GEOLOGICAL SURVEY OF NEW JERSEY

HENRY B. KÜMMEL, STATE GEOLOGIST

BULLETIN 11.

THE MINERAL INDUSTRY OF NEW JERSEY FOR 1912

BY

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ILLUSTRATION.

Letter of Transmittal.

TRENTON, August 25th, 1913.

The State Printing Board, Trenton, N. J.:

GENTLEMEN—I hereby request that the State Printing Board order the publication of 2,700 copies of a Bulletin on the Mineral Industry of New Jersey for 1912, the manuscript of which is transmitted herewith. The publication of this report has been approved by the Board of Managers of the Geological Survey, and favorable action by the State Printing Board is requested, as provided by Chapter 46, Laws of 1910. The printing contract for 1912–1913 provides for the publication of such Bulletins of the Geological Survey as shall be ordered by your Board.

The Bulletin shows that the Mineral Industry of New Jersey during 1912 had a value of $40,391,548. This was $2,675,137 more than in 1911, and was greater than ever before in the history of the industry.

Very respectfully,

HENRY B. KÜMMEL,

State Geologist.

The Mineral Industry of New Jersey.

By M. W. Twitchell.

GENERAL SUMMARY.

As in 1910 and 1911, the statistics of the mineral production of New Jersey for the calendar year 1912 were collected by the Geological Survey of New Jersey in co-operation with the United States Geological Survey. This method avoids the necessity of troubling producers by requests from two organizations, and insures greater accuracy and completeness in the results.

The total value of the mineral production in New Jersey in 1912 was $40,391,548. This is $2,675,137 more than in 1911. It is distributed among the different industries as follows:

VALUE OF THE MINERAL INDUSTRY IN 1912.

	Value.	*Increase or Decrease Compared to 1910.*
Zinc Mining,	$9,626,191[a]	$797,410 I
Iron Mining,	1,192,816	35,545 I
Clay and Clay-working Industries,	20,540,561	1,703,458 I
Stone,[b]	1,738,473	114,589 I
Sand and Gravel,	1,146,640	87,714 I
Portland Cement,	3,052,098	207,430 D
Lime,	65,241	48,543 D
Mineral Water,	209,726	397 D
Sand-lime Brick,	6,924	10,786 D
Mineral Paints, Coke and By-products,	2,812,424[d]	205,154 I
Miscellaneous,[c]	454	.....
Total,	$40,391,548	$2,675,137 I

[a] Value of recoverable output figured as metallic zinc.
[b] Includes Slate and Talc.
[c] Includes Greensand Marl and Gems.
[d] Combined in order to conceal the output of individual producers.

DISTRIBUTION OF ACTIVE MINERAL INDUSTRIES.

The distribution of the *active* mineral industries in New Jersey in 1912 is shown on the accompanying map (Plate 1). Only mines, quarries, pits and works actually in operation and reporting a production during 1912 are shown. At quite a number of places more plants exist than could be shown. This is especially true of Trenton, where there are thirty-four pottery manufacturers, some having several plants.

The distribution of these industries presents a number of features of interest.

The only operating *Zinc* mines are near Franklin Furnace, Sussex County. The active *Iron* mines are in the Highlands and extend from near Ringwood, Passaic County, by way of Hibernia and Dover in Morris County, to Oxford Furnace, near Belvidere, in Warren County.

Limestone is quarried in Sussex, Warren, Morris and Hunterdon Counties. *Slate* is quarried at only two points, both in Sussex County. The *Trap-rock* quarries are chiefly in the Triassic area, and are scattered along the ridges, including the Palisades, the Watchung Mountains, Rocky Hill, etc. The *Granite* quarries are in the Highlands, chiefly around Pompton, Passaic County; Waterloo, Sussex County, and Boonton, German Valley and Hibernia, Morris County. The *Sandstone* quarries are chiefly in the Triassic area, especially near Stockton, Byram, Princeton and Wilburtha. The only *Talc* and *Soapstone* quarry is near Phillipsburg.

Most of the *Clay* pits and clay-working plants are located along the Cretaceous belt extending from Woodbridge, Middlesex County, to Salem, in Salem County, although quite a number are scattered over the rest of the State.

All of the operating *Portland Cement* plants are in Warren County, near Phillipsburg. The only *Coke* works reporting is located at Camden. The *Sand-lime Brick* works are at West Palmyra, Burlington County, Penbryn and Haddonfield, Camden County, and Rockaway, Morris County. The *Mineral-paint* plants are at Newark, Essex County, Lincoln, Middlesex County, and Grasselli, Union County.

The *Sand and Gravel* pits are widely distributed throughout the State, though the majority are located in the southern part. In 1912, there were pits in sixteen out of the twenty-one counties, Essex, Hudson, Hunterdon, Salem and Somerset being the only ones not reporting a production. Of the 95 producers, 21 were in Burlington, 17 in Middlesex, 10 in Cumberland, 8 in Gloucester, 7 in Camden, 6 in Morris, 5 in Sussex, 4 in Bergen, 3 each in Warren, Passaic and Cape May, 2 each in Union, Monmouth and Mercer, and 1 each in Atlantic and Ocean.

Metallic Ores.

ZINC.

The mines at Franklin Furnace and Ogdensburg, Sussex County, both controlled by the New Jersey Zinc Company, are the only zinc mines in the State. During 1912, as for several years past, the Franklin Furnace mine was the only one operated, although some development work was done upon the Ogdensburg property. The Franklin Furnace mine is one of the most important zinc mines in the United States, its production alone being sufficient to place New Jersey *first* as a producer of zinc among the Eastern or Appalachian States and *second* in the United States, the leading State being Missouri.

The figures for New Jersey are given in the following table, which also includes those of the other Eastern or Appalachian States for comparison:

MINE PRODUCTION OF ZINC IN THE EASTERN OR APPALACHIAN STATES IN 1912.a

State.	*Ore Mined (Short Tons).*	*Zinc Production (figured as spelter in pounds).*	*Value.*
New Jersey, ...	459,585	139,510,008	$9,626,191
New York, ...	b	28,000	1,932
North Carolina, ...	b	283,320	19,549
Tennessee, ...	b	4,381,300	302,310
Virginia, ...	b	497,235	34,309
Total, 1912, ...		144,699,863	$9,984,291
Total, 1911, ...		159,351,558	$9,083,039

(a) Modified from table compiled by Mr. H. D. McCaskey of the U. S. Geological Survey.

(b) Mine production of zinc ore not available. In 1911 the ore production of Tennessee was 22,564 tons; and the combined production of Virginia and New York, including lead-zinc ores, was 16,704 tons; while that of New Jersey was 374,064 tons.

There was a decrease in the New Jersey production from 154,890,900 pounds (all figured as spelter) in 1911 to 139,510,008 pounds in 1912; but because of higher prices, the value increased from $8,828,781 in 1911 to $9,626,191, a gain of $797,410.

The quantity of ore hoisted during the year 1912, as reported by the New Jersey Zinc Company, was 411,489 tons, while according to figures furnished by the U. S. Geological Survey the quantity of ore sold or treated was 459,585 tons, 363,588 tons being treated in the concentrating mills and 95,997 tons sold in the crude state.

According to C. E. Siebenthal, of the U. S. Geological Survey, the actual production of zinc (or spelter) from New Jersey ores in 1912 was 16,941 tons, or 23,882,000 pounds. This was probably smelted in the smelter of the New Jersey Zinc Company at Palmerton, Pennsylvania, which has a capacity of 5,772 retorts. On the basis of the 1912 figures, New Jersey ranks fourth in the production of spelter. A large part of the output of the New Jersey zinc mines has, as a rule, been made into zinc white, or zinc oxide, at the plant of the New Jersey Zinc Company at Newark, but no production of zinc white at this plant is reported by this company for the year 1912.

ZINC ORE MINED IN NEW JERSEY SINCE 1880.

Previously reported,	4,504,784 tons
Mined in 1912,	411,489 "
Total,	5,116,273 tons

IRON.

The iron ore mined in the United States in 1912 amounted to the great total of 55,150,147 long tons, compared with 43,876,552 tons mined in 1911, an increase of 11,273,595 tons, or 25.69 per cent., according to an advance statement by Ernest F. Burchard, of the United States Geological Survey. The following table gives the quantities of iron ore mined in the ten leading States in 1912 in long tons:

IRON ORE PRODUCTION BY STATES, 1912.

Rank.	State.	1912.
1	Minnesota,	34,431,768
2	Michigan,	11,191,430
3	Alabama,	4,563,603
4	New York,	1,216,672
5	Wisconsin,	860,600
6	Pennsylvania,	517,081
7	Virginia,	446,305
8	Tennessee,	416,885
9	New Jersey,	364,673
10	Georgia,	134,637
	Total (ten States),	54,143,654
	Other States,[1]	1,006,493
	Total (U. S.),	55,150,147

There was no marked change in the condition of the iron-mining industry in New Jersey in 1912. There was a decrease in the amount of iron ore mined of 101,561 long tons, as compared with 1911, but an increase in the amount marketed of 7,102 long tons and an increase in the value of the amount marketed of $34,545.

