SEVENTEENTH ANNUAL REPORT

OF THE

UNITED STATES GEOLOGICAL SURVEY

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IN THREE PARTS

PART III (continued).—MINERAL RESOURCES OF THE UNITED STATES, 1895
NONMETALLIC PRODUCTS, EXCEPT COAL

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PART III (continued).—MINERAL RESOURCES OF THE UNITED STATES, 1895,
NONMETALLIC PRODUCTS, EXCEPT COAL.

COKE.

By Joseph D. Weeks.

[The ton used in this report is uniformly the short ton of 2,000 pounds.]

INTRODUCTION.

In this report, as in previous ones of the series, the word "coke" is used to define that coke which is made from bituminous coal in ovens, pits, etc., which, for convenience, may be termed "oven coke." The statistics and statements in no way refer to that other commercial coke which is a residual or by-product of the manufacture of illuminating gas, and which may be termed "gas coke."

The coal used in coking in the United States is mined from all five of its great coal fields: (1) The Appalachian; (2) the Central; (3) the Western; (4) the Rocky Mountain, and (5) the Pacific Coast. With the exception of that made from the coals of the Appalachian field, however, the tonnage of coke produced in the United States is quite small, but 445,473 tons of the total of 13,333,714 tons made in 1895, or about 3.34 per cent, being produced outside of this field. While the production in the fields outside of the Appalachian region is quite small in percentage, it is really a growing one, the amount there made in 1895 being somewhat larger than the amount produced in 1893 or 1894.

PRODUCTION OF COKE IN THE UNITED STATES.

In the following table will be found a statement of the production of coke in the United States in 1895, by States, followed, for purposes of comparison, by similar tables for 1894 and 1893:

Manufacture of coke in the United States, by States and Territories, in 1895.

State or Territory.	Establishments.	Ovens.		Coal used.	Yield of coal in coke.	Coke produced.	Total value of coke.	Value of coke per ton.
		Built.	Building.					
				Short tons.	*Per ct.*	*Short tons.*		
Alabama	22	5,658	50	2,459,465	58.7	1,444,339	$3,033,521	$2.10
Colorado (*a*)	9	*b* 1,169	0	580,584	58.6	340,357	940,987	2.76
Georgia	1	330	0	118,900	50.6	60,212	70,580	1.17
Illinois	3	129	0	3,600	62.5	2,250	4,500	2.00

a Includes Utah's production of coal and coke and value of same.

b Includes 36 gas retorts.

Manufacture of coke in the United States, by States and Territories, in 1895—Continued.

State or Territory.	Establishments.	Ovens.		Coal used.	Yield of coal in coke.	Coke produced.	Total value of coke.	Value of coke per ton.
		Built.	Building.					
				Short tons.	*Per ct.*	*Short tons.*		
Indiana	2	94	0	9,898	48.5	4,804	$9,333	$1.94
Indian Territory	1	80	0	11,825	43.8	5,175	17,657	3.41
Kansas	5	55	0	8,424	62.8	5,287	11,289	2.14
Kentucky	5	293	0	63,419	40.1	25,460	37,249	1.46
Missouri	3	10	0	3,120	65	2,028	2,442	1.20
Montana	3	303	0	55,770	45.4	25,337	189,856	7.49
New Mexico	1	50	0	22,385	65.5	14,663	29,491	2.01
New York	1	12	13	22,207	83.4	18,521	....	......
Ohio	8	377	0	51,921	56	29,050	69,655	2.40
Pennsylvania	99	26,042	170	14,211,567	66.2	9,404,215	11,908,162	1.266
Tennessee	12	1,903	0	684,655	57.9	396,790	754,926	1.90
Texas	1	6	0	530	54	286	....	......
Utah	1	84	0	....	......	*a* 22,519	....	......
Virginia	5	832	350	410,737	59.6	244,738	322,564	1.32
Washington	3	110	0	22,973	65.9	15,129	64,632	4.27
West Virginia	78	7,834	55	2,087,816	61.6	1,285,206	1,724,239	1.34
Wisconsin	1	120	0	8,287	60	4,972	26,103	5.25
Wyoming	1	74	0	10,240	47.8	4,895	17,133	3.50
Total	265	45,565	638	20,848,323	64	13,333,714	19,234,319	1.44

a Included with Colorado's coke production.

From this table it appears that the total production of coke in the United States in 1895 was 13,333,741 tons, as compared with 9,203,632 tons in 1894, 9,477,580 tons in 1893, and 12,010,829 tons in 1892. Just as the production in 1894 was the smallest in the history of coking in the United States since 1888, so the production in 1895 was the largest in its history, the nearest approach being in 1892. This great increase in production in 1895 is due to the greatly increased production of pig iron last year, just as the decline in 1894 was due to the decrease in pig-iron production. The total production of pig iron in the United States smelted with coke exclusively, or with a mixture of coke and anthracite, in 1894 was 6,314,891 long tons. In 1895 it was 9,164,365 tons, an increase of practically 50 per cent. The increase in the production of coke in 1895 over 1894 was very nearly the same as the increase in the production of pig iron smelted with coke or with a mixture of coke and anthracite.

In the following tables are given, by States, a statement of the production of coke in the United States in 1893 and 1894.

Manufacture of coke in the United States, by States and Territories, in 1894.

State or Territory.	Establishments.	Ovens. Built.	Ovens. Building.	Coal used.	Yield of coal in coke.	Coke produced.	Total value of coke.	Value of coke per ton.
				Short tons.	Per ct.	Short tons.		
Alabama	22	5,551	50	1,574,245	58.7	923,817	$1,871,348	$2.025
Colorado (a)	8	b 1,154	250	542,429	58.5	317,196	903,970	2.85
Georgia	1	338	0	166,523	55.9	93,029	116,286	1.25
Illinois	1	24	0	3,800	57.9	2,200	4,400	2.00
Indiana	2	94	0	13,489	48.6	6,551	13,102	2.00
Indian Territory	1	80	0	7,274	42	3,051	10,693	3.50
Kansas	6	61	0	13,288	63.5	8,439	15,660	1.855
Kentucky	6	293	0	66,418	44.8	29,748	51,566	1.73
Missouri	3	10	0	3,442	65.4	2,250	3,563	1.58
Montana	2	153	0	33,313	52.2	17,388	165,187	9.50
New Mexico	1	50	0	13,042	50	6,529	28,213	4.32
Ohio	8	363	0	55,324	59	32,640	90,875	2.78
Pennsylvania	101	25,824	118	9,059,118	66.9	6,063,777	6,585,489	1.086
Tennessee	11	1,860	0	516,802	56.6	292,646	480,124	1.64
Utah	1	83	0	....	......	c 16,056	....	......
Virginia	2	736	100	280,524	64.2	180,091	295,747	1.84
Washington	3	84	0	8,563	61.2	5,245	18,249	3.48
West Virginia	78	7,858	60	1,976,128	60.4	1,193,933	1,639,687	1.373
Wisconsin	1	120	0	6,343	67	4,250	19,465	4.58
Wyoming	1	24	0	8,685	50	4,352	15,232	3.50
Total	259	44,760	578	14,348,750	64	9,187,132	12,328,856	1.34
New York	1	12	13	....	......	16,500	....	......
	260	44,772	591	....	......	9,203,632	....	......

a Includes Utah's production of coal and coke and value of same.
b Includes 36 gas retorts.
c Included with Colorado's coke production.

Manufacture of coke in the United States, by States and Territories, in 1893.

State or Territory.	Establishments.	Ovens. Built.	Ovens. Building.	Coal used.	Yield of coal in coke.	Coke produced.	Total value of coke.	Value of coke per ton.
				Short tons.	Per ct.	Short tons.		
Alabama	23	5,548	60	2,015,398	58	1,168,085	$2,648,632	$2.27
Colorado (a)	8	b 1,154	200	628,935	57.7	362,986	1,137,488	3.13
Georgia	1	338	0	171,645	52.8	90,726	136,089	1.50
Illinois	1	24	0	3,300	66.7	2,200	4,400	2.00

a Includes Utah's production of coal and coke and value of same.
b Includes 36 gas retorts.

Manufacture of coke in the United States, by States and Territories, in 1893—Continued.

State or Territory.	Establishments.	Ovens.		Coal used.	Yield of coal in coke.	Coke produced.	Total value of coke.	Value of coke per ton.
		Built.	Building.					
				Short tons.	*Per ct.*	*Short tons.*		
Indiana	2	94	0	11,549	49.6	5,724	$9,048	$1.58
Indian Territory.	1	80	0	15,118	47	7,135	25,072	3.51
Kansas	6	75	0	13,645	62.8	8,565	18,640	2.18
Kentucky	4	283	100	97,212	50	48,619	97,350	2.00
Missouri	3	10	0	8,875	66.5	5,905	9,735	1.65
Montana	2	153	0	61,770	48.5	29,945	239,560	8.00
New Mexico	1	50	0	14,698	39.5	5,803	18,476	3.18
New York	1	12	0	15,150	84.8	12,850	35,925	2.80
Ohio	9	435	0	42,963	52	22,436	43,671	1.95
Pennsylvania	102	25,744	19	9,386,702	66	6,229,051	9,468,036	1.52
Tennessee	11	1,942	0	449,511	59	265,777	491,523	1.85
Utah	1	83	0	....	......	*a* 16,005	....	......
Virginia	2	594	206	194,059	64.5	125,092	282,898	2.26
Washington	3	84	0	11,374	59	6,731	34,207	5.08
West Virginia	75	7,354	132	1,745,757	60.8	1,062,076	1,716,907	1.62
Wisconsin	1	120	0	24,085	62	14,958	95,851	6.41
Wyoming	1	24	0	5,400	54	2,916	10,206	3.50
Total	258	44,201	717	14,917,146	63.5	9,477,580	16,523,714	1.74

a Included with Colorado's coke production.

It will be noted by reference to these three tables that Pennsylvania maintains its supremacy as the chief coke-producing State in the Union, its production in 1892 being 69 per cent of the total; in 1893, 65.7 per cent; in 1894, 65.9 per cent, and in 1895, 70.5 per cent. West Virginia produced in 1894 about 13 per cent of the total production and in 1895 only a little over 9.6 per cent, while Alabama, which produced 10 per cent of the total in 1894, produced about 10.9 per cent in 1895. Tennessee produced in 1895 about 3 per cent of the total, as compared with 3.2 per cent in 1894. Colorado follows Tennessee closely, producing in 1895 about 2.4 per cent of the total. Virginia's proportion of the total in 1895 was the same as in 1894, being about 2 per cent.

Comparing the tonnage of the States in 1894 and 1895 it will be seen that all of the six chief coke-producing States increased their total production in 1895 over 1894. The increased production in Pennsylvania in 1895 over 1894 was 3,340,438 tons, or 55 per cent; in West Virginia, 91,273 tons, or 8 per cent; in Alabama, 520,522 tons, or 56 per cent; in Tennessee, 104,144 tons, or about 36 per cent; in Colorado, 16,698 tons, or 5½ per cent, and in Virginia, 64,647 tons, or nearly 36 per cent.

In the following table are consolidated the statistics of the manufacture of coke in the United States from 1880 to 1895, inclusive:

Statistics of the manufacture of coke in the United States, 1880 to 1895, inclusive.

Year.	Establishments.	Ovens. Built.	Ovens. Building.	Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
				Short tons.	*Short tons.*			*Per ct.*
1880...	186	12, 372	1, 159	5, 237, 741	3, 338, 300	$6, 631, 267	$1. 99	63
1881...	197	14, 119	1, 005	6, 546, 662	4, 113, 760	7, 725, 175	1. 88	63
1882...	215	16, 356	712	7, 577, 648	4, 793, 321	8, 462, 167	1. 77	63
1883...	231	18, 304	407	8, 516, 670	5, 464, 721	8, 121, 607	1. 49	64
1884...	250	19, 557	812	7, 951, 974	4, 873, 805	7, 242, 878	1. 49	61
1885...	233	20, 116	432	8, 071, 126	5, 106, 696	7, 629, 118	1. 49	63
1886...	222	22, 597	4, 154	10, 688, 972	6, 845, 369	11, 153, 366	1. 63	64
1887...	270	26, 001	3, 584	11, 859, 752	7, 611, 705	15, 321, 116	2. 01	64
1888...	261	30, 059	2, 587	12, 945, 350	8, 540, 030	12, 445, 963	1. 46	66
1889...	252	34, 165	2, 115	15, 960, 973	10, 258, 022	16, 630, 301	1. 62	64
1890...	253	37, 158	1, 547	18, 005, 209	11, 508, 021	23, 215, 302	2. 02	64
1891...	243	40, 245	911	16, 344, 540	10, 352, 688	20, 393, 216	1. 97	63
1892...	261	42, 002	1, 893	18, 813, 337	12, 010, 829	23, 536, 141	1. 96	64
1893...	258	44, 201	717	14, 917, 146	9, 477, 580	16, 523, 714	1. 74	63. 5
1894...	260	44, 772	591	a14,348, 750	9, 203, 632	a12,328, 856	1. 34	64
1895...	265	45, 565	638	20, 848, 323	13, 333, 714	b19,234, 319	1. 44	64

a Excluding New York. b Excluding New York and Texas.

TOTAL NUMBER OF COKE WORKS IN THE UNITED STATES.

The following table gives the number of establishments manufacturing coke in the United States at the close of each year from 1880 to 1895, by States:

Number of establishments in the United States manufacturing coke on December 31 of each year from 1880 to 1895.

State or Territory.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.
Alabama	4	4	5	6	8	11	14	15
Colorado	1	2	5	7	8	7	7	7
Georgia	1	1	1	1	1	2	2	2
Illinois	6	6	7	7	9	9	9	8
Indiana	2	2	2	2	2	2	4	4
Indian Territory	1	1	1	1	1	1	1	1
Kansas	2	3	3	4	4	4	4	4
Kentucky	5	5	5	5	5	5	6	6
Missouri	0	0	0	0	0	0	0	1

Number of establishments in the United States manufacturing coke on December 31 of each year from 1880 to 1895—Continued.

State or Territory.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.
Montana	0	0	0	1	3	2	4	2
New Mexico	0	0	2	2	2	2	2	1
New York	......	......	......	......	......	......	......	......
Ohio	15	15	16	18	19	13	15	15
Pennsylvania	124	132	137	140	145	133	108	151
Tennessee	6	6	8	11	13	12	12	11
Texas	0	0	0	0	0	0	1	0
Utah	1	1	1	1	1	1	1	0
Virginia	0	0	0	1	1	1	2	2
Washington	0	0	0	0	1	1	1	1
West Virginia	18	19	22	24	27	27	29	39
Wisconsin	0	0	0	0	0	0	0	0
Wyoming	0	0	0	0	0	0	0	0
Total	186	197	215	231	250	233	222	270

State or Territory.	1888.	1889.	1890.	1891.	1892.	1893.	1894.	1895.
Alabama	18	19	20	21	20	23	22	22
Colorado	7	9	8	7	9	8	8	9
Georgia	1	1	1	1	1	1	1	1
Illinois	8	4	4	1	1	1	1	3
Indiana	3	4	4	2	2	2	2	2
Indian Territory	1	1	1	1	1	1	1	1
Kansas	6	6	7	6	6	6	6	5
Kentucky	10	9	9	7	5	4	6	5
Missouri	1	3	3	3	3	3	3	3
Montana	1	2	2	2	2	2	2	3
New Mexico	1	2	2	1	1	1	1	1
New York	......	......	......	......	......	1	1	1
Ohio	15	13	13	9	10	9	8	8
Pennsylvania	120	109	106	109	109	102	101	99
Tennessee	11	12	11	11	11	11	11	12
Texas	0	0	0	0	0	0	0	1
Utah	0	1	1	1	1	1	1	1
Virginia	2	2	2	2	2	2	2	5
Washington	3	1	2	2	3	3	3	3
West Virginia	52	53	55	55	72	75	78	78
Wisconsin	1	1	1	1	1	1	1	1
Wyoming	0	1	1	1	1	1	1	1
Total	261	253	253	243	261	258	260	265

The word "establishment" is rather an indefinite one. In some cases proprietors of coke works owning several different banks or blocks of ovens will report them all as one establishment, they being under one general management. In other cases they will be reported separately. The number differs so much from year to year as to make this table of but little value for comparison.

The number of establishments in the country for each year since 1850 for which there are any returns is as follows:

Number of coke establishments in the United States since 1850.

Year.	Number.	Year.	Number.
1850 (census year)	4	1886, December 31	222
1860 (census year)	21	1887, December 31	270
1870 (census year)	25	1888, December 31	261
1880 (census year)	149	1889, December 31	253
1880, December 31	186	1890, December 31	253
1881, December 31	197	1891, December 31	243
1882, December 31	215	1892, December 31	261
1883, December 31	231	1893, December 31	258
1884, December 31	250	1894, December 31	260
1885, December 31	233	1895, December 31	265

NUMBER OF COKE OVENS IN THE UNITED STATES.

The following table shows the number of coke ovens in each State and Territory on December 31 of each year from 1880 to 1895, together with the total number of ovens in the United States at the close of each of these years. In the earlier years covered by this table some coke was made in pits and on the ground, and in testing the adaptability of certain coals to the manufacture of coke this is still customary, though in the latter years but little of the coke reported as produced in the United States was made by any other method than in ovens.

Number of coke ovens in the United States on December 31 of each of the years from 1880 to 1895.

State or Territory.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.
Alabama	316	416	536	767	976	1,075	1,301	1,555
Colorado	200	267	344	352	409	434	483	532
Georgia	140	180	220	264	300	300	300	300
Illinois	176	176	304	316	325	320	335	278
Indiana	45	45	37	37	37	37	100	119
Indian Territory	20	20	20	20	20	40	40	80
Kansas	6	15	20	23	23	23	36	39
Kentucky	45	45	45	45	45	33	76	98

Number of coke ovens in the United States on December 31 of each of the years from 1880 to 1895—Continued.

State or Territory.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.
Missouri	0	0	0	0	0	0	0	4
Montana	0	0	0	2	5	2	16	27
New Mexico	0	0	0	12	70	70	70	70
New York	......	......	......	......	......	......	......	......
Ohio	616	641	647	682	732	642	560	585
Pennsylvania	9,501	10,881	12,424	13,610	14,285	14,553	16,314	18,294
Tennessee	656	724	861	992	1,105	1,387	1,485	1,560
Texas	......	......	......	......	......	......	......	......
Utah	20	20	20	20	20	20	20	0
Virginia	0	0	0	200	200	200	350	350
Washington	0	0	0	0	0	2	11	30
West Virginia	631	689	878	962	1,005	978	1,100	2,080
Wisconsin	0	0	0	0	0	0	0	0
Wyoming	0	0	0	0	0	0	0	0
Total	12,372	14,119	16,356	18,304	19,557	20,116	22,597	26,001

State or Territory.	1888.	1889.	1890.	1891.	1892.	1893.	1894.	1895.
Alabama	2,475	3,944	4,805	5,068	5,320	5,548	5,551	5,658
Colorado	602	834	916	948	*a*1,128	*a*1,154	*a*1,154	*a*1,169
Georgia	290	300	300	300	300	338	338	330
Illinois	221	149	148	25	24	24	24	129
Indiana	103	111	101	84	84	94	94	94
Indian Territory	80	78	78	80	80	80	80	80
Kansas	58	68	68	72	75	75	61	55
Kentucky	132	166	175	115	287	283	293	293
Missouri	4	9	10	10	10	10	10	10
Montana	40	90	140	140	153	153	153	303
New Mexico	70	70	70	*b*0	50	50	50	50
New York	......	......	......	......	......	*c*12	*c*12	*c*12
Ohio	547	462	443	421	436	435	363	377
Pennsylvania	20,381	22,143	23,430	25,324	25,366	25,744	25,824	*d*26,042
Tennessee	1,634	1,639	1,664	1,995	1,941	1,942	1,860	1,903
Texas	......	......	......	......	......	......	......	6
Utah	0	34	80	80	83	83	83	84
Virginia	550	550	550	550	594	594	736	832
Washington	30	30	30	80	84	84	84	110
West Virginia	2,792	3,438	4,060	4,621	5,843	7,354	7,858	7,834
Wisconsin	50	50	70	120	120	120	120	120
Wyoming	0	0	20	24	24	24	24	74
Total	30,059	34,165	37,158	40,057	42,002	44,201	44,772	45,565

a Includes 36 gas retorts.
b Coke was made in pits.
c Semet-Solvay ovens.
d Includes 60 Otto-Hoffmann ovens.

From the above table it will be noted that the total number of coke ovens in the United States increased from 44,772 in 1894 to 45,565 in 1895. As we have heretofore stated, a calculation based on this table and the one showing production indicates that ovens in certain States were in more active operation than those in other States. For instance, Alabama in 1895 had 5,658 ovens, while West Virginia had 7,834, and yet Alabama, with its smaller number of ovens, produced a larger amount of coke. The product per oven in West Virginia in 1895 was 164 tons, in Alabama 255 tons, and in Pennsylvania 361 tons. In 1894 the product per oven in these States was, in West Virginia 152 tons, in Alabama 166 tons, and in Pennsylvania 235 tons.

Most of the coke ovens in the United States are of the solid-wall type, in which the coal is coked by heat generated in the oven itself. Most of these ovens are of the regular beehive shape. A few are somewhat modified in form, the oven being long and shaped like a muffle. Other ovens, while they retain the beehive form, have hollow tiles near the top into which the air previously heated enters for combustion.

At the close of 1895 there were in operation in the United States, in addition to the 12 Semet-Solvay ovens that have been operated for the past two years at Syracuse, 60 Otto-Hoffmann ovens at Johnstown, Pa., while 50 Semet-Solvay ovens were in course of construction at Dunbar, Pa., 50 more of the same type at Sharon, Pa., and the foundations were in for 60 additional Otto-Hoffmann ovens at Johnstown. Three ovens on the Slocum principle, which is like all of the horizontal ovens, a modified Carvès, were built at Bolivar, Pa., and 30 by-product beehive ovens on the Newton-Chambers system were nearly finished at Latrobe, Pa. Since the close of 1895 Mr. H. M. Whitney has completed arrangements to erect a large number of by-product ovens on the Slocum principle at Boston, the chief object being the saving of the gas for fuel and illuminating purposes, Mr. Whitney having made a contract with the Boston Gas Company to supply them with all of the gas they will use for a term of years. The Illinois Steel Company have also arranged with Mr. Huessener for the erection of a bank of modified Huessener ovens, which will be located either in the Connellsville region or at their works at South Chicago. Other blocks of ovens are contemplated, but, so far as has been learned, these are the only ones that are absolutely under construction.

NUMBER OF OVENS BUILDING IN THE UNITED STATES.

The following table gives the number of ovens actually in course of construction at the close of each year from 1880 to 1895. It should be understood that this table does not include the increase in the number of ovens during the year. It only gives the number of ovens actually in course of construction at the close of each year. It will be noted that the number in course of erection at the close of 1895 was 638.

Number of coke ovens building in the United States at the close of each of the years from 1880 to 1895.

State or Territory.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.
Alabama	100	120	0	122	242	16	1,012	1,362
Colorado	50	0	0	0	24	0	0	0
Georgia	40	40	44	36	0	0	0	0
Illinois	0	0	0	0	0	0	0	0
Indiana	0	0	0	0	0	0	18	0
Indian Territory	0	0	0	0	0	0	0	0
Kansas	0	0	0	0	0	0	0	0
Kentucky	0	0	0	0	0	0	2	0
Missouri	0	0	0	0	0	0	0	0
Montana	0	0	0	0	12	0	0	0
New Mexico	0	0	12	28	0	0	0	0
New York	......	......	......	......	......	......	......	......
Ohio	25	0	0	0	0	0	0	223
Pennsylvania	836	761	642	211	232	317	2,558	802
Tennessee	68	84	14	10	175	36	126	165
Texas	0	0	0	0	0	0	0	0
Virginia	0	0	0	0	0	0	100	300
Washington	0	0	0	0	0	0	21	0
West Virginia	40	0	0	0	127	63	317	742
Wisconsin	0	0	0	0	0	0	0	0
Wyoming	0	0	0	0	0	0	0	0
Total	1,159	1,005	712	407	812	432	4,154	3,594

State or Territory.	1888.	1889.	1890.	1891.	1892.	1893.	1894.	1895.
Alabama	406	427	371	50	90	60	50	50
Colorado	100	50	30	21	220	200	250	0
Georgia	0	0	0	0	0	0	0	0
Illinois	0	0	0	0	0	0	0	0
Indiana	0	0	0	0	0	0	0	0
Indian Territory	0	0	0	0	0	0	0	0
Kansas	0	0	0	0	0	0	0	0
Kentucky	2	100	303	24	100	100	0	0
Missouri	0	0	0	0	0	0	0	0
Montana	0	50	0	0	0	0	0	0
New Mexico	0	0	0	0	0	0	0	0
New York	......	......	......	......	......	......	*a* 13	*a* 13
Ohio	12	0	1	0	0	0	0	0
Pennsylvania	1,565	567	74	11	269	19	118	*b* 170
Tennessee	84	40	292	0	0	0	0	0
Texas	0	0	0	0	0	0	0	0
Virginia	0	250	250	250	206	206	100	350
Washington	100	0	80	0	30	0	0	0
West Virginia	318	631	334	555	978	132	60	55
Wisconsin	0	0	0	0	0	0	0	0
Wyoming	0	0	0	0	0	0	0	0
Total	2,587	2,115	1,735	911	1,893	717	591	638

a Semet-Solvay. *b* Includes 60 Otto-Hoffmann and 50 Semet-Solvay ovens.

PRODUCTION OF COKE FROM 1880 TO 1895.

The production of coke in the several States and Territories from 1880 to 1895 is shown in the following table:

Amount of coke produced, in short tons, in the United States from 1880 to 1895, inclusive, by States and Territories.

State or Territory.	1880.	1881.	1882.	1883.	1884.	1885.
Alabama	60, 781	109, 033	152, 940	217, 531	244, 009	301, 180
Colorado	25, 568	48, 587	102, 105	133, 997	115, 719	131, 960
Georgia	38, 041	41, 376	46, 602	67, 012	79, 268	70, 669
Illinois	12, 700	14, 800	11, 400	13, 400	13, 095	10, 350
Indiana	0	0	0	0	0	0
Indian Territory	1, 546	1, 768	2, 025	2, 573	1, 912	3, 584
Kansas	3, 070	5, 670	6, 080	8, 430	7, 190	8, 050
Kentucky	4, 250	4, 370	4, 070	5, 025	2, 223	2, 704
Missouri	0	0	0	0	0	0
Montana	0	0	0	0	75	175
New Mexico	0	0	1, 000	3, 905	18, 282	17, 940
New York	....	....	....	....	....	....
Ohio	100, 596	119, 469	103, 722	87, 834	62, 709	39, 416
Pennsylvania	2, 821, 384	3, 437, 708	3, 945, 034	4, 438, 464	3, 822, 128	3, 991, 805
Tennessee	130, 609	143, 853	187, 695	203, 691	219, 723	218, 842
Utah	1, 000	0	250	0	0	0
Virginia	0	0	0	25, 340	63, 600	49, 139
Washington	0	0	0	....	400	311
West Virginia	138, 755	187, 126	230, 398	257, 519	223, 472	260, 571
Wisconsin	0	0	0	0	0	0
Wyoming	0	0	0	0	0	0
Total	3, 338, 300	4, 113, 760	4, 793, 321	5, 464, 721	4, 873, 805	5, 106, 696

State or Territory.	1886.	1887.	1888.	1889.	1890.
Alabama	375, 054	325, 020	508, 511	1, 030, 510	1, 072, 942
Colorado	142, 797	170, 698	179, 682	187, 638	245, 756
Georgia	82, 680	79, 241	83, 721	94, 727	102, 233
Illinois	8, 103	9, 198	7, 410	11, 583	5, 000
Indiana	6, 124	17, 658	11, 956	8, 301	6, 013
Indian Territory	6, 351	10, 060	7, 502	6, 639	6, 639
Kansas	12, 493	14, 950	14, 831	13, 910	12, 311
Kentucky	4, 528	14, 565	23, 150	13, 021	12, 343
Missouri	0	2, 970	2, 600	5, 275	6, 136
Montana	0	7, 200	12, 000	14, 043	14, 427
New Mexico	10, 236	13, 710	8, 540	3, 460	2, 050

Amount of coke produced, in short tons, in the United States from 1880 to 1895, inclusive, by States and Territories—Continued.

