrified				
Quantity	22,313,000	18,792,000	27,239,000	28,216,000
Value	$204,000	$175,670	$266,638	$264,796
Average per M	$9 14	$9 35	$9 78	$9 38
Fancy or ornamental—value	$13,439	$36,050	(a)	$9,437
Fire brick—value	$12,510	$28,350	$24,245	$29,766
Drain tile—value	$820,602	$475,919	$559,524	$622,198
Sewer pipe—value	$42,000	$125,839	$156,450	$134,980
Ornamental terra cotta—value	(a)	(a)	(a)	$43,100
Fireproofing—value	(a)	$136,461	$121,835	$74,629
Tile, not drain—value	$139,463	$175,390	$223,750	$247,990
Pottery:				
Earthenware and stoneware—value	$111,900	$51,345	$29,725	$42,742
Miscellaneous—value	$123,990	$162,100	$222,660	$280,343
Total value	$3,117,520	$2,674,325	$2,712,309	$3,211,512

*From Twentieth Ann. Rep. U. S. Geol. Surv., 1898-99, Pt. VI, p, 59.
(a) Included in miscellaneous.

CEMENT RESOURCES.

The cement industry in Indiana is a growing one, and promises much for the future. Two kinds of cement are manufactured in the State. Hydraulic rock cement is made in large quantities in Clark County, and just across the river at Louisville, there having been 2,040,000 barrels, valued at $816,000, produced in this district in 1898. With the exception of New York, this was more than double the amount produced in any other State, and was one-fourth the entire amount produced in the United States.

Hydraulic Cement Rock.

Large unworked deposits of hydraulic limestone, suitable for making this cement, occur in Scott and Jennings counties, and a similar deposit has been recently discovered near Laurel, Franklin County.

The Portland cement industry promises even greater results than that of the hydraulic cement. Portland cement is made from carbonate of lime and clay—about 78 per cent. of the former and 22 of the latter—intimately ground and mixed and then burned into a clinker and reground. The burning is mostly done in rotary steel kilns. A plant with an output of 500 barrels daily, complete with machinery up to date, will cost, approximately, $150,000.

No mineral industry in the United States has grown more rapidly during the last eight years than that of the manufacture of Portland cement. In 1891, 454,813 barrels were made in this country, while 2,988,313 were imported. In 1898 the home production had risen to 3,692,284 barrels, valued at $5,970,773, while the imports were 2,013,818 barrels, showing a total consumption of 5,706,102 barrels. But 2,500 barrels were made in Indiana in 1898, there being but one small factory, located at South Bend, in operation in the State.

The carbonate of lime used in the production of Portland cement is either marl or limestone. Of the production in the United States in 1898, 3,112,000 barrels were made from limestone, and 580,000 barrels from marl.

Marls for Portland Cement.

Marl of excellent quality is found in abundance in the northern third of Indiana. It occurs in the vicinity of lakes, either present or extinct, and is probably due, in large part, to deposits from calcareous springs, the waters of which contain much lime in solution.

A rapid reconnoissance of the marl bearing lakes and marshes of northern Indiana was made by this Department in the fall of 1899. The region in question contains several hundred lakes with areas of from several square miles each down to a few acres. With hardly an exception these lakes contain deposits of marl. In most cases these

deposits are too small to be workable except on a very small scale. A deposit of 40 acres, three feet thick, is sometimes considered workable. On the large scale on which most of the cement factories are being built at present a deposit, to be considered workable, should be equivalent to 200 acres of marl, 10 feet in thickness. Such a deposit, of proper chemical composition, and not too far from a railroad, may be considered a *first-class* deposit, warranting the erection of a plant with a capacity of 1,000 or more barrels a day. Such deposits were noted at the following places:

Fish Lake in Laporte County, close to the Grand Trunk and Wabash railroads.

Chain and *Bass lakes*, west of South Bend, St. Joseph County, close to the Lake Shore and Vandalia railroads. The quality of marl here appeared to be below the average.

Lake Maxinkuckee, close to Vandalia Railroad. Deposit in lake, and principally in 10 feet or over of water. The marl is over 22 feet in thickness in places.