In last year's statement in regard to the iron-mining industry (Bulletin 7 of the N. J. Geological Survey, p. 8) the "production" for 1911 was given as 359,721 long tons. This was a mistake, as the actual production, or ore mined, was 466,234 long tons, and the figure given, 359,721 long tons, was the amount of ore marketed. One result of taking the "production" at 359,721 tons was to emphasize the apparent decrease in 1911 as compared with 1910. The actual decrease in ore mined was only 55,598 tons, instead of 162,111 tons.

The following table gives the details of the iron-ore production for 1912, together with the totals for 1911 for comparison:

IRON ORE PRODUCTION IN NEW JERSEY, IN 1912.

County.	Active Producers.	Ore Mined[1] (long tons).	Ore Marketed[1] (long tons).	Value of Ore Marketed.	Stock on Hand Dec. 31, 1912, (long tons).
Morris,	6	163,389	186,038	$609,013	867
Passaic and Warren,	3	201,284	180,785	583,803	121,779
Total, 1912,	9	364,673	366,823	$1,192,816	122,646
Total, 1911,[2]	10	466,234	359,721	$1,158,271	124,080

[1] Including the 17 other States that reported a production in 1912.
[1] Nearly all magnetite.
[2] The figures for 1911 have been somewhat revised since they were published last year.

Morris County continued to be the largest producer, its total of ore mined in 1912 being 163,389 long tons; while the combined output of Passaic and Warren Counties was 21,284 tons. There were nine active mines, six in Morris, two in Warren and one in Passaic County. The distribution of these mines is given on Plate I.

The Washington mine at Oxford, Warren County, was the largest producer in 1912, displacing the Richard, at Wharton, Morris County, which was second. The Peters, at Ringwood, Passaic County, was third. The other active mines were the Wharton, at Hibernia, Mt. Hope, at Mt. Hope, Hoff, at Wharton, and High Ledge, at Ledgewood, in Morris County; and the Ahles, at Oxford, Warren County.

IRON ORE MINED IN NEW JERSEY SINCE 1870.

Previously reported (with correction for 1911),	19,450,294 tons
Mined in 1912,	364,673 "
Total,	19,814,967 tons

SPECIAL STATISTICS REGARDING THE IRON-MINING INDUSTRY IN NEW JERSEY IN 1909.[1]

Number of operators,	8
Number of mines,	10
Capital,	$3,612,024
Expenses of operation and development,	$1,321,915
This is distributed as follows:	
Services—	
Salaried officers and clerks,	66,049
Wage earners,	840,967
Miscellaneous—	
Supplies,	199,707
Fuel and rent of power,	168,368
Royalties and rent of mines,	7,091
Taxes,	7,350
Rent of offices and other sundry expenses,	32,383
Value of product,	$1,651,091
Persons engaged in industry,	2,148
This is distributed as follows:	
Proprietors and salaried officers and clerks,	53
Wage earners (Dec. 15th or nearest representative day),	2,095

[1] Modified from tables in 13th Census of the United States, supplement for New Jersey, published in 1913 on figures for 1909.

Land controlled, acres,	13,668
Owned,	5,169
Held under lease,	8,499
Primary horse-power,	6,585

ELECTRIC SMELTING OF IRON ORES.

Much has been said and written in recent years regarding the direct smelting of iron ores in the electric furnace. In "Mineral Resources of the United States for 1911," the U. S. Geological Survey gave an interesting resumé of the experiments so far conducted along this line. The following brief extract from this article summarizes the situation at the present time:

"Kershaw in the Iron Trade Review for January, 1912, gives a tabular summary of comparative costs of electrically produced pig iron, which is given below, with the addition of dates":

Comparative Costs of Electrically Produced Pig Iron.

Date.	*Type of Furnace.*	*Location.*	*Power Kilowatt Hours.*	*Estimated Cost (2,204 pounds).*	*Notes.*
1903	Stassano,	..Darfo, Italy, ...	2,866	$18.60	Power at $9 per electric horse-power year.
1904	Keller,	....Livet, France, ..	2,589	13.27	
1906	Heroult,	...Sault St. Marie, Canada, ...	1,642	11.77	Power at $10.71 per electrical horse-power year; ore at $1.50 per ton.
1908	Gronwall,	..Trollhättan, Sweden,.....	1,957	13.56	Estimate based on early trials.
1910	"	..Trollhättan, Sweden, ...	1,735	13.00	Actual results obtained at Trollhättan, Sept. 3, 1911.
1910	Heroult,	...Heroult, Shasta Co., Cal., ...		15.00	Power at $12 per electrical horse-power year; ore $1.50 per ton.

"With regard to the future of electric smelting of pig iron there are certain controlling factors that will doubtless limit it to localities like Trollhättan and Heroult where all physical and commercial conditions are favorable to its development. The main point seems to be that the saving in coke effected by the use of electric heating is so small that electric power must be produced or sold at a cost of $8 to $10 per electrical horse-power year, a figure far below the possibilities of the great majority of hydroelectric power stations at present. The electric process is also further handicapped by the cost of carbon electrodes, an expense which the ordinary blast furnace does not have to bear. These conclusions, it should be noted, have no bearing on the refining of steel in the electric furnace, a practice which is already established, and is rapidly expanding in Europe and America."

PIG IRON AND STEEL.

According to figures furnished by the Bureau of Statistics of the American Iron and Steel Institute, New Jersey produced 36,876 long tons of pig iron (including ferro alloys) in 1912. This amount is not included in the State total given elsewhere as it would involve a duplication of a part of the value already given for iron ore production.

According to the same authority as that mentioned above, New Jersey produced the following amounts of pig iron of all kinds from 1908 to 1912:

PRODUCTION OF PIG IRON IN NEW JERSEY, 1908–1912.

1908,	225,372	long tons.
1909,	294,474	" "
1910,	264,781	" "
1911,	40,663	" "
1912,	36,876	" "

According to figures furnished by the Bureau of Statistics of the American Iron and Steel Institute, New Jersey produced the following amounts of all kinds of finished rolled iron and steel from 1908 to 1912:

PRODUCTION OF ROLLED IRON AND STEEL IN NEW JERSEY, 1908 TO 1912.

1908,	147,347	long tons.
1909,	188,256	" "
1910,	165,057	" "
1911,	154,563	" "
1912,	175,143	" "

As it would involve a duplication of values, this amount is not included in the State total.

COPPER.

None of the copper mines in this State reported any production in either 1911 or 1912.

THE PAHAQUARRY MINE.

The efforts which have been under way for several years to develop the Pahaquarry mine, near Dunnfield, Warren County, were continued. In 1911 the mine was operated for three months and the 200-ton concentrating mill for two months, but no concentrates were shipped. The ore mineral, chalcocite, was reported to break too fine for profitable extraction by the process used, and losses were considerable. Experiments were being made to improve the saving.[1] It was recently reported that during 1912 a large plant for roasting and leaching the low grade ore was completed.[2]

[1] Mineral Resources of the United States for 1911, Part 1, p. 881.
[2] Mineral Resources of the United States for 1912, Advanced Chapter.

Non-Metallic Minerals and Products.

CLAY AND CLAY-WORKING INDUSTRY.

The total value of the products of the clay and clay-working industry of New Jersey passed the $20,000,000 mark in 1912. The exact figures are $20,540,561; of which $19,838,553 is the total for clay products, and $702,008 the total for raw clay mined and sold by the miner. As the corresponding figures for 1911 were raw clay, $658,875, clay products, $18,178,228, and grand total $18,837,103, a substantial increase is shown. The total increase over the figures of 1911 is $1,703,458, of which $43,133 was in raw clay mined and sold and $1,660,325 was in manufactured clay products.

The following table gives the rank of the five leading States in the manufacture of clay products in 1911:

PRODUCTION OF CLAY PRODUCTS BY LEADING STATES, 1911.

State.	*Rank.*	*No. of Operators.*	*Value.*	*Percentage of Total Product.*
Ohio,	1	633	$32,663,895	20.13
Pennsylvania,	2	423	20,270,033	12.49
New Jersey,	3	162	18,178,228	11.21
Illinois,	4	330	14,333,011	8.83
New York,	5	222	10,184,376	6.28
Total,			$95,629,543	58.94
All other producing States,			66,606,638	41.06
Total (United States),			$162,236,181	100.00

From the above table it will be seen that New Jersey is one of the foremost States in the manufacture of clay products. With 48 States reporting an individual production varying from over $32,000,000 down to less than $30,000, New Jersey ranks third, being exceeded only by Ohio and Pennsylvania. It will also be

noted that the average individual production of the New Jersey operators was much greater than that of any other State.