State or Territory.	1886.	1887.	1888.	1889.	1890.
New York	....	0	0	0	0
Ohio	34, 932	93, 004	67, 194	75, 124	74, 633
Pennsylvania	5, 406, 597	5, 832, 849	6, 545, 779	7, 659, 055	8, 560, 245
Tennessee	368, 139	396, 979	385, 693	359, 710	348, 728
Utah	0	0	0	761	8, 528
Virginia	122, 352	166, 947	149, 199	146, 528	165, 847
Washington	825	14, 625	0	3, 841	5, 837
West Virginia	264, 158	442, 031	531, 762	607, 880	833, 377
Wisconsin	0	0	500	16, 016	24, 976
Wyoming	0	0	0	0	0
Total	6, 845, 369	7, 611, 705	8, 540, 030	10, 258, 022	11, 508, 021

State or Territory.	1891.	1892.	1893.	1894.	1895.
Alabama	1, 282, 496	1, 501, 571	1, 168, 085	923, 817	1, 444, 339
Colorado	277, 074	365, 920	346, 981	301, 140	317, 838
Georgia	103, 057	81, 807	90, 726	92, 029	60, 212
Illinois	5, 200	3, 170	2, 200	2, 200	2, 250
Indiana	3, 798	2, 207	5, 724	6, 551	4, 804
Indian Territory	9, 464	3, 569	7, 135	3, 051	5, 175
Kansas	14, 174	9, 132	8, 565	8, 439	5, 287
Kentucky	33, 777	36, 123	48, 619	29, 748	25, 460
Missouri	6, 872	7, 299	5, 905	2, 250	2, 028
Montana	29, 009	34, 557	29, 945	17, 388	25, 237
New Mexico	2, 300	0	5, 803	6, 529	14, 663
New York	0	0	12, 850	16, 500	18, 521
Ohio	38, 718	51, 818	22, 436	32, 640	29, 050
Pennsylvania	6, 954, 846	8, 327, 612	6, 229, 051	6, 063, 777	9, 404, 215
Tennessee	364, 318	354, 096	265, 777	292, 646	396, 790
Texas	0	0	0	0	286
Utah	7, 949	7, 309	16, 005	16, 056	22, 519
Virginia	167, 516	147, 912	125, 092	180, 091	244, 738
Washington	6, 000	7, 177	6, 731	5, 245	15, 129
West Virginia	1, 009, 051	1, 034, 750	1, 062, 076	1, 193, 933	1, 285, 206
Wisconsin	34, 387	33, 800	14, 958	4, 250	4, 972
Wyoming	2, 682	0	2, 916	4, 352	4, 895
Total	10, 352, 688	12, 010, 829	9, 477, 580	9, 203, 632	13, 333, 714

The following table gives the relative rank of the States and Territories in the production of coke in the years 1880 to 1895, both inclusive:

Rank of the States and Territories in production of coke from 1880 to 1895.

State or Territory.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.	1891.	1892.	1893.	1894.	1895.
Pennsylvania	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Alabama	5	5	4	3	2	2	2	4	3	2	2	2	2	2	3	2
West Virginia	2	2	2	2	3	3	4	2	2	3	3	3	3	3	2	3
Tennessee	3	3	3	4	4	4	3	3	4	4	4	4	5	5	5	4
Colorado	7	6	6	5	5	5	5	5	5	5	5	5	4	4	4	5
Virginia	......	......	......	8	7	7	6	6	6	6	6	6	6	6	6	6
Georgia	6	7	7	7	6	6	7	8	7	7	7	7	7	7	7	7
Ohio	4	4	5	6	8	8	8	7	8	8	8	8	8	10	8	8
Kentucky	9	10	10	11	12	13	14	12	9	12	11	10	9	8	9	9
Montana	......	......	......	......	15	15	......	16	12	10	10	11	10	9	10	10
Utah	12	......	13	......	......	......	......	......	......	19	13	14	13	11	12	11
New York	......	......	......	......	......	......	......	......	......	......	......	......	......	13	11	12
Washington	......	......	......	......	14	14	15	11	10	17	17	16	15	16	16	13
New Mexico	......	......	12	12	9	9	10	13	14	18	19	20	......	18	15	14
Kansas	10	9	9	10	11	11	9	10	11	11	12	12	12	14	13	15
Indian Territory	11	11	11	13	13	12	12	14	15	15	14	13	16	15	19	16
Wisconsin	......	......	......	......	......	......	......	......	18	9	9	9	11	12	18	17
Wyoming	......	......	......	......	......	......	......	......	......	......	......	19	......	20	17	18
Indiana	......	......	......	......	......	......	13	9	13	14	16	18	17	19	14	19
Illinois	8	8	8	9	10	10	11	15	16	13	18	17	18	21	21	20
Missouri	......	......	......	......	......	......	......	17	17	16	15	15	14	17	20	21
Texas	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	22

An inspection of the above table indicates that one change in the relative rank of the coke-producing States was between Alabama and West Virginia, these two States exchanging places, Alabama becoming second, whereas it was third in 1894, and West Virginia becoming third, whereas it was second in 1894. Colorado and Tennessee also exchanged places, Tennessee becoming fourth and Colorado fifth of the States.

VALUE AND AVERAGE SELLING PRICE OF COKE.

In the following table is given the total value of coke produced in the United States in each year from 1880 to 1895, inclusive:

Total value at the ovens of the coke made in the United States in the years from 1880 to 1895, inclusive, by States and Territories.

State or Territory.	1880.	1881.	1882.	1883.	1884.	1885.
Alabama	$183,063	$326,819	$425,940	$598,473	$609,185	$755,645
Colorado	145,226	267,156	476,665	584,578	409,930	512,162
Georgia	81,789	88,753	100,194	147,166	169,192	144,198
Illinois	41,950	45,850	29,050	28,200	25,639	27,798
Indiana	0	0	0	0	0	0
Indian Territory	4,638	5,304	6,075	7,719	5,736	12,902
Kansas	6,000	10,200	11,460	16,560	14,580	13,255
Kentucky	12,250	12,630	11,530	14,425	8,760	8,499
Missouri	0	0	0	0	0	0
Montana	0	0	0	0	900	2,063
New Mexico	0	0	6,000	21,478	91,410	89,700
New York	....	....	....	....	....	....
Ohio	255,905	297,728	266,113	225,660	156,294	109,723
Pennsylvania	5,255,040	5,898,579	6,133,698	5,410,387	4,783,230	4,981,656
Tennessee	316,607	342,585	472,505	459,126	428,870	398,459
Utah	10,000	0	2,500	0	0	0
Virginia	0	0	0	44,345	111,300	85,993
Washington	0	0	0	0	1,900	1,477
West Virginia	318,797	429,571	520,437	563,490	425,952	485,588
Wisconsin	0	0	0	0	0	0
Wyoming	0	0	0	0	0	0
Total	6,631,265	7,725,175	8,462,167	8,121,607	7,242,878	7,629,118

State or Territory.	1886.	1887.	1888.	1889.	1890.
Alabama	$993,302	$775,090	$1,189,679	$2,372,417	$2,589,447
Colorado	569,120	682,778	716,305	643,479	959,246
Georgia	179,031	174,410	177,907	149,059	150,995
Illinois	21,487	19,594	21,038	29,764	11,250
Indiana	17,953	51,141	31,993	25,922	19,706
Indian Territory	22,229	33,435	21,755	17,957	21,577

Total value at the ovens of the coke made in the United States in the years from 1880 to 1895, inclusive, by States and Territories—Continued.

State or Territory.	1886.	1887.	1888.	1889.	1890.
Kansas	$19, 204	$28, 575	$29, 073	$26, 593	$29, 116
Kentucky	10, 082	31, 730	47, 244	29, 769	22, 191
Missouri	0	10, 395	9, 100	5, 800	9, 240
Montana	0	72, 000	96, 000	122, 023	125, 655
New Mexico	51, 180	82, 260	51, 240	18, 408	10, 025
New York	....	....	....	....	....
Ohio	94, 042	245, 981	166, 330	188, 222	218, 090
Pennsylvania	7, 664, 023	10, 746, 352	8, 230, 759	10, 743, 492	16, 333, 674
Tennessee	687, 865	870, 900	490, 491	731, 496	684, 116
Utah	0	0	0	3, 042	37, 196
Virginia	305, 880	417, 368	260, 000	325, 861	278, 724
Washington	4, 125	102, 375	0	30, 728	46, 696
West Virginia	513, 843	976, 732	905, 549	1, 074, 177	1, 524, 746
Wisconsin	0	0	1, 500	92, 092	143, 612
Wyoming	0	0	0	0	0
Total	11, 153, 366	15, 321, 116	12, 445, 963	16, 630, 301	23, 215, 302

State or Territory.	1891.	1892.	1893.	1894.	1895.
Alabama	$2, 986, 242	$3, 464, 623	$2, 648, 632	$1, 871, 348	$3, 033, 521
Colorado	896, 984	*a* 1, 234, 320	*a* 1, 137, 488	*a* 903, 970	*a* 940, 987
Georgia	231, 878	163, 614	136, 089	116, 286	70, 580
Illinois	11, 700	7, 133	4, 400	4, 400	4, 500
Indiana	7, 596	6, 472	9, 048	13, 102	9, 333
Indian Territory	30, 483	12, 402	25, 072	10, 693	17, 657
Kansas	33, 296	19, 906	18, 640	15, 660	11, 289
Kentucky	68, 281	72, 563	97, 350	51, 566	37, 249
Missouri	10, 000	10, 949	9, 735	3, 563	2, 442
Montana	258, 523	311, 013	239, 560	165, 187	189, 856
New Mexico	10, 925	0	18, 476	28, 213	29, 491
New York	....	....	35, 925	....	....
Ohio	76, 901	112, 907	43, 671	90, 875	69, 655
Pennsylvania	12, 679, 826	15, 015, 336	9, 468, 036	6, 585, 489	11, 908, 162
Tennessee	701, 803	724, 106	491, 523	480, 124	754, 926
Utah	35, 778	....	....	....	....
Virginia	265, 107	322, 486	282, 898	295, 747	322, 564
Washington	42, 000	50, 446	34, 207	18, 249	64, 632
West Virginia	1, 845, 043	1, 821, 965	1, 716, 907	1, 639, 687	1, 724, 239
Wisconsin	192, 804	185, 900	95, 851	19, 465	26, 103
Wyoming	8, 046	0	10, 206	15, 232	17, 133
Total	20, 393, 216	23, 536, 141	16, 523, 714	12, 328, 856	19, 234, 319

a Including Utah's value.

While this table gives the totals of the values as returned in the schedules, the figures do not always represent the same thing. A statement as to the actual selling price of the coke was asked for, and in most cases, including possibly 80 per cent of all the coke produced, the figures are the actual selling price. In some cases, however, the value is an estimate. Considerable of the coke made in the United States is produced by proprietors of blast furnaces for consumption in their own furnaces, none being sold. The value, therefore, given for this coke would be an estimate, based in some instances, where there are coke works in the neighborhood selling coke for the general market, upon the price obtained for this coke; in other cases the cost is estimated at the cost of the coke at the furnace, plus a small percentage for profit on the coking operation, while in still other cases the value given is only the actual cost of the coke at the ovens.

In the following table is given the average value per short ton of the coke made in the United States for each year from 1880 to 1895, inclusive, by States and Territories.

Average value per short ton at the ovens of the coke made in the United States in the years from 1880 to 1895, inclusive, by States and Territories.

State or Territory.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.	1891.	1892.	1893.	1894.	1895.
Alabama	$3.01	$3.00	$2.79	$2.75	$2.50	$2.50	$2.65	$2.39	$2.34	$2.30	$2.41	$2.33	$2.31	$2.27	$2.025	$2.10
Colorado	5.68	5.29	4.67	4.36	3.45	3.88	3.99	4.00	4.00	3.43	3.90	3.24	3.31	*a* 3.13	*a* 2.85	*a* 2.76
Georgia	2.15	2.15	2.15	2.20	2.13	2.04	2.17	2.20	2.12	1.57	1.48	2.25	2.00	1.50	1.25	1.17
Illinois	3.30	3.10	2.55	2.10	1.96	2.68	2.65	2.13	2.84	2.57	2.25	2.25	2.25	2.00	2.00	2.00
Indiana	...	...	...	...	...	...	2.93	2.81	2.68	3.12	3.28	2.00	2.02	1.58	2.00	1.94
Indian Territory	3.00	3.00	3.00	3.00	3.00	3.60	3.50	3.33	2.90	2.70	3.25	3.22	3.47	3.51	3.50	3.41
Kansas	1.95	1.80	1.70	1.96	2.02	1.65	1.54	1.91	1.96	1.91	2.37	2.35	2.18	2.18	1.855	2.14
Kentucky	2.88	2.89	2.83	2.87	3.94	3.14	2.23	2.18	2.04	2.28	1.80	2.02	2.01	2.00	1.73	1.46
Missouri	...	...	...	...	...	...	...	3.50	3.50	1.10	1.51	1.46	1.50	1.65	1.58	1.20
Montana	...	...	...	...	12.00	11.72	...	10.00	8.00	8.69	8.71	8.91	9.00	8.00	9.50	7.49
New Mexico	...	...	6.00	5.50	5.00	5.00	5.00	6.00	6.00	5.32	4.89	4.75	0	3.18	4.32	2.01
New York	...	...	...	...	...	...	...	...	...	...	...	...	...	2.80	...	...
Ohio	2.54	2.49	2.57	2.57	2.49	2.78	2.69	2.65	2.48	2.50	2.92	1.99	2.18	1.95	2.78	2.40
Pennsylvania	1.86	1.70	1.55	1.22	1.25	1.25	1.42	1.84	1.26	1.40	1.91	1.82	1.80	1.52	1.086	1.266
Tennessee	2.42	2.33	2.52	2.25	1.95	1.31	1.87	2.19	1.27	2.03	1.96	1.93	2.05	1.85	1.64	1.90
Utah	10.00	...	10.00	...	...	...	...	...	...	4.00	4.36	4.50	0	...	...	...
Virginia	...	...	...	1.75	1.75	1.75	2.50	2.50	1.74	2.22	1.68	1.58	2.18	2.26	1.64	1.32
Washington	...	...	...	...	4.75	4.75	5.00	7.00	0	8.00	8.00	7.00	7.03	5.08	3.48	4.27
West Virginia	2.30	2.30	2.26	2.19	1.19	1.86	1.94	2.22	1.70	1.76	1.83	1.83	1.76	1.62	1.373	1.34
Wisconsin	...	...	...	...	...	...	...	...	3.00	5.75	5.75	5.61	5.50	6.41	4.58	5.25
Wyoming	...	...	...	...	...	...	...	...	...	...	...	3.00	0	3.50	*b* 3.50	3.50
Average	1.99	1.88	1.77	1.49	1.49	1.49	1.63	2.01	1.46	1.62	2.02	1.97	1.96	1.74	1.34	1.44

a Including Utah's value. *b* Value estimated.

From this table it appears that the average value per ton of coke in the United States in 1895 was 10 cents a ton in excess of the value for 1894. The average values of coke per ton in 1894 and 1895 were lower than in any other year since the beginning of the compilation of these statistics. In 1895 the average value per ton varied from $1.266 in Pennsylvania to $7.49 in Montana. In considering the above prices the statement previously made as to the meaning of these values must be borne in mind.

COAL CONSUMED IN THE MANUFACTURE OF COKE.

In the following table is given the total number of tons of coal used in the manufacture of coke in the United States for the years 1880 to 1895:

Amount of coal used in the manufacture of coke in the United States from 1880 to 1895, inclusive, by States and Territories.

[Short tons.]

State or Territory.	1880.	1881.	1882.	1883.	1884.	1885.
Alabama	106,283	184,881	261,839	359,699	413,184	507,934
Colorado	51,891	97,508	180,549	224,089	181,968	208,069
Georgia	63,402	68,960	77,670	111,687	132,113	117,781
Illinois	31,240	35,240	25,270	31,370	30,168	21,487
Indiana	....	....	....	....	....	....
Indian Territory	2,494	2,852	3,266	4,150	3,084	5,781
Kansas	4,800	8,800	9,200	13,400	11,500	15,000
Kentucky	7,206	7,406	6,006	8,437	3,451	5,075
Missouri	....	....	....	....	....	....
Montana	....	....	....	....	165	300
New Mexico	....	....	1,500	6,941	29,990	31,889
New York	....	....	....	....	....	....
Ohio	172,453	201,145	181,577	152,502	108,164	68,796
Pennsylvania	4,347,558	5,393,503	6,149,179	6,823,275	6,204,604	6,178,500
Tennessee	217,656	241,644	313,537	330,961	348,295	412,538
Utah	2,000	....	500	....	....	....
Virginia	....	....	....	39,000	99,000	81,899
Washington	....	....	....	....	700	544
West Virginia	230,758	304,823	366,653	411,159	385,588	415,533
Wisconsin	....	....	....	....	....	....
Wyoming	....	....	....	....	....	....
Total	5,237,741	6,546,762	7,577,646	8,516,670	7,951,974	8,071,126

State or Territory.	1886.	1887.	1888.	1889.	1890.
Alabama	635,120	550,047	848,608	1,746,277	1,809,964
Colorado	228,060	267,487	274,212	299,731	407,023
Georgia	136,133	158,482	140,000	157,878	170,388
Illinois	17,806	16,596	13,020	19,250	9,000
Indiana	13,030	35,600	26,547	16,428	11,753

Amount of coal used in the manufacture of coke in the United States from 1880 to 1895, inclusive, by States and Territories—Continued.

[Short tons.]

State or Territory.	1886.	1887.	1888.	1889.	1890.
Indian Territory.	10, 242	20, 121	13, 126	13, 277	13, 278
Kansas	23, 062	27, 604	24, 934	21, 600	21, 809
Kentucky	9, 055	29, 129	42, 642	25, 192	24, 372
Missouri	....	5, 400	5, 000	8, 485	9, 491
Montana	....	10, 800	20, 000	30, 576	32, 148
New Mexico	18, 194	22, 549	14, 628	7, 162	3, 980
New York	....	....	....	....	....
Ohio	59, 332	164, 974	124, 201	132, 828	126, 921
Pennsylvania	8, 290, 849	8, 938, 438	9, 673, 097	11, 581, 292	13, 046, 143
Tennessee	621, 669	655, 857	630, 099	626, 016	600, 387
Texas	....	....	....	....	....
Utah	....	....	....	2, 217	24, 058
Virginia	200, 018	235, 841	230, 529	238, 793	251, 683
Washington	1, 400	22, 500	....	6, 983	9, 120
West Virginia	425, 002	698, 327	863, 707	1, 001, 372	1, 395, 266
Wisconsin	....	....	1, 000	25, 616	38, 425
Wyoming	....	....	....	....	....
Total	10, 688, 972	11, 859, 752	12, 945, 350	15, 960, 973	18, 005, 209

State or Territory.	1891.	1892.	1893.	1894.	1895.
Alabama	2, 144, 277	2, 585, 966	2, 015, 398	1, 574, 245	2, 459, 465
Colorado	452, 749	*a* 599, 200	*a* 628, 935	*a* 542, 429	*a* 580, 584
Georgia	164, 875	158, 978	171, 645	166, 523	118, 900
Illinois	10, 000	4, 800	3, 300	3, 800	3, 600
Indiana	8, 688	6, 456	11, 549	13, 489	9, 898
Indian Territory.	20, 551	7, 138	15, 118	7, 274	11, 825
Kansas	27, 181	15, 437	13, 645	13, 288	8, 424
Kentucky	64, 390	70, 783	97, 212	66, 418	63, 419
Missouri	10, 377	11, 088	8, 875	3, 442	3, 120
Montana	61, 667	64, 412	61, 770	33, 313	55, 770
New Mexico	4, 000	0	14, 698	13, 042	22, 385
New York	....	....	15, 150	....	22, 207
Ohio	69, 320	95, 236	42, 963	55, 324	51, 921
Pennsylvania	10, 588, 544	12, 591, 345	9, 386, 702	9, 059, 118	14, 211, 567
Tennessee	623, 177	600, 126	449, 511	516, 802	684, 655
Texas	....	....	....	....	530
Utah	25, 281	....	....	....	....
Virginia	285, 113	226, 517	194, 059	280, 524	410, 737
Washington	10, 000	12, 372	11, 374	8, 563	22, 973
West Virginia	1, 716, 976	1, 709, 183	1, 745, 757	1, 976, 128	2, 087, 816
Wisconsin	52, 904	54, 300	24, 085	6, 343	8, 287
Wyoming	4, 470	0	5, 400	8, 685	10, 240
Total	16, 344, 540	18, 813, 337	14, 917, 146	14, 348, 750	20, 848, 323

a Including Utah's consumption.

In regard to this table, it is to be noted that in many cases the statement as to the amount of coal used in the production of coke is an estimate. At but few works is the coal weighed before being charged into the ovens. A great deal of the coke made in the United States is from run of mine—that is, all of the product of mining, lump, nut, and slack, as it comes to the mouth of the pit in the mine car is charged into the ovens—and if no coal is sold as coal it is comparatively easy to ascertain from the amounts paid for mining what is the amount of coal charged into the ovens. But even in such cases considerable difficulty arises from the fact that mining is paid for by the measured bushel or ton of so many cubic feet, while our statistics are by weight, and the measured bushel or ton is often not the equivalent of the weighed bushel or ton. It is also true that in certain districts where the men are paid by the car the car contains even of measured tons more than the men are paid for. Under such circumstances it is not to the interest of the operator to weigh the coal as it is charged into the oven.

Further, in many districts coke making is simply for the purpose of utilizing the slack coal produced in mining or that which falls through the screen at the tipple when lump is sold. In such cases the slack is rarely, if ever, weighed as it is charged into the ovens, so that any statement as to the amount of coal used at such works will be an estimate. At some works the coal is often weighed for a brief period, and, the coke being weighed as it is sold, a percentage of yield is ascertained which is used in statements as to the amount of coal used and the yield of this coal in coke.

Great care has been exercised, in view of these facts, to reach a satisfactory estimate as to the amount of coal used in the production of coke, as given in the table immediately preceding, and the percentage yield of coal in coke as shown in the table next subsequent. Analyses of coals from most of the districts in the United States have been secured. These analyses, checked by personal knowledge as to the wastefulness of the methods of coking in each district, have enabled the writer to reach a conclusion as to whether the returns made were approximately correct or not. Where it has been judged that they were incorrect, correspondence has usually led to revision. It is sometimes the custom of coke manufacturers who do not weigh the coal charged into the ovens to estimate that the yield of coke is equal to the percentage of the fixed carbon and ash in the coal. A report from a certain coke works showed a yield of 77 per cent. This was equal to the average amount of fixed carbon and ash in the coal. Further inquiry developed the fact that at other mines in this district, using the same character of coal, the yield as reported varied from 50 to 66 per cent. Upon the attention of the party making the return showing 77 per cent being called to these facts the yield was reduced to 63 per cent. As coke is sold by weight it has always been assumed that the report of production of coke was accurate, and where the coal was not weighed, the yield of coal in coke being ascertained, a calculation could be made which would show approximately the amount of coal used.

But even under these conditions it is believed that more coal was actually used in the production of coke in each of the years covered by the above table than is shown.

The amount of coal necessary to produce a ton of coke, assuming that the above tables are approximately correct, was as follows:

Coal required to produce a ton of coke in tons or pounds.

Year.	Tons.	Pounds.	Year.	Tons.	Pounds.
1880	1.57	3,140	1888	1.51	3,020
1881	1.59	3,180	1889	1.55	3,100
1882	1.58	3,160	1890	1.56	3,120
1883	1.56	3,120	1891	1.58	3,160
1884	1.63	3,260	1892	1.57	3,140
1885	1.58	3,160	1893	1.57	3,140
1886	1.56	3,120	1894	1.56	3,120
1887	1.56	3,120	1895	1.56	3,120

In the following table is shown the percentage yield of coal in the manufacture of coke for the years 1880 to 1895. By the "yield" is of course meant the percentage of the constituents of the coal that remain as coke after the process of coking.

While these tables show an average of something like 64 per cent for most of the years, it is believed that even this is a little too high. Probably the actual yield of coal in coke throughout the United States, if the actual weight of coal charged into the ovens and the actual weight of the coke drawn had been taken, would not have exceeded 60 or 61 per cent.

Percentage yield of coal in the manufacture of coke in the United States in the years 1880 to 1895, inclusive, by States and Territories.

State or Territory.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.	1891.	1892.	1893.	1894.	1895.
Alabama	57	59	58	60	60	59	59	59	60	59	59	60	58	58	58.7	58.7
Colorado	49	50	57	60	64	63	62.6	64	65.6	63	60	61	63.9	*a* 57.7	*a* 58.5	*a* 58.6
Georgia	60	60	60	60	60	60	60	50	60	60	60	62.5	51.5	52.8	55.9	50.6
Illinois	41	42	45	43	43	48	46	55.5	56.9	60	55	52	66	66.7	57.9	62.5
Indiana	0	0	0	0	0	0	47	50	45	51	51	44	49.7	49.6	48.6	48.5
Indian Territory	62	62	62	62	62	62	62	50	57	50	50	46	50	47	42	43.8
Kansas	64	64.4	65	62.9	62.3	53.7	54.2	54	59	64	56	52	59.2	62.8	63.5	62.8
Kentucky	60	60	59	60	64	53	50	50	54	52	51	52	51	50	44.8	40.1
Missouri	0	0	0	0	0	0	0	55	52	62	65	66	65.8	66.5	65.4	65
Montana	0	0	0	0	46	58.5	0	66.7	60	46	45	47	53.6	48.5	52.2	45.4
New Mexico	0	0	66.7	57.3	57.5	56.3	56	61	58	48	51.5	57.5	0	39.5	50	65.5
New York	......	......	......	......	......	......	......	......	......	......	......	......	......	84.8	......	83.4
Ohio	58	59	57	58	58	57	59	56	54	56	59	56	54.4	52	59	56
Pennsylvania	65	64	64	65	62	64.6	65.2	65.3	68	66	65	66	66.1	66	66.9	66.2
Tennessee	60	60	60	62	63	53	59	61	61	57	58	58	59	59	56.6	57.9
Texas	0	0	0	0	0	0	50	0	0	0	0	0	0	0	0	54
Utah	50	0	50	0	0	0	0	0	0	34	35	31	......	......	......	......
Virginia	0	0	0	64.5	64.3	60	61.1	70.8	64.7	61	66	58.8	65.3	64.5	64.2	59.6
Washington	0	0	0	0	57.5	57	58.9	65	0	55	64	60	58	59	61.2	65.9
West Virginia	60	61	63	63	62	63	62	63.3	61.6	61	59	58.8	60.5	60.8	60.4	61.6
Wisconsin	0	0	0	0	0	0	0	0	50	62.5	65	65	62.2	62	67	60
Wyoming	0	0	0	0	0	0	0	0	0	0	0	60	0	54	50	47.8
Total average	63	63	63	64	61	63	64	64.2	66	64	64	63	64	63.5	64	64

a Average, including Utah.

In the following table will be found a statement of the amount and value of coal used in the manufacture of coke in the United States in the years 1895, 1894, and 1893. The chief point in these tables is to show the average value per ton of coal used and the amount and value of coal necessary to make a ton of coke. The average value of coal per ton in 1893 was 70 cents; in 1894, 65.8 cents, and in 1895, 66 cents. The amount of coal necessary to make a ton of coke in 1893 was 1.57 tons; in 1894 and 1895, 1.56 tons. The value of the coal necessary to make a ton of coke in 1893 was $1.10; in 1894 and 1895, $1.03.

Some interesting comparisons can be deduced from this table and the one published elsewhere as to the average value at the oven of the coke made in the United States. For example, the average price per ton of all coke produced in the United States in 1895 was $1.44; it will be noted, therefore, that the amount received for the coke per ton above the value of the coal was 41 cents. Making a comparison by States it will be seen that the average price received for a ton of coke in Pennsylvania in 1895 was $1.266, while the average value of the coal was 93 cents a ton, leaving 33.6 cents as the price received for the coke in excess of the value of the coal that went into a ton. In Alabama the selling price of coke was $2.10, while the value of coal was $1.49. In Colorado the relative figures were $2.76 per ton for coke and value of coal $1.66; in Tennessee, $1.90 for coke and $1.31 for coal; in Virginia, $1.32 for coke and $1.11 for coal; in West Virginia, $1.34 for coke and 87 cents for coal.

Amount and value of coal used in the manufacture of coke in the United States in 1895, and amount and value of same per ton of coke.

State or Territory.	Coal used.	Total value of coal.	Value of coal per ton.	Amount of coal per ton of coke.	Value of coal to a ton of coke.
	Short tons.			*Short tons.*	
Alabama	2,459,465	$2,153,233	$0.875	1.70	$1.49
Colorado (*a*)	580,584	568,067	.978	1.70	1.66
Georgia	118,900	77,285	.65	1.97	1.28
Illinois	3,600	900	.25	1.60	.40
Indiana	9,898	4,749	.48	2.06	.99
Indian Territory	11,825	2,956	.25	2.28	.57
Kansas	8,424	3,555	.42	1.59	.67
Kentucky	63,419	12,841	.20	2.49	.50
Missouri	3,120	1,248	.40	1.54	.62
Montana	55,770	146,967	2.64	2.20	5.81
New Mexico	22,385	12,024	.537	1.53	.82
Ohio	51,921	50,593	.97	1.79	1.74
Pennsylvania	14,211,567	8,752,418	.616	1.51	.93
Tennessee	684,655	518,401	.757	1.73	1.31

a Figures given for Colorado include the statistics of Utah.

Amount and value of coal used in the manufacture of coke in the United States in 1895, and amount and value of same per ton of coke—Continued.

State or Territory.	Coal used.	Total value of coal.	Value of coal per ton.	Amount of coal per ton of coke.	Value of coal to a ton of coke.
	Short tons.			*Short tons.*	
Virginia	410, 737	$271, 056	$0. 66	1. 68	$1. 11
Washington	22, 973	43, 532	1. 89	1. 52	2. 87
West Virginia	2, 087, 816	1, 126, 161	. 539	1. 62	. 87
Wisconsin	8, 287	19, 474	2. 35	1. 67	3. 92
Wyoming	10, 240	7, 680	. 75	2. 09	1. 57
Total and averages	20, 825, 586	13, 773, 140	. 66	1. 56	1. 03

Amount and value of coal used in the manufacture of coke in the United States in 1894, and amount and value of same per ton of coke.