Simonton, *Mud* and *Cooley lakes*, northeast of Elkhart, Elkhart County. Four miles from Lake Shore Railroad.

Syracuse Lake, at Syracuse, Kosciusko County, on B. & O. Railroad. Marl in places over 36 feet in thickness.

Turkey or *Wawasee Lake*, on B. & O. Railroad. Contains, probably, the largest deposit in the State.

Milford and *Dewart lakes*, southeast of Milford, Kosciusko County. Near Big Four Railway.

Tippecanoe Lake, Kosciusko County, four miles from Big Four Railway. This lake contains considerable good marl, but the location is not so desirable on account of the deposit being strung along a long shore line.

Grass Lake, southeast of Lagrange, Lagrange County. A dry deposit, 200 acres, over 30 feet deep.

Whitmer, *Atwood*, *Long*, *Third* and *Dallas lakes*, northwest of Wolcottville, Lagrange County, close to Wabash Railway. These lakes ccontain a very fine deposit, but it is also along a long shore line.

Turkey and *Little Turkey lakes*, Lagrange and Steuben counties, contain several hundred acres of marl over 10 feet, and reported up to 45 feet, in thickness.

Lake James, northwest of Angola, Steuben County, and 2½ miles from Ft. Wayne branch of Lake Shore Railroad, contains a large deposit, which is also much strung out.

At three of the above localities, namely, Syracuse Lake, Milford and Dewart lakes, and the Turkey lakes of Lagrange and Steuben counties,

large cement factories are, at the present writing, in process of erection, while options on a number of other deposits have been secured by parties who hope to form companies for their development in the near future. At many other localities deposits not so close to railways or not so large as those mentioned were found. Full details of all deposits of workable size, together with maps of the lakes, will appear in the next annual report. It is only necessary to say in this connection that northern Indiana can, if called upon, furnish marl sufficient to supply material for making Portland cement for the entire United States for many years to come.

On account of the absence of lakes, southern Indiana possesses no deposits of marl, but that portion of the State contains beds of oölite and oölitic limestone, suitable in every particular for the manufacture of Portland cement.

Oölitic Stone for Portland Cement.

The oölitic stone of Lawrence, Monroe and Owen counties has been tested and found to make Portland cement of a superior quality. Briquettes, after 30 days, showed a tensile strength of more than 700 pounds. The oölitic stone contains from 93 to 98 per cent. carbonate of lime, and is almost free from magnesia, the element most harmful in the manufacture of cement. Millions of tons of spalls and refuse pieces of this stone, unfit for building purposes but in every way suited for cement manufacture, are thrown aside yearly from the leading quarries. The stone, when first quarried, is soft, and much more easily ground than is generally supposed. Lying, as it does, adjacent to fuel, the shales and other clays of the coal bearing counties to the westward, there is no reason why this oölitic stone region should not become the center of the Portland cement industry in Indiana.

Oölite for Portland Cement.

Large beds of oölite, which is whiter and much softer than oölitic limestone, occur at Milltown and Marengo, Crawford County, right by the side of the "Air Line" Railway. The bed at Milltown as exposed, is 13 feet thick and 1,500 feet in length, when it disappears in the bluffs of Blue River. An analysis showed the oölite to contain 99.18 per cent. carbonate of lime. It is, therefore, purer than oölitic limestone, and, being softer, the expense of the preparatory grinding will not be so great. Good clay can be secured at Huntingburg and other points to the westward on the "Air Line" Railway.

TRIPOLI.

Tripoli or infusorial earth occurs at a few localities in Indiana. A large deposit which was formerly somewhat extensively worked is found near Ferdinand, Dubois county, on the land of Joseph Brinkman. It is a fine-grained, highly siliceous product of excellent quality, but lack of capital and transportation facilities have put a stop to its development. Another extensive deposit, darker in color and showing the presence of 83.71 per cent. of silica, 8.92 per cent. of alumina and 1.54 per cent. of iron oxide, was found in September, 1899, on the farm of A. H. Harbaugh, near Freetown, Jackson County.

Tripoli is used mainly as a polishing powder for brass and other metal work; also as an absorbent of nitroglycerine in the manufacture of dynamite, and as a protective packing about steam boilers. Three thousand eight hundred and thirty-three short tons, valued at $22,835, were produced in the United States in 1898.