In 1911 New Jersey stood first among the States in the production of raw clay, second in the total value of all pottery and fourth in the total value of all brick and tile. It ranked first in the manufacture of sanitary ware, first in china, third in white ware and third in porcelain electrical supplies. It was first in fireproofing, second in "tile, not drain," which includes roofing, floor, wall and art tile, second in architectural terra cotta, third in front brick and fourth in common brick. The chief change here over 1910 is in the advance from fifth to fourth place in the making of brick and tile. As the figures for all the States for 1912 are not yet available, comparative statements can be made for 1911 only; but it is not likely that there will be any very notable change when the 1912 figures become available.

SPECIAL STATISTICS REGARDING THE CLAY-WORKING INDUSTRIES IN NEW JERSEY IN 1909.[1]

	Pottery, Terra Cotta and Fire Clay Products.[2]	*Brick and Tile.*[2]	*Total.*
Number of establishments,	88	76	164
Capital,	$22,349,000	$7,355,000	$29,704,000
Expenses for services and materials,	$10,248,000	$2,674,000	$12,922,000
This is distributed as follows:			
Salaries,	$1,036,000	$205,000	$1,241,000
Wages,	5,661,000	1,625,000	7,286,000
Cost of materials,	3,551,000	844,000	4,395,000
Value of products,	$13,139,000	$4,073,000	$17,212,000
Value added by manufacture,	$9,588,000	$3,229,000	$12,817,000
Persons engaged in industry,	10,542	3,619	14,161
Distributed as follows:			
Proprietors and firm-members,	38	64	102
Salaried employees,	689	150	839
Wage earners, average number,	9,815	3,405	13,220
Primary horse-power,	11,817	11,419	23,236

[1] Modified from data published in the 13th Census of the United States, Supplement for New Jersey, published in 1913, on figures collected in 1910.
[2] Expressed to the nearest thousand.

CLAY.

Only a small part of the clay mined in New Jersey is included under this head. All that used by the miner in the manufacture of brick, tile, etc., is reported as the finished product, and only that sold by the miner is here included. For several years New Jersey has stood first, both as regards quantity and value, among the States in the production of raw clay.

The details regarding the production of clay are given in the following table:

CLAY MINED AND SOLD RAW, 1912.

	No. of Producers.	*Amt. in Short Tons.*	*Value in 1912.*	*Value in 1911.*
Ball clay,	5	2,649	$9,152	$6,433
Fire clay, including sagger clay,	37	291,474	502,053	471,695
Stoneware clay,	5	20,031	39,905	64,068
Brick clay,	8	50,186	33,168	20,326
Miscellaneous,	9	74,543	117,730	96,353
Total,	48	438,883	$702,008	$658,875

The above table shows increases in all items except brick clay, in which case there was a decrease. The total increase was $43,133.

As usual, fire clay greatly exceeded all other kinds combined. Of course, it is to be borne in mind that this means only fire clay mined and sold raw, and is compared with other clays mined and sold raw. There was also a large amount of fire clay dug and made into fire brick directly; and, on the other hand, there was probably more brick clay actually dug than fire clay, but most of it was used at once by the miner. The value of clay so dug but not sold is included elsewhere in the returns for the clay products manufactured.

Only six counties made returns of clay dug and sold. Middlesex, as usual, stood first, with a production of 383,300 tons, valued at $616,440. This constituted 87.8 per cent. of the total production. Mercer was second, 14,530 tons, value $37,870; Burlington third, 15,062 tons, value $20,587. Ocean, Camden and Cumberland follow in the order given, their total production being 25,991 tons, valued at $27,111.

POTTERY.

According to a recent report of Mr. Middleton, of the United States Geological Survey, the pottery industry of the United States "was in a high state of development during the year 1912, and the value of the pottery products marketed was the largest in the history of the industry. This was due partly to the general prosperity enjoyed by the country at large, but more especially to the steady improvement in the wares themselves in body, design and decoration. American pottery is gaining a stronger hold on the market, becoming more popular every year. Many if not most of the best hotels and clubs in the country are now using large quantities of domestic china." The total value of the production of the United States in 1912 was $36,504,164.

New Jersey continued to rank second among the States in the production of pottery, Ohio, as during the preceding year, standing first. The total value of New Jersey's production in 1912 was $8,935,920. This was $533,979 more than in 1911 and $347,465 more than in 1910. Of the total production of the United States, the output of New Jersey constituted 24.47 per cent., or practically one-fourth.

The following table giving the pottery production of the ten leading States in 1912 brings out more clearly the position of New Jersey as one of the leading States:

POTTERY PRODUCTION OF THE TEN LEADING STATES IN 1912.(b)

Rank.	State.	Active Producers	Red Earthenware.	Stoneware and Yellow ware, Etc.	Whiteware, Etc.	China, Etc.	Sanitary Ware.	Porcelain Electrical Supplies.	Miscellaneous.	Total.	Percentage of Total.
1	Ohio,	106	263,085	1,832,266	9,969,491	.....	451,971	1,827,290	1,164,632	15,508,735	42.49
2	New Jersey,	52	36,655	48,297	1,090,683	1,155,766	5,199,278	1,146,467	258,774	8,935,920	24.48
3	West Virginia,	14	.....	(a)	2,051,987	50,002	1,156,478	(a)	36,444	3,365,166	9.22
4	New York,	24	31,497	(a)	(a)	691,065	(a)	1,269,108	51,988	2,405,532	6.59
5	Pennsylvania,	29	162,137	281,526	902,585	280,472	185,000	307,636	9,184	2,128,540	5.83
6	Indiana,	10	(a)	46,100	(a)	.....	633,578	(a)	.....	1,077,102	2.95
7	Illinois,	24	35,827	675,244	(a)	.....	(a)	(a)	23,812	931,951	2.55
8	Massachusetts,	12	163,010	26,300	(a)	.....	.....	(a)	12,789	252,099	.69
9	California,	12	36,091	54,087	(a)	.....	(a)	(a)	6,126	219,653	.60
10	Michigan,	6	99,555	.....	(a)	.....	.....	(a)	(a)	194,892	.53
	Total (10 States),	289	827,857	2,963,820	14,014,746	2,177,305	7,626,305	4,550,501	1,563,749	35,019,590	95.93
	Other States, (c)	145	130,413	955,958	814,685	.....	275,950	376,815	226,060	d1,484,554	4.06
	Total (U. S.),	434	958,270	3,919,778	14,829,431	2,177,305	7,902,255	4,927,316	1,789,809	36,504,164	100.00

(a) Included in "Other States" and State totals.
(b) This table is modified from one published by the United States Geological Survey.
(c) Includes products made by less than three producers.
(d) Made up of State totals of the States not named above.

The principal pottery product of New Jersey is sanitary ware, and in this, as is evident from the above table, this State stands first. The total value of the sanitary ware produced by the United States in 1912 was $7,902,255, and of this New Jersey's portion was $5,197,278 or 65.76 per cent.

The following table gives the different kinds of pottery, with the amount of each kind produced in New Jersey in 1912. The figures for 1911 are also given, for the sake of comparison:

POTTERY PRODUCTION BY VARIETIES, 1912.

	No. of Producers Reporting.	*1911.*	*1912.*	*Increase or Decrease.*
Red earthenware,	7	$38,910	$36,655	$2,255 D.
Stoneware and yellow or Rockingham ware,	3	75,915	48,297	27,618 D.
White ware, including C. C. ware, white granite, semi-porcelain ware and semi-vitreous porcelain ware,	10	1,148,904	1,090,683	58,221 D.
China, bone china, delft and belleek ware,	8	1,105,278	1,155,766	50,488 I.
Sanitary ware,	20	4,898,588	5,199,278	300,690 I.
Porcelain electrical supplies,	12	913,921	1,146,467	232,546 I.
Miscellaneous,[1]	11	220,425	258,744	38,349 I.
Total,		$8,401,941	$8,935,920	$533,979 I.

As will be seen from the above table, there were decreases in the value of red earthenware, stoneware and yellow ware and white ware; but gratifying increases in china, sanitary ware, porcelain electrical supplies and miscellaneous products.

The production of the leading counties is as follows:

POTTERY PRODUCTION BY COUNTIES, 1912.

Rank.	*Counties.*	*No. of Producers Reporting.*	*Value.*	*Per Cent.*
1	Mercer,	33	$8,069,694	90.30
2	Middlesex,	5	353,285	3.95
3	Camden,	3	242,973	2.72
4	Hunterdon,	3	173,998	1.94
	All other counties,[1]	..	85,970	.96
	Total,		$8,935,920	

[1] Includes chemical ware, art pottery, clay tobacco pipes, doorknobs, porcelain hardware trimmings and druggists' earthenware.

As is evident from this table, Mercer County not only stands first in the production of pottery, but its output is over 90 per cent. of the State total. As all of the Mercer County potteries are located at Trenton, the production given, $8,069,694, is that of Trenton alone, making it one of the two leading pottery centers of the United States, East Liverpool, Ohio, being the other. Parkersburg, West Virginia, is coming to the front as another leading center; and will be assisted materially if the General Porcelain Company of East Liverpool carries out its recently announced intention of moving its seven plants to Parkersburg and there consolidating them into one large plant.