State or Territory.	Coal used.	Total value of coal.	Value of coal per ton.	Amount of coal per ton of coke.	Value of coal to a ton of coke.
	Short tons.			*Short tons.*	
Alabama	1, 574, 245	$1, 443, 043	$0. 917	1. 70	$1. 56
Colorado (*a*)	542, 429	539, 065	. 994	1. 71	1. 70
Georgia	166, 523	121, 882	. 73	1. 79	1. 31
Illinois	3, 800	950	. 25	1. 73	. 43
Indiana	13, 489	6, 265	. 465	2. 06	. 96
Indian Territory	7, 274	1, 819	. 25	2. 38	. 60
Kansas	13, 288	6, 275	. 47	1. 57	. 74
Kentucky	66, 418	14, 304	. 215	2. 23	. 48
Missouri	3, 442	1, 556	. 45	1. 53	. 69
Montana	33, 313	99, 940	3. 00	1. 92	5. 75
New Mexico	13, 042	18, 259	1. 40	2. 00	2. 80
Ohio	55, 324	52, 689	. 95	1. 70	1. 62
Pennsylvania	9, 059, 118	5, 317, 695	. 589	1. 49	. 88
Tennessee	516, 802	377, 229	. 73	1. 77	1. 29
Virginia	280, 524	309, 730	1. 10	1. 56	1. 72
Washington	8, 563	16, 391	1. 914	1. 63	3. 12
West Virginia	1, 976, 128	1, 102, 105	. 558	1. 66	. 93
Wisconsin	6, 343	17, 443	2. 75	1. 50	4. 13
Wyoming	8, 685	5, 211	*b* . 60	2. 00	1. 20
Total and averages	14, 348, 750	9, 451, 851	. 658	1. 56	1. 03

a Figures given for Colorado include the statistics of Utah.
b Value estimated.

Amount and value of coal used in the manufacture of coke in the United States in 1893, and amount and value of same per ton of coke.

State or Territory.	Coal used.	Total value of coal.	Value of coal per ton.	Amount of coal per ton of coke.	Value of coal to a ton of coke.
	Short tons.			*Short tons.*	
Alabama	2,015,398	$1,894,666	$0.94	1.725	$1.62
Colorado (*a*)	628,935	599,773	.95	1.73	1.65
Georgia	171,645	171,645	1.00	1.89	1.89
Illinois	3,300	660	.20	1.50	.30
Indiana	11,549	4,043	.35	2.02	.71
Indian Territory	15,118	3,779	.25	2.12	.53
Kansas	13,645	7,117	.52	1.59	.82
Kentucky	97,212	34,804	.36	2.00	.72
Missouri	8,875	3,168	.36	1.50	.54
Montana	61,770	185,310	3.00	2.06	6.18
New Mexico	14,698	21,069	1.43	2.53	3.63
New York	15,150	39,550	2.61	1.18	3.08
Ohio	42,963	24,700	.58	1.91	1.10
Pennsylvania	9,386,702	5,738,798	.61	1.51	.92
Tennessee	449,511	363,260	.808	1.69	1.37
Virginia	194,059	212,467	1.09	1.55	1.70
Washington	11,374	25,163	2.21	1.69	3.74
West Virginia	1,745,757	1,044,219	.60	1.64	.9
Wisconsin	24,085	*b* 72,255	3.00	1.61	4.83
Wyoming	5,400	3,240	.60	1.85	1.11
Total and averages.	14,917,146	10,449,686	.70	1.57	1.10

a Figures given for Colorado include the statistics of Utah. *b* Value estimated.

CONDITION IN WHICH COAL IS CHARGED INTO OVENS.

In the following table will be found a statement of the condition of coal when charged into ovens—that is, whether it is run of mine, slack, washed, or unwashed. The tables for 1895, 1894, and 1893 are given. The headings explain themselves. It is only necessary to state that run of mine, washed, includes that run-of-mine coal which is crushed before being washed.

Character of coal used in the manufacture of coke in 1895.

State or Territory.	Run of mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*
Alabama	1,208,020	0	32,068	1,219,377	2,459,465
Colorado (*a*)	119,868	0	453,597	7,119	580,584
Georgia	0	118,900	0	0	118,900
Illinois	0	0	0	3,600	3,600
Indiana	0	0	0	9,898	9,898
Indian Territory	0	0	0	11,825	11,825
Kansas	0	0	8,424	0	8,424
Kentucky	0	502	624	62,293	63,419
Missouri	0	0	3,120	0	3,120
Montana	0	0	0	55,770	55,770
New Mexico	*b* 10,000	0	*b* 12,385	0	22,385
New York	0	0	22,207	0	22,207
Ohio	28,053	0	10,868	13,000	51,921
Pennsylvania	13,618,376	34,728	440,869	117,594	14,211,567
Tennessee	96,744	59,284	285,906	242,721	684,655
Texas	0	0	0	530	530
Virginia	114,802	0	295,935	0	410,737
Washington	0	0	0	22,973	22,973
West Virginia	405,725	24,054	1,476,003	182,034	2,087,816
Wisconsin	8,287	0	0	0	8,287
Wyoming	0	0	10,240	0	10,240
Total	15,609,875	237,468	3,052,246	1,948,734	20,848,323

a Including Utah's consumption.
b Quantity estimated.

From the above table it appears that of the 20,848,323 tons of coal coked in the United States 15,847,343 tons were run of mine and 5,000,980 tons slack. Of the run-of-mine coal used only 237,468 tons were washed, and of the 5,000,980 tons of slack used 1,948,734 tons were washed; so that of the total of 20,848,323 tons of coal made into coke in the United States in 1895 but 2,186,202 tons, or 10½ per cent, were washed.

For comparison the table on the following page is inserted, showing the character of coal used in the manufacture of coke in the United States in 1893 and 1894.

Character of coal used in the manufacture of coke in 1894 and 1893.

State or Territory.	1894.					1893.				
	Run of mine.		Slack.		Total.	Run of mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.		Unwashed.	Washed.	Unwashed.	Washed.	
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*
Alabama	411, 097	7, 429	477, 820	677, 899	1, 574, 245	1, 246, 307	51, 163	292, 198	425, 730	2, 015, 398
Colorado (*a*)	126, 642	0	415, 787	0	542, 429	109, 915	0	519, 020	0	628, 935
Georgia	0	166, 523	0	0	166, 523	0	0	0	171, 645	171, 645
Illinois	0	0	0	3, 800	3, 800	0	0	0	3, 300	3, 300
Indiana	0	0	8, 689	4, 800	13, 489	0	0	930	10, 619	11, 549
Indian Territory	0	0	0	7, 274	7, 274	0	0	0	15, 118	15, 118
Kansas	0	0	13, 288	0	13, 288	0	0	12, 445	1, 200	13, 645
Kentucky	0	2, 980	7, 900	55, 538	66, 418	825	11, 973	26, 759	57, 655	97, 212
Missouri	0	0	3, 442	0	3, 442	0	0	8, 875	0	8, 875
Montana	0	33, 313	0	0	33, 313	0	44, 000	0	17, 770	61, 770
New Mexico	0	0	13, 042	0	13, 042	14, 698	0	0	0	14, 698
New York	....	....	....	....	....	....	....	15, 150	....	15, 150
Ohio	0	0	14, 845	40, 479	55, 324	0	0	24, 859	18, 104	42, 963
Pennsylvania	8, 671, 534	118, 279	204, 811	64, 494	9, 059, 118	8, 302, 307	216, 762	739, 128	128, 505	9, 386, 702
Tennessee	166, 990	61, 841	149, 958	138, 013	516, 802	179, 126	0	137, 483	132, 902	449, 511
Virginia	103, 874	0	176, 650	0	280, 524	107, 498	0	86, 561	0	194, 059
Washington	0	0	0	8, 563	8, 563	0	10, 974	0	405	11, 374
West Virginia	162, 270	14, 901	1, 607, 735	191, 222	1, 976, 128	324, 932	15, 240	1, 176, 656	228, 929	1, 745, 757
Wisconsin	6, 343	0	0	0	6, 343	20, 474	0	3, 611	0	24, 085
Wyoming	0	0	8, 685	0	8, 685	0	0	5, 400	0	5, 400
Total	9, 648, 750	405, 266	3, 102, 652	1, 192, 082	14, 348, 750	10, 306, 082	350, 112	3, 049, 075	1, 211, 877	14, 917, 146

a Including Utah's consumption.

From a comparison of the three tables given above it appears that in 1893, 71.4 per cent of the coal used was run of mine; in 1894, 70 per cent, and in 1895, 76 per cent. In 1893, 28.6 per cent of the coal used was slack; in 1894, 30 per cent, and in 1895, 24 per cent. In 1893, 10.5 per cent of the total was washed; in 1894, 11 per cent, and in 1895, 10.5 per cent.

In the following table the statistics regarding the character of the coal for the years 1890 to 1895, inclusive, are consolidated:

Character of coal used in the manufacture of coke in the United States since 1890.

Year.	Run of mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*
1890	14,060,907	338,563	2,674,492	931,247	18,005,209
1891	12,255,415	290,807	2,945,359	852,959	16,344,540
1892	14,453,638	324,050	3,256,493	779,156	18,813,337
1893	10,306,082	350,112	3,049,075	1,211,877	14,917,146
1894	9,648,750	405,266	3,102,652	1,192,082	14,348,750
1895	15,609,875	237,468	3,052,246	1,948,734	20,848,323

IMPORTS.

The following table gives the quantities and value of coke imported and entered for consumption in the United States from 1869 to 1895, inclusive. In the reports of the Treasury Department the quantities given are long tons. These have been reduced to short tons to make the table consistent with the other tables in this report:

Coke imported and entered for consumption in the United States, 1869 to 1895, inclusive.

Year ending—	Quantity.	Value.	Year ending—	Quantity.	Value.
	Short tons.			*Short tons.*	
June 30, 1869	....	$2,053	June 30, 1883	20,634	$113,114
1870	....	6,388	1884	14,483	36,278
1871	....	19,528	1885	20,876	64,814
1872	9,575	9,217	Dec. 31, 1886	28,124	84,801
1873	1,091	1,366	1887	35,320	100,312
1874	634	4,588	1888	35,201	107,914
1875	1,046	9,648	1889	28,608	88,008
1876	2,065	8,657	1890	20,808	101,767
1877	4,068	16,686	1891	50,753	223,184
1878	6,616	24,186	1892	27,420	86,350
1879	6,035	24,748	1893	37,183	99,683
1880	5,047	18,406	1894	32,566	70,359
1881	15,210	64,987	1895	29,622	71,366
1882	14,924	53,244			

THE COKING INDUSTRY BY STATES.

ALABAMA.

Alabama again assumes the position it held from 1889 to 1894 as second in amount of production of the coke-producing States. West Virginia, which exceeded it in production in 1894, drops again to the third place, Pennsylvania still holding first rank.

The coal fields of Alabama are divided into three subdistricts, known as the Warrior, the Coosa, and the Cahaba, these districts being named from the rivers which drain them. Coke ovens are built in all three districts, but coke was made in 1895 in but two—the Warrior and the Cahaba. The most important of these districts, both as a coal producer and coke maker, is the Warrior, the ovens in this district being located near Birmingham. Of the 5,658 coke ovens in Alabama, 5,024 are in the Warrior district, and of the total production of 1,444,339 tons of coke in 1895, 1,405,439 tons were made in the Warrior district.

While most of the ovens built in this State are of the ordinary beehive pattern, the more recent ones being of the usual dimensions, 12 feet in diameter and 7 feet high, it is evident from the frequent attempts that have been made to introduce other ovens that the beehive oven as a coker of Alabama coal is not entirely satisfactory. The ovens other than beehive, which have thus far been introduced successfully into Alabama, are solid-wall ovens, or ovens in which there are no flues in the walls, and in which the coking chamber or combustion chamber, wherein the heat for coking is produced, are the same. Two forms of these modified solid-wall ovens are in use in Alabama at the present time, one known as the "Thomas" oven, which has already been described in this series of reports, and the other as the "double oblong." These ovens are 21 feet long and 9 feet wide, open at both ends. The ovens are charged from the top and drawn at the ends. They produce in a given time some 75 per cent more coke than the ordinary beehive oven.

Another notable feature in the manufacture of coke in Alabama is the greatly increased amount of washed coal that is used. In 1891 but 8,570 tons of washed coal, all of which was slack, were used in the manufacture of coke in this State out of a total of 2,144,277 tons. In 1895, however, of the total consumption of coal in coke of 2,459,465 tons, practically one-half was washed, or 1,219,377 tons. All but 32,068 tons of the slack used were washed. From reports received it appears that this washing has greatly improved the character of the coke made in this State. It has not only reduced the ash and sulphur, but the physical structure of the coke has not been injured, if, indeed, in many cases it has not been improved by the washing.

The following are the statistics of the manufacture of coke in Alabama from 1880 to 1895, inclusive.

Statistics of the manufacture of coke in Alabama from 1880 to 1895, inclusive.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per ct.*
1880..	4	316	100	106, 283	60, 781	$183, 063	$3. 01	57
1881..	4	416	120	184, 881	109, 033	326, 819	3. 00	59
1882..	5	536	....	261, 839	152, 940	425, 940	2. 79	58
1883..	6	767	122	359, 699	217, 531	598, 473	2. 75	60
1884..	8	*a*976	242	413, 184	244, 009	609, 185	2. 50	60
1885..	11	1, 075	16	507, 934	301, 180	755, 645	2. 50	59
1886..	14	*a*1, 301	1, 012	635, 120	375, 054	993, 302	2. 65	59
1887..	15	1, 555	1, 362	550, 047	325, 020	775, 090	2. 39	59
1888..	18	2, 475	406	848, 608	508, 511	1, 189, 579	2. 34	60
1889..	19	3, 944	427	1, 746, 277	1, 030, 510	2, 372, 417	2. 30	59
1890..	20	4, 805	371	1, 809, 964	1, 072, 942	2, 589, 447	2. 41	59
1891..	21	5, 068	50	2, 144, 277	1, 282, 496	2, 986, 242	2. 33	60
1892..	20	5, 320	90	2, 585, 966	1, 501, 571	3, 464, 623	2. 31	58
1893..	23	5, 548	60	2, 015, 398	1, 168, 085	2, 648, 632	2. 27	58
1894..	22	5, 551	50	1, 574, 245	923, 817	1, 871, 348	2. 025	58. 7
1895..	22	5, 658	50	2, 459, 465	1, 444, 339	3, 033, 521	2. 10	58. 7

a One establishment made coke on the ground.

From the above table it appears that the total production of coke in Alabama in 1895 was 1,444,339 tons, as compared with 923,817 tons in 1894; an increase of 520,522 tons, or 56 per cent—a most remarkable showing. The production of coke in 1895 was the largest in the history of the State with the exception of 1892, when some 1,501,571 tons were produced, only about 60,000 tons more than was made in 1895.

The number of establishments remains the same; one establishment has gone out of existence, but another has taken its place. There has been an increase in the number of ovens of 107. The yield of coal in coke remains the same. The increase in the price of coke, however, was but slight, the average value as compared with 1894 having increased but 7½ cents a ton.

The character of the coal used in the manufacture of coke in Alabama since 1890 is shown in the following table.

Character of coal used in the manufacture of coke in Alabama since 1890.

Year.	Run of mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*
1890....	1,480,669	0	206,106	123,189	1,809,964
1891....	1,943,469	0	192,238	8,570	2,144,277
1892....	2,463,366	0	11,100	111,500	2,585,966
1893....	1,246,307	51,163	292,198	425,730	2,015,398
1894....	411,097	7,429	477,820	677,899	1,574,245
1895....	1,208,020	0	32,068	1,219,377	2,459,465

COLORADO.

Colorado still holds its place as the chief coke-producing State outside of the Appalachian region. Its coal fields and coking coals are thoroughly described in the Mineral Resources volumes for 1892 and 1894.

The districts in which coke is produced in this State are those named by Mr. R. C. Hills—the Raton, the Grand River, and the La Plata. In the first named, the Raton, are the Trinidad and the Raton Canyon subdistricts or fields, both in Las Animas County. These are so closely related as coking districts that we have regarded them as one, and included them under the common name of the Trinidad or Elmoro district. In this district are four coke works, with 702 ovens, which produced 196,934 tons of coke in 1895.

In the Grand River district are the Crested Butte and Coal Basin subdistricts. Coal from the former is coked at Crested Butte, and from the latter at Cardiff, the coal used at Cardiff being from Spring Gulch. Mr. Hills regards the Coal Basin subfield as the most important area of coking coal in the State. The coke produced, he suggests, is "better adapted for lead smelters' use than any other produced in the State, though it is probably not as well glazed as an iron smelter would desire." There are in this district two coke works—the Crested Butte, with 154 ovens, and the Cardiff, with 225 ovens. Of the latter, 91 are Belgian, the others beehive. The production of coke at these works in 1895 was 105,410 tons.

The La Plata district, which is the coking district we have called Durango, has three works with 49 ovens. The total production in this district in 1895 was 9,194 tons.

Coke is also produced in Denver from coal brought from other districts. It is coked in a species of retort, operated somewhat on the plan of a gas retort and somewhat as a by-product coke oven. The plant consists of 36 retorts. A portion of the gas is used to fire the benches, for lighting, and also to raise steam. In addition to the gas used for these purposes there is a surplus of some 120,000 cubic feet per day which is sold to the Denver Consolidated Gas Company for illuminating purposes. The coke made is used for domestic purposes in place of anthracite coal.

The statistics of the production of coke in Colorado from 1880 to 1895 are given in the following table. From 1892 to 1895, both inclusive, the statements of production of coke in Utah are included. The production of Colorado in 1895 was 317,838 tons, as compared with 301,140 tons in 1894, with 346,981 tons in 1893, and 365,920 tons in 1892.

Statistics of the manufacture of coke in Colorado from 1880 to 1895.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1880	1	200	50	51, 891	25, 568	$145, 226	$5. 68	49
1881	2	267	0	97, 508	48, 587	267, 156	5. 29	50
1882	5	344	0	180, 549	102, 105	476, 665	4. 67	57
1883	7	352	0	224, 089	133, 997	584, 578	4. 36	60
1884	8	409	24	181, 968	115, 719	409, 930	3. 45	64
1885	7	434	0	208, 069	131, 960	512, 162	3. 88	63
1886	7	483	0	228, 060	142, 797	569, 120	3. 99	62. 6
1887	7	532	0	267, 487	170, 698	682, 778	4. 00	64
1888	7	602	100	274, 212	179, 682	716, 305	4. 00	65. 6
1889	9	834	50	299, 731	187, 638	643, 479	3. 43	63
1890	8	916	30	407, 023	245, 756	959, 246	3. 90	60
1891	7	948	21	452, 749	277, 074	896, 984	3. 24	61
1892 (*a*).	9	*b* 1, 128	220	599, 200	*c* 373, 229	1, 234, 320	3. 31	62. 3
1893 (*a*).	8	*b* 1, 154	200	628, 935	*d* 362, 986	1, 137, 488	3. 13	57. 7
1894 (*a*).	8	*b* 1, 154	250	542, 429	*e* 317, 196	903, 970	2. 85	58. 5
1895 (*a*).	9	*b* 1, 169	0	580, 584	*f* 340, 357	940, 987	2. 76	58. 6

a Includes Utah's production and value of coal and coke.
b Includes 36 gas retorts.
c Colorado's coke production, 365,920 tons.
d Colorado's coke production, 346,981 tons.
e Colorado's coke production, 301,140 tons.
f Colorado's coke production, 317,838 tons.

The character of the coal used in the manufacture of coke in Colorado and Utah since 1890 is shown in the following table:

Character of coal used in the manufacture of coke in Colorado and Utah since 1890.

Year.	Run of mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*
1890..........	36, 058	0	395, 023	0	431, 081
1891..........	93, 752	0	384, 278	0	478, 030
1892..........	82, 098	0	517, 102	0	599, 200
1893..........	109, 915	0	519, 020	0	628, 935
1894..........	126, 642	0	415, 787	0	542, 429
1895..........	119, 868	0	453, 597	7, 119	580, 584

From the above table it will be noted that most of the coal used in coking in Colorado and Utah was unwashed slack. Of the 580,584 tons of coal coked in these two States, 453,597 tons, or 78 per cent of the total, was unwashed slack; the remainder, except 7,119 tons, was unwashed run of mine. This is the first time for some years that coal was washed previous to coking in Colorado. In certain districts, especially in Elmoro, the coal in many cases, principally when slack is used, is quite high in ash, and in the earlier years of the production of coke attempts were made to reduce the ash and increase the value of the coke by washing, but it was found that this process removed a large quantity of the bituminous matter which was necessary to give the coke the proper physical structure, and it was decided that it would be more economical to allow the ash to remain in the coke and flux it out by the expenditure of the carbon of the coke rather than to wash the coal before coking. Our report this year indicates, however, that washing has once again been tried.

GEORGIA.

Coking in Georgia is an industry of comparatively little importance. The only coal produced in the State is from the extreme northwestern portion, which is cut by the eastern border of the Appalachian coal field. In this small field there is one mine, nearly all of the coal from which is made into coke. The coal as it is mined is washed before being coked. The amount of coal charged into the ovens is the amount mined and not the weight of the coal after being washed.

The total production of coke in 1895 was 60,212 tons, as compared with 93,029 tons in 1894. The production in 1895 was the smallest of any year since 1882. The coke produced is all used at the furnaces of the Walker Iron and Coal Company, Rising Fawn, Ga., and the Chattanooga Iron Company, Chattanooga, Tenn., controlled by the Georgia Mining, Manufacturing, and Investment Company.

Analyses of the coke made by Mr. John J. H. McCandless, chemist, of Atlanta, Ga., are as follows:

Analyses of coke made by the Georgia Mining, Manufacturing, and Investment Company, Atlanta, Ga.

	June 10, 1893.	September 27, 1895.
	Per cent.	*Per cent.*
Moisture	0.20	....
Volatile combustible matter	2.13	....
Fixed carbon	79.01	78.21
Ash	18.66	20.67
Total	100.00	98.88
Sulphur	.70	....

The statistics of the production of coke in Georgia, 1880 to 1895, are as follows:

Statistics of the manufacture of coke in Georgia, 1880 to 1895.

Year.	Establishments.	Ovens. Built.	Ovens. Building.	Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
				Short tons.	*Short tons.*			*Per cent.*
1880	1	140	40	63,402	38,041	$81,789	$2.15	60
1881	1	180	40	68,960	41,376	88,753	2.15	60
1882	1	220	44	77,670	46,602	100,194	2.15	60
1883	1	264	36	111,687	67,012	147,166	2.20	60
1884	1	300	0	132,113	79,268	169,192	2.13	60
1885	2	300	0	117,781	70,669	144,198	2.04	60
1886	2	300	0	136,133	82,680	179,031	2.17	60
1887	2	300	0	158,482	79,241	174,410	2.20	50
1888	1	290	0	140,000	83,721	177,907	2.12	60
1889	1	300	0	157,878	94,727	149,059	1.57	60
1890	1	300	0	170,388	102,233	150,995	1.48	60
1891	1	300	0	164,875	103,057	231,878	2.25	62.5
1892	1	300	0	158,978	81,807	163,614	2.00	51.5
1893	1	338	0	171,645	90,726	136,089	1.50	52.8
1894	1	338	0	166,523	93,029	116,286	1.25	55.9
1895	1	330	0	118,900	60,212	70,580	1.17	50.6

The character of the coal used in the manufacture of coke in Georgia since 1890 is shown in the following table:

Character of coal used in the manufacture of coke in Georgia since 1890.

Year.	Run of mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*
1890..........	0	0	0	170,388	170,388
1891..........	106,131	0	0	58,744	164,875
1892..........	0	0	0	158,978	158,978
1893..........	0	0	0	171,645	171,645
1894..........	0	166,523	0	0	166,523
1895..........	0	118,900	0	0	118,900

ILLINOIS.

After many years of decadence the coke industry of Illinois began in 1895 to show signs of a revival. The number of coke works in this State had dropped from nine, with 325 ovens, and a production of 13,095 tons in 1884, to one establishment, with 24 ovens, and a production of 2,200 tons of coke in 1894. In 1895, however, after a very careful series of experiments in washing and coking the coal, a bank of 102 beehive ovens was built at Rosboro, in Randolph County, going into operation at the close of the year, while the Illinois Steel Company has, it is reported, made arrangements to build a block of by-product coke ovens on the Huessener principle in 1896.

No little amount of money and engineering skill have been expended in the endeavor to establish a coke industry in this State. There are large bodies of coal that may be properly classed as coking coal. The coking qualities, however, of the coal from different mines vary greatly. Some coals coke readily in beehive ovens; others only after wetting; while some will not coke at all in beehive ovens, though experiments made in a crucible show they are true coking or binding coals. The impurities in Illinois coal, chiefly sulphur, also interfere with the manufacture of a good metallurgical coke. Many attempts have been made to separate these impurities by washing, but until quite recently none of these have been successful in preparing the coal for making a moderately clean and strong coke. Recently, however, two washing plants have been erected in the State that seem to have solved this problem, at least experiments made in coking the washed coals have been very satisfactory, the coke being fairly strong, hard, and not too high in ash.

The recent interest that has been taken in the United States in by-product ovens has extended to Illinois, and it is believed by those who have given the subject careful consideration that a good metallurgical coke can be made in these ovens from Illinois coal. Quite a number of tests on a commercial scale with and without washing the coal have been made in these by-product ovens. In some cases the coals from various pits and sections have been mixed, while other coals from quite a number of localities have been tested. The results show that under proper conditions as to preparation of the coal and as to heat and speed in the oven quite a number of Illinois coals give a fairly good coke. Further trials on an extensive scale will be made in 1896. It is also not at all improbable that coke ovens designed primarily to produce gas will be erected in the near future in the vicinity of one or more of the large cities of Illinois.

Analyses of washed slack and coke made from it in some so-called Belgian ovens of the Equality Coal Company, of Equality, in Gallatin County, Ill., are given in the following table:

Analyses of coal and coke from Gallatin County, Ill.

	Coal.	Coke.
	Per cent.	*Per cent.*
Water	2.15	1.10
Volatile matter	36.11	3.70
Fixed carbon	50.26	79.92
Sulphur	1.38	1.98
Phosphorus		.009
Ash	10.10	13.291
Total	100.00	100.000

At the close of 1895 there were three coke works in Illinois, with 129 ovens, of which 105 were beehive and 24 so-called Belgian; an increase of 2 works and 105 ovens. Coke, however, was made at but one works, the new plant at Rosboro going into operation on a commercial scale only at the close of the year. The total production of coke during the year was, therefore, at but one bank of ovens, the amount being 2,250 tons.

The following are the statistics of the manufacture of coke in Illinois for the years from 1880 to 1895:

Statistics of the manufacture of coke in Illinois from 1880 to 1895.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1880	6	176	0	31,240	12,700	$41,950	$3.30	41
1881	6	176	0	35,240	14,800	45,850	3.10	42
1882	7	304	0	25,270	11,400	29,050	2.55	45
1883	7	316	0	31,170	13,400	28,200	2.10	43

Statistics of the manufacture of coke in Illinois from 1880 to 1895—Continued.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1884	9	325	0	30,168	13,095	$25,639	$1.96	43
1885	9	320	0	21,487	10,350	27,798	2.68	48
1886	9	335	0	17,806	8,103	21,487	2.65	46
1887	8	278	0	16,596	9,108	19,594	2.13	55.5
1888	8	221	0	13,020	7,410	21,038	2.84	56.9
1889	4	149	0	19,250	11,583	29,764	2.57	60
1890	4	148	0	9,000	5,000	11,250	2.25	55
1891	1	25	0	10,000	5,200	11,700	2.25	52
1892	1	24	0	4,800	3,170	7,133	2.25	66
1893	1	24	0	3,300	2,200	4,400	2.00	66.7
1894	1	24	0	3,800	2,200	4,400	2.00	57.9
1895	3	129	0	3,600	2,250	4,500	2.00	62.5

The character of the coal used in the manufacture of coke in Illinois since 1890 is shown in the following table:

Character of coal used in the manufacture of coke in Illinois since 1890.

Year.	Run of mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*
1890	0	0	0	9,000	9,000
1891	0	0	10,000	0	10,000
1892	0	0	4,800	0	4,800
1893	0	0	0	3,300	3,300
1894	0	0	0	3,800	3,800
1895	0	0	0	3,600	3,600

INDIANA.

Though there is an abundance of good coking coal in Indiana, up to the present time the coke industry has been of but little importance in this State. The coals of Indiana are better coking coals in some cases than those of Illinois. They are not quite so impure, but the variety of coals is greater in Indiana than in Illinois. In some of the experiments with Illinois coals in by-product ovens, referred to in the statement in connection with Illinois, the noncoking block coals of Indiana were mixed with the coking coals of Illinois, some of the best cokes made being from such a mixture. It is not at all improbable that the results of these experiments will lead to the use of Indiana coals, mixed in some cases, in other cases used separately, for the manufacture of coke for metallurgical purposes.