"Drift marl," a very fine grained silty clay containing 40 per cent. or more of calcium carbonate, and valuable as a polishing powder, occurs in quantity on the farms of Marion W. McCann, near Rushville, and David B. Wilson, Carbon, Clay County; also near Gosport, Owen County, and Boone Grove, Porter County.

MINERAL PAINTS.

Minerals suitable for making paints are found in quantity in several places in southern Indiana.

In section 6, Pierson Township, Vigo County, there is a large deposit of very fine grained, grayish shale, known as the "Paint Mine." For a number of years this has been ground and shipped in barrels to be used as a body for paints. It serves the purpose admirably, and a lack of capital and transportation facilities alone have prevented the development of the industry on a larger scale.

On the land of Chas. Grimes (Sec. 20, T. 9, R. 5), Jefferson Township, Owen County, three miles east of the E. & I. Railway, is a large deposit of iron oxide suitable for a mineral paint. A similar deposit of finer texture occurs near Worthington, Greene County.

One mile west of Dover Hill, Martin County, is a bed of ferruginous shale and clay, 15 feet and more thick, which furnishes umber, and red and yellow sienna of excellent quality. When Dover Hill was the county seat of Martin County, this deposit was extensively worked, but on account of a lack of transportation facilities it has, for many years, remained untouched.

Near Ferdinand, Dubois County, in the S. ½ Sec. 34, T. 3, R. 4, are extensve beds of red oxide of iron and clay which, about 1870, were

worked on a large scale. Paints of a dozen or more different colors were made which were highly esteemed for their beauty and durability. A lack of capital and shipping facilities, however, in time put a stop to the enterprise. Large deposits of ochre and other paint clays are found farther south in the same region.

Deposits of a ferruginous clay suitable for umber also occur in quantity near Dillsboro, Dearborn County.

WHETSTONE AND GRINDSTONE ROCKS.

The fine-grained siliceous rocks in Orange and Martin counties have long been used for the manufacture of abrasive materials. In the annual report for 1895 issued by this Department was an extensive paper on the whetstone and grindstone industry of the State, prepared by Mr. E. M. Kindle. This was accompanied by an accurate geological map of the area mentioned. The principal quarries are near French Lick, Georgia, Orangeville and Paoli.

Indiana ranks second among the states of the Union in the production of whetstones and grindstones, being excelled only by Arkansas. The output of this State is not large, being in 1898 but 320,000 pounds, valued at $15,000. The demand, however, is constantly increasing, and if better railway facilities were provided the industry would soon become a prominent one in the area which contains the raw material.

MOLDING SAND.

Molding sand for use in foundries occurs in a number of places in northern and central Indiana. The best known deposit is near Centerton, Morgan county. Other beds, extensively used in Chicago, are located near McCool, Porter County, and four miles southeast of Valparaiso in the same county. Near Hobart, Lake County, is a fine deposit 8½ feet in thickness and covering a large area, which is, as yet, unworked. Other good deposits are found near Gosport, Owen County; Salem, Washington County, and Rockport, Spencer County.

GLASS SAND.

Sand suitable for glass making is found in quantity near Pendleton, Madison County; Montpelier, Blackford County, and Lapel, Hamilton County. These deposits are largely used by the glass factories in the gas belt. A large deposit, as yet but little developed, occurs near Wolcott, White County.

On Sec. 15, T. 14 N., R. 8 W., one-half mile east of Coxville, Parke County, is also a large deposit which in the past few years has been shipped in quantity for use in window glass making at Muncie, Orestes

and other points. A switch from the T. H. & L. Railway is laid to the deposit, and a branch of the C. & E. I. runs within a half a mile. Three analyses of this sand showed its average composition to be as follows: Silica, 98.77; iron oxide, .685; calcium carbonate, .426; magnesium carbonate, .113. At the point where produced, this sand is 40 feet thick. The deposit extends for a mile or more along the bluffs of Raccoon Creek, and, in most places, is underlain with a four-foot vein of good coal.

IRON ORES.