Middlesex County, with two new producers, increased its production by $153,597 over the previous year, and moved from third to second place. Camden and Hunterdon were the third and fourth of the leading counties. Besides the four leading counties just mentioned, pottery was produced by Union, Essex, Burlington, Monmouth, Cumberland and Atlantic Counties, in the order given; the value of the total output of these counties being $85,970.

Of the different classes of pottery, Mercer County produced all of the white ware and china, all of the sanitary ware except to the value of $536,510, and by far the larger portion of the porcelain electrical supplies. Hunterdon County continued to lead in the manufacture of stoneware and yellow ware, and Essex County in red earthenware. Camden County held its place as second in sanitary ware, with Middlesex third. Hunterdon was the only county beside Mercer which produced any porcelain electrical supplies.

BRICK AND TILE.

The brick and tile industry was in a prosperous condition in 1912. The total value of the New Jersey production was $10,902,633, which was $1,126,346 more than in 1911 and $1,656,779 more than in 1910.

[1] Less than three producers each, or the amount is so small that the output of individual operators is actually or approximately revealed.

The statistics regarding the manufacture of brick and tile in 1912 are summarized in the following table:

PRODUCTION OF BRICK AND TILE BY VARIETIES, 1912.

	Counties.	No. of Producers.	Production in Thousands.	Value.	Aver. value per M.	Increase or Decrease.
Common brick, ...	19	65	429,309	$2,592,091	$6.04	$190,129 I
Front brick, ...	7	11	48,852	558,372	11.43	27,348 I
Fancy brick, ...	2	2	.....	384,169	....	47,949 D
Enameled brick, ...	1	2				
Fire brick, ...	3	13	60,782	1,460,988	24.03	116,104 I
Total brick, ...				$4,995,620		$285,632 I
Drain tile, ...	5	8	.....	50,984	....	24,482 I
Architectural terra cotta, ...	3	6	.....	2,330,065	....	660,092 I
Fireproofing and hollow blocks, ...	4	12	.....	2,031,350	....	302,539 I
Tile (not drain), ...	3	14	.....	1,255,246	....	57,916 I
Miscellaneous,[1]	4	9	.....	239,368	....	204,315 D
Total all products, ...				$10,902,633		$1,126,346 I

It will be noted that there were increases in all classes of brick and tile except fancy and enameled brick and some of the miscellaneous products. The greatest increases were in architectural terra cotta ($660,092) and fireproofing and hollow blocks ($302,539). The increased use of fireproofing and hollow blocks has been one of the most significant features in the clay working industries throughout the country in the last few years. The value of burned clay products as fireproof building material is being realized more and more, and their use is steadily increasing. In connection with the increased use of hollow block, the following statement by Mr. Joseph Middleton, of the United States Geological Survey, is of interest: "The decrease in the common-brick output[1] may be partly accounted for by the increased use of hollow block or tile for the construction of large buildings and even of dwelling houses. This form of construction offers many advantages, among which are economy in con-

[1] Includes sewer pipe, stove lining, glass-house pots, gas-furnace linings, conduits, gas logs, wall coping and flue lining. Last year sewer pipe was listed separately.

[1] There was a decrease in the output of common brick for the whole country in 1911.

struction, the ease and rapidity with which it can be put in the wall, and its non-conductivity. All of these should be factors in the extension of its use. Structures made of hollow tile may be faced with either brick, stucco or other material. It seems, therefore, likely that the production of common brick will not show rapid increase in the future, and it is probable that the use of hollow tile or block will largely increase."[2]

The production of brick and tile in the leading counties was as follows:

PRODUCTION OF BRICK AND TILE BY COUNTIES, 1912.

Rank.	*Counties.*	*Producers.*	*Value.*	*Per cent.*
1	Middlesex,	37	$8,062,219	76.69
2	Mercer,	11	703,353	6.45
3	Monmouth,	9	510,314	4.68
4	Somerset,	3	332,423	3.04
5	Bergen,	10	307,913	2.82
6	Camden,	4	257,877	2.36
7	Burlington,	8	167,868	1.54
8	Atlantic	4	132,579	1.21
	All other counties,[1]		428,087	3.92
	Total,		$10,902,633	

Middlesex County retained its pre-eminent position in the production of brick and tile, its thirty-seven producers making over three-fourths of the total output of the State. Mercer County was again second, though its production was far below that of Middlesex. Monmouth, which was fifth in 1911, became third; Somerset changed from sixth to fourth place, and Burlington moved forward from eighth to seventh place; on the other hand, Bergen, Camden and Atlantic showed decreases, and changed positions from third, fourth and seventh to fifth, sixth and eighth respectively.

Common brick were manufactured in all counties of the State except Cape May, Essex and Sussex. Middlesex stood first, the value of its output being $1,282,407; Bergen second, $307,913; Monmouth third, $178,628, displacing Mercer, which became fourth, with an output of $165,418; then Burlington ($140,718),

[2] Mineral resources of the United States for 1911, Part II, p. 521.

[1] In these counties there are either less than three producers, or the amount is so small that the output of individual operators would be actually or approximately revealed if separately given.

Camden ($134,189), Atlantic ($88,376) and Passaic ($73,500). There were 64 producers who reported making common brick.

Front brick were produced by Middlesex, Camden, Atlantic, Mercer, Morris, Monmouth and Cumberland Counties, in the order given, but separate figures for the counties cannot be given, because in each case there were less than three producers.

Fancy and enameled brick were made in Middlesex and Camden counties, the former being the greater producer.

Fire brick were produced in Middlesex, Hudson and Mercer counties; the production of Middlesex amounting to $1,283,668, an increase of $128,976, and constituting 87.80 per cent. of the total output of the State.

The total value of the drain tile produced was $50,984, which was about twice that of the previous year. The producing counties were Middlesex, Salem, Monmouth, Burlington and Camden, in the order given.

Middlesex produced 86.47 per cent. of the architectural terra cotta, its product having a value of $2,014,842; the other producing counties, in order, being Somerset and Burlington.

By far the larger part of the fireproofing was also made in Middlesex County, its product having a value of $1,818,241, an increase of $209,976. The other producing counties were Monmouth, Burlington and Warren, in the order given.

Tile (not drain) were made in Middlesex, Mercer and Monmouth counties, the value being $664,848, $464,899 and $125,499, respectively.

Sewer pipe, stove linings, glass-house pots, gas-furnace linings, conduits, gas logs, wall coping and flue lining constitute the group of miscellaneous products; their total value being $239,368. The sewer pipe was made in Middlesex and Atlantic counties, the glass-house pots in Cumberland, the gas-furnace linings in Mercer, and the conduits, stove linings, gas logs, wall coping and flue linings in Middlesex. There was a decided decrease in the amount of sewer pipe made. In 1911 there were four producers, and the value of the output was published as a separate item as $103,137; while in 1912 there were only two producers, and the amount is included among the miscellaneous products.

STONE.

The production of stone has been an important industry in the State for many years. The chief product is crushed stone for various purposes, especially road metal. In 1912 crushed stone constituted 77.71 per cent. of the total stone output. Trap rock is the chief variety quarried, forming 69.16 per cent. of all stone produced in 1912 and 85.63 per cent. of the crushed stone. Although the value of the building and monumental stone for 1912 was only $157,042, and it constituted only 9.03 per cent. of the total stone production, there was an increase of $24,029 over that of 1911 and of $56,704 over that of 1910, an encouraging evidence of steady growth along this line. The total stone production for 1912 was valued at $1,738,473, while that of 1911 was $1,623,884, an increase of $114,589.

The production of stone for 1912 by varieties and by uses is given in the following tables:

PRODUCTION OF STONE BY VARIETIES, 1912.

	Value.	*Per cent.*
Trap,	$1,202,397	69.16
Limestone,	205,334	11.81
Sandstone,	166,583	9.58
Granite,	142,515	8.19
Slate, Talc and Serpentine,	21,644	1.24
Total, 1912,	$1,738,473	100.00
Total, 1911,	1,623,884	

PRODUCTION OF STONE BY USES, 1912.

	Value.	*Value.*	*Per cent.*
Building stone and monuments,	.....	$157,042	9.03
Rough,	$106,927	.....	.....
Dressed,	50,115	.....	.....
Paving,	.....	32,571	1.87
Crushed stone,	.....	1,341,046	77.71
Road metal,	679,768	.....	.....
Railroad ballast,	266,136	.....	.....
Concrete,	395,142	.....	.....
Blast furnace flux,	.....	122,943	7.07
Agricultural,	.....	24,329	1.39
Other uses,[1]	.....	60,542	3.48
Total, 1912,		$1,738,473	100.00
Total, 1911,		1,623,884	

[1] Includes curbing, flagging, rip-rap, rubble and others of minor importance.

TRAP ROCK.

New Jersey stood second among the States in the production of trap rock in 1910, 1911 and probably in 1912, California being second.

Of the stone quarried in the State in 1912, the trap rock was, as usual, the chief variety, constituting 69.16 per cent. The total value was $1,202,397, an increase over 1911 of $66,012. Of the total output $1,148,394, or 85.63 per cent., was crushed stone, $616,674 being for road metal, $189,641 for railroad ballast and $342,079 for concrete. As in 1911, there was a decrease in the amount used for road metal and an increase in the amount used for concrete.