The statistics of the manufacture of coke in Indiana from 1886 to 1895, both inclusive, are given in the following table:

Statistics of the manufacture of coke in Indiana from 1886 to 1895.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1886........	4	100	18	13, 030	6, 124	$17, 953	$2. 93	47
1887........	4	119	0	35, 600	17, 658	51, 141	2. 81	50
1888........	3	103	0	26, 547	11, 956	31, 993	2. 68	45
1889........	4	111	0	16, 428	8, 301	25, 922	3. 12	51
1890........	4	101	0	11, 753	6, 013	19, 706	3. 28	51
1891........	2	84	0	8, 688	3, 798	7, 596	2. 00	44
1892........	2	84	0	6, 456	3, 207	6, 472	2. 02	49. 7
1893........	2	94	0	11, 549	5, 724	9, 048	1. 58	49. 6
1894........	2	94	0	13, 489	6, 551	13, 102	2. 00	48. 6
1895........	2	94	0	9, 898	4, 804	9, 333	1. 94	48. 5

The character of the coal used in the manufacture of coke in Indiana since 1890 is shown in the following table:

Character of coal used in the manufacture of coke in Indiana since 1890.

Year.	Run of mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*
1890........	0	0	0	11, 753	11, 753
1891........	0	0	0	8, 688	8, 688
1892........	0	0	0	6, 456	6, 456
1893........	0	0	930	10, 619	11, 549
1894........	0	0	8, 689	4, 800	13, 489
1895........	0	0	0	9, 898	9, 898

INDIAN TERRITORY.

The coke works of the Osage Coal and Mining Company, located at McAlester, are the only ones in Indian Territory. These works use only the slack coal produced in mining. The coke finds its chief market for smelting purposes in Kansas and Missouri.

The statistics of the manufacture of coke in the Indian Territory from 1880 to 1895 are as follows:

Statistics of the manufacture of coke in the Indian Territory from 1880 to 1895.

Year.	Establishments.	Ovens built.	Ovens building.	Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
				Short tons.	*Short tons.*			*Per cent.*
1880	1	20	0	2,494	1,546	$4,638	$3.00	62
1881	1	20	0	2,852	1,768	5,304	3.00	62
1882	1	20	0	3,266	2,025	6,075	3.00	62
1883	1	20	0	4,150	2,573	7,719	3.00	62
1884	1	20	0	3,084	1,912	5,736	3.00	62
1885	1	40	0	5,781	3,584	12,902	3.60	62
1886	1	40	0	10,242	6,351	22,229	3.30	62
1887	1	80	0	20,121	10,060	33,435	3.33	50
1888	1	80	0	13,126	7,502	21,755	2.90	57
1889	1	78	0	13,277	6,639	17,957	2.70	50
1890	1	78	0	13,278	6,639	21,577	3.25	50
1891	1	80	0	20,551	9,464	30,483	3.22	46
1892	1	80	0	7,138	3,569	12,402	3.47	50
1893	1	80	0	15,118	7,135	25,072	3.51	47
1894	1	80	0	7,274	3,051	10,693	3.50	42
1895	1	80	0	11,825	5,175	17,657	3.41	43.8

The character of the coal used in the manufacture of coke in Indian Territory since 1890 is shown in the following table:

Character of coal used in the manufacture of coke in Indian Territory since 1890.

Year.	Run of mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*
1890	0	0	0	13,278	13,278
1891	0	0	9,500	11,051	20,551
1892	0	0	0	7,138	7,138
1893	0	0	0	15,118	15,118
1894	0	0	0	7,274	7,274
1895	0	0	0	11,825	11,825

KANSAS.

The coke industry of Kansas is only of local importance, the production of coke in this State being chiefly for domestic purposes and the smelting of lead. Most of the coke produced in the State is made by the lead and zinc smelters for their own use.

The statistics of the manufacture of coke in Kansas from 1880 to 1895 are as follows:

Statistics of the manufacture of coke in Kansas from 1880 to 1895.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1880	2	6	......	4,800	3,070	$6,000	$1.95	64
1881	3	15	......	8,800	5,670	10,200	1.80	64.4
1882	3	20	......	9,200	6,080	11,460	1.70	65
1883	4	23	......	13,400	8,430	16,560	1.96	62.9
1884	4	23	......	11,500	7,190	14,580	2.02	62.5
1885	4	23	......	15,000	8,050	13,255	1.65	53⅔
1886	4	36	......	23,062	12,493	19,204	1.54	54.2
1887	4	39	......	27,604	14,950	28,575	1.91	54
1888	6	58	......	24,934	14,831	29,073	1.96	59
1889	6	68	......	21,600	13,910	26,593	1.91	64
1890	7	68	......	21,809	12,311	29,116	2.37	56
1891	6	72	......	27,181	14,174	33,296	2.35	52
1892	6	75	......	15,437	9,132	19,906	2.18	59.2
1893	6	75	0	13,645	8,565	18,640	2.18	62.8
1894	6	61	0	13,288	8,439	15,660	1.855	63.5
1895	5	55	0	8,424	5,287	11,289	2.14	62.8

The character of the coal used in the manufacture of coke in Kansas since 1890 is shown in the following table:

Character of coal used in the manufacture of coke in Kansas since 1890.

Year.	Run of mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*
1890	0	0	19,619	2,190	21,809
1891	0	0	27,181	0	27,181
1892	0	0	15,437	0	15,437
1893	0	0	12,445	1,200	13,645
1894	0	0	13,288	0	13,288
1895	0	0	8,424	0	8,424

KENTUCKY.

Nothing can be added to the statement made in the report for 1894 regarding the coking coals of Kentucky and cokes made from them. The continued depression in the iron business has resulted in continued decrease in the production of coke in the State, the total production of 1895 being but 25,460 tons, as compared with 29,748 tons in 1894. This is the smallest production since 1890, and was almost entirely the output of the St. Bernard Coal Company in the western part of the State, the output of the Pineville region being practically nothing.

The statistics of the manufacture of coke in Kentucky from 1880 to 1895 are as follows:

Statistics of the manufacture of coke in Kentucky from 1880 to 1895.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1880	5	45	......	7,206	4,250	$12,250	$2.88	60
1881	5	45	......	7,406	4,370	12,630	2.89	60
1882	5	45	......	6,906	4,070	11,530	2.83	59
1883	5	45	......	8,437	5,025	14,425	2.87	60
1884	5	45	......	3,451	2,223	8,760	3.94	64
1885	5	33	......	5,075	2,704	8,489	3.14	53
1886	6	76	2	9,055	4,528	10,082	2.23	50
1887	6	98	......	29,129	14,565	31,730	2.18	50
1888	10	132	2	42,642	23,150	47,244	2.04	54
1889	9	166	100	25,192	13,021	29,769	2.28	52
1890	9	175	303	24,372	12,343	22,191	1.80	51
1891	7	115	24	64,390	33,777	68,281	2.02	52
1892	5	287	100	70,783	36,123	72,563	2.01	51
1893	4	283	100	97,212	48,619	97,350	2.00	50
1894	6	293	0	66,418	29,748	51,566	1.73	44.8
1895	5	293	0	63,419	25,460	37,249	1.46	40.1

The character of the coal used in the manufacture of coke in Kentucky since 1890 is shown in the following table:

Character of coal used in the manufacture of coke in Kentucky since 1890.

Year.	Run of mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*
1890	0	3,000	2,100	19,272	24,372
1891	11,000	0	3,500	49,890	64,390
1892	0	5,955	7,883	56,945	70,783
1893	825	11,973	26,759	57,655	97,212
1894	0	2,980	7,900	55,538	66,418
1895	0	502	624	62,293	63,419

MISSOURI.

The same statement can be made regarding the production of coke in Missouri as is made regarding the Kansas coke industry. The three works in this State at which coke is made are all run in connection with the smelting of zinc, the coke being made especially for this purpose.

The statistics of the production of coke in Missouri from 1887, when coking began in this State, to 1895 are as follows:

Statistics of the manufacture of coke in Missouri from 1887 to 1895.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1887	1	4	......	5,400	2,970	$10,395	$3.50	55
1888	1	4	......	5,000	2,600	9,100	3.50	52
1889	3	9	......	8,485	5,275	5,800	1.10	62
1890	3	10	......	9,491	6,136	9,240	1.51	65
1891	3	10	......	10,377	6,872	10,000	1.45	66
1892	3	10	......	11,088	7,299	10,949	1.50	65.8
1893	3	10	0	8,875	5,905	9,735	1.65	66.5
1894	3	10	0	3,442	2,250	3,563	1.58	65.4
1895	3	10	0	3,120	2,028	2,442	1.20	65

The character of the coal used for coke in Missouri since 1890 is shown in the following table:

Character of coal used in the manufacture of coke in Missouri since 1890.

Year.	Run of mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*
1890	0	0	9,491	0	9,491
1891	0	0	10,377	0	10,377
1892	0	0	11,088	0	11,088
1893	0	0	8,875	0	8,875
1894	0	0	3,442	0	3,442
1895	0	0	3,120	0	3,120

MONTANA.

In the production of coke in Montana in 1894 the influence of the decline in the production of silver was very manifest, the production having dropped from 29,945 tons in 1893 to 17,388 tons in 1894. In

1895, however, there was a marked improvement, the production having risen to 25,337 tons.

In 1895 there were three coke works in Montana with 303 ovens, which made 25,337 tons of coke from 55,770 tons of coal, a yield of 45.4 per cent. The coke produced in this State finds a ready market at the smelting works in the immediate neighborhood of the ovens.

The statistics of the manufacture of coke in Montana from 1883, when ovens were first reported, to 1895, are as follows:

Statistics of the manufacture of coke in Montana from 1883 to 1895.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1883	1	2	0	0	0	0	0	0
1884	3	5	12	165	75	$900	$12.00	46
1885	2	2	0	300	175	2,063	11.72	58.5
1886	4	16	0	0	0	0	0	0
1887	2	27	0	10,800	7,200	72,000	10.00	66⅔
1888	1	40	0	20,000	12,000	96,000	8.00	60
1889	2	90	50	30,576	14,043	122,023	8.69	46
1890	2	140	0	32,148	14,427	125,655	8.71	45
1891	2	140	0	61,667	29,009	258,523	8.91	47
1892	2	153	0	64,412	34,557	311,013	9.00	53.6
1893	2	153	0	61,770	29,945	239,560	8.00	48.5
1894	2	153	0	33,313	17,388	165,187	9.50	52.2
1895	3	303	0	55,770	25,337	189,856	7.49	45.4

The character of the coal used in the manufacture of coke in Montana since 1890 is shown in the following table:

Character of coal used in the manufacture of coke in Montana since 1890.

Year.	Run of mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*
1890	0	22,852	0	9,296	32,148
1891	0	34,000	0	27,667	61,667
1892	0	28,000	0	36,412	64,412
1893	0	44,000	0	17,770	61,770
1894	0	33,313	0	0	33,313
1895	0	0	0	55,770	55,770

NEW MEXICO.

All of the coke made in New Mexico is for the use of the silver smelters of the Territory. The production in 1895 was 14,663 tons, the largest since 1885, and more than double the production of 1894.

The statistics of the production of coke in New Mexico from 1882, when coke ovens were first reported, until 1895, are as follows:

Statistics of the manufacture of coke in New Mexico from 1882 to 1895.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built. (a)	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1882	2	0	12	1,500	1,000	$6,000	$6.00	66⅔
1883	2	12	28	6,941	3,905	21,478	5.50	57¼
1884	2	70	0	29,990	18,282	91,410	5.00	57¼
1885	2	70	0	31,889	17,940	89,700	5.00	56¼
1886	2	70	0	18,194	10,236	51,180	5.00	56
1887	1	70	0	22,549	13,710	82,260	6.00	61
1888	1	70	0	14,628	8,540	51,240	6.00	58
1889	2	70	0	7,162	3,460	18,408	5.32	48
1890	2	70	0	3,980	2,050	10,025	4.89	51.5
1891	1	70	0	4,000	2,300	10,925	4.75	57.5
1892	1	50	0	0	0	0	0	0
1893	1	50	0	14,698	5,803	18,476	3.18	39.5
1894	1	50	0	13,042	6,529	28,213	4.32	50
1895	1	50	0	22,385	14,663	29,491	2.01	65.5

a At one works there are ten stone pits, with an average capacity of 10 tons each.

The character of the coal used in the manufacture of coke in New Mexico since 1890 is shown in the following table:

Character of coal used in the manufacture of coke in New Mexico since 1890.

Year.	Run of mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*
1890	3,980	0	0	0	3,980
1891	4,000	0	0	0	4,000
1892	0	0	0	0	0
1893	14,698	0	0	0	14,698
1894	0	0	13,042	0	13,042
1895	....	....	....	....	22,385

NEW YORK.

The only coke works in New York is the bank of 12 Semet-Solvay by-product ovens built at Syracuse in 1892. The coal used has been chiefly from Morris Run (Blossburg, Pa.), which is a coal containing, as will be seen from the following analysis, but 20.04 per cent of volatile matter. This works has also during the year 1895 been engaged in testing a number of coals to show their adaptability to use in the by-product oven.

The total production of coke at this works in 1895 was 18,521 tons, and the coal used in its manufacture 22,207 tons. The coke made is chiefly for use at the soda ash works of the Solvay Process Company, which owns the ovens. There are 12 finished ovens at the works; 13 more are building.

We are furnished the following facts regarding the coal used and coke produced at this coke works by the Solvay Process Company:

Coal used and coke produced at Geddes, New York.

	Tons.	Per cent.
Average yield of coke per oven per year	1,543	
Coal used in 1895 (10 months Morris Run, 2 months Connellsville)	22,207	
Coke produced in 1895	18,521	
Coal obtained in coke (all kinds)		83.4
Coal obtained in Morris Run coke		84.5
Yield of Morris Run (Blossburg) coal in beehive ovens		a 60.0
Gain of yield of coke in Semet-Solvay over beehive oven		41.0

a U. S. Geological Survey Report for 1893.

The following are analyses of Morris Run coal and of the coke made from it in Semet-Solvay coke ovens:

Analyses of Morris Run (New York) coal and coke.

	Coal.	Coke.
	Per cent.	*Per cent.*
Moisture	0.42	0.47
Volatile matter	20.04	1.97
Fixed carbon	70.98	85.17
Ash	8.84	12.39
Total	100.28	100.00
Sulphur	1.30	.91

The statistics of the manufacture of coke in New York from 1893 to 1895 are as follows:

Statistics of the manufacture of coke in New York, 1893 to 1895.

	1893.	1894.	1895.
Number of establishments	1	1	1
Number of ovens built	12	12	12
Number of ovens building	13	13	13
Amount of coke produced ..... tons	12, 850	16, 500	18, 521
Amount of coal used ..... do	15, 150	....	22, 207
Yield of coal in coke ..... per cent	84. 8	....	83. 4

The company declines to place a value on the coke made or the coal used.

OHIO.

Notwithstanding the large consumption of coke in Ohio, and the large fields of coking coal that exist in the State, the coking industry is of such slight importance that no detailed description of the various coal fields from which coke has been or can be produced need be given here.

In this report, as in that for 1894, we have divided the coking districts in Ohio into two: The Cincinnati district, which includes the ovens in the neighborhood of Cincinnati, all of which made coke from coal brought down the Ohio River from points usually outside of the State; and, second, the Ohio district, which includes the ovens at Leetonia, those in the Hocking Valley, and those near Steubenville and Bridgeport, these three sections making coke from entirely different seams.

Cincinnati district.—All the coke made in this district is from the dust and screenings of the coal yards at Cincinnati and from the coal boats and barges that bring coal from the upper Ohio, chiefly from the Pittsburg and the Kanawha regions of West Virginia. Some run of mine and slack from Pittsburg mines is also used in the North Bend block of ovens, which is situated on the Ohio River, a short distance below Cincinnati, when the ovens are in operation.

The statistics of the manufacture of coke in the Cincinnati district from 1880 to 1895 are as follows:

Statistics of the manufacture of coke in the Cincinnati district, Ohio, from 1880 to 1895.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	Short tons.			Per cent.
1880	4	32	0	16, 141	10, 326	$42, 255	$4. 09	64
1881	4	32	0	20, 607	13, 237	54, 439	4. 11	64
1882	4	32	0	19, 687	12, 045	47, 437	3. 78	64
1883	5	57	0	33, 978	20, 106	65, 990	3. 28	59

Statistics of the manufacture of coke in the Cincinnati district, Ohio, etc.—Continued.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1884	5	57	0	32,134	18,840	$61,072	$3.24	59
1885	5	82	0	17,480	10,962	35,873	3.27	63
1886	5	82	0	17,015	10,566	31,633	2.99	62.1
1887	5	150	20	56,723	32,894	95,754	2.91	56
1888	6	156	12	63,217	35,868	95,618	2.67	57
1889	5	146	0	75,892	45,108	120,899	2.68	59
1890	5	150	0	68,266	43,278	171,848	3.97	63
1891	3	130	0	13,403	9,080	31,529	3.47	67.6
1892	4	146	0	31,330	19,320	64,319	3.33	61.6
1893	3	142	0	13,700	9,000	27,000	3.00	65.7
1894	3	92	0	42,995	26,417	81,751	3.09	61
1895	3	92	0	9,628	5,657	16,971	3.00	58.8

Ohio district.—This district, as noted above, includes all of the ovens coking Ohio coal, and the ovens at Leetonia, in the Hocking Valley, and in the vicinity of Steubenville and Bridgeport, which latter place is opposite Wheeling. The following table gives the statistics of the production of coke in the Ohio district for the years 1880 to 1895:

Statistics of the manufacture of coke in the Ohio district, Ohio, from 1880 to 1895.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1880	11	584	25	156,312	90,270	$213,650	$2.37	57
1881	11	609	0	180,438	106,232	243,289	2.39	59
1882	12	615	0	161,890	91,677	218,676	2.39	57
1883	13	625	0	118,524	67,728	159,670	2.36	57
1884	14	675	0	76,030	43,869	95,222	2.17	58
1885	8	560	0	51,316	28,454	73,850	2.60	55
1886	10	478	0	42,317	24,366	62,409	2.56	57¾
1887	10	435	203	108,251	60,110	150,227	2.50	55½
1888	9	391	0	60,984	1,326	70,712	2.25	51
1889	8	316	0	56,936	30,016	67,323	2.24	52.7
1890	8	293	1	58,655	31,335	46,242	1.47	53.4
1891	6	291	0	55,917	39,638	45,372	1.53	53
1892	6	290	0	63,905	22,498	48,588	1.50	50.9
1893	6	293	0	29,263	33,436	16,671	1.24	46
1894	5	271	0	12,329	16,223	9,124	1.466	50.5
1895	5	285	0	42,293	23,393	52,684	2.25	55.3

TOTAL PRODUCTION OF COKE IN OHIO.

In the following table the statistics of the production of coke in the several districts of Ohio for the years 1880 to 1895 are consolidated:

Statistics of the manufacture of coke in Ohio from 1880 to 1895.

Year.	Establishments.	Ovens. Built.	Ovens. Building.	Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
				Short tons.	*Short tons.*			*Per cent.*
1880	15	616	25	172,453	100,596	$255,905	$2.54	58
1881	15	641	0	201,045	119,469	297,728	2.49	59
1882	16	647	0	181,577	103,722	266,113	2.57	57
1883	18	682	0	152,502	87,834	225,660	2.57	58
1884	19	732	0	108,164	62,709	156,294	2.49	58
1885	13	642	0	68,796	39,416	109,723	2.78	57
1886	15	560	0	59,332	34,932	94,042	2.69	59
1887	15	585	223	164,974	93,004	245,981	2.65	56
1888	15	547	12	124,201	67,194	166,330	2.48	54
1889	13	462	0	132,828	75,124	188,222	2.50	56
1890	13	443	1	126,921	74,633	218,090	2.92	59
1891	9	421	0	69,320	38,718	76,901	1.99	56
1892	10	436	0	95,236	51,818	112,907	2.18	54.4
1893	9	435	0	42,963	22,436	43,671	1.95	52
1894	8	363	0	55,324	32,640	90,875	2.78	59
1895	8	377	0	51,921	29,050	69,655	2.40	56

The character of the coal used in the manufacture of coke in Ohio since 1890 is shown in the following table:

Character of coal used in the manufacture of coke in Ohio since 1890.

Year.	Run of mine. Unwashed.	Run of mine. Washed.	Slack. Unwashed.	Slack. Washed.	Total.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*
1890	34,729	0	54,473	37,719	126,921
1891	5,200	0	64,120	0	69,320
1892	35,334	0	32,402	27,500	95,236
1893	0	0	24,859	18,104	42,963
1894	0	0	14,845	40,479	55,324
1895	28,053	0	10,868	13,000	51,921

PENNSYLVANIA.

The coking districts of Pennsylvania have been so frequently described in previous volumes of Mineral Resources that it is not necessary to enter into any details regarding them. As it is important, however, that the dividing line between these districts should be kept in mind in examining these statistics, the following brief statement as to the territory included in these districts is given.

The Alleghany Mountain district includes the ovens along the line of the Pennsylvania Railroad from Gallitzin eastward over the crest of the Alleghanies to beyond Altoona. The Alleghany Valley district includes the coke works of Armstrong and Butler counties and one of those in Clarion County, the other ovens in the latter county being included in the Reynoldsville-Walston district. The Beaver district includes the ovens in Beaver County; the Blossburg and Broad Top those in the Blossburg and Broad Top coal fields. The ovens of the Clearfield-Center district are chiefly in the two counties from which it derives its name. The Connellsville district is the well-known region in western Pennsylvania, in Westmoreland and Fayette counties, extending from just south of Latrobe to Fairchance. The Greensburg, Irwin, Pittsburg, and Reynoldsville-Walston districts include the ovens near the towns which have given the names to these districts. The Upper Connellsville district, sometimes called the Latrobe district, is near the town of Latrobe.

In the following table the statistics are given of the production of coke in Pennsylvania for the years 1880 to 1895:

Statistics of the manufacture of coke in Pennsylvania from 1880 to 1895.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per ct.*
1880...	124	9,501	836	4,347,558	2,821,384	$5,255,040	$1.86	65
1881...	132	10,881	761	5,393,503	3,437,708	5,898,579	1.70	64
1882...	137	12,424	642	6,149,179	3,945,034	6,133,698	1.55	64
1883...	140	13,610	211	6,823,275	4,438,464	5,410,387	1.22	65
1884...	145	14,285	232	6,204,604	3,822,128	4,783,230	1.25	62
1885...	133	14,553	317	6,178,500	3,991,805	4,981,656	1.25	64.6
1886...	108	16,314	2,558	8,290,849	5,406,597	7,664,023	1.42	65.2
1887...	151	18,294	802	8,938,438	5,832,849	10,746,352	1.84	65.3
1888...	120	20,381	1,565	9,673,097	6,545,779	8,230,759	1.26	68
1889...	109	22,143	567	11,581,292	7,659,055	10,743,492	1.40	66
1890...	106	23,430	74	13,046,143	8,560,245	16,333,674	1.91	65.6
1891...	109	25,324	11	10,588,544	6,954,846	12,679,826	1.82	66
1892...	109	25,366	269	12,591,345	8,327,612	15,015,336	1.80	66.1
1893...	102	25,744	19	9,386,702	6,229,051	9,468,036	1.52	66
1894...	101	25,824	118	9,059,118	6,063,777	6,585,489	1.086	66.9
1895...	99	26,042	170	14,211,567	9,404,215	11,908,162	1.266	66.2

In the following tables will be found the statistics of the production of coke in Pennsylvania, by districts, for the years 1893, 1894, and 1895:

Coke production in Pennsylvania in 1895, by districts.

District.	Establishments.	Number of ovens.	Number of ovens building.	Coal used.	Coke produced.	Value of coke at ovens.	Average price per ton.	Yield of coal in coke.
				Short tons.	*Short tons.*			*Per ct.*
Alleghany Mountain	13	*a*1,233	*b*60	271,096	173,965	$214,741	$1.23	64
Alleghany Valley	2	116	0	0	0	0	0	0
Beaver	2	8	0	2,888	1,584	3,940	2.49	54.8
Blossburg	1	200	0	976	488	1,220	2.50	50
Broad Top	5	460	0	133,276	85,842	150,224	1.75	64.4
Clearfield-Center	8	695	0	155,088	99,469	131,188	1.32	64
Connellsville	29	18,028	*c*80	12,174,597	8,181,179	10,122,458	1.237	67.2
Greensburg	3	118	0	31,300	20,309	22,340	1.10	65
Irwin	5	725	0	166,124	103,872	105,609	1.017	62.5
Pittsburg	9	973	0	452,845	232,529	547,284	2.35	51.3
Reynoldsville-Walston	8	1,637	0	504,092	296,820	357,266	1.20	58.9
Upper Connellsville	14	1,849	*d*30	319,285	208,158	251,892	1.21	65
Total	99	26,042	170	14,211,567	9,404,215	11,908,162	1.266	66.2

a Includes 60 Otto-Hoffmann ovens.
b Otto-Hoffmann ovens.
c Includes 50 Semet-Solvay ovens.
d By-product beehive ovens.

Coke production in Pennsylvania in 1894, by districts.

District.	Establishments.	Number of ovens.	Number of ovens building.	Coal used.	Coke produced.	Value of coke at ovens.	Average price per ton.	Yield of coal in coke.
				Short tons.	*Short tons.*			*Per ct.*
Alleghany Mountain	15	1,253	0	92,965	58,823	$71,161	$1.21	63.3
Alleghany Valley	2	116	0	0	0	0	0	0
Beaver	2	8	0	2,968	1,624	4,251	2.62	54.7
Blossburg	1	250	0	670	332	896	2.70	49.6
Broad Top	5	454	14	53,216	34,089	51,815	1.52	64.1
Clearfield-Center	8	694	0	61,428	38,825	51,482	1.33	63.2
Connellsville	29	17,829	0	7,656,169	5,192,080	5,405,691	1.04	67.8
Greensburg	3	118	0	27,290	15,872	18,413	1.16	58.2
Irwin	5	725	0	176,318	110,995	119,764	1.08	63
Pittsburg	9	779	104	371,569	227,100	351,825	1.55	61.1
Reynoldsville-Walston	8	1,755	0	336,554	207,238	297,596	1.44	61.6
Upper Connellsville	14	1,843	0	279,971	176,799	212,595	1.20	63.1
Total	101	25,824	118	9,059,118	6,063,777	6,585,489	1.086	66.9

Coke production in Pennsylvania in 1893, by districts.

District.	Establishments.	Number of ovens.	Number of ovens building.	Coal used.	Coke produced.	Value of coke at ovens.	Average price per ton.	Yield of coal in coke.
				Short tons.	*Short tons.*			*Per ct.*
Alleghany Mountain	15	1,260	0	275,865	173,131	$264,292	$1.53	62.8
Alleghany Valley	2	116	0	10,927	6,557	11,147	1.70	60
Beaver	2	10	0	2,998	1,644	4,446	2.70	54.8
Blossburg	2	407	0	22,176	11,463	31,427	2.74	51.7
Broad Top	5	456	14	136,069	86,752	150,196	1.73	63.8
Clearfield-Center	8	695	0	155,119	98,650	171,482	1.74	63.6
Connellsville	28	17,504	5	7,095,491	4,805,623	7,141,031	1.49	67.7
Greensburg	3	88	0	29,983	18,393	26,303	1.43	61
Irwin	5	725	0	238,832	150,463	195,609	1.30	63
Pittsburg	10	885	0	357,400	216,268	438,801	2.03	60.5
Reynoldsville-Walston	8	1,755	0	562,033	339,314	586,212	1.73	60.4
Upper Connellsville	14	1,843	0	499,809	320,793	447,090	1.39	64
Total	102	25,744	19	9,386,702	6,229,051	9,468,036	1.52	66

From the above tables it will be seen that the production of coke in Pennsylvania in 1895 was the largest in its history, it being nearly 1,000,000 tons in excess of the production of 1890, which was the year of the largest production before 1895.

The production increased from 6,063,777 tons in 1894 to 9,404,215 tons in 1895, an increase of 3,340,438 tons, or 55 per cent.

By referring to the table giving the production of coke in the United States in 1895, it will be noted that of the 13,333,714 tons produced in the country in 1895, Pennsylvania produced 70.5 per cent.

In the production of these 9,404,215 tons of coke in Pennsylvania in 1895, 14,211,567 tons of coal were used, or 1.51 tons of coal per ton of coke. As has already been explained, this amount of product is probably in excess of the actual yield. The probability is that the actual product is somewhat less than 66 per cent. Much of the coal is not weighed before charging, and consequently the yield is only an estimate, and much of that which is charged is paid for by the measured bushel, while the coke is sold by the weighed ton. Of the 14,211,567 tons of coal used, over 95 per cent was unwashed run of mine; 34,728 tons, or a little over two-tenths of 1 per cent, washed run of mine; 440,869 tons, or 3 per cent, unwashed slack; 117,594 tons, or about 1 per cent, washed slack. The amount of washed coal used in coking in Pennsylvania was but 152,322 tons, or about 1 per cent of the total.

The character of the coal used in the manufacture of coke in Pennsylvania since 1890 is shown in the following table:

Character of coal used in the manufacture of coke in Pennsylvania since 1890.