Limonite, brown hematite, siderite and pyrites are the ores of iron occurring in Indiana. Limonite or bog iron ore is found in largest quantities in Greene, Martin, Monroe and Perry counties in the south, and in the swamps of Lake, Porter and St. Joseph counties in the northwest. In general it is too siliceous to compete with the richer hematites of the Lake Superior, Missouri, Tennessee and Georgia iron regions. As a proof of this, it is only necessary to state that of fourteen blast furnaces which have been erected in the State in the past to use these bog and other iron ores, not one is in operation at the present. Most of them have long since gone to ruin, and of those still standing, the last one went out of blast in 1893.

Three miles east of Bloomfield, Greene County, are large deposits of a mixture of limonite and brown hematite which are, perhaps, the richest ores of iron in the State. The veins are from five to eight feet in thickness and cover an area of more than 1,500 acres. An analysis of this ore, probably from picked samples, made by Dr. Robert Lyons, of Indiana University, showed as follows:

	Per cent.
Metallic iron	55.09
Phosphorus	.60
Silica (free)	11.66

Samples sent to me by interested parties were submitted to Dr. Noyes, the chemist of this Department, who found that they contained 47.25 per cent. metallic iron.

The old Richland furnace, which was located two miles southeast of Bloomfield, was used in reducing these ores between the years 1841 and 1858. About nine tons of pig iron were produced daily. The closing down of the old Wabash and Erie Canal left the furnace 30 miles from the nearest transportation point, and so caused its final closing down. A semi-block coal of good quality is found in veins 2 to 3½ feet in thickness, in the immediate vicinity of this iron ore. The

Bloomfield branch of the Monon Railway is distant to the southward about two miles.

Siderite or carbonate of iron, often called kidney iron ore, is found associated with the overlying shales in most of the coal bearing counties. In western Vigo and Vermillion counties it is especially common in the shales overlying coal VII. Large quantities were formerly used in the blast furnace at Terre Haute, and in the old Indiana Furnace on Brouillet's Creek, about eight miles to the northwest.

Pyrites or iron sulphide, known also as "fools' gold," is the most widely distributed ore of iron in the State. Its constituents are iron, 46.7 per cent.; sulphur, 53.3 per cent. It is probably to be found in greater or less quantities in every county. It occurs most abundantly associated with coal VI, or coal L—the thickest vein of bituminous coal mined in the State. Hundreds of thousands of tons of pyrites have been thrown out on the dumps of the mines of this vein of coal between Edwardsport, Knox County, and Coxville, Parke County. Within the past two years this pyrites has greatly increased in value on account of the rapid rise in the price of sulphur. The pyrites is used mainly in the manufacture of copperas, or iron sulphate, and sulphuric acid; 100 tons of the pyrites being used in making 50 tons of the acid.

As usually thrown on the dumps the pyrites is mixed too largely with coal and other impurities for use. A plant or separator for freeing it from impurities can be erected for about $2,500, and the pyrites will then bring $2.25 or more per ton. In 1898, 143,201 tons of pyrites, valued at $391,541, were produced in the United States, while 259,546 tons, valued at $747,419, were imported.

Sulphuric acid is by far the most important chemical compound known to man. Sodium nitrate and pyrites are the two ingredients used in its making. The nitrate for any factory in the United States has to be imported from South America. With the pyrites and fuel present in large quantity, western Indiana offers a most excellent site for a great sulphuric acid factory.

OTHER MINERALS AND ORES.

With the exception of small quantities of drift gold, in the form of minute grains and scales, which are found in the sands and gravel beds along the streams of Brown, Morgan and other counties near the southern limit of the drift area, no gold, silver or other precious metal occurs in the State. Much money has been foolishly spent and time wasted by people who have thought otherwise; and hardly a day

passes but specimens of rock supposed to contain gold or silver are brought or sent into this office. Most of these specimens contain either pyrites of iron, commonly called "fools' gold," or scales of mica which glisten when exposed to light.

An occasional lump of lead ore or galena is sent in from some county in the State, but it, too, is of drift origin, as is also any piece of native copper found in Indiana. Zinc blende, or zinc sulphide, occurs in a few localities in the western and southwestern counties, but nowhere in commercial quantities.