The details regarding the production of trap rock are given in the following table:

PRODUCTION OF TRAP ROCK, 1912.

	No. of Producers.	*Amount Short Tons.*	*Value.*	*Average Price Per Unit.*	*Increase or Decrease.*
Building stone, rough and dressed,	10	.....	$9,213	.....	$3,059 I
Paving blocks,	7	(1,015,841M)	31,646	$31.40	5,205 I
Rubble,	3	.....	1,197	.....	3,882 D
Rip-rap,	6	.....	3,160	.....	.....
Crushed stone—					
Road metal,	51	770,578	616,674	.80	29,535 D
R. R. ballast,	11	272,406	189,641	.69	12,622 I
Concrete,	31	434,420	342,079	.78	70,876 I
Other values,	3	.....	8,787	.....	.....
Total, 1912,	56	1,477,404[1]	$1,202,397	.....	$66,012 I
Total, 1911,			1,136,385		

LIMESTONE.

The limestone statistics do not include the amounts nor value of stone used in the manufacture of lime or of Portland cement, this portion of the production being included in the value of those manufactured products.

The total value of the limestone quarried for other uses was $205,334, an increase of $67,186 compared to 1910. This increase was chiefly in stone for flux, the value of which showed a

[1] Total of crushed rock only.

$31,162 increase, not sufficient, however, to offset the very large decrease (over $100,000) of the previous year.

PRODUCTION OF LIMESTONE IN 1912.

Uses.	*No. of Producers.*	*Short Tons.*	*Value.*
Road making,	4	30,113	$19,509
Concrete,	4	16,180	9,014
Blast furnace flux,	12	230,822	122,943
Agricultural,	3	.....	24,329
Other uses,[1]	5	.....	29,539
Total,	15	.....	$205,334

The two leading counties were Sussex, $146,117, and Warren, $31,988; Hunterdon and Somerset together produced $21,196, The chief centres in Sussex County were McAfee and Ogdensburg, and Buttzville in Warren County.

SANDSTONE.

Sandstone was reported from seventeen producers in five counties, the total value being $166,583, a gain of $10,818 as compared with 1911.

The different uses, value of stone and number of producers is shown in the following table:

PRODUCTION OF SANDSTONE IN 1912.

	No. of Producers.	*Value.*
Building stone, rough,	13	$55,609
Building stone, dressed,	5	49,665
Concrete,	3	37,529
Road metal, Rubble, Rip-rap,	5	11,676
Flagging, Paving, Curbing,	3	9,045
Other uses,	4	3,059
Total,	17	$166,583

There was a decrease in the output of road metal; but an increase in the amount of crushed stone for concrete as compared with 1911.

[1] Includes limestone for building, railroad ballast and other purposes of minor importance, here grouped together to conceal the output of individual operators.

Bergen County led in 1912 in the quarrying of sandstone, with value of $67,320, displacing Mercer County, which was second, value $52,689; Hunterdon, Essex and Somerset counties follow in the order named with total value of $46,574. Most of the stone from Mercer County was rough building stone, while in Bergen most of the product was dressed building stone. The larger part of the crushed stone for concrete was produced in Hunterdon County.

Practically all of the sandstone quarried was from the Triassic formations. Included under the heading of sandstone is some bluestone, and some argillite. The increased use of the dark argillite as a building stone is a new development in this industry. In building, the joint surfaces are made the exposed surfaces, some of them being dark and others, owing to a coating of silica, light. The handsome Cleveland Tower and large group of graduate school buildings at Princeton University are being constructed of this argillite in the manner described.

GRANITE.

Granite and granite-gneiss were quarried by 25 producers located in Passaic, Morris and Sussex counties. The total value was $142,515, as against $162,112 for 1911, a decrease of $24,597. Details are shown in the following table:

PRODUCTION OF GRANITE IN 1912.

	No. of Producers.	*Value 1912.*
Sold rough—building,	5	$25,880
Sold rough—monumental,	2	
Sold rough—other uses,	1	16,050
Dressed—building,	2	
Rubble,	2	
Rip-rap,	3	2,495
Crushed stone—		
Road making,	2	
Railroad ballast,	3	90,670
Concrete,	5	6,520
Other uses,	..	900
Total,	25	$142,515

Passaic County led in the production, its value being $71,343, although it had fewer producers than Morris, which was second and not far behind.

There was a decrease in the output of crushed stone and a notable increase in the production of building stone.

SLATE, TALC AND SOAPSTONE.

The combined value of slate, talc and soapstone for 1911 was $21,644, a decrease of $4,830. As there were less than three active producers in each of these industries, the values are combined in order that the figures of individual producers may not appear.

The two active slate properties are at Lafayette and Newton, both in Sussex County, and both producing roofing slate.

The single producer of talc and soapstone is located just north of Phillipsburg, in Warren County. The product is sold partly in the crude form and partly ground into "mineral pulp," which is then sold and used for various purposes.

SPECIAL STATISTICS REGARDING THE STONE INDUSTRIES IN NEW JERSEY IN 1909.[1]

	Trap Rock.	*Sand-stone.*	*Lime-stone.*	*Granite.*	*Total.*
No. of operators, ...	55	15	6	6	82
No. of quarries, ...	58	16	6	6	86
Capital, ...	$870,955	$176,285	$73,489	$31,479	$1,152,208
Expenses of operation and development, ...	$1,048,945	$143,458	$163,877	$52,371	$1,408,651
This is distributed as follows:					
Services—					
Salaried officers and clerks	58,446	8,540	8,470	1,227	76,683
Wage earners, ...	591,476	93,291	115,384	39,343	839,494
Miscellaneous—					
Supplies, ...	156,565	17,973	25,902	8,491	208,931
Fuel and rent of power, ...	54,700	4,704	2,037	2,161	63,602
Royalties and rent of mines, ...	36,830	1,900	6,109	120	44,959
Taxes, ...	5,172	1,237	189	34	6,632
Contract work, ...	29,550	820	....	....	30,370
Rent of offices and other sundry expenses, ...	116,206	14,993	5,786	995	137,980
Value of products, ...	$1,166,345	$187,272	$180,604	$60,174	$1,594,395

Persons engaged in industry, ...	1,722	240	451	122	2,535
Proprietors and salaried officers, and clerks, ...	114	32	14	8	168
Wage-earners (Dec. 15, 1909, or nearest representative day),	1,608	208	437	114	2,367
Land controlled, acres, ..	1,449	247	662	156	2,514
Owned, ...	845	244	109	91	1,289
Held under lease, ...	604	3	553	65	1,225
Primary horse-power, ...	5,348	694	565	215	6,822

[1] Modified from the table published in 13th Census of the United States, Supplement for New Jersey, published in 1913.

STARTING A NEW QUARRY.

There are doubtless still many deposits of good stone of various kinds in New Jersey yet undeveloped. Many owners hesitate to undertake the opening up of their deposits because they do not know just how to go about it. Of course, in the development of such properties many things have to be taken into consideration, which determine success or failure. Among these are the quantity and quality of the stone, the demand and available supply of the kind of stone involved, the nearness of the deposit to transportation routes and to good markets, ease and facilities of quarrying, financing the proposition, etc., etc. The quality of stone is only partially determinable by a hand specimen; it is necessary to open up the quarry to a certain extent before one can speak positively regarding quality. Sometimes the rock proves to be so broken up by joint cracks that large blocks cannot be quarried, and it can only be used for rough work or for crushed stone. There are certain defects affecting different kinds of stone for different purposes whose presence or absence can hardly be determined until the quarry has been at least partially opened up. For example, in the case of granite there may be large areas spoiled by the presence of black mica or biotite balls, or by wavy streaks of alternating dark and light-colored rock. The demand for a particular kind of stone may be affected by changes in public taste, a notable case of this kind being evident

in the decreased demand for brown sandstone in recent years. On this Dr. J. Volney Lewis says:[1]

"In the brownstone regions, the larger quarries that once supplied the stone for numerous buildings in all the larger cities of the east are now closed and their machinery is rusting away. Some of these, as in the city of Newark, have become more valuable for building space and are now overrun by the growth of the city; but this is not the case with the great Belleville quarries, and there are many places in the surrounding country that could supply this stone in vast quantities. Public taste has changed. Brownstone houses and brownstone 'fronts' are no longer fashionable. The colors are too somber to suit the popular taste for residences, and are not adapted to the prevailing styles of architecture. Fewer large buildings of a public or a semi-public character are constructed of it, and even the churches are adopting the lighter tints."