Year.	Run of mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*
1890	11,788,625	303,591	630,195	323,732	13,046,143
1891	9,470,646	256,807	558,106	302,985	10,588,544
1892	11,237,253	159,698	1,059,994	134,400	12,591,345
1893	8,302,307	216,762	739,128	128,505	9,386,702
1894	8,671,534	118,279	204,811	64,494	9,059,118
1895	13,618,376	34,728	440,869	117,594	14,211,567

The remarkable feature of this exhibit is the increase in production in all of the important districts as compared with 1894. The production of the Connellsville district has increased from 5,192,080 tons in 1894 to 8,181,179 tons in 1895, an increase of 2,989,099 tons, or nearly 58 per cent. The Alleghany Mountain district has largely increased its production over that of 1894 and the Upper Connellsville somewhat, but the greatest increase is in the Connellsville region.

One of the notable features of this statement for Pennsylvania is that for the first time there is a report of the existence of by-product coke ovens in this State, though no production is reported. The work in the 60 Otto-Hoffmann ovens built by the Cambria Iron Works, near Johnstown, in the Alleghany Mountain district, was begun late in November and their operations for the remainder of the year were largely trials and coal tests. The foundations are in at these works for 60 more Otto-Hoffmann ovens, which will probably be built during the year. Since the beginning of the year ground has been broken at Glassport, some 4 miles above McKeesport, on the Monongahela River, for 20 Otto-Hoffman ovens, but as work was not begun on these until after January 1 they do not appear in the report. In addition to these, there were 50 ovens of the Semet-Solvay type built at Dunbar in the Connellsville region at the first of the year. These are expected to begin operations in the early summer. Fifty Semet-Solvay ovens also are contracted for to be built at Sharon, Pa. These do not appear in the above record.

The 30 by-product beehive ovens built in the Upper Connellsville region were in course of construction near Latrobe the first of the year. They have since been completed and put in operation. They are of the Newton-Chambers type.

Connellsville district.—The Connellsville district still remains the most important coke-producing center in the United States, its production of coke in 1895 being 8,181,179 tons, as compared with 5,192,080 tons in 1894. The largest production in any previous year was in 1890, when 6,464,156 tons were made. The increase in 1895, therefore, over the largest production previous was 1,717,023 tons, or nearly 27 per cent. As the total production of coke in Pennsylvania in 1895 was 9,404,215 tons, the proportion of the Connellsville region was 87 per cent. The Connellsville region also produced 61 per cent of the total amount produced in the United States in 1895.

The following are the statistics of the manufacture of coke in the Connellsville region from 1880 to 1895:

Statistics of the manufacture of coke in the Connellsville region, Pennsylvania, from 1880 to 1895.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1880...	67	7, 211	731	3, 367, 856	2, 205, 946	$3, 948, 643	$1. 79	66. 5
1881...	70	8, 208	654	4, 018, 782	2, 639, 002	4, 301, 573	1. 63	65. 7
1882...	72	9, 283	592	4, 628, 736	3, 043, 394	4, 473, 789	1. 47	65. 8
1883...	74	10, 176	101	5, 355, 380	3, 552, 402	4, 049, 738	1. 14	66. 3
1884...	76	10, 543	200	4, 829, 054	3, 192, 105	3, 607, 078	1. 13	66. 1
1885...	68	10, 471	48	4, 683, 831	3, 096, 012	3, 776, 388	1. 22	66. 1
1886...	36	11, 324	1, 895	6, 305, 460	4, 180, 521	5, 701, 086	1. 36	66. 3
1887...	73	11, 923	98	6, 182, 846	4, 146, 989	7, 437, 669	1. 79	67
1888...	38	12, 818	1, 320	7, 191, 708	4, 955, 553	5, 884, 081	1. 19	69
1889...	29	14, 458	430	8, 832, 371	5, 930, 428	7, 974, 633	1. 34	67
1890...	28	15, 865	30	9, 748, 449	6, 464, 156	12, 537, 370	1. 94	66
1891...	33	17, 551	0	7, 083, 705	4, 760, 665	8, 903, 454	1. 87	67
1892...	31	17, 309	0	9, 389, 549	6, 329, 452	11, 598, 407	1. 83	67. 4
1893...	28	17, 504	5	7, 095, 491	4, 805, 623	7, 141, 031	1. 49	67. 7
1894...	29	17, 829	0	7, 656, 169	5, 192, 080	5, 405, 691	1. 04	67. 8
1895...	29	18, 028	80	12, 174, 597	8, 181, 179	10, 122, 458	1. 237	67. 2

In the Connellsville region the old beehive oven still holds its place, every oven in operation in this district in 1895 being of this type. Among the 80 ovens reported in the above table as building, 50 are by-product ovens of the Semet-Solvay type, which are in course of construction at Dunbar. It is probable that the character of the coke made in the Connellsville region is so good that the oven owners do not see any necessity of attempting to improve its quality. It is probable that the quality of the coke would not be improved in a by-product oven, but certainly the enormous waste of material that passes out with the gases would be avoided were the by-product ovens used.

In the following table will be found a statement taken from the files of the American Manufacturer, showing the number of cars shipped out of the Connellsville region for each month in 1895. It will be remembered that in 1894 there was an important strike in this region, the effect of which on shipments is shown in the following statement:

Monthly shipments of coke from the Connellsville region during 1894 and 1895.

Month.	Cars.	
	1894.	1895.
January	17,558	29,530
February	20,560	31,643
March	23,216	44,384
April	20,678	29,674
May	3,328	32,930
June	11,518	30,507
July	11,518	32,944
August	23,476	41,820
September	35,841	35,568
October	30,294	37,251
November	30,714	47,680
December	31,774	38,885
Total	260,475	432,816

Regarding the market for Connellsville coke in 1895, it may be said that with the opening of the year the trade was in a fair condition and the production during some of the early months was quite large. In fact, one of the largest monthly shipments of the year from the Connellsville region was during the month of March. When the activity in the iron and steel trade showed itself fully, the coke trade of course shared in the general improvement. Through the months of June, July, and August shipments increased. During September they fell off somewhat, but picked up again the following month, and the closing months showed the largest shipments of the year.

Coke prices, as fixed by circular, were changed but twice within the year. With the opening of the year furnace coke was $1 per ton; foundry, $1.15, and crushed coke, $1.40 per ton f. o. b. at ovens. On April 1 the rates were advanced to $1.35 for furnace, $1.55 for foundry, and $1.65 for crushed coke. At the beginning of the last quarter another advance was made, leaving furnace coke at $1.60 at the close of the year. The H. C. Frick Coke Company then announced another advance, making furnace coke $2 per ton with the opening of the year 1896.

In the following table is given the average monthly circular prices of Connellsville coke for each month of the year.

Average monthly prices of coke during 1895.

Month.	Furnace.	Foundry.	Crushed.
January	$1.00	$1.15	$1.40
February	1.00	1.15	1.40
March	1.00	1.15	1.40
April	1.35	1.50	1.65
May	1.35	1.50	1.65
June	1.35	1.50	1.65
July	1.35	1.50	1.65
August	1.35	1.50	1.65
September	1.35	1.50	1.65
October	1.60	2.00	2.25
November	1.60	2.00	2.25
December	1.60	2.00	2.25

The following table gives the ruling and circular prices of blast-furnace coke free on board at the ovens for the past fifteen years:

Monthly prices of Connellsville blast-furnace coke free on board at ovens.

Month.	1881.		1882.		1883.		1884.
January	$1.50 to	$1.75	$1.70 to	$1.80	$1.15 to	$1.20	$1.00
February	1.50	1.75	1.70	1.80	1.10	1.20	1.00
March	1.50	1.75	1.70	1.75		1.05	1.00
April	1.60	1.75	1.70	1.75		1.05	1.10
May	1.60	1.65	1.65	1.70	.95	1.05	1.10
June	1.60	1.65	1.50	1.65		.90	1.10
July	1.50	1.60	1.35	1.50		.90	1.10
August		1.60		1.35		.90	1.10
September		1.60	1.25	1.35		1.00	1.10
October	1.60	1.65		1.25		1.00	1.10
November	1.60	1.65	1.25	1.35		1.00	1.10
December	1.60	1.70	1.15	1.35		1.00	1.10

Month.	1885.	1886.	1887.	1888.		1889.	
January	$1.10	$1.20	$1.50		$1.75		$1.25
February	1.10	1.20	2.00		1.75		1.25
March	1.10	1.35	2.00	$1.25 to	1.50		1.25
April	1.20	1.35	2.00		1.00		1.15
May	1.20	1.50	2.00		1.00		1.10
June	1.20	1.50	2.00		1.00		1.10
July	1.20	1.50	2.00		1.00	$1.00 to	1.10
August	1.20	1.50	2.00		1.00		1.10
September	1.20	1.50	2.00		1.00	1.25	1.50
October	1.20	1.50	2.00		1.00		1.50
November	1.20	1.50	2.00		1.25		1.75
December	1.20	1.50	2.00		1.25		1.75

Monthly prices of Connellsville blast-furnace coke free on board at ovens—Continued.

Month.	1890.	1891.	1892.	1893.	1894.		1895.
January	$1.75	$1.90	$1.90	$1.90	$0.95 to $1.00		$1.00
February	1.75	1.90	1.90	1.90		.95	1.00
March	2.15	1.90	1.90	1.90		1.00	1.00
April	2.15	1.90	1.90	1.70		.92	1.35
May	2.15	1.90	1.80	1.60		.92	1.35
June	2.15	1.90	1.80	1.50		1.00	1.35
July	2.15	1.90	1.75	1.45		1.00	1.35
August	2.15	1.90	1.75	1.25	1.15	2.00	1.35
September	2.15	1.85	1.75	1.20	1.30	1.40	1.35
October	2.15	1.85	1.75	1.20		1.00	1.60
November	2.15	1.80	1.75	1.10		1.01	1.60
December	2.15	1.80	1.75	1.05		1.00	1.60

Upper Connellsville district.—This district includes that portion of the Connellsville coal trough or basin that is located northward from a point just below Latrobe. The coal differs somewhat from that found in the lower part of the basin.

The following are the statistics of the manufacture of coke in the Upper Connellsville region for the years 1880 to 1895:

Statistics of the manufacture of coke in the Upper Connellsville district from 1880 to 1895.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1880	8	757	0	319,927	229,433	$397,945	$1.73	59
1881	10	986	0	588,924	343,728	548,362	1.60	58
1882	11	1,118	0	650,174	375,918	536,503	1.43	58
1883	11	1,118	0	668,882	389,053	422,174	1.08	58
1884	11	1,118	0	496,894	294,477	311,665	1.06	59
1885	11	1,168	40	555,735	319,297	346,168	1.08	57
1886	12	1,337	29	691,331	442,968	572,073	1.29	64.1
1887	16	1,442	87	717,274	470,233	840,144	1.79	65.6
1888	16	1,977	0	657,966	441,966	617,189	1.40	68
1889	13	1,568	80	635,220	417,263	609,828	1.46	65.6
1890	14	1,569	28	889,277	577,246	1,008,102	1.75	64.9
1891	14	1,724	0	1,000,184	649,316	1,111,056	1.71	65
1892	14	1,843	0	706,171	451,975	691,323	1.53	64
1893	14	1,843	0	499,809	320,793	447,090	1.39	64
1894	14	1,843	0	279,971	176,799	212,595	1.20	63
1895	14	1,849	*a*30	319,285	208,158	251,892	1.21	65

a By-product beehive ovens.

From the above table it will be noted that while there was an increase in production in this district in 1895 over 1894, it has by no means reached the importance as a coke-producing district that it had prior to 1894. Indeed, the production of 1895 is the lowest, with the exception of 1894, of any year in the history of this district since statistics have been compiled.

Alleghany Mountain district.—In this district are included not only the ovens along the line of the Pennsylvania Railroad east of Blairsville, but the ovens in Somerset County as well.

The statistics of the manufacture of coke in the Alleghany Mountain district from 1880 to 1895 are as follows:

Statistics of the manufacture of coke in the Alleghany Mountain district of Pennsylvania from 1880 to 1895.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1880......	8	291	0	201,345	127,525	$289,929	$2.27	63
1881......	9	371	0	225,563	144,430	329,198	2.28	64
1882......	10	481	0	284,544	179,580	377,286	2.10	63
1883......	10	532	0	200,343	135,342	240,641	1.78	68
1884......	12	614	0	241,459	156,290	203,213	1.30	65
1885......	11	523	82	327,666	212,242	286,539	1.30	65
1886......	10	579	14	351,070	227,369	374,013	1.64	64.8
1887......	10	694	150	461,922	297,724	671,437	2.25	64.4
1888......	12	950	145	521,047	335,689	479,845	1.43	64.4
1889......	16	1,069	20	564,112	354,288	601,964	1.69	63.5
1890......	16	1,171	0	633,974	402,514	730,048	1.81	63.5
1891......	16	1,201	0	708,523	448,067	782,175	1.75	63
1892......	16	1,260	0	724,903	448,522	775,927	1.73	61.9
1893......	15	1,260	0	275,865	173,131	264,292	1.53	62.8
1894......	15	1,253	0	92,965	58,823	71,161	1.21	63.3
1895......	13	1,233	60	271,096	173,965	214,741	1.23	64

From the above table it will be noted that, while the production of coke in this district in 1895 was nearly three times the production of 1894, it only about equaled the production of 1893 and was much below the production of any of the years from 1885 to 1892, inclusive.

Clearfield-Center district.—This district includes the ovens in Clearfield and Center counties, including Snow Shoe, Moshannon, and other well-known coal districts. While it has great promises for the future, much of its coke is made from slack coal, and the prosperity of the coke industry in the district depends not only on the demand for coke, but also on the demand for coal and amount of slack available.

The statistics of the manufacture of coke in the Clearfield-Center district for the years 1880 to 1895 are as follows:

Statistics of the manufacture of coke in the Clearfield-Center district, Pennsylvania, from 1880 to 1895.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1880	1	0	0	200	100	$200	$2.00	50
1881	2	50	0	20,025	13,350	22,695	1.70	67
1882	1	50	0	25,000	17,160	27,406	1.60	69
1883	1	60	0	26,500	18,696	28,844	1.50	71
1884	1	60	0	33,000	23,431	32,849	1.40	71
1885	2	245	0	69,720	48,103	70,331	1.46	69
1886	3	299	20	84,870	55,810	94,877	1.70	66
1887	6	523	10	154,566	97,852	198,095	2.02	63.3
1888	6	601	0	172,999	115,338	174,220	1.51	66.6
1889	6	671	0	195,473	120,734	215,112	1.78	61.7
1890	7	701	0	331,104	212,286	391,957	1.85	64
1891	7	666	0	293,542	183,911	339,082	1.84	63
1892	7	731	0	231,357	147,819	264,422	1.79	63.9
1893	8	695	0	155,119	98,650	171,482	1.74	63.6
1894	8	694	0	61,428	38,825	51,482	1.33	63
1895	8	695	0	155,088	99,469	131,188	1.32	64

In the Clearfield-Center, as in the Alleghany Mountain district, the production of 1895 was about the same as in 1893, but much below the production for the years 1888 to 1882.

Broad Top district.—In this district are included the ovens in what is known as the Broad Top coal field, the ovens being situated in Bedford and Huntingdon counties. There has also been considerable fluctuation in the production of coke in this district. The amount turned out in 1895 was about the same as in 1893, but below that of the years from 1882 to 1892.

The statistics of the manufacture of coke in the Broad Top region, Pennsylvania, for the years of 1880 to 1895, are stated in the table on the following page.

Statistics of the manufacture of coke in the Broad Top region, Pennsylvania, from 1880 to 1895.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1880	5	188	105	92,894	51,130	$123,748	$2.40	55
1881	5	188	105	111,593	66,560	167,074	2.51	59
1882	5	293	50	170,637	105,111	215,079	2.05	62
1883	5	343	110	220,932	147,154	271,692	1.84	66
1884	5	453	0	227,954	151,959	264,569	1.74	66
1885	5	537	0	190,836	112,073	185,656	1.65	5[illegible]
1886	5	562	100	171,137	108,294	187,321	1.73	63.3
1887	5	581	0	262,730	164,535	347,061	2.11	62.6
1888	5	591	0	196,015	119,469	286,655	2.40	61
1889	5	589	0	152,090	91,256	186,718	2.05	60
1890	5	482	16	247,823	157,208	314,416	2.00	63
1891	5	448	0	146,008	90,728	197,048	2.17	62
1892	5	448	8	185,600	117,554	216,090	1.84	63.3
1893	5	456	14	136,069	86,752	150,196	1.73	63.8
1894	5	454	14	53,216	34,089	51,815	1.52	64
1895	5	460	0	133,276	85,842	150,224	1.75	64.4

Pittsburg district.—Much of the coal made into coke in the Pittsburg district is slack, usually obtained from the mines along the several pools of the Monongahela River and brought to Pittsburg by barges. Latterly also considerable coal has been brought from the fourth pool of the Monongahela River to Pittsburg for coking. The indications are that the Pittsburg district will, in the near future, assume much greater importance as a coke-producing center than it has heretofore enjoyed, in view of the fact that a large number of by-product ovens will be built in and near Pittsburg along the Monongahela River. In this district are included the ovens at and near Pittsburg, as well as the ovens in Washington County that use slack from the coal mines of that county.

The statistics of the manufacture of coke in the Pittsburg district, Pennsylvania, for the years 1880 to 1895 are stated in the table on the following page.

Statistics of the manufacture of coke in the Pittsburg district, Pennsylvania, from 1880 to 1895.

Year.	Estab-lish-ments.	Ovens.		Coal used.	Coke pro-duced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Build-ing.					
				Short tons.	*Short tons.*			*Per cent.*
1880........	21	534	0	194,393	105,974	$254,500	$2.40	55
1881........	21	538	0	178,509	96,310	206,965	2.15	54
1882........	21	557	0	114,956	64,779	134,378	2.07	61
1883........	20	542	0	119,310	66,820	126,020	1.89	56
1884........	20	535	0	97,367	53,857	99,911	1.87	55
1885........	17	416	4	91,101	46,930	72,509	1.55	51.5
1886........	18	730	0	228,874	138,646	221,617	1.88	60.6
1887........	20	880	235	366,184	177,097	315,546	1.78	48.4
1888........	22	980	0	428,899	264,156	350,818	1.33	62
1889........	17	600	21	233,571	141,324	283,402	2.00	60.5
1890........	14	541	0	149,230	93,984	171,465	1.82	63
1891........	13	590	11	154,054	94,160	201,458	2.14	61
1892........	15	725	261	292,357	176,365	376,613	2.14	60.3
1893........	10	885	0	357,400	216,268	438,801	2.03	60.5
1894........	9	779	104	371,569	227,100	351,825	1.55	61
1895........	9	973	0	452,845	232,529	547,284	2.35	51.3

From the above table it appears that the production of coke in the Pittsburg district in 1895 was 232,529 tons—but little in excess of the production of 1893 and 1894. It was, however, the largest production with one exception, that of 1888, in the history of this district.

Beaver district.—The coke industry in this district is of so little importance that it requires no description.

The following are the statistics of the manufacture of coke in the Beaver district, Pennsylvania, for the years 1880 to 1895:

Statistics of the manufacture of coke in the Beaver district, Pennsylvania, from 1880 to 1895.

Year.	Estab-lish-ments.	Ovens.		Coal used.	Coke pro-duced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Build-ing.					
				Short tons.	*Short tons.*			*Per cent.*
1880........	5	106	......	8,013	4,880	$10,150	$2.08	61
1881........	5	106	......	6,887	4,333	9,013	2.08	63
1882........	5	106	......	11,699	7,960	15,124	1.90	68
1883........	5	107	......	19,510	12,395	21,062	1.70	64
1884........	4	89	......	2,250	1,390	2,168	1.56	62
1885........	4	89	......	686	438	696	1.59	63
1886........	3	87	......	698	411	646	1.57	59

Statistics of the manufacture of coke in the Beaver district, Pennsylvania, etc.—Cont'd.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke
		Built.	Buildings.					
				Short tons.	*Short tons.*			*Per cent.*
1887........	3	65	......	25, 207	13, 818	$24, 137	$1. 75	55
1888........	4	145	......	262	175	260	1. 48	66. 6
1889........	3	90	......	3, 100	1, 853	3, 848	2. 07	60
1890........	3	90	......	4, 010	2, 148	4, 564	2. 12	53. 5
1891........	3	88	......	4, 224	2, 332	6, 663	2. 86	55
1892........	2	10	0	3, 925	2, 154	6, 270	2. 91	54. 9
1893........	2	10	0	2, 998	1, 644	4, 446	2. 70	54. 8
1894........	2	8	0	2, 968	1, 624	4, 251	2. 62	54. 7
1895........	2	8	0	2, 888	1, 584	3, 940	2. 49	54. 8

Alleghany Valley district.—This district includes the coke works of Armstrong and Butler counties, situated in the valley of the Allegheny River. No coke was made in this district either in 1894 or 1895, but as there promises to be production again in this district in the near future we continue the report.

The statistics of the manufacture of coke in the Alleghany Valley district for the years 1880 to 1895 are as follows:

Statistics of the manufacture of coke in the Alleghany Valley district, Pennsylvania, from 1880 to 1895.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1880........	5	97	0	45, 355	23, 470	$49, 068	$2. 10	52
1881........	5	109	0	55, 676	29, 650	64, 664	2. 18	53
1882........	6	159	0	76, 000	41, 897	80, 294	1. 92	55
1883........	6	159	0	64, 810	34, 868	62, 982	1. 81	54
1884........	7	209	0	55, 110	31, 430	54, 859	1. 75	57
1885........	5	208	0	28, 630	15, 326	30, 151	1. 97	53. 5
1886........	5	208	0	51, 580	28, 948	44, 422	1. 54	56
1887........	5	288	88	77, 666	44, 621	84, 913	1. 90	57. 1
1888........	5	376	0	37, 792	21, 719	36, 008	1. 66	57. 5
1889........	4	198	0	13, 105	6, 569	10, 538	1. 62	50
1890........	3	148	0	33, 049	18, 733	40, 204	2. 15	56. 7
1891........	3	148	0	21, 833	11, 314	25, 909	2. 29	52
1892........	3	148	0	0	0	0	0	0
1893........	2	116	0	10. 927	6, 557	11, 147	1. 70	60
1894........	2	116	0	0	0	0	0	0
1895........	2	116	0	0	0	0	0	0

Reynoldsville-Walston district.—This district includes all the ovens on the Rochester and Pittsburg Railroad, as well as those on the Low Grade Division of the Alleghany Valley Railway, and the mines of the New York, Lake Erie and Western Railroad. It is at the present time one of the most important coking districts in Pennsylvania, and gives promise of great increase in production in the near future.

The following are the statistics of the manufacture of coke in the Reynoldsville-Walston district for the years 1880 to 1895:

Statistics of the manufacture of coke in the Reynoldsville-Walston district, Pennsylvania, from 1880 to 1895.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1880......	3	117	0	45,055	28,090	$46,359	$1.65	62
1881......	4	125	2	99,489	44,260	80,785	1.85	44
1882......	5	177	0	87,314	44,709	80,339	1.80	51
1883......	6	229	0	76,580	37,044	65,584	1.77	48
1884......	7	321	0	159,151	78,646	113,155	1.44	49
1885......	8	600	143	183,806	114,409	153,795	1.35	62
1886......	9	783	500	271,037	161,828	217,834	1.35	59.7
1887......	11	1,492	134	507,320	316,107	592,728	1.88	62.3
1888......	9	1,636	100	404,346	253,662	320,203	1.26	62.7
1889......	8	1,747	0	514,461	313,011	436,857	1.40	60.8
1890......	8	1,737	0	652,966	406,184	771,996	1.90	62
1891......	7	1,747	0	769,100	470,479	744,098	1.58	61
1892......	8	1,734	0	683,539	425,250	743,227	1.75	62.2
1893......	8	1,755	0	562,033	339,314	586,212	1.73	60.4
1894......	8	1,755	0	336,554	207,238	297,596	1.44	61.6
1895......	8	1,637	0	504,092	296,820	357,266	1.20	58.9

Blossburg district.—This district, which was at one time of great importance as a coke-producing district, especially to central and western New York, produced very little coke in the last two years. Considerable coal produced in this district is shipped to Syracuse and coked there, but this is reported in connection with New York.

The following are the statistics of the manufacture of coke in the Blossburg district, Pennsylvania, from 1880 to 1895.

Statistics of the manufacture of coke in the Blossburg district, Pennsylvania, from 1880 to 1895.

Year.	Establishments.	Ovens. Built.	Ovens. Building.	Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
				Short tons.	*Short tons.*			*Per cent.*
1880	1	200	0	72,520	44,836	$134,500	$3.00	62
1881	1	200	0	88,055	56,085	168,250	3.00	64
1882	1	200	0	100,119	64,526	193,500	3.00	64
1883	2	344	0	71,028	44,690	122,450	2.74	63
1884	2	344	32	62,365	39,043	93,763	2.40	63
1885	2	296	0	46,489	26,975	59,423	2.17	58
1886	2	405	0	136,136	81,801	174,532	2.13	60
1887	2	406	0	182,623	103,873	234,622	2.26	56.9
1888	2	407	0	62,063	38,052	81,400	2.14	61
1889	2	407	0	31,806	18,422	47,765	2.59	58
1890	2	407	0	41,785	23,196	62,804	2.71	55.5
1891	2	407	0	46,084	24,351	66,195	2.72	53
1892	2	404	0	30,746	16,675	45,855	2.75	54.2
1893	2	407	0	22,176	11,463	31,427	2.74	50.7
1894	1	250	0	670	332	896	2.70	50
1895	1	200	0	976	488	1,220	2.50	50

Greensburg district.—The Greensburg district includes a small number of ovens situated in the Greensburg coal basin, erected chiefly for the utilization of the slack coal. The coal is all from the Pittsburg vein.

The following are the statistics of the manufacture of coke in the Greensburg district from 1889 to 1895:

Statistics of the manufacture of coke in the Greensburg district, Pennsylvania, from 1889 to 1895.

Year.	Establishments.	Ovens. Built.	Ovens. Building.	Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
				Short tons.	*Short tons.*			*Per cent.*
1889	2	50	16	32,070	20,459	$21,523	$1.05	63.8
1890	2	58	0	44,000	30,261	44,290	1.46	68.7
1891	2	58	0	38,188	22,441	36,627	1.63	59
1892	2	58	0	15,005	9,037	13,173	1.46	60.2
1893	3	88	0	29,983	18,393	26,303	1.43	61
1894	3	118	0	27,290	15,872	18,413	1.16	58.2
1895	3	118	0	31,300	20,309	22,340	1.10	65

Irwin district.—The Irwin district comprises the ovens situated near the town of that name; also those located in what may be termed the Irwin basin, on the Youghiogheny River. It will be noted that this district is of considerable importance as a coke producer. Most of the coke made in the district is produced by the Carnegie Steel Company, Limited, at Larimer, where slack from the gas coal mined in the immediate vicinity is made into coke.

The following are the statistics of the manufacture of coke in the Irwin district for the years 1889 to 1895:

Statistics of the manufacture of coke in the Irwin district, Pennsylvania, from 1889 to 1895.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1889	4	696	0	373,913	243,448	$351,304	$1.44	65
1890	4	661	0	270,476	172,329	256,458	1.49	63.7
1891	4	696	0	323,099	197,082	266,061	1.35	61
1892	4	696	0	328,193	202,809	284,029	1.40	61.8
1893	5	725	0	238,832	150,463	195,609	1.30	63
1894	5	725	0	176,318	110,995	119,764	1.08	63
1895	5	725	0	166,124	103,872	105,609	1.017	62.5

TENNESSEE.

Tennessee ranks as the fourth State in the production of coke, it being exceeded by Pennsylvania, Alabama, and West Virginia, in the order stated. The production of Colorado approaches very closely to that of Tennessee, and these five States, with Virginia and Georgia, are the only ones that produce upwards of 60,000 tons of coke a year.

The following are the statistics of the manufacture of coke in Tennessee for the years 1880 to 1895:

Statistics of manufacture of coke in Tennessee from 1880 to 1895.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1880	6	656	68	217,656	130,609	$316,607	$2.42	60
1881	6	724	84	241,644	143,853	342,585	2.38	60
1882	8	861	14	313,537	187,695	472,505	2.52	60
1883	11	992	10	330,961	203,691	459,126	2.25	62

Statistics of manufacture of coke in Tennessee from 1880 to 1895—Continued.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building					
				Short tons.	*Short tons.*			*Per cent.*
1884......	*a* 13	1,105	175	348,295	219,723	$428,870	$1.95	63
1885......	12	1,387	36	412,538	218,842	398,459	1.82	53
1886......	12	1,485	126	621,669	368,139	687,865	1.87	59
1887......	11	1,560	165	655,857	396,979	870,900	2.19	61
1888......	11	1,634	84	630,099	385,693	490,491	1.27	61
1889......	12	1,639	40	626,016	359,710	731,496	2.03	57
1890......	11	1,664	292	600,387	348,728	684,116	1.96	58
1891......	11	1,995	0	623,177	364,318	701,803	1.93	58
1892......	11	1,941	0	600,126	354,096	724,106	2.05	59
1893......	11	1,942	0	449,511	265,777	491,523	1.85	59
1894......	11	1,860	0	516,802	292,646	480,124	1.64	56.6
1895......	12	1,903	0	684,655	396,790	754,926	1.90	57.9

a One establishment made coke in pits.