E. R. Buckley looks for a change in taste to occur again. He says:

"The market value of a stone is often influenced by its color, without regard to its strength and durability. The market value of stone, as well as other products, is controlled by the law of supply and demand. The supply of a certain kind of stone may remain constant, but the demand for that stone may fluctuate on account of fashion. In stone, color, as a rule, is the only element which is subject to the influence of fashion. Until a few years ago brown stone was all the rage, both for business blocks and residences, but the eye became weary of gazing at long rows or somber-colored buildings, and the fashion changed to light-colored stone, where it now rests, awaiting the next reversal. Immense quantities of light-colored stone are now being used, but its prestige is only temporary. The tide will swing back again in a few years, and it is to be hoped that the halt will be made at a place where the use of neither dark nor light-colored stone will be supreme. A judicious use of both will serve to relieve the monotony occasioned by long rows of somber brownstone buildings or the dazzling glare of white limestone and marble."

Ease of quarrying frequently affects the cost of getting out stone considerably. One of the largest granite quarries in the South, which the writer has visited several times, consists of a large hill of the finest monumental granite, uniform in texture and color, with only a few joint cracks, without any soil cover, practically free of weathered rock and with a fine rift which has been developed by a lift parallel to the surface of the hill. All that is necessary in quarrying is to split off great blocks, let them slide part way down hill, then split them up into pieces of any size desired, and load by derrick onto the flat cars awaiting a few feet below. What a contrast this presents to those quarries

[1] Building Stones of New Jersey, An. Rept. State Geologist for 1908, p. 58.
[2] Building and Ornamental Stones of Wisconsin, p. 14.

where the blocks have to be hoisted from pits 200 and 300 feet deep!

The financial side of developing a new quarry is, of course, of the greatest importance. No matter how large and how good a deposit of stone there may be, nor how favorably situated for working, the whole proposition may easily prove a failure by reason of poor financial methods. In this connection we quote certain paragraphs from an article by Mr. George Barnum, in *Stone* for April, 1913, which contain some valuable advice to those having in mind the "Starting of a New Quarry":

"If a stone property is to be exploited, the raising of money is, of course, the first essential. Even a small quarry with a modest equipment cannot be opened without the expenditure of a considerable sum. The stripping, even if it be all soil, is expensive, and if several layers of waste stone have to be removed, the cost may be quadrupled. The development of a quarry face takes time, and time is money, besides which there may be considerable wild rock to be disposed of. Then there are the provisions that must be made for the shipping out of the stone, whether it be by rail or over wagon roads. The equipment is entirely problematical, depending upon the nature of the stone and the amount that is to be quarried.

"Having decided to develop a stone property, the raising of the necessary money becomes the first consideration. Just here is where a mistake is usually made. Perhaps the man who is making the venture has availed himself of so-called 'expert' advice. It is reasonably certain that this advice will not be along the line of modest, conservative, gradual growth. The expert jumps at once the preliminary stages, and has in mind the active quarry with an output of thousands of feet a month. The equipment he suggests is along this line, and it is safe to say that there will be no actual need for much of the machinery he recommends for fully a year's time. * * * How often it has happened that a new man in the stone industry has spent all of his money and secured a splendid equipment before his quarry was half ready to begin production. * * *

"There is sometimes a more sinister manifestation which has the same effect. A company which is the sport of promoters may install an equipment of the most elaborate character, and entirely beyond any real needs of the quarry for months or years to come. This is done to 'make a showing,' to impress the public so that it may be possible to sell more stock or float a new bond issue. * * *

"One of the shrewedest stone men I have ever known, and one who has had experience in widely different fields, and always with success, told me that the policy always followed by himself and his associates was that 'a quarry must always pay its own way.' This cannot be taken with absolute literalness, for, as I have said above, there is much preliminary work that must be paid for in advance of production. What he meant was that he never assumed before it was demonstrated that any quarry was to be a great big paying venture. In other words, he always began modestly, not from any lack of abundant means, but from a wise conservatism. The quarry would be opened in a small way, with the least possible equipment. When the ledges of stone proved their worth, every cent of income was turned back into development. Of course, there soon came a time when it would be shown that a quarry was to be a great money-maker, and then all the resources of this man and his associates were available to make the most of the opportunity. In this way, and through this intelligent effort, have grown up some of the greatest quarries in this country.

"The great trouble with most new ventures in the stone industry is that those in charge of the enterprise are not willing to begin in a sufficiently modest way. Perhaps they have no money in hand themselves, and, finding that they must raise capital for operations, they think it would not pay to 'make two bites at a cherry,' and so they seek to get all the money needed for one or two years' operations, or sufficient to put the quarry on a paying basis. The weakness in this course is that at this stage of the game the promoters have nothing to show save unworked ledges of stone, and they must pay big premiums and make large sacrifices in order to secure funds. If it is worked as a straight business proposition, it will be found that capitalists are not fond of giving their money for a minority interest in any enterprise. The man who yields control of his business in exchange for the money to carry it along is never in a very happy position. If the matter is put in the hands of the professional promoters, as is too often done, it will be found that such an enormous commission must be paid that success is well nigh impossible. I know of one stone company, capitalized for a very large amount, where one dollar out of every three that was raised went to the promoters. What chance was there for the paying of dividends when so large a proportion of the capital stock was diverted from its legitimate purpose? It is the carrying of burdens of this kind, on indebtedness representing no productive power, that has brought so many stone companies to bankruptcy.

"It is impossible to deny that a few companies that have started in this way, with a liberal sale of stock and bonds, have achieved a success, although by far the larger proportion of them have failed and passed into other hands. As a rule, those which have steadily and surely made their way to prosperity have gone about it in other ways. There has been a modest capitalization at the outset with the sale of stock among those who were locally interested in the success of their scheme. The money in hand was intelligently used for the development of some sort of a quarry face. The least equipment that could possibly suffice was installed. Stone was gotten out and sold. Often it was hauled for miles by teams before it could find rail shipment. The main effort was not to show profit in operation, because the method of extraction might be crude and the expenses of handling excessive. The work that was done served to demonstrate the quantity, quality and availability of the stone and that there was a market for it. With these facts at hand the raising of money to carry along the work on a much more extensive scale becomes greatly simplified. Local capital may be very timid as far as an entirely new enterprise is concerned, but it will readily respond where the question is one of building up an industry already on a sound footing, even if it be a small one for the moment. Pay rolls and supplies play a prominent part, and the local banks will generally be found willing to lend a hand. I personally know of a number of quarries that have started out in this conservative way and have put themselves on a paying basis in an almost incredibly short space of time."

SAND AND GRAVEL.

The total production of sand and gravel in New Jersey in 1912 was 3,245,767 short tons, valued at $1,146,640, an increase of $87,714. The details regarding the production are given in the following tables:

SAND AND GRAVEL MINED IN 1912.

Variety.	*No. of Producers.*	*Amt. in Short Tons.*	*Value.*
Moulding sand,	39	459,397	$279,948
Glass sand,	8	102,782	70,027
Building sand,	45	1,425,861	316,435
Grinding and polishing sand,	5	95,690	47,854
Fire sand,	11	105,843	97,841
Engine sand,	4	55,344	22,077
Paving sand,	6	168,233	35,883
Other sands,	9	55,706	47,218
Gravel,	36	776,911	220,357
Total,	95	3,245,767	$1,146,640

PRODUCTION OF SAND AND GRAVEL BY COUNTIES, 1912.

County.	*No. of Producers.*	*Amt. in Short Tons.*	*Value.*
Burlington,	21	1,584,343	$362,074
Middlesex,	17	493,611	245,108
Cumberland,	10	386,504	213,896
Cape May,	3	190,076	87,130
Morris,	6	183,668	62,433
All others,[1]	38	407,565	175,999
Total,	95	3,245,767	$1,146,640

Glass sand is produced chiefly in Cumberland County, with Gloucester second. Cumberland also leads in the production of moulding sand, with Middlesex second. Burlington stands first in the production of grinding and polishing sand, Cumberland being second. The fire sand is chiefly obtained in Middlesex County, Morris standing second. Middlesex leads in the production of engine sand and paving sand, while Burlington is second in both cases. In the production of gravel Burlington stands first, while Monmouth is second.

PORTLAND CEMENT.

The recent growth of the American Portland cement industry has been so rapid that its present relative standing among our great industries is realized by few, even of those directly inter-

[1] Includes Monmouth, Camden, Gloucester, Warren, Bergen, Ocean, Union, Atlantic, Sussex, Passaic and Mercer in the order given. It is not feasible to give the individual figures in these cases.

ested. Its importance, both commercially and financially, is perhaps best brought out by comparison with the American iron industry, whose standing is everywhere fully understood. The following table, compiled by E. C. Eckel, of the United States Geological Survey, gives the output of pig iron and Portland cement in long tons during every fifth year from 1880 to 1910, inclusive.

COMPARATIVE GROWTH OF CEMENT AND IRON INDUSTRIES.