From the above table it appears that the production of coke in Tennessee has been much more regular than that of any other State, the range of production in the last ten years being only from 265,777 to 396,790 tons.

The character of the coal used in the manufacture of coke in Tennessee since 1890 is shown in the following table:

Character of coal used in the manufacture of coke in Tennessee since 1890.

Year.	Run of mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*
1890...........	255,359	0	273,028	72,000	600,387
1891...........	184,556	0	377,914	60,707	623,177
1892...........	176,453	15,000	367,827	40,846	600,126
1893...........	179,126	0	137,483	132,902	449,511
1894...........	166,990	61,841	149,958	138,013	516,802
1895...........	96,744	59,284	285,906	242,721	684,655

TEXAS.

No coke has ever been made in this State on a commercial scale. A number of experiments have been made with the coals to test their coking qualities, but until recently the results have not been such as to justify beginning its manufacture. In 1895 six coke ovens were built and some coke was made as an experiment, the total production being but 286 tons, 530 tons of coal being used in its manufacture. As this coke was made entirely in an experimental way no value is given for it.

UTAH.

As there is but one works in Utah, we have included the statistics of the production of coke with that of Colorado, as the coals in this State are practically of the same character as those in the western district of Colorado.

The following are the statistics of the production of coke in Utah from 1889 to 1895:

Production of coke in Utah from 1889 to 1895.

Year.	Tons.	Year.	Tons.
1889	761	1893	16,005
1890	8,528	1894	16,056
1891	7,949	1895	22,519
1892	7,309		

VIRGINIA.

For the first time since the beginning of the publication of these reports on the manufacture of coke in the United States, Virginia shows a coke production that may be properly described as a Virginia product. Of the two coke works that have heretofore been reported upon in this State, one, the coke works at Pocahontas, in the Flat Top region, conducted its mining operations both in Virginia and West Virginia, along the boundary line between the two States, its pit openings being in Virginia and much of the coal coming from West Virginia; the other works, that at Low Moor, on the line of the Chesapeake and Ohio Railroad, just east of the West Virginia line, drew its entire coal supply from the New River coal fields of West Virginia. In 1895, however, we have reports from three additional coke works: The Wise County Coke Company, the Big Stone Gap Colliery Company, and the Virginia Coal and Iron Company, which are all located in the southwestern part of the State. Two of these works made coke in 1895; at the third, ovens were building, and 50 additional ovens are building at the Wise County Coke Works. In view of the fact that but a small amount of coke has been manufactured in this district in 1895, and in view of the further fact that no personal examination of the district has been made, a statement regarding the character of the coal and coke is deferred until the next report. It may be proper, however, to give the following analyses of coke made from washed and unwashed coal in the ovens of the Wise County Coke Company. It should be understood, however, that the work done by this company in 1895 was simply experimental and testing.

Analyses of Wise County, Va., coke.

	No. 1, unwashed.	No. 2, washed.
	Per cent.	*Per cent.*
Volatile matter	3.13	2.01
Fixed carbon	86.64	90.55
Ash	10.40	7.44
Sulphur	.63	
Total	100.80	100

NOTE.—Analysis No. 1 was made by the chemist of Pulaski Iron Company; analysis No. 2 was made at the Dora Furnace laboratory, Pulaski.

The following are the statistics of the manufacture of coke in Virginia from 1883 to 1895:

Statistics of the manufacture of coke in Virginia from 1883 to 1895.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1883	1	200	0	39,000	25,340	$44,345	$1.75	65
1884	1	200	0	99,000	63,600	111,300	1.75	64.25
1885	1	200	0	81,899	40,139	85,993	1.75	60
1886	2	350	100	200,018	122,352	305,880	2.50	61.2
1887	2	350	300	235,841	166,947	417,368	2.50	70.8
1888	2	550	0	230,529	140,199	260,000	1.74	64.7
1889	2	550	250	238,793	146,528	325,861	2.22	61
1890	2	550	250	251,683	165,847	278,724	1.68	66
1891	2	550	250	285,113	167,516	265,107	1.58	58.8
1892	2	594	206	226,517	147,912	322,486	2.18	65.3
1893	2	594	206	194,059	125,092	282,898	2.26	64.5
1894	2	736	100	280,524	180,091	295,747	1.64	64.2
1895	5	832	350	410,737	244,738	322,564	1.32	59.6

The character of the coal used in the manufacture of coke in Virginia since 1890 is shown in the following table:

Character of coal used in the manufacture of coke in Virginia since 1890.

Year.	Run of mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*
1890	98, 215	0	153, 468	0	251, 683
1891	107, 498	0	177, 615	0	285, 113
1892	106, 010	0	120, 507	0	226, 517
1893	107, 498	0	86, 561	0	194, 059
1894	103, 874	0	176, 650	0	280, 524
1895	114, 802	0	295, 935	0	410, 737

WASHINGTON.

In Washington there are but three coke works, two of which were in operation in 1895, both making coke from washed slack, one from the coal of the Wilkeson coal field near Tacoma, the other at Cokedale, near Fairhaven, in Skagit County. These coals, like those of Colorado and Montana, are Cretaceous, and still preserve at many places their lignite characteristics. At some localities, however, these lignitic coals have been locally altered in character and are true coking coals.

The following are analyses of the coal and of the coke made from it at the coke ovens of the Fairhaven Land Company, at Cokedale, in Skagit County:

Analyses of coal and coke made from same at Cokedale, Washington.

	Coal.	Coke.
	Per cent.	*Per cent.*
Moisture	0. 35	0. 10
Volatile matter	28. 75	2. 38
Fixed carbon	60. 95	82. 22
Ash	9. 95	14. 84
Total	100. 00	99. 54
Sulphur	....	. 46

We have in previous volumes of Mineral Resources given analyses of the Wilkeson coke.

On the next page will be found the statistics of the manufacture of coke in Washington for the years 1884 to 1895, the only years in which coke has been made.

Statistics of the production of coke in Washington from 1884 to 1895.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1884	1	0	0	700	400	$1,900	$4.75	57.5
1885	1	2	0	544	311	1,477	4.75	57
1886	1	11	21	1,400	825	4,125	5.00	58.9
1887	1	30	0	22,500	14,625	102,375	7.00	65
1888	3	30	100	0	0	0	0	0
1889	1	30	0	6,983	3,841	30,728	8.00	55
1890	2	30	80	9,120	5,837	46,696	8.00	64
1891	2	80	0	10,000	6,000	42,000	7.00	60
1892	3	84	30	12,372	7,177	50,446	7.03	58
1893	3	84	0	11,374	6,731	34,207	5.08	59
1894	3	84	0	8,563	5,245	18,249	3.48	61.2
1895	3	110	0	22,973	15,129	64,632	4.27	65.9

It will be noticed from the above table that the production of coke in Washington in 1895 was the greatest of any year in its history, it being 15,129 tons. The nearest approach to this was in 1887, when 14,625 tons were made.

The character of the coal used in the manufacture of coke in Washington since 1890 is shown in the following table:

Character of coal used in the manufacture of coke in Washington since 1890.

Year.	Run of mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*
1890	0	9,120	0	0	9,120
1891	0	0	10,000	0	10,000
1892	0	0	0	12,372	12,372
1893	0	10,974	0	405	11,379
1894	0	0	0	8,563	8,563
1895	0	0	0	22,973	22,973

WEST VIRGINIA.

In West Virginia five coking districts are recognized, viz, the Kanawha, the New River, the Flat Top, the Upper Monongahela, and the Upper Potomac. The first two are compact and continuous. They include the ovens along the line of the Chesapeake and Ohio Railroad from west of Low Moor, in Virginia, to the Kanawha Valley. The Flat Top region includes the ovens in what is sometimes called the Pocahontas district. The fourth district, the Upper Monongahela or Northern, is a scattered one, including the ovens in Preston, Taylor, Harrison, and Marion counties, on the upper waters of the Monongahela. The district we have termed the Upper Potomac includes the coke ovens in the Elk Garden and Upper Potomac fields. We have so frequently described these districts that we need not repeat the description at this point, but refer those interested to previous volumes of Mineral Resources.

PRODUCTION OF COKE IN WEST VIRGINIA, BY DISTRICTS.

In the following table will be found consolidated the statistics of the production of coke in West Virginia in the three years especially covered by this report, viz, 1893, 1894, and 1895, by districts:

Production of coke in West Virginia in 1895, by districts.

District.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke produced.	Average price of coke per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	Short tons.			Per ct.
Kanawha	6	506	0	267,520	164,729	$270,879	$1.64	61.6
New River	14	978	0	385,899	244,815	404,978	1.65	63.4
Flat Top	36	4,648	18	858,913	524,252	656,494	1.25	61
Upper Monongahela	20	1,260	37	392,297	240,657	265,293	1.10	61.3
Upper Potomac	2	442	0	183,187	110,753	126,595	1.14	60.5
Total	78	7,834	55	2,087,816	1,285,206	1,724,239	1.34	61.6

Production of coke in West Virginia in 1894, by districts.

District.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke produced.	Average price of coke per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	Short tons.			Per ct.
Kanawha	6	506	0	176,746	104,160	$181,586	$1.74	58.9
New River	14	1,089	0	222,900	140,842	245,154	1.74	63.2
Flap Top	36	4,648	18	1,229,136	746,762	989,876	1.33	60.7
Upper Monongahela	20	1,221	42	280,748	158,623	179,525	1.13	56.5
Upper Potomac	2	394	0	66,598	43,546	43,546	1.00	65.4
Total	78	7,858	60	1,976,128	1,193,933	1,639,687	1.373	60.4

Production of coke in West Virginia in 1893, by districts.

District	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke produced.	Average price of coke per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per ct.*
Kanawha	6	506	0	215,108	122,241	$237,308	$1.94	56.8
New River	13	947	10	281,600	178,049	355,965	2.00	63
Flat Top	34	4,349	80	746,051	451,503	713,261	1.58	60.5
Upper Monongahela	19	1,158	42	379,506	225,676	295,123	1.31	59
Upper Potomac	3	394	0	123,492	84,607	115,250	1.36	68.5
Total	75	7,354	132	1,745,757	1,062,076	1,716,907	1.62	60.8

From the above three tables it will be noted that the increase in production in 1895 over 1894 was about 8 per cent. In all districts there has been quite a difference in production; for example, the Upper Potomac increased its production from 43,546 tons in 1894 to 110,753 tons in 1895, an increase of 67,207 tons, or 154 per cent; the Upper Monongahela district, in which are included the ovens on the upper waters of the Monongahela, increased from 158,623 tons to 240,657 tons, an increase of 82,034 tons, or nearly 52 per cent; the production of the Flat Top region, strange to relate, fell from 746,762 tons in 1894 to 524,252 tons in 1895, a decrease of 222,510 tons, or about 30 per cent; the increase in the New River district was from 140,842 tons in 1894 to 244,815 tons in 1895, or nearly 75 per cent; the increase in the Kanawha district was something over 60,000 tons, or nearly 60 per cent. In regard to the falling off in production in the Flat Top region it should be noted that the coke made by the Southwest Virginia Improvement Company is reported in connection with Virginia. This production increased considerably in 1895 over 1894, so that while there was a notable decrease in the entire Flat Top district in 1895 over 1894 it was not quite so great as appears in the above exhibit. This falling off was due to the strike, which not only reduced the demand during its continuance, but, as it led to loss of yearly contracts which were placed elsewhere during the strike, it also had a marked effect on shipments after the strike ended. The indications, however, for 1896 are that the production in the Flat Top region will be fully up to the average. It should be remembered, however, that the great increase in production in 1894 over any previous year was due probably to the strike in the Connellsville region, the Flat Top region getting many of the orders which had before been sent to the Connellsville, as in 1895 the Connellsville got many of the orders which the Flat Top had in 1894.

In the following table will be found statistics of the manufacture of coke in West Virginia from 1880 to 1895. It will be noted that though there was somewhat of a falling off in production in the Flat Top district, due to the strike, the production of coke in this State in 1895 was the largest in its history. Each year has shown an increase in production in this State since 1884, the production for that year being 223,472 tons, and the production in 1895 being nearly six times this amount.

Statistics of the manufacture of coke in West Virginia from 1880 to 1895.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1880....	18	631	40	230, 758	138, 755	$318, 797	$2. 30	60
1881....	19	689	0	304, 823	187, 126	429, 571	2. 30	61
1882....	22	878	0	366, 653	230, 398	520, 437	2. 26	63
1883....	24	962	9	411, 159	257, 519	563, 490	2. 19	63
1884....	27	1, 005	127	385, 588	223, 472	425, 952	1. 91	62
1885....	27	978	63	415, 533	260, 571	485, 588	1. 86	63
1886....	29	1, 100	317	425, 002	264, 158	513, 843	1. 94	62
1887....	39	2, 080	742	698, 327	442, 031	976, 732	2. 21	63. 3
1888....	51	2, 764	318	854, 531	525, 927	896, 797	1. 71	61. 5
1889....	53	3, 438	631	1, 001, 372	607, 880	1, 074, 177	1. 76	60
1890....	55	4, 060	334	1, 395, 266	833, 377	1, 524, 746	1. 83	60
1891....	55	4, 621	555	1, 716, 976	1, 009, 051	1, 845, 043	1. 83	58. 8
1892....	72	5, 843	978	1, 709, 183	1, 034, 750	1, 821, 965	1. 76	60. 5
1893....	75	7, 354	132	1, 745, 757	1, 062, 076	1, 716, 907	1. 62	60. 8
1894....	78	7, 858	60	1, 976, 128	1, 193, 933	1, 639, 687	1. 373	60. 4
1895....	78	7, 834	55	2, 087, 816	1, 285, 206	1, 724, 239	1. 34	61. 6

The character of the coal used in the manufacture of coke in West Virginia since 1890 is shown in the following table:

Character of coal used in the manufacture of coke in West Virginia since 1890.

Year.	Run of mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*
1890......	324, 847	0	930, 989	139, 430	1, 395, 266
1891......	276, 259	0	1, 116, 060	324, 657	1, 716, 976
1892......	298, 824	115, 397	1, 108, 353	186, 609	1, 709, 183
1893......	324, 932	15, 240	1, 176, 656	228, 929	1, 745, 757
1894......	162, 270	14, 901	1, 607, 735	191, 222	1, 976, 128
1895......	405, 725	24, 054	1, 476, 003	182, 034	2, 087, 816

But little coal coked in West Virginia is made from washed coal, most of the washing being done in the Northern or Upper Monongahela district. About 10 per cent of the coal made into coke in this State in 1895 was washed coal.

Pocahontas-Flat Top district.—This is one of the most important coking districts of the country and shares with the Connellsville in producing a typical blast-furnace coke. Indeed, it is chemically a better fuel than the Connellsville, being lower in ash. By some ironmasters it is also regarded as a blast-furnace fuel physically the equal of the Connellsville. The statistics of the manufacture of coke in the Flat Top district for the years 1886 to 1895 are as follows:

Statistics of the manufacture of coke in the Flat Top district of West Virginia from 1886 to 1895.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1886.....	2	10	38	1,075	658	$1,316	$2.00	61.2
1887.....	5	348	642	76,274	51,071	100,738	1.97	67
1888.....	13	882	200	164,818	103,947	183,938	1.77	63
1889.....	16	1,433	431	387,533	240,386	405,635	1.69	64
1890.....	17	1,584	252	566,118	325,576	571,239	1.75	57.5
1891.....	19	1,889	358	537,847	312,421	545,367	1.70	58
1892.....	30	2,848	933	595,734	353,696	596,911	1.69	59.3
1893.....	34	4,349	80	746,051	451,503	713,261	1.58	60.5
1894.....	36	4,648	18	1,229,136	746,762	989,876	1.325	60.7
1895.....	36	4,648	18	858,913	524,252	656,494	1.25	61

New River district.—This district includes the ovens along the Chesapeake and Ohio Railroad from Quinnimont to Nuttallburg. The coal makes an excellent coke and is in great demand, its market being chiefly east of the mountains. The statistics of the manufacture of coke in the New River district from 1880 to 1895 are as follows:

Statistics of the manufacture of coke in the New River district, West Virginia, from 1880 to 1895.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1880......	6	468	40	159,032	98,427	$239,977	$2.14	62
1881......	6	499	0	219,446	136,423	334,652	2.45	62
1882......	6	518	0	233,361	148,373	352,415	2.38	64
1883......	6	546	0	264,171	167,795	384,552	2.29	64

Statistics of the manufacture of coke in the New River district, West Virginia, etc.—Cont'd.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1884......	8	547	12	219,839	135,335	$274,988	$2.03	62
1885......	8	519	0	244,769	156,007	325,001	2.08	63¾
1886......	8	513	5	203,621	127,006	281,778	2.22	62
1887......	11	518	50	253,373	159,836	401,164	2.51	63
1888......	12	743	0	334,695	199,831	390,182	1.95	60
1889......	12	773	0	268,185	157,186	351,132	2.23	58.6
1890......	12	773	4	275,458	174,295	377,847	2.17	63
1891......	13	787	102	309,073	193,711	426,630	2.20	63
1892......	14	965	0	315,511	196,359	429,376	2.19	62
1893......	13	947	10	281,600	178,049	355,965	2.00	63
1894......	14	1,089	0	222,900	140,842	245,154	1.74	63.2
1895......	14	978	0	385,899	244,815	404,978	1.65	63.4

From the above table it will be seen that the production in 1895 was the largest in its history. It increased from 140,842 tons in 1894 to 244,815 tons 1895. It is probable that this large production is in a measure due to the demand for coke following the strike in the Flat Top region.

Kanawha district.—The production of coke in the Kanawha district in 1895, like the production in the New River district, with which it is connected, was the largest in its history, the increase being from 104,160 tons in 1894 to 164,729 tons in 1895. This increase was also no doubt due to the strike in the Flat Top region.

The statistics of the manufacture of coke in the Kanawha district from 1880 to 1895 are as follows:

Statistics of the manufacture of coke in the Kanawha district, West Virginia, from 1880 to 1895.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1880......	4	18	0	6,789	4,300	$9,890	$2.30	63.3
1881......	4	18	0	11,516	6,900	16,905	2.45	60
1882......	5	*a* 138	0	40,782	26,170	62,808	2.40	64
1883......	5	*a* 147	0	58,735	37,970	88,090	2.32	64.6
1884......	6	*a* 177	15	60,281	39,000	76,070	1.95	64.6

a Eighty of these ovens are Coppée, the balance beehive.

Statistics of the manufacture of coke in the Kanawha district, West Virginia, etc.—Cont'd.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1885......	7	*a* 181	63	65, 348	37, 551	$63, 082	$1. 68	57
1886......	7	302	170	89, 410	54, 329	117, 649	2. 17	60. 7
1887......	7	548	0	153, 784	96, 721	201, 418	2. 08	63
1888......	9	572	8	141, 641	84, 052	146, 837	1. 75	59
1889......	6	474	0	109, 466	63, 678	117, 340	1. 84	58
1890......	6	474	0	182, 340	104, 076	196, 583	1. 89	57
1891......	6	474	0	241, 427	134, 715	276, 420	2. 05	56
1892......	6	506	0	242, 627	140, 641	284, 174	2. 02	58
1893......	6	506	0	215, 108	122, 241	237, 308	1. 94	56. 8
1894......	6	506	0	176, 746	104, 160	181, 586	1. 74	58. 9
1895......	6	506	0	267, 520	164, 729	270, 879	1. 64	61. 6

a Sixty of these ovens are Coppée, the balance beehive.

Upper Monongahela district.—The Upper Monongahela district includes the ovens in the group of counties lying along the line of the Baltimore and Ohio Railroad, near the headwaters of the Monongahela River—Preston, Taylor, Harrison, and Marion counties. This is becoming an important coking district, and though the coke is made largely from washed slack it is a good fuel and finds a place in the markets of the country.

The statistics of the production of coke in the Upper Monongahela district of West Virginia from 1880 to 1895 are as follows:

Statistics of the manufacture of coke in the Upper Monongahela district, West Virginia, from 1880 to 1895.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1880......	8	145	0	64, 937	36, 028	$68, 930	$1. 91	55
1881......	9	172	0	73, 863	43, 803	78, 014	1. 78	59
1882......	11	222	0	92, 510	55, 855	105, 214	1. 88	60
1883......	13	269	0	88, 253	51, 754	90, 848	1. 76	59
1884......	13	281	100	78, 468	49, 139	74, 894	1. 52	63
1885......	12	278	0	105, 416	67, 013	97, 505	1. 45	63. 5
1886......	12	275	104	131, 896	82, 165	113, 100	1. 38	62. 3
1887......	15	646	0	211, 330	132, 192	268, 990	2. 03	62. 5
1888......	17	567	110	213, 377	138, 097	175, 840	1. 27	64. 7

Statistics of the manufacture of coke in the Upper Monongahela district, West Virginia, from 1880 to 1895—Continued.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1889......	17	674	200	210,083	128,685	$171,511	$1.33	62.5
1890......	18	1,051	50	276,367	167,459	260,574	1.56	60
1891......	15	1,081	56	517,615	291,605	462,677	1.58	56
1892......	19	1,129	45	441,266	265,363	390,296	1.47	60.1
1893......	19	1,158	42	379,506	225,676	295,123	1.31	59
1894......	20	1,221	42	280,748	158,623	179,525	1.13	56.5
1895......	20	1,260	37	392,297	240,657	265,293	1.10	61.3

Upper Potomac district.—In the Upper Potomac district are included the ovens along the line of the West Virginia Central and Pittsburg Railway, running south from near Cumberland, Md. This district has been thoroughly described, not only in previous volumes of Mineral Resources, but also in a separate publication by the Survey.

Statistics of the production of coke in the Upper Potomac district of West Virginia are as follows:

Statistics of the manufacture of coke in the Upper Potomac district of West Virginia from 1887 to 1895.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1887........	1	20	50	3,565	2,211	$4,422	$2.00	62
1888........	1	28	0	9,176	5,835	8,752	1.50	64
1889........	2	84	0	26,105	17,945	28,559	1.58	69
1890........	2	178	28	94,983	61,971	118,503	1.91	65
1891........	2	390	39	111,014	76,599	133,549	1.75	69
1892........	3	395	0	114,045	78,691	121,208	1.54	69
1893........	3	394	0	123,492	84,607	115,250	1.36	68.5
1894........	2	394	0	66,598	43,546	43,546	1.00	65.4
1895........	2	442	0	183,187	110,753	126,595	1.14	60.5

The increase in production in this district in 1895 over that of 1894 is a notable one, the production in 1895 being 110,753 tons and in 1894 but 43,546 tons, an increase of 67,207 tons, or nearly 155 per cent. While it is probable that the strike in the Flat Top region is in a measure responsible for this great increase of production, there can be no doubt that this coking district is assuming greater importance in the markets of the country.

WISCONSIN.

All the coke made in Wisconsin is from Connellsville (Pa.) coal, and the coke is standard Connellsville. Its production, therefore, is not of so much interest as the production of coke for developing certain regions. It is an interesting product, however, as showing that coal can be carried to a distance and successfully made into coke.

The statistics of the manufacture of coke in Wisconsin from 1888 to 1895, inclusive, are as follows:

Statistics of the manufacture of coke in Wisconsin.

Year.	Establishments.	Ovens.		Coal used.	Coke produced.	Total value of coke at ovens.	Value of coke at ovens, per ton.	Yield of coal in coke.
		Built.	Building.					
				Short tons.	*Short tons.*			*Per cent.*
1888	1	50	......	1,000	500	$1,500	$3.00	50
1889	1	50	......	25,616	16,016	92,092	5.75	62.5
1890	1	70	......	38,425	24,976	143,612	5.75	65
1891	1	120	0	52,904	34,387	192,804	5.61	65
1892	1	120	0	54,300	33,800	185,900	5.50	62.2
1893	1	120	0	24,085	14,958	95,851	6.41	62
1894	1	120	0	6,343	4,250	19,465	4.58	67
1895	1	120	0	8,287	4,972	26,103	5.25	60

The character of the coal used in the manufacture of coke in Wisconsin since 1890 is shown in the following table:

Character of coal used in the manufacture of coke in Wisconsin since 1890.

Year.	Run of mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*
1890	38,425	0	0	0	38,425
1891	52,904	0	0	0	52,904
1892	54,300	0	0	0	54,300
1893	20,474	0	3,611	0	24,085
1894	6,343	0	0	0	6,343
1895	8,287	0	0	0	8,287

WYOMING.

There is but one coke works in Wyoming—that of the Cambria Mining Company, located at Cambria, Weston County. This works began the manufacture of coke in 1891, but produced no coke in 1892, resuming the manufacture again in 1893, and producing coke in 1894 and

1895. The coal occurs probably in the lowest portion of the Dakota measures of the Colorado Cretaceous and almost upon the topmost rocks of the Jurassic. The vein is 6½ to 7½ feet in thickness, with good roof and floor. Regarding the character of the coal, it has been classed all the way from lignite to a high-grade coking bituminous coal. This difference in classification may be due to the fact that the samples upon which judgment was based were taken from different parts of the vein, in which there may have been actual variations caused by partial metamorphism by heat.

All of the coal used in coking was unwashed slack, which does not give as good a result as washed slack. When the latter is used the coke is of fine texture and very strong. It is dense and capable of sustaining any weight ordinarily required of coke used, as this is, in silver smelting. As at present produced, however, the coke is very high in ash.

The statistics of the production of coke in Wyoming from 1891 to 1895, inclusive, are as follows:

Statistics of the production of coke in Wyoming from 1891 to 1895.

	1891.	1892.	1893.	1894.	1895.
Number of establishments	1	1	1	1	1
Number of ovens built	24	24	24	24	74
Number of ovens building	0	0	0	0	0
Amount of coal used...short tons	4,470	0	5,400	8,685	10,240
Coke produced...do	2,682	0	2,916	4,352	4,895
Total value of coke at ovens	$8,046	0	$10,206	$15,232	$17,133
Value of coke per ton	$3.00	0	$3.50	a$3.50	$3.50
Yield of coal in coke....per cent	60	0	54	50	47.8

a Value estimated.

The character of the coal used in the manufacture of coke in Wyoming is shown in the following table:

Character of coal used in the manufacture of coke in Wyoming since 1891.

Year.	Run of mine.		Slack.		Total.
	Unwashed.	Washed.	Unwashed.	Washed.	
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	*Short tons.*
1891	0	0	4,470	0	4,470
1892	0	0	0	0	0
1893	0	0	5,400	0	5,400
1894	0	0	8,685	0	8,685
1895	0	0	10,240	0	10,240

PETROLEUM.[1]

By Joseph D. Weeks.

[The barrel used in this report, unless otherwise specified, is of 42 Winchester gallons.]

IMPORTANT FEATURES OF THE YEAR.

The most notable features in connection with the production of crude petroleum in 1895 are: (1) The notable increase in production, especially in Ohio, Indiana, and California; (2) the decrease in stocks; (3) the rise in prices; and (4) the extension southward of the profitable producing districts in the Appalachian range.

Briefly summarized, the facts regarding these four features of 1895 are as follows:

INCREASED PRODUCTION IN 1895.

The production of petroleum in the United States increased from 49,344,516 barrels in 1894 to 52,983,526 barrels in 1895, most of the important producing districts sharing in this increase. The production of Pennsylvania increased from 18,077,559 barrels in 1894 to 18,231,442 barrels in 1895, an increase of 153,883 barrels, or eighty-five hundredths of 1 per cent; of Ohio from 16,792,154 barrels in 1894 to 19,545,233 barrels in 1895, an increase of 2,753,079 barrels, or 16.4 per cent. This increase in Ohio was fairly distributed throughout the two important Ohio producing districts. The production of Indiana increased from 3,688,666 barrels in 1894 to 4,386,132 barrels in 1895, an increase of 697,466 barrels, or nearly 19 per cent, while the production of California, owing to the new discoveries at Los Angeles, increased from 705,969 barrels in 1894 to 1,208,482 barrels in 1895, an increase of 71 per cent, the largest percentage increase of any of the States. On the other hand, there was a slight decrease in the production of West Virginia and New York.

[1]For much of the statistical information used in this report the writer is indebted to the previous publications of Mineral Resources and to the reports of the Eleventh Census, the Oil City Derrick, the American Manufacturer and Iron World, and Stowell's Petroleum Reporter, of Pittsburg. During the year Mr. Boverton Redwood's Petroleum and Its Products has been published. This is the most important work on petroleum that has yet appeared, and we desire in this place to make a general acknowledgment of the frequent use to which the volume has been put. Other special acknowledgments will be given in the body of the report.

DECREASE IN STOCKS.

The stocks of crude petroleum in the Appalachian oil field at the close of 1895 were 5,344,784 barrels, as compared with 6,499,880 barrels at the close of 1894. The largest stocks at the close of any one month in 1895 were 5,859,348 barrels in January, as compared with 11,755,219 barrels, the largest stocks in 1894, which were also at the close of January. The smallest stocks at the close of any one month in 1895 were those of June, being 4,275,506 barrels, while the smallest stocks at the close of any one month in 1894 were those of December, as noted above. The average stocks at the close of each month in 1895 were 4,879,775 barrels.

INCREASE IN PRICE.

The average value of certificate oil in the Pennsylvania field in 1895 was \$1.35$\frac{7}{8}$, as compared with 83$\frac{7}{8}$ cents in 1894. This is the highest average price since 1877. The highest average price during any one month in 1895 was \$1.79 in April; the lowest, 99 cents in January. In the Lima field the average price advanced from 48 cents a barrel in 1894 to 71$\frac{3}{4}$ cents in 1895. The total value of the 49,344,516 barrels produced in the United States in 1894 was \$35,522,095, or nearly 72 cents a barrel, while the total value of the 52,983,526 barrels produced in 1895 was \$57,691,279, or about \$1.09.

EXTENSION OF THE APPALACHIAN FIELD.

The results of drilling in the Appalachian district in 1895, in the States of Pennsylvania, New York, West Virginia, and eastern Ohio, are noted in the following statement:

PENNSYLVANIA.

Greene County.—The gas companies supplying the city of Pittsburg have been active during the year in Greene County in a field southwest of that of their previous operations, but the great cost of wells has deterred the oil operators from prospecting in that section of country.

Some good gas wells have been opened in the southwest portion of the county, and in a number of places oil has been found in these wells, but not in paying quantities. There has been one new well drilled in the extreme southwest corner of the county that produces oil from the Fourth sand in paying quantities, which will probably lead to further development in that section. Considerable new production has been added to the old Mount Morris field by an extension to the north, but the strike has proved treacherous, the attempt to follow it out resulting in many dry holes. The different gas companies have work under way and much additional territory has been leased.

Fayette County.—Two paying wells in the "100 foot" have been completed near Masontown. Some good gas wells have also been drilled, but the result of operations in that vicinity has so far been discouraging to the operator.

SOUTHEASTERN OHIO.

Monroe County.—This has been the principal point of interest during the past season. A phenomenal oil well was completed on the Freiden farm, about 7 miles northwest of Sistersville. Great excitement followed the opening of this well and extravagant prices were paid for leases. Thirty days later a gusher was drilled in on the Deist farm. This second gusher in the same field resulted in an activity that has been unsurpassed in any field. New wells were rapidly completed, and the production reached 6,000 barrels a day within a few weeks. The pool, however, covered a small acreage, and all efforts to extend it have been futile.

Belmont County.—A well drilled near Colerain in the early summer resulted in a small producer. Several "dusters" have been completed, but late in the year a second paying well was drilled on the Sharkey farm, and a new interest is being taken in the field. In all, seven wells have been completed, three of them finding oil in paying quantities.

A number of wild-cat wells have been drilled in Jefferson, Belmont, Monroe, Noble, and Washington counties, but the result was discouraging to the investors, as, with the exception of Colerain, no new pools were opened.

WEST VIRGINIA.

Developments in West Virginia during the year have been watched with interest, not only on account of the activity displayed, but because of the possibilities of that region. The Big Injun sand is known to underlie the entire northwestern portion of the State, and it has already been determined that the Fifth sand covers large areas. Both of these strata have proved very productive in places, and the Keener sand (a stray sand above the Big Injun) has furnished at least one pool and augmented the output of many Big Injun sand wells in other places. The Cow Run sand, in the Bull Run district, and the Salt sand, in the Cairo region, are also small factors in the situation.

Marshall County.—Early in the year a well was completed in the extreme southwest corner of this county that gave evidence of a fair oil well in the Big Injun sand, resulting in the investment of considerable capital in leases and the starting of additional wells in the vicinity. Later operations proved the first well to be small, the second crop of wells was not so good as the first, and the territory has been abandoned for the present. Several dry holes have been comleted in other parts of the county. A few courageous operators still have faith enough in the eastern part of the county to carry their leases, and several wells are under way with a view to develop gas rather than oil.

Tyler County.—There has not been much extension of the Sistersville field during the year, although there has been considerable drilling done within the well-defined limits of the field, and the staying qualities of the old wells have met the expectations of the most sanguine operators in the field. The Dye-Brooks wells, on Middle Island Creek, caused intense excitement in the early summer; a score of wells were started, and in ninety days some dozen or more dry holes had defined the pool. The Keener sand development, to the northeast of the Dye-Brooks pool, seems to be fully defined, and although quite limited in area has been fairly productive. The completion of a small oil well on Sancho Creek in the early spring started the drill in that region, and several light wells were drilled; but, although the results were discouraging and no new work is under way, owners of territory have not entirely lost faith in the field. In December the Victor Oil Company completed a well on the Kyle farm, near the Big Moses gas well on Indian Creek, that flowed at the rate of 40 to 60 barrels per hour. The same company completed a gas well on the Percy Furbee farm, in the same section, a mile west of the Big Moses well, that soon began spraying oil, and is now making 30 to 40 barrels per day.

Several new wells were started on adjacent farms, and at this writing (March 1, 1896) two of these have been completed, one of them (the Daul Weekly No. 1) starting at 50 barrels per hour; the other one, located between the two good wells, stands full of oil and salt water, but it does not flow. Both of the large wells began to produce salt water, which seems to be increasing from day to day, and it is feared that it will eventually overcome the oil and ruin the wells. This feature is being watched with great interest by operators, as it is of rare occurrence.

Pleasants County.—An extension to the Eureka field by the completion in October of a well on the Hammett farm has created considerable activity in that section. The result, up to the close of the year, has been very discouraging, yet considerable work is now being undertaken.

Marion County.—A new Fifth sand pool of importance has been opened to the northwest of the Mannington district. The cost and the length of time required to complete a well in this district make developments slow, but the results so far have been satisfactory to the operators, and there seem to be large areas of Fifth sand territory in the Mannington district yet undrilled.

Wood County.—A new Cow Run sand development near Waverly is attracting some attention. Though as yet confined to a small area, it has reached a production of about 1,000 barrels per day, with a smaller percentage of dry holes than is usual in that stratum.

Doddridge and Wetzel counties.—Many test wells have been drilled in these counties during the year. A Big Injun sand has been opened on Beech Run, Wetzel County, which is extending over the county line into Doddridge County, and at this writing is not yet defined; the wells are of good caliber and hold up well. The Big Flint district in

Doddridge County has doubled in area during the year, and is not yet fully defined. Some large wells have recently been completed, and the outlook in this and the Beech Run district seems to be the most promising in West Virginia.

The Eagle Mills district, on the line of Doddridge and Tyler counties, a few miles to the northwest of the Big Flint district, has doubled its area and its production during the year. The eastern and northern limits of this field seem to be defined, but some operators think it will eventually connect with the new Indian Creek pool in Tyler County, some 3½ miles distant, and there has been no drilling yet done that contradicts their theory.

PRODUCTION AND VALUE.

LOCALITIES.

The petroleum-producing localities in the United States remain about as they were in 1894, the only important addition to the producing territory being the Los Angeles district in southern California, but this is hardly to be regarded as new territory, as it is surrounded by the older producing districts of that section of the State.

Most of the oil produced in the United States in 1895 is still from the Appalachian district, all of that produced in New York, Pennsylvania, and West Virginia, together with that produced in Macksburg, the eastern and southern Ohio, and Mecca-Belden districts of Ohio, being from this great field. In this district there were produced in 1895 30,959,139 barrels out of the total of 52,983,526 barrels, or nearly 58½ per cent.

TOTAL PRODUCTION AND VALUE.

In the following table is given a statement of the total amount and the total value of all crude petroleum produced in the United States in 1894 and 1895, by States and important districts:

Total amount and value of crude petroleum produced in the United States in 1894 and 1895.

State and district.	1894.		1895.		Average value per barrel.
	Barrels.	Value.	Barrels.	Value.	
New York	942,431	$790,464	912,948	$1,240,468	$1.35⅞
Pennsylvania:					
Pennsylvania	18,017,869	15,112,488	18,180,331	24,702,525	1.35⅞
Franklin	57,070	228,280	48,711	194,844	4.00
Smiths Ferry	2,620	2,198	2,400	3,261	1.35⅞
Total	18,077,559	15,342,966	18,231,442	24,900,630	....

Total amount and value of crude petroleum produced in the United States in 1894 and 1895—Continued.

State and district.	1894.		1895.		Average value per barrel.
	Barrels.	Value.	Barrels.	Value.	
West Virginia:					
West Virginia... Burning Springs.	8,553,046	$7,173,867	8,105,341	$11,013,132	$1.35⅝
Volcano	14,560	38,176	10,170	20,158	....
Petroleum	10,018	9,674	4,614	5,480	....
Total	8,577,624	7,221,717	8,120,125	11,038,770	....
Ohio:					
Eastern	3,183,370	2,670,052	3,693,248	5,018,201	1.35⅝
Lima	13,607,844	6,531,765	15,850,609	11,372,812	.71¾
Mecca-Belden ...	940	4,476	1,376	8,229	....
Total	16,792,154	9,206,293	19,545,233	16,399,242	....
Indiana	3,688,666	1,774,260	4,386,132	2,807,124	.64
Kentucky	1,500	450	1,500	600	.40
Missouri	8	40	10	50	....
Colorado	515,746	303,652	529,482	399,313	.754
California	705,969	823,423	1,208,482	849,082	.70
Texas	60	300	50	250	5.00
Indian Territory	130	810	37	252	....
Illinois	300	1,800	200	1,200	6.00
Wyoming	2,369	15,920	3,455	27,640	8.00
Kansas	40,000	40,000	44,430	26,658	.60
Grand total...	49,344,516	35,522,095	52,983,526	57,691,279	1.0888

From the above table it will be seen that the total production of petroleum in the United States in 1895 was 52,983,526 barrels, as compared with 49,344,516 barrels in 1894, an increase of 3,639,010 barrels, or a little over 7 per cent. Ohio, Indiana, and California show notable increases in production.

VALUE OF PETROLEUM PRODUCED IN 1895.

The total value of the petroleum produced in 1895 was $57,691,279, or $1.09 a barrel, as compared with $35,522,095, or nearly 72 cents a barrel, in 1894. The price per barrel ranged from 40 cents in Kentucky to $8 in Wyoming. The average value of certificate oil, which includes most of that produced in the Appalachian field, in 1895 was $1.35⅞. The average value of Lima oil was 71¾ cents per barrel; of Indiana oil, 64 cents; of Franklin oil, $4; of Colorado oil, 75.4 cents; of California oil, 70 cents; of Wyoming oil, $8, and of Kansas oil, 60 cents.

PRODUCTION BY FIELDS.

The production of petroleum in the chief producing fields of the United States in 1894 and 1895 was as follows:

Production of petroleum in the United States in 1894 and 1895, by fields.

[Barrels of 42 gallons.]

Field.	Production.	
	1894.	1895.
Appalachian	30,781,924	30,959,139
Lima-Indiana	17,296,510	20,236,741
Florence, Colorado	515,746	529,482
Southern California	705,969	1,208,482
Kansas	40,000	44,430
Wyoming	2,369	3,455
Other	1,998	1,797
Total	49,344,516	52,983,526

From the above table it will be noted that every field named in the United States shows an increase in production in 1895 as compared with 1894. The increase in the Appalachian field was fifty-seven one-hundredths of 1 per cent; in the Lima-Indiana field, 17 per cent; in the Florence, Colo., field, 2.6 per cent; in the southern California field, 71 per cent; in the Kansas field, 11 per cent, and in the Wyoming field, nearly 50 per cent.

PRODUCTION OF CRUDE PETROLEUM IN THE UNITED STATES, 1859 TO 1895.

In the following table will be found a statement of the production of crude petroleum in the United States from the beginning of production, marked by the drilling of the Drake well in 1859, up to and including the production of 1895, the table being by years and States.

Product of crude petroleum in the United States from 1859 to 1895

[Barrels.]

Year.	Pennsylvania and New York.	Ohio.	West Virginia.	Colorado.	California.	Indiana.
1859	2,000					
1860	500,000					
1861	2,113,609					
1862	3,056,690					
1863	2,611,309					
1864	2,116,109					
1865	2,497,700					
1866	3,597,700					
1867	3,347,300					
1868	3,646,117					
1869	4,215,000					
1870	5,260,745					
1871	5,205,234					
1872	6,293,194					
1873	9,893,786					
1874	10,926,945					
1875	8,787,514	a 200,000	a 3,000,000		a 175,000	
1876	8,968,906	31,763	120,000		12,000	
1877	13,135,475	29,888	172,000		13,000	
1878	15,163,462	38,179	180,000		15,227	
1879	19,685,176	29,112	180,000		19,858	
1880	26,027,631	38,940	179,000		40,552	
1881	27,376,509	33,867	151,000		99,862	
1882	30,053,500	39,761	128,000		128,636	
1883	23,128,389	47,632	126,000		142,857	
1884	23,772,209	90,081	90,000		262,000	
1885	20,776,041	661,580	91,000		325,000	
1886	25,798,000	1,782,970	102,000		377,145	
1887	22,356,193	5,022,632	145,000	76,295	678,572	
1888	16,488,668	10,010,868	119,448	297,612	690,333	
1889	21,487,435	12,471,466	544,113	316,476	303,220	33,375
1890	28,458,208	16,124,656	492,578	368,842	307,360	63,496
1891	33,009,236	17,740,301	2,406,218	665,482	323,600	136,634
1892	28,422,377	16,362,921	3,810,086	824,000	385,049	698,068
1893	20,314,513	16,249,769	8,445,412	594,390	470,179	2,335,293
1894	19,019,990	16,792,154	8,577,624	515,746	705,969	3,688,666
1895	19,144,390	19,545,233	8,120,125	529,482	1,208,482	4,386,132
Total.	516,657,260	133,343,773	37,179,604	4,188,325	6,683,901	11,341,664

a Including all production prior to 1876 in Ohio, West Virginia, and California.

Product of crude petroleum in the United States from 1859 to 1895—Continued.

[Barrels.]

Year.	Kentucky and Tennessee.	Illinois.	Kansas.	Texas.	Missouri.	Indian Territory.	Wyoming.	United States.
1859								2,000
1860								500,000
1861								2,113,609
1862								a3,056,690
1863								2,611,309
1864								2,116,109
1865								2,497,700
1866								3,597,700
1867								3,347,300
1868								3,646,117
1869								4,215,000
1870								5,260,745
1871								5,205,234
1872								6,293,194
1873								9,893,786
1874								10,926,945
1875								b12,162,514
1876								9,132,669
1877								13,350,363
1878								15,396,868
1879								19,914,146
1880								26,286,123
1881								27,661,238
1882	c160,933							30,510,830
1883	4,755							23,449,633
1884	4,148							24,218,438
1885	5,164							21,858,785
1886	4,726							28,064,841
1887	4,791							28,283,483
1888	5,096							27,612,025
1889	5,400	1,460	500	48	20			35,163,513
1890	6,000		1,200	54	278			45,822,672
1891	9,000		1,400	54	25	30		54,291,980
1892	6,500			45	10	80		50,509,136
1893	3,000			50	50	10		48,412,666
1894	1,500	300	40,000	60	8	130	2,369	49,344,516
1895	1,500	200	44,430	50	10	37	3,455	52,983,526
Total	222,513	1,960	87,530	361	401	287	5,824	709,713,403

a In addition to this amount, it is estimated that for want of a market some 10,000,000 barrels ran to waste in and prior to 1862 from the Pennsylvania fields; also a large amount from West Virginia and Tennessee.

b Including all production prior to 1876 in Ohio, West Virginia, and California.

c This includes all the petroleum produced in Kentucky and Tennessee prior to 1883.

From the above table it appears that the enormous total of 709,713,403 barrels of crude petroleum have been produced in the United States since the beginning of operations at Titusville, Pa., in 1859. By far the largest portion of this has been produced in what is known as the "Pennsylvania and New York oil fields," these fields producing alone 516,657,260 barrels of the total of 709,713,403 barrels, or nearly 73 per cent. Ohio has produced 133,343,773 barrels and West Virginia 37,179,604 barrels; California and Colorado have produced, respectively, 6,683,901 and 4,188,325 barrels, while Indiana, which did not figure as a producer of petroleum until 1889, has produced 11,341,664 barrels, more than one-third of which was produced in 1895.

For convenience of reference a statement is given below of the production of petroleum in the United States from 1890 to 1895, by States:

Production of petroleum in the United States from 1890 to 1895.

[Barrels of 42 gallons.]

State.	1890.	1891.	1892.
Pennsylvania and New York	28,458,208	33,009,236	28,422,377
Ohio	16,124,656	17,740,301	16,362,921
West Virginia	492,578	2,406,218	3,810,086
Colorado	368,842	665,482	824,000
California	307,360	323,600	385,049
Indiana	63,496	136,634	698,068
Kentucky	6,000	9,000	6,500
Illinois	....	....	....
Kansas	1,200	1,400	....
Texas	64	54	45
Missouri	278	25	10
Indian Territory	....	30	80
Wyoming	....	....	....
Total	45,822,672	54,291,980	50,509,136

State.	1893.	1894.	1895.
Pennsylvania and New York	20,314,513	19,019,990	19,144,390
Ohio	16,249,769	16,792,154	19,545,233
West Virginia	8,445,412	8,577,624	8,120,125
Colorado	594,390	515,746	529,482
California	470,179	705,969	1,208,482
Indiana	2,335,293	3,688,666	4,386,132
Kentucky	3,000	1,500	1,500
Illinois	....	300	200

Production of petroleum in the United States from 1890 to 1895—Continued.

[Barrels of 42 gallons.]

State.	1893.	1894.	1895.
Kansas	....	40,000	44,430
Texas	50	60	50
Missouri	50	8	10
Indian Territory	10	130	37
Wyoming	....	2,369	3,455
Total	48,412,666	49,344,516	52,983,526

EXPORTS.

In the following table are given the exports of crude petroleum and its products from the United States from 1871 to 1895, together with a statement of the production of the United States in the years named. The figures of exports are from the Statistical Abstract of the United States, published by the Bureau of Statistics, Treasury Department. The figures of production were collected by the writer.

Quantity of crude petroleum produced in, and the quantities and values of petroleum products exported from, the United States during each of the calendar years from 1871 to 1895, inclusive.

Year ending December 31—	Production.		Exports.					
			Mineral, crude (including all natural oils without regard to gravity).		Mineral, refined or manufactured.			
	Barrels (of 42 gallons).	Gallons.			Naphthas, benzine, gasoline, etc.		Illuminating.	
			Gallons.	*Dollars.*	*Gallons.*	*Dollars.*	*Gallons.*	*Dollars.*
1871	5, 205, 234	218, 619, 828	11, 278, 589	2, 171, 706	8, 396, 905	895, 910	132, 178, 843	33, 493, 351
1872	6, 293, 194	264, 314, 148	16, 363, 975	2, 761, 094	8, 688, 257	1, 307, 058	118, 259, 832	29, 456, 453
1873	9, 893, 786	415, 539, 012	19, 643, 740	2, 665, 171	10, 250, 497	1, 266, 962	207, 595, 988	41, 357, 686
1874	10, 926, 945	458, 931, 690	14, 430, 851	1, 428, 494	10, 616, 644	997, 355	206, 562, 977	30, 168, 747
1875	12, 162, 514	510, 825, 588	16, 536, 800	1, 738, 589	14, 048, 726	1, 392, 192	203, 678, 748	28, 168, 572
1876	9, 132, 669	383, 572, 098	25, 343, 271	3, 343, 763	13, 252, 751	1, 502, 498	220, 831, 608	44, 089, 066
1877	13, 350, 363	560, 715, 246	28, 773, 233	3, 267, 309	19, 565, 909	1, 938, 672	307, 373, 842	51, 366, 205
1878	15, 396, 868	646, 668, 456	24, 049, 604	2, 169, 790	13, 431, 782	1, 077, 402	306, 212, 506	36, 855, 798
1879	19, 914, 146	836, 394, 132	28, 601, 650	2, 069, 458	19, 524, 582	1, 367, 996	365, 597, 467	32, 811, 755
1880	26, 286, 123	1, 104, 017, 166	36, 748, 116	2, 772, 400	15, 115, 131	1, 344, 529	286, 131, 557	29, 047, 908
1881	27, 661, 238	1, 161, 771, 996	40, 430, 108	3, 089, 297	20, 655, 116	1, 981, 197	444, 666, 615	42, 122, 683
1882	30, 510, 830	1, 281, 454, 860	45, 011, 154	3, 373, 302	16, 969, 839	1, 304, 041	428, 424, 581	37, 635, 981
1883	23, 449, 633	984, 884, 586	59, 018, 537	4, 439, 097	17, 365, 314	1, 195, 035	440, 150, 660	39, 470, 352
1884	24, 218, 438	1, 017, 174, 396	79, 679, 395	6, 102, 810	13, 676, 421	1, 132, 528	433, 851, 275	39, 450, 794
1885	21, 858, 785	918, 068, 970	81, 435, 609	6, 040, 685	14, 739, 469	1, 160, 999	445, 880, 518	39, 476, 082
1886	28, 064, 841	1, 178, 723, 322	76, 346, 480	5, 068, 409	14, 474, 951	1, 264, 736	485, 120, 680	39, 012, 922
1887	28, 283, 483	1, 187, 906, 286	80, 650, 286	5, 141, 833	12, 382, 213	1, 049, 043	485, 242, 107	37, 007, 336
1888	27, 612, 025	1, 159, 705, 050	77, 549, 452	5, 454, 705	13, 481, 706	1, 083, 429	455, 045, 784	37, 236, 111
1889	35, 163, 513	1, 476, 867, 546	85, 189, 658	6, 134, 002	13, 984, 407	1, 208, 116	551, 769, 666	41, 215, 192
1890	45, 822, 672	1, 924, 552, 224	96, 572, 625	6, 535, 499	12, 462, 636	1, 050, 613	550, 873, 438	39, 826, 086
1891	54, 291, 980	2, 280, 263, 160	96, 722, 807	5, 365, 579	11, 424, 993	868, 137	531, 445, 099	34, 879, 759
1892	50, 509, 136	2, 121, 383, 712	104, 397, 107	4, 696, 191	16, 393, 284	1, 037, 558	589, 418, 185	31, 826, 545
1893	48, 412, 666	2, 033, 331, 972	111, 703, 508	4, 567, 391	17, 304, 005	1, 074, 710	642, 239, 816	31, 719, 404
1894	49, 344, 516	2, 072, 469, 672	121, 926, 349	4, 415, 915	15, 555, 754	943, 970	730, 368, 626	30, 676, 217
1895	52, 983, 526	2, 225, 308, 092	111, 285, 264	5, 161, 710	14, 801, 224	910, 988	714, 859, 144	34, 706, 844

Year ending December 31—	Exports—Continued.					
	Mineral, refined or manufactured—Continued. Lubricating (heavy paraffin, etc.).		Residuum (tar, pitch, and all other from which the light bodies have been distilled).		Total.	
	Gallons.	*Dollars.*	*Gallons.*	*Dollars.*	*Gallons.*	*Dollars.*
1871	240, 228	92, 408	101, 052	10, 450	152, 195, 617	36, 663, 825
1872	438, 425	180, 462	568, 218	56, 618	144, 318, 707	33, 761, 685
1873	1, 502, 503	517, 466	1, 377, 180	117, 595	240, 369, 908	45, 924, 880
1874	993, 068	269, 886	2, 504, 628	177, 794	235, 108, 168	33, 042, 276
1875	938, 052	265, 837	2, 323, 986	169, 671	237, 526, 312	31, 734, 861
1876	1, 157, 929	370, 431	2, 863, 896	239, 461	263, 449, 455	49, 545, 219
1877	1, 914, 129	577, 610	4, 256, 112	390, 077	361, 883, 225	57, 539, 873
1878	2, 525, 545	698, 182	3, 126, 816	220, 835	349, 346, 253	41, 022, 007
1879	3, 168, 561	713, 208	4, 827, 522	273, 050	421, 719, 782	37, 235, 467
1880	5, 607, 009	1, 141, 825	3, 177, 630	198, 983	346, 779, 443	34, 505, 645
1881	5, 053, 862	1, 165, 605	3, 756, 018	197, 321	514, 561, 719	48, 556, 103
1882	8, 821, 536	2, 034, 487	4, 265, 352	275, 263	503, 492, 462	44, 623, 074
1883	10, 108, 394	2, 193, 245	6, 502, 524	465, 350	533, 145, 429	47, 763, 079
1884	11, 985, 219	2, 443, 385	5, 303, 298	327, 599	544, 495, 608	49, 457, 116
1885	12, 978, 955	2, 659, 210	5, 713, 908	334, 767	560, 784, 459	49, 671, 743
1886	13, 948, 367	2, 689, 464	1, 993, 824	109, 673	591, 884, 302	48, 145, 204
1887	20, 582, 613	3, 559, 280	2, 989, 098	141, 350	601, 846, 317	46, 898, 842
1888	24, 510, 437	4, 215, 449	1, 870, 596	116, 009	572, 457, 975	48, 105, 703
1889	27, 903, 267	4, 638, 724	1, 858, 458	97, 265	680, 705, 456	53, 293, 299
1890	32, 090, 537	4, 766, 850	1, 830, 612	91, 905	693, 829, 848	52, 270, 953
1891	33, 310, 264	4, 999, 978	1, 002, 414	61, 382	673, 905, 577	46, 174, 835
1892	34, 026, 855	5, 130, 643	403, 032	38, 220	744, 638, 463	42, 729, 157
1893	32, 432, 857	4, 738, 892	541, 044	41, 661	804, 221, 230	42, 142, 058
1894	40, 190, 577	5, 449, 000	211, 008	14, 704	908, 252, 314	41, 499, 806
1895	43, 418, 942	5, 867, 477	137, 508	13, 063	884, 502, 082	46, 660, 082

FOREIGN MARKETS.

In the following table is given a statement showing the foreign markets for our oil in the past six years. As will be seen from this table, the total exports of illuminating oils have increased.

Exports of petroleum in its various forms from the United States from 1890 to 1895, by countries.

Countries.	1890.	1891.	1892.	1893.	1894.	1895.
CRUDE.						
Europe:	*Gallons.*	*Gallons.*	*Gallons.*	*Gallons.*	*Gallons.*	*Gallons.*
France	68, 947, 436	61, 663, 973	69, 100, 657	69, 424, 609	84, 434, 953	72, 802, 459
Germany	1, 188, 266	3, 107, 137	5, 247, 209	4, 182, 963	4, 877, 593	3, 966, 870
Spain	13, 934, 088	17, 103, 416	17, 064, 929	21, 112, 042	15, 176, 034	15, 188, 547
United Kingdom						3, 997, 013
Other Europe	3, 680, 631	2, 380, 600	1, 935, 014	3, 948, 842	2, 009, 727	2, 590, 441
Total	87, 750, 421	84, 255, 126	93, 347, 809	98, 668, 456	106, 498, 307	98, 545, 330
North America:						
Mexico	2, 217, 846	3, 854, 176	3, 499, 514	5, 508, 769	8, 026, 189	5, 229, 983
Cuba	4, 913, 330	3, 300, 455	6, 316, 406	6, 955, 315	6, 865, 549	6, 980, 372
Other North America	36, 806	4, 338	425, 348	548, 068	534, 304	523, 579
Total	7, 167, 982	7, 158, 969	10, 241, 268	13, 012, 152	15, 426, 042	12, 733, 934
All other countries	532, 250	1, 000	3, 690	22, 900	2, 000	6, 000
Total crude	95, 450, 653	91, 415, 095	103, 592, 767	111, 703, 508	121, 926, 349	111, 285, 264

REFINED.						
Naphthas.						
Europe:						
France	4, 195, 704	2, 831, 929	1, 561, 284	4, 080, 839	3, 764, 569	1, 564, 360
Germany	2, 015, 298	3, 227, 106	3, 471, 652	4, 127, 354	4, 278, 757	4, 900, 028
United Kingdom	5, 603, 994	5, 058, 325	6, 813, 416	8, 209, 526	6, 834, 760	7, 343, 355
Other Europe	928, 616	824, 537	686, 398	658, 270	364, 135	577, 378
Total	12, 743, 612	11, 941, 897	12, 532, 750	17, 076, 989	15, 242, 221	14, 385, 121
North America	59, 563	86, 910	35, 762	122, 237	173, 649	230, 269
South America	78, 180	71, 192	89, 609	55, 940	79, 777	135, 752
Asia and Oceanica	45, 214	55, 005	57, 787	39, 625	57, 057	45, 217
Africa	10, 864	16, 143	12, 070	9, 214	3, 050	4, 865
Total	193, 821	229, 250	195, 228	227, 016	313, 533	416, 103
Total naphthas	12, 937, 433	12, 171, 147	12, 727, 978	17, 304, 005	15, 555, 754	14, 801, 224
Illuminating.						
Europe:						
Belgium	41, 391, 323	32, 397, 015	31, 471, 121	33, 541, 439	36, 312, 974	35, 385, 765
Denmark	7, 147, 115	9, 135, 043	7, 019, 575	12, 262, 308	9, 290, 251	14, 626, 436
France	2, 088, 291	3, 764, 974	3, 005, 535	8, 161, 023	11, 812, 001	6, 204, 663
Germany	140, 264, 082	162, 187, 071	133, 417, 314	119, 277, 484	86, 388, 785	100, 829, 413
Italy	19, 747, 758	20, 955, 728	22, 324, 113	22, 815, 279	22, 945, 037	28, 017, 572
Netherlands	47, 315, 526	54, 879, 032	76, 607, 780	51, 298, 480	31, 868, 189	45, 900, 640
Sweden and Norway	11, 772, 106	8, 957, 350	11, 159, 824	16, 312, 922	9, 848, 074	24, 623, 246
United Kingdom	66, 393, 246	81, 028, 529	94, 901, 777	180, 996, 321	274, 555, 010	279, 064, 424
Other Europe	7, 464, 013	8, 759, 531	6, 450, 040	8, 654, 660	7, 232, 024	6, 586, 826
Total	343, 583, 460	382, 064, 273	386, 357, 079	453, 319, 916	490, 252, 345	541, 238, 985

Export of petroleum in its various forms from the United States from 1890 to 1895, by countries—Continued.