Year.	*Pig Iron Long Tons.*	*Portland Cement, Long Tons.*	*Percentage of cement to Pig Iron.*
1880,	7,749,233	7,000	0.1
1885,	7,415,469	25,000	.3
1890,	9,202,703	56,000	.6
1895,	9,446,308	165,000	1.7
1900,	13,789,242	1,414,000	10.3
1905,	22,992,380	5,874,469	24.3
1910,	26,674,123	12,986,152	48.7

The production of Portland cement in 1912 in the United States was 82,438,096 barrels. The production of the leading States was as follows:

PRODUCTION OF PORTLAND CEMENT BY STATES, 1912.[1]

State.	*No. of Producing Plants.*	*Quantity in Barrels.*
Pennsylvania,	23	26,441,338
Indiana,	5	9,924,124
California,	8	5,974,299
New York,	7	4,492,806
Missouri,	5	4,355,741
Illinois,	5	4,299,357
New Jersey,	3	4,246,803
Michigan,	10	3,494,621
Iowa,	3	3,228,192
Kansas,	10	3,225,040
Total (ten States),		69,682,321
Total (other States),[2]		12,755,775
Total, United States,		82,438,096

[1] From advanced chapter of Mineral Resources of the United States for 1912.

[2] Includes the fourteen additional States reporting.

The shipments of the ten leading States was as follows:

SHIPMENTS OF PORTLAND CEMENT BY STATES, 1912.[1]

State.	Shipping Plants.	Quantity (Barrels).	Value.	Average price per Barrel.
Pennsylvania,	26	27,539,076	$18,918,165	$0.687
Indiana,	5	9,634,582	7,237,591	.751
California,	8	6,093,790	8,215,894	1.348
Missouri,	5	4,614,547	3,700,776	.802
Illinois,	5	4,602,617	3,444,085	.748
New York,	7	4,543,060	3,448.735	.759
New Jersey,	3	4,490,645	3,052,098	.680
Michigan,	10	3,651,094	3,145,001	.861
Kansas,	12	3,592,148	2,815,113	.784
Iowa,	3	3,190,354	2,790,396	.875
Total (ten States),		71,951,913	$56,767,854	
Total (other States),[2]		13,060,643	12,341,946	
Total, United States,		85,012,556	$69,109,800	

From the above tables it is evident that New Jersey occupies a creditable position among the cement producing States, being among the ten which produced about 85 per cent. of the total, and standing seventh among these ten. The total production of New Jersey in 1912 was 4,246,803 barrels. This was 165,087 barrels less than the amount produced in 1911, involving a decrease in value of $112,259. The whole Lehigh district, of which New Jersey is regarded as a part, reported a decreased production in 1912, which "was probably due in large measure to an overproduction in 1910 and to the building of many mills in other parts of the United States, which have restricted the trade territory of the Lehigh district."[1]

This year, in addition to the production, the shipments of Portland cement can be furnished for the first time. The total shipments in New Jersey in 1912 were 4,490,645 barrels, valued at $3,052,098. The average price per barrel was $0.68, as against $0.738 in 1911. At the close of the year the stock on hand amounted to 231,398 barrels.

[1] From advanced chapter of Mineral Resources of the United States for 1912.
[2] Includes the fourteen additional States reporting.
[1] According to E. A. Burchard, in advanced chapter from the Mineral Resources of the United States for 1912.

As during the previous year, there were three active plants, all located in Warren County, and all making use of limestone and cement rock as raw materials.

LIME.

The stone used in making lime is not included in the statistics of limestone in the stone-industry, as to do so would result in a duplication of values.

The production of lime in 1912 amounted to 16,538 short tons, valued at $65,241, which is a decrease of 10,519 tons and $48,543 in value, a larger decrease than that of the previous year. The average value per ton in 1911 was $3.94 per ton as against $4.20 in 1911. There were 19 active producers, most of them burning the blue magnesian limestone. Four firms, however, use the white crystalline limestone and manufacture the larger part of the output.

The chief facts regarding the industry are tabulated as follows:

PRODUCTION OF LIME IN 1912.

Uses.	*No. of Producers.*	*Amount. Short Tons.*	*Value.*	*Value Per Ton.*
Building lime,	4	229	$1,102	....
Chemical works,	1			
Paper mills,	2	6,921	37,831	....
Dealers,	1			
Fertilizer,	15	9,388	26,308	....
Total,	19	16,538	$65,241	$3.94

Sussex County was first; Warren, second; Hunterdon, third; Somerset, fourth, and Morris, fifth.

Most of the lime made in New Jersey in 1912 was for use as a fertilizer.

SAND-LIME BRICK.

As in 1911, only two counties produced sand-lime brick, Camden and Morris. An additional plant was started in Camden County, making three in that county which, with the one in

Morris, makes four plants in operation. Despite this increase in the number of plants, however, there was a decrease in the total value of the production of $10,786, or 60.9 per cent. The total production for 1912 was 961 thousand, with a value of $6,924. In 1911 the production was 1,988 thousand, with a value of $17,710.

The New Jersey figures do not appear to reflect the general conditions in this industry. According to recently published figures of the United States Geological Survey, "the value of the product of the United States reported in 1912 was $1,170,884, compared with $897,664 in 1911, an increase of $273,220, or 30.44 per cent."[1]

The authority just quoted makes the following interesting general statement regarding the history and conditions of the sand-lime industry:

"The sand-lime brick industry has been established in the United States a little over 10 years, and in Europe, especially in Germany, where it is a large and flourishing industry, for a much longer period. In this country it has passed through many vicissitudes. At first it grew rapidly, rising from 1 plant in 1901 to 16 in 1903 and to 57 in 1904, and in 1907, 94 plants were in active operation, reporting products valued at $1,225,769. This growth was not, however, a healthy one. Many plants were erected where market conditions were not propitious and others where suitable materials were not available; others, although conditions and materials were satisfactory, failed for want of technical skill or because of poor management. Consequently many plants that were erected in the beginning of the industry are not now operating, and some of them never even began operations. Notwithstanding this serious handicap and the fact that the value of the product decreased almost constantly from 1907 to 1911, in 1912 the number of plants in operation increased and the value of the product showed a large gain. During 1912 some of the abandoned plants were taken over by skilled men, were remodeled in accordance with the latest developments, and are now being operated successfully. The prospects for 1913 are bright, the future of the industry seems established, and a steady growth may be expected. There appears to be a successful field for the sand-lime brick industry, especially where other building materials are scarce and sand is plentiful and lime accessible. The product, as shown by experience at home and abroad, may be made durable and attractive, and tests made on it show that it meets all requirements as a building material."[1]

The leading State in the production of sand-lime brick is Michigan, which had 10 operating plants reporting in 1912, and

[1] Advance chapter, "Mineral Resources of the United States for 1912."

made 32,889 thousand common brick and 2,726 thousand front brick, the total value of which was $210,000.

MINERAL WATERS.

There was a fair increase in quantity but a slight decrease in value in the mineral water production of New Jersey in 1912, as compared with 1911. The quantity in 1912 was 2,386,217 gallons, valued at $209,726; while in 1911 the quantity was 2,233,627 gallons, valued at $210,123. The increase in quantity was 152,590 gallons, while the decrease in value was only $397. The average price per gallon received in 1912 was 8.8 cents; while in 1911 it was 9.4 cents.

On the basis of use, the total value for 1912 is made up of $2,150 for medicinal water and $207,576 for table water. There was also 44,600 gallons used in the manufacture of soft drinks, the value of which is not included in the totals here given.

Twelve springs reported sales in 1912, of which 4 were in Bergen County, 3 in Somerset, and one each in Camden, Morris, Mercer, Monmouth and Union.

GREENSAND MARL.

Only four producers, all in Burlington County, reported a production of greensand marl in 1912, their total being only 915 tons, valued at $229. As even this output was chiefly used by the owners of the pits, the value represents hardly more than the cost of digging. This industry, which, thirty or forty years ago was one of the most important mineral industries of New Jersey, has gradually declined until it has practically ceased to exist. In some respects this is unfortunate for the agricultural interests of the State, as it has been clearly demonstrated that many of the most fertile and productive farms now under cultivation owe their fertility largely to their having been marled many years ago.

Greensand marl is a slow fertilizer, requiring years to yield its beneficial constitutents to the soil. The chief of these con-

stituents is potash, though in a less degree calcium phosphate and calcium carbonate are also gradually yielded to the soils on which the marl has been spread. The potash comes from the mineral glauconite, the dark, olive-green mineral which forms the distinguishing constitutents of the marl, the calcium phosphate comes chiefly from the fragments of the bones of prehistoric vertebrate animals scattered through the beds and the calcium carbonate is derived from the disintegrating shells of the fossil mollusks which often occur in considerable abundance in the marl. The chief reasons for the decrease in the use of marl are probably the labor attached to digging it and its slow action, as compared with the easily obtained and quick acting commercial fertilizers. During work in the field the writer has frequently advised farmers owning marl beds to use it on certain fields which are allowed to lie fallow while other parts of the farm are treated with commercial fertilizers; or to use it on land under cultivation in addition to the commercial fertilizers, going ahead as if the marl had not been used and counting on its benefiting the land in years to come instead of during the present season.

MINERAL PAINTS.

The mineral paint industry includes natural pigments, pigments made directly from ores and chemically manufactured pigments. Shale is ground and made into a pigment at one plant in Middlesex County. Zinc oxide is usually made at Newark, by the New Jersey Zinc Company, directly from the zinc ore mined at Franklin Furnace, but this company reports no output in 1912.

Most of the mineral paints made in New Jersey in 1912 were of the chemically manufactured type. Of these the principal one was lithopone, which was made by three producers, one in Camden County, one in Essex County and one in Union County. The combined production of these producers in 1912 was 12,743 short tons, valued at $905,543. This is more than the whole amount made in the United States in 1910 and only 4,123 tons

less than the whole amount for 1911. The use of lithopone is increasing, and in view of the fact that New Jersey is one of the leading, if not the leading producer, the following details regarding it may be of interest:

"Lithopone, a very white pigment, is precipitated by the double decomposition of zinc sulphate and barium sulphide, thereby forming an intimate mixture of zinc sulphide and barium sulphate. The peculiar property which it possesses, of darkening under the actinic rays of the sun, makes it essential that it be combined with other more stable pigments to prolong its life when exposed to weather. Lithopone contains approximately 70 per cent. barium sulphate, 25 to 28 per cent. zinc sulphide, and as high as 5 per cent. of zinc oxide. Its specific gravity is about 4.25. It is excellently suited for interior use in the manufacture of enamels and wall finishes. When properly mixed with other pigments, such as zinc oxide and calcium carbonate, fair results are obtained as a pigment for outside work. Lead pigments are never used with lithopone, as lead sulphide results, giving a black appearance. The characteristic flocculent, non-crystalline appearance is plainly evident when examined under the microscope."[1]

In addition to lithopone, red lead, litharge and white lead were made in Essex County.

The total for mineral paints is combined with that of coke and its by-products, in order to conceal the production of individual operators; the combined total for 1912 being $2,812,424.

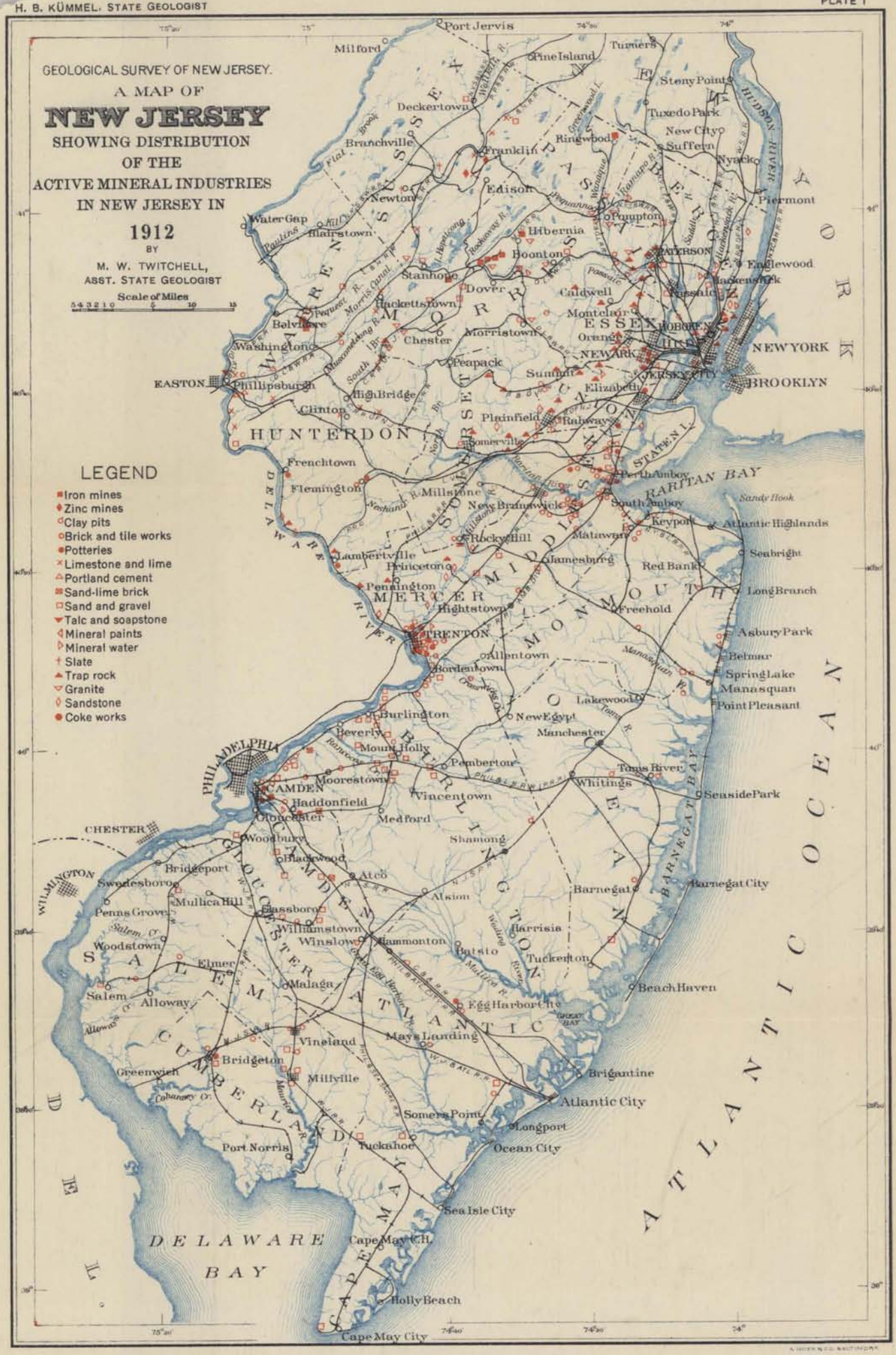
COKE.

Coke, with its by-products, tar, liquid ammonia and gas (illuminating and fuel), was manufactured at Camden. Since there was only one producer, separate quantities and values cannot be given and the total value of the coke and its by-products produced has been combined with that of mineral paints. In 1912 the combined total amounted to $2,812,424.

GEMS.

It is not generally known that a small quantity of minerals are found each year in New Jersey which are cut and used as gems. In 1912 the total value of such minerals was $225. This included quartz pebbles used for jewelry.

[1] Bull. Sci. Sec. Paint Mnfrs. Assoc. W. S. No. 29, 1910, p. 10, quoted in Min. Res. of W. S. for 1911.


GEOLOGICAL SURVEY OF NEW JERSEY.
A MAP OF
NEW JERSEY
SHOWING DISTRIBUTION
OF THE
ACTIVE MINERAL INDUSTRIES
IN NEW JERSEY IN
1912
BY
M. W. TWITCHELL,
ASST. STATE GEOLOGIST
Scale of Miles
LEGEND
Iron mines
Zinc mines
Clay pits
Brick and tile works
Potteries
Limestone and lime
Portland cement
Sand-lime brick
Sand and gravel
Talc and soapstone
Mineral paints
Mineral water
Slate
Trap rock
Granite
Sandstone
Coke works
Port Jervis
Milford
Pine Island
Turners
Stony Point
Tuxedo Park
New City
Suffern
Nyack
Piermont
Englewood
Hackensack
Deckertown
Branchville
Franklin
Ringwood
Newton
Edison
Water Gap
Blairstown
Hibernia
Boonton
Paterson
Passaic
Caldwell
Montclair
Orange
Hoboken
Jersey City
Newark
New York
Brooklyn
Stanhope
Dover
Hackettstown
Morristown
Chester
Peapack
Summit
Elizabeth
Bloomsbury
Belvidere
Washington
Phillipsburg
Easton
High Bridge
Clinton
Plainfield
Raiway
Somerville
Hunterdon
Frenchtown
Flemington
Millstone
New Brunswick
Perth Amboy
South Amboy
Staten I.
Raritan Bay
Sandy Hook
Keyport
Atlantic Highlands
Matawan
Rocky Hill
Lambertville
Princeton
Jamesburg
Red Bank
Seabright
Pennington
Mercer
Hightstown
Freehold
Long Branch
Trenton
Asbury Park
Allentown
Bordentown
Belmar
Spring Lake
Manasquan
Point Pleasant
Lakewood
New Egypt
Manchester
Burlington
Beverly
Mount Holly
Pemberton
Toms River
Whitings
Seaside Park
Philadelphia
Camden
Moorestown
Haddonfield
Vincentown
Gloucester
Medford
Chester
Woodbury
Shamong
Blackwood
Bridgeport
Swedesboro
Atco
Barnegat
Barnegat City
Wilmington
Mulica Hill
Penns Grove
Glassboro
Alsion
Williamstown
Winslow
Hammonton
Harrisia
Woodstown
Salem
Elmer
Malaga
Tuckerton
Beach Haven
Alloway
Egg Harbor City
Vineland
Mays Landing
Bridgeton
Greenwich
Millville
Brigantine
Somers Point
Atlantic City
Longport
Port Norris
Tuckahoe
Ocean City
Sea Isle City
Cape May C.H.
Delaware Bay
Holly Beach
Cape May City
Atlantic Ocean
Delaware River
Passaic River
Hudson River
Raritan Bay
Barnegat Bay