Countries.	1890.	1891.	1892.	1893.	1894.	1895.
REFINED—continued.						
Illuminating—Continued.						
North America:	*Gallons.*	*Gallons.*	*Gallons.*	*Gallons.*	*Gallons.*	*Gallons.*
British North America	5, 104, 864	5, 230, 259	5, 735, 411	6, 311, 042	8, 218, 417	7, 621, 352
West Indies	4, 404, 548	3, 303, 506	4, 262, 935	4, 439, 118	4, 174, 856	4, 109, 358
Other North America	2, 520, 131	3, 303, 608	2, 250, 162	2, 204, 602	1, 759, 565	1, 501, 157
Total	12, 029, 543	11, 837, 373	12, 248, 508	12, 984, 762	14, 182, 838	13, 231, 867
South America:						
Argentina	3, 113, 750	3, 476, 192	4, 825, 196	4, 070, 719	3, 162, 846	5, 876, 742
Brazil	8, 695, 291	10, 470, 656	14, 028, 476	15, 556, 685	12, 154, 709	15, 315, 196
Uruguay	3, 492, 158	3, 165, 880	4, 293, 400	2, 882, 105	2, 520, 571	3, 898, 514
Other South America	6, 236, 596	4, 792, 161	6, 827, 814	6, 041, 571	5, 503, 680	7, 245, 123
Total	21, 537, 795	21, 904, 889	29, 974, 886	28, 551, 080	23, 341, 806	32, 335, 575
Asia and Oceanica:						
China	13, 072, 000	27, 160, 660	17, 370, 600	27, 874, 230	40, 377, 296	18, 022, 800
Hongkong	11, 150, 220	10, 814, 630	16, 529, 790	12, 758, 820	16, 888, 820	10, 595, 610
East Indies	63, 456, 071	63, 285, 770	55, 907, 410	57, 404, 175	85, 907, 557	46, 680, 054
Japan	37, 892, 930	31, 000, 629	23, 761, 930	26, 869, 510	37, 272, 450	24, 298, 170
British Australasia	7, 976, 572	10, 276, 095	10, 376, 260	11, 053, 991	11, 821, 881	14, 686, 752
Other Asia and Oceanica	3, 982, 465	4, 630, 690	3, 095, 516	2, 637, 250	2, 944, 958	3, 636, 230
Total	137, 530, 258	147, 168, 474	127, 041, 536	138, 597, 976	195, 212, 962	117, 919, 616

Africa	8, 426, 714	8, 058, 806	8, 865, 999	8, 206, 932	7, 049, 455	9, 676, 741
All other countries	187, 320	85, 990	408, 650	579, 150	329, 220	456, 360
Total illuminating	523, 295, 090	571, 119, 805	564, 896, 658	642, 239, 816	730, 368, 626	714, 859, 144
Lubricating.						
Europe:						
Belgium	1, 955, 145	2, 337, 030	2, 632, 954	2, 426, 926	2, 931, 204	2, 679, 832
France	3, 088, 183	3, 948, 257	2, 461, 722	2, 426, 659	3, 050, 547	3, 271, 804
Germany	3, 670, 937	4, 186, 225	4, 512, 639	3, 798, 953	5, 637, 471	5, 378, 398
Italy	510, 622	591, 996	404, 971	788, 805	1, 356, 340	1, 381, 587
Netherlands	2, 037, 437	1, 504, 623	2, 229, 116	1, 842, 608	2, 346, 896	2, 641, 209
United Kingdom	17, 035, 447	18, 767, 573	18, 779, 806	17, 683, 132	19, 668, 767	21, 209, 497
Other Europe	146, 557	111, 165	209, 713	249, 474	415, 385	520, 025
Total	28, 444, 328	31, 446, 869	31, 240, 921	29, 216, 557	35, 406, 610	37, 082, 352
North America	524, 898	570, 380	656, 991	1, 043, 770	1, 725, 709	1, 565, 025
South America	721, 669	889, 610	798, 194	1, 207, 232	1, 509, 708	2, 159, 844
Asia and Oceanica	457, 363	582, 392	813, 618	888, 032	1, 433, 191	2, 438, 975
Africa	14, 264	25, 479	81, 352	77, 266	115, 359	172, 746
Total	1, 718, 194	2, 067, 861	2, 350, 155	3, 216, 300	4, 783, 967	6, 336, 590
Total lubricating	30, 162, 522	33, 514, 730	33, 591, 076	32, 432, 857	40, 190, 577	43, 418, 942
Residuum (barrels).						
Europe	10, 017	9, 058	6, 361	10, 404	2, 056	2, 099
North America	42, 141	28, 833	6, 622	2, 202	2, 460	1, 045
All other countries	758	175	287	276	513	130
Total residuum	52, 916	38, 066	13, 270	12, 882	5, 029	3, 274

PRODUCTION BY STATES AND FOREIGN COUNTRIES.

APPALACHIAN OIL FIELD.

The Appalachian oil field includes those oil-producing territories that lie within the limits of the well-known and well-defined Appalachian region of the eastern part of the United States. In the production of this field is included the petroleum output of New York, Pennsylvania, West Virginia, the eastern part of Ohio, and those portions of Kentucky, Tennessee, Alabama, and Georgia that are within the limits of the Appalachian region. The production of oil, however, in this region at the present time is confined chiefly to New York, Pennsylvania, West Virginia, and eastern Ohio.

The older districts in this territory are well known and have been frequently described in these reports.

PRODUCTION OF THE APPALACHIAN OIL FIELD FROM 1889 TO 1895.

Bearing in mind what has been so frequently said in these reports as to the difficulty of dividing the production by States, we give the following estimate as to the production of petroleum in the Appalachian oil field from 1889 to 1895, showing the production of the three chief producing divisions, namely: (1) Pennsylvania and New York; (2) West Virginia; (3) eastern Ohio.

Production of petroleum in the Appalachian oil field from 1889 to 1895.

[Barrels of 42 gallons.]

Year.	Pennsylvania and New York.	West Virginia.	Eastern Ohio.	Total.
1889	21, 487, 435	544, 113	318, 277	32, 349, 825
1890	28, 458, 208	492, 578	1, 116, 521	30, 067, 307
1891	33, 009, 236	2, 406, 218	424, 323	35, 839, 777
1892	28, 422, 377	3, 810, 086	1, 193, 414	33, 425, 877
1893	20, 314, 513	8, 445, 412	2, 602, 965	31, 362, 890
1894	19, 019, 990	8, 577, 624	3, 184, 310	30, 781, 924
1895	19, 144, 390	8, 120, 125	3, 694, 624	30, 959, 139

From the above table it appears that the production in this field for the last two years has been practically the same, but much below the production of 1891. The production in 1891 was 33,425,877 barrels. The production fell off about 2,400,000 barrels in 1892 as compared with 1891. It was again reduced by about 2,100,000 barrels in 1893, and still further by some 600,000 barrels in 1894, but the year 1895 shows an increase, though of something less than 200,000 barrels.

PRODUCTION IN THE APPALACHIAN OIL FIELD, BY MONTHS.

In the following table is given the production of crude petroleum in the Appalachian oil field from 1890 to 1895, by months:

Production of crude petroleum in the Appalachian field from 1890 to 1895, by months.

[Barrels.]

Month.	1890.	1891.	1892.	1893.	1894.	1895.
January	2,170,937	2,968,164	3,016,062	2,491,853	2,627,123	2,469,941
February	2,102,264	2,451,901	2,923,272	2,350,490	2,330,582	2,083,087
March	2,384,864	2,618,394	2,885,531	2,769,501	2,671,051	2,504,645
April	2,381,786	2,592,998	2,802,221	2,493,590	2,494,772	2,588,727
May	2,451,461	2,549,787	2,741,848	2,673,648	2,654,299	2,586,710
June	2,450,622	2,565,856	2,757,436	2,669,110	2,637,416	2,488,551
July	2,603,281	2,540,907	2,759,309	2,658,141	2,659,718	2,673,621
August	2,598,332	2,740,797	2,851,348	2,757,351	2,605,494	2,753,417
September	2,666,877	3,088,801	2,698,196	2,682,296	2,465,689	2,685,766
October	2,858,500	3,823,643	2,729,444	2,651,591	2,638,689	2,717,958
November	2,676,825	4,070,287	2,606,646	2,513,281	2,460,880	2,661,700
December	2,721,558	3,828,242	2,654,564	2,652,038	2,536,211	2,745,016
Total	30,067,307	35,839,777	33,425,877	31,362,890	30,781,924	30,959,139

From the above table it appears that the average monthly production of crude petroleum in the Appalachian field in 1895 was 2,579,928 barrels, and that the production in each month was remarkably uniform when the number of days in the month is taken into consideration. There are no notable increases of production in any one month in 1895 as there was in 1891, when, in the month of November, the total production was 4,070,287 barrels, as compared with 2,540,907 barrels in the July previous, the month of November of that year indicating the time of highest production in the McDonald field.

AVERAGE DAILY PRODUCTION OF THE APPALACHIAN FIELD FROM 1890 TO 1895.

The figures that are usually in the mind of the oil operator, either producer, refiner, or dealer, when production is spoken of is the average daily production.

This is given in the following table for the years from 1890 to 1895. These averages are ascertained by dividing the production of each month by the number of days in the month, and the average for the year is obtained by dividing the total production of the year by 365 or 366, as the case may be.

Average daily product of crude petroleum in the Appalachian field each month for the years 1890 to 1895, by months and years.

[Barrels.]

Month.	1890.	1891.	1892.	1893.	1894.	1895.
January	70,030	95,747	97,292	80,382	84,746	79,676
February	75,081	87,568	100,802	83,946	83,235	74,396
March	76,931	84,464	93,082	89,339	86,163	80,795
April	79,393	86,433	93,407	83,120	83,159	86,291
May	79,079	82,251	88,447	86,247	85,622	83,443
June	81,687	85,529	91,915	88,970	87,914	82,952
July	83,977	81,965	89,010	85,746	85,797	86,246
August	83,817	88,412	91,979	88,947	84,048	88,820
September	88,896	102,960	89,940	89,410	82,190	89,526
October	92,210	123,343	88,047	85,535	85,119	87,676
November	89,228	135,676	86,888	83,776	82,030	88,723
December	87,792	123,492	85,631	85,550	81,813	88,549
Average	82,376	98,191	91,328	85,926	84,334	84,820

As usually given, the tables of average daily production include only the average daily receipts from wells as published by the pipe lines—that is, the average of the runs from the wells, as they are usually termed. By the above table is meant the average total production, including some oil that is not reported in the daily returns of pipe-line runs. The average daily production in the Appalachian field for the last six months of the year was somewhat in excess of the first six months. The range of average daily production from July to December, however, was from 86,246 barrels in July to 89,526 barrels in September, and 88,549 barrels in December. The range, however, for the first six months was from 74,396 barrels in February to 86,291 barrels in April.

PIPE-LINE RUNS IN THE APPALACHIAN OIL FIELD IN 1895.

Usually the terms "production" and "pipe-line runs" are regarded as synonymous, but production is somewhat in excess of runs. The expression "pipe-line runs" means the amounts of oil which the several pipe lines receive from the wells. If all oil were sent from the wells by pipe lines, these runs would indicate the total production of petroleum in a given year less the oil remaining in tanks at the wells. In other words, on the basis that all oil was shipped from the wells by pipe lines, the total production of a year would be the total runs plus the stocks of oil on hand at the wells at the close of the year minus the well stocks at the beginning of the year. However, as some oil is not sent to the pipe lines, the table of production of the Appalachian oil field, as given elsewhere, will be greater than the pipe-line runs. The production of the Appalachian field in 1895 is given as 30,959,139 barrels. The pipe-line runs are 30,351,414 barrels, making a difference between the pipe-line runs and the production of 607,725 barrels.

In the following table will be found the pipe-line runs in the Appalachian oil field in 1895, by lines and by months:

Pipe-line runs in the Appalachian oil field in 1895, by lines and months.

[Barrels.]

Month.	National Transit.	Tide-Water.	Southwest.	Franklin.	Eureka.	Elk.
January	714,765	143,664	403,558	2,802	598,712	19,518
February	608,034	116,773	334,774	2,467	503,666	16,992
March	729,440	146,445	408,101	5,892	597,532	20,666
April	802,106	195,961	397,854	4,882	593,580	19,066
May	765,829	145,015	423,215	3,981	608,547	18,915
June	738,404	151,117	426,160	5,031	562,094	17,488
July	767,567	149,239	480,880	4,228	609,294	19,760
August	759,728	156,634	470,679	3,674	654,280	19,749
September	730,075	142,813	447,486	4,878	634,161	21,408
October	751,823	147,057	449,840	3,656	625,104	22,101
November	739,644	147,893	450,738	3,744	619,013	21,997
December	756,291	161,025	560,093	3,476	707,268	26,179
Total	8,863,706	1,803,636	5,253,378	48,711	7,313,251	243,839

Month.	Emery.	Mellon.	Producers and Refiners' Pipe Line Company, Limited.	Buckeye-Macksburg.	Total.
January	28,256	161,486	142,435	94,999	2,310,195
February	21,097	132,123	117,272	181,155	2,034,353
March	29,321	171,890	130,385	220,883	2,460,555
April	27,405	172,375	126,560	229,159	2,568,948
May	28,163	183,606	129,937	225,816	2,533,024
June	25,963	167,226	131,045	227,643	2,452,171
July	28,874	194,635	142,453	251,003	2,647,933
August	29,426	195,560	142,118	279,602	2,711,450
September	27,648	203,217	125,788	310,400	2,647,874
October	27,460	207,060	119,470	322,439	2,676,010
November	28,060	196,198	122,382	286,932	2,616,601
December	28,990		124,531	324,447	2,692,300
Total	330,663	1,985,376	1,554,376	2,954,478	30,351,414

SHIPMENTS OF OIL FROM THE APPALACHIAN FIELD.

In the following table are given the total deliveries of petroleum by the pipe lines of the Appalachian oil field from 1889 to 1895, by years and months. These figures must not be regarded as showing the actual consumption of the petroleum produced in this field. To them must be added, in order to ascertain what becomes of the oil produced in this region, all of the sediment, dump oil, or oil that does not pass through the pipe lines, as well as the oil that is destroyed by fire or accident, or disposed of in other ways than by refining and direct consumption. There is also a certain amount of loss by evaporation and otherwise. This is provided for by pipe lines in receiving oil from the producers, a certain number of gallons per barrel being allowed for such loss. Forty-four gallons are usually delivered to the pipe line as a barrel, but certificates are issued for 42 gallons only.

The table given below only shows the deliveries of oil to customers in the regular way of business. The total consumption of oil during the year can be ascertained only by adding to the production of a year the stocks at the beginning of the year and subtracting from this total the stocks at the close of the year. This will in no case be the same as deliveries. For example, at the close of 1894 the total stocks of petroleum in the Appalachian field reported in tanks was 6,499,880 barrels. The total production of this field in 1895 was 30,959,139 barrels, making a total of stocks at the beginning of the year and production during the year of 37,459,019 barrels. The total stocks at the close of the year were 5,344,784 barrels, which, subtracted from the above total of available petroleum for 1894, namely, 37,459,019, leaves a remainder of 32,114,235 barrels, which may be regarded as the total consumption of the oil produced in the Appalachian field. Pipe line deliveries were, however, but 32,032,626 barrels, which shows a consumption during 1895 of 81,609 barrels more than the pipe-line deliveries. This excess is made up of dump oil, direct deliveries, waste, and the amounts which were from time to time credited by the pipe-line companies for increase in "B. S."

Total shipments of petroleum in the Appalachian oil field from 1889 to 1895, by months.

[Barrels.]

Month.	1889.	1890.	1891.	1892.
January	2,400,456	2,681,646	2,475,783	2,420,825
February	2,288,229	2,185,007	2,170,172	2,443,546
March	2,286,948	2,184,018	2,430,705	2,586,075
April	2,244,615	2,348,385	2,157,605	2,338,421
May	2,265,150	2,488,036	2,073,199	2,278,027
June	2,277,214	2,509,056	2,163,811	2,108,386

Total shipments of petroleum in the Appalachian oil field from 1889 to 1895, by months—Continued.

[Barrels.]

Month.	1889.	1890.	1891.	1892.
July	2, 964, 866	2, 687, 061	2, 260, 996	2, 314, 405
August	2, 640, 433	2, 645, 399	2, 498, 573	2, 626, 043
September	2, 590, 127	2, 711, 887	2, 704, 645	2, 770, 472
October	2, 797, 732	2, 783, 121	2, 802, 254	2, 824, 508
November	2, 441, 055	2, 717, 439	2, 604, 135	2, 916, 265
December	2, 718, 608	2, 743, 225	2, 783, 766	2, 978, 921
Average	2, 492, 953	2, 557, 023	2, 427, 137	2, 550, 491
Total	29, 915, 433	30, 684, 280	29, 125, 644	30, 605, 894

Month.	1893.	1894.	1895.
January	2, 957, 358	3, 141, 722	3, 140, 864
February	2, 584, 742	2, 656, 026	2, 808, 801
March	2, 843, 938	2, 912, 594	2, 608, 232
April	2, 666, 199	2, 846, 805	2, 781, 379
May	3, 033, 700	2, 819, 413	2, 845, 334
June	3, 074, 443	2, 914, 400	2, 816, 698
July	3, 319, 658	2, 927, 036	2, 634, 880
August	3, 248, 873	3, 256, 397	2, 424, 843
September	3, 000, 740	2, 966, 864	2, 332, 271
October	3, 316, 914	3, 271, 371	2, 573, 915
November	3, 096, 578	3, 208, 560	2, 655, 325
December	3, 152, 238	3, 286, 087	2, 410, 084
Average	3, 024, 615	3, 017, 273	2, 669, 386
Total	36, 295, 381	36, 207, 275	32, 032, 626

From the above table it will be seen that the total shipments in 1895 of petroleum produced in the Appalachian field were nearly 4,000,000 barrels less than the shipments in 1894. The table shows an average consumption of 2,669,386 barrels a month, while the production was only about 2,579,928 barrels a month, the consumption being 1,073,487 barrels in excess of the production for the entire year, or nearly 90,000 barrels a month.

STOCKS OF PETROLEUM IN THE APPALACHIAN FIELD.

In the following table will be found a statement of the stocks of petroleum in the tanks of the pipe-line companies in the Appalachian oil field at the close of each month from 1889 to 1895:

Total stocks of petroleum in the Appalachian oil field at the close of each month from 1889 to 1895.

[Barrels of 42 gallons.]

Month.	1889.	1890.	1891.	1892.
January	18, 529, 228	11, 356, 634	11, 068, 179	16, 973, 225
February	17, 597, 956	11, 282, 453	11, 340, 147	17, 416, 399
March	16, 994, 558	11, 472, 854	11, 419, 782	17, 587, 512
April	16, 441, 298	11, 503, 776	11, 793, 604	18, 028, 753
May	16, 044, 384	11 445, 975	12 138, 347	18, 464, 378
June	15, 656, 582	11, 318, 438	12, 455, 630	19, 056, 902
July	14, 928, 784	11, 170, 539	12, 640, 790	19, 446, 441
August	14, 248, 456	11, 057, 828	12, 791, 156	19, 563, 635
September	13, 581, 845	10, 942, 934	13, 039, 230	19, 394, 242
October	12, 823, 467	10, 923, 831	13, 936, 108	19, 039, 149
November	12, 353, 863	10, 783, 567	15, 413, 864	18, 529, 914
December	11, 873, 442	10, 691, 729	16, 457, 089	18, 037, 385
Average	15, 089, 489	11, 162, 547	12, 874, 494	18, 461, 495

Month.	1893.	1894.	1895.
January	17, 305, 206	11, 755, 219	5, 859, 348
February	17, 042, 245	11, 384, 776	5, 087, 498
March	16, 834, 533	11, 295, 959	4, 942, 643
April	16, 641, 773	10, 751, 983	4, 730, 819
May	16, 285, 855	10, 639, 454	4, 506, 874
June	15, 845, 548	10, 381, 209	4, 275, 506
July	15, 182, 551	9, 869, 915	4, 306, 287
August	14, 730, 600	9, 210, 959	4, 592, 906
September	14, 261, 432	8, 730, 456	4, 908, 593
October	13, 559, 543	8, 038, 376	5, 013, 941
November	12, 904, 344	7, 283, 988	4, 988, 092
December	12, 316, 611	6, 499, 880	5, 344, 784
Average	15, 242, 520	9, 653, 515	4, 879, 775

The stocks in the above table do not include all of the stocks of oil held in the Appalachian region, but only those held by the pipe lines, stocks at the wells, as a rule, not being included unless the tanks at the wells are in the custody of the pipe-line companies and the oil has been measured as it runs into them. A notable feature in this table is the great decline in average stocks held at the close of each month in 1895 as compared with stocks at a similar period for 1894. The average stocks held at the close of each month in 1894 were 9,653,515 barrels, while the average stocks for 1895 were but 4,879,775 barrels, or, roughly, about one-half.

PRICES OF CRUDE PETROLEUM IN THE APPALACHIAN OIL FIELD.

The prices of crude petroleum in the Appalachian oil field given in the following table, which is taken from Stowell's Petroleum Reporter, show the monthly and yearly average prices of pipe-line certificate or of crude petroleum at the primary markets from 1860 to 1894. In the earlier years covered by the table there were no pipe lines, and the price given for oil is the price per barrel either at the wells or at some delivery point in the oil region, usually the price at the wells. In the later years the price given is that of pipe-line certificates, which, until recently, have been issued by the pipe-line companies, usually for 1,000 barrels each, to the owners of the oil in their tanks, these certificates being to bearer and transferable. The price quoted for these certificates is the price at the wells or at the tanks of the pipe lines near the wells into which the oil is received from the wells. As a rule, the holder of the certificate desiring to receive the oil represented by the certificate could secure it from any of the tanks of the company wherever situated—that is, on a certificate (except in unusual cases calling for a given amount of oil of a certain grade) there was no statement as to where the oil covered by the certificate was to be delivered. In such cases, however, the pipe-line company is entitled to make a charge for storage and pipage, the storage charged per month, as well as the pipage, being regulated somewhat by the selling price of the oil. In the selling price of the oil, therefore, no charges for storage in the tanks nor for transportation are included. Practically, therefore, the prices given are the prices for the oil at or near the wells.

The average prices cover only the ordinary grades of oil. They do not include the prices of special oils, such as that from the Franklin district in Pennsylvania, or the lubricating oils from Petroleum or Volcano in West Virginia, nor the oil from the Mecca-Belden district in Ohio, but only that grade of oil which is known as Pennsylvania oil and is used chiefly for the production of illuminants. It is also true that at certain times oils from different districts in the Appalachian field have been worth an advance on certificate oil, and frequently old oil or tank oil—that is, oil that has stood for some time in tanks—is worth less than fresh oil, or oil that has been recently produced. This is especially the case when there is a large demand for the lighter oils, fresh oils producing a larger percentage of the lighter products than old oil. These averages, it should be understood, are not true averages—that is, averages which consider the price and the quantity sold at that price—but they are averages of the prices obtained for certificates or for oil at the primary markets from day to day. It is probable that the true average prices would be slightly under the averages obtained by averaging the prices. The figures given in the following table are, under the circumstances, the only ones that can be ascertained, and do not vary much from the true average.

Monthly and yearly average prices of pipe-line certificates of crude petroleum at wells from 1860 to 1895.

[Per barrel.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1860	$19.25	$18.00	$12.62½	$11.00	$10.00	$9.50	$8.62½
1861	1.00	1.00	1.00	.62½	.50	.50	.50
1862	.10	.15	.22½	.50	.85	1.00	1.25
1863	2.25	2.50	2.62½	2.87½	2.87½	3.00	3.25
1864	4.00	4.37½	5.50	6.56	6.87½	9.50	12.12½
1865	8.25	7.50	6.00	6.00	7.37½	5.62½	5.12½
1866	4.50	4.40	3.75	3.95	4.50	3.87½	3.00
1867	1.87½	1.85	1.75	2.07½	2.35	1.90	2.62½
1868	1.95	2.00	2.55	2.82⅛	3.75	4.50	5.12½
1869	5.75	6.95	6.00	5.70	5.35	4.95	5.37½
1870	4.52½	4.52½	4.45	4.22½	4.40	4.17½	3.77½
1871	3.82½	4.38	4.25	4.01	4.60	3.85½	4.79
1872	4.02½	3.80	3.72½	3.52½	3.80	3.85	3.80
1873	2.60	2.20	2.12½	2.30	2.47½	2.22½	2.00
1874	1.20	1.40	1.60	1.90	1.62½	1.32½	1.02½
1875	1.03	1.52½	1.75	1.36½	1.40	1.26½	1.09
1876	1.80	2.60	2.01	2.02½	1.90½	2.01¾	2.24½
1877	3.53¼	2.70	2.67½	2.58	2.24	1.94⅝	2.07½
1878	1.43	1.65¼	1.59	1.37½	1.35¼	1.14	.98¾
1879	1.03	.98	.86¼	.78½	.76	.68⅜	.69⅞
1880	1.10¼	1.03⅛	.88¾	.78	.80	1.00	1.06¼
1881	.95½	.90⅜	.83⅜	.86¼	.81⅞	.81¼	.76⅞
1882	.83⅛	.84½	.81⅜	.78⅜	.71½	.54⅜	.57⅜
1883	.93¾	1.01	.97⅝	.94⅜	1.00⅛	1.16⅜	1.05⅞
1884	1.11	1.04⅜	.98⅛	.94	.85⅝	.68⅝	.63½
1885	.70⅞	.72⅜	.80⅜	.78½	.79	.82	.92½
1886	.88⅜	.79⅞	.77¼	.74⅛	.70	.66½	.66
1887	.70	.64⅝	.63⅜	.64⅞	.64⅛	.62⅝	.59¼
1888	.91¼	.91⅝	.98⅝	.82⅝	.86¾	.75⅞	.80⅝
1889	.86⅝	.89¼	.90⅞	.88	.83⅛	.83⅞	.95⅛
1890	1.05¾	1.05⅛	.90	.82⅝	.88⅞	.89¼	.89⅛
1891	.74¼	.78⅜	.74¼	.71½	.69¾	.68⅛	.66½
1892	.62⅜	.60¼	.57⅛	.57⅞	.57⅜	.54⅛	.52½
1893	.53½	.57⅜	.65¼	.68¾	.58¾	.60¼	.57⅝
1894	.79¾	.80⅝	.82	.84¼	.86	.89⅜	.83⅛
1895	.99	1.04⅜	1.09¾	1.79	1.74¼	1.53⅝	1.46⅝

Monthly and yearly average prices of pipe-line certificates of crude petroleum at wells from 1860 to 1895—Continued.

[Per barrel.]

Year.	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly average.
1860	$7.50	$6.62½	$5.50	$3.75	$2.75	$9.50
1861	.25	.20	.10	.10	.10	.49
1862	1.25	1.25	1.75	2.00	2.25	1.05
1863	3.37½	3.50	3.75	3.85	3.95	3.15
1864	10.12½	8.87½	7.75	10.00	11.00	8.06
1865	4.62½	6.75	8.12½	7.25	6.50	6.59
1866	3.75	4.50	3.39	3.10	2.12½	3.74
1867	3.15	3.40	3.55	2.50	1.87½	2.41
1868	4.57½	4.00	4.12½	3.75	4.35	3.62½
1869	5.57½	5.50	5.50	5.80	5.12½	5.63¾
1870	3.15	3.25	3.27½	3.22½	3.40	3.86
1871	4.66	4.65	4.82½	4.25	4.00	4.34
1872	3.58½	3.25	3.15	3.83½	3.32½	3.64
1873	1.42½	1.15	1.20	1.25	1.00	1.83
1874	.95	.95	.85	.55	.61½	1.17
1875	1.13	1.33	1.32½	1.44	1.55	1.35
1876	2.71⅝	3.81	3.37½	3.11	3.73	2.56¼
1877	2.51	2.38	2.56¾	1.91	1.80	2.42
1878	1.01	.86⅝	.82½	.89⅜	1.16	1.19
1879	.67⅛	.69⅜	.88⅛	1.05⅝	1.18⅛	.85⅞
1880	.91	.96	.96⅞	.91⅞	.91⅝	.94½
1881	.78⅛	.97⅛	.91¼	.85¼	.84⅜	.85⅞
1882	.58⅝	.72⅛	.93¾	1.14	.96	.78⅛
1883	1.08	1.12½	1.11⅛	1.14½	1.14¾	1.05¾
1884	.81⅞	.78	.71⅛	.72½	.74⅜	.83½
1885	1.00¼	1.00¾	1.05½	1.04⅜	.89⅝	.87⅞
1886	.62⅛	.63⅜	.65⅛	.71⅝	.70⅝	.71¼
1887	.60⅛	.67	.70⅞	.73⅞	.80¾	.66¾
1888	.90⅛	.93⅝	.90⅝	.85⅜	.89¼	.87⅝
1889	.99½	.99⅛	1.01⅜	1.08½	1.04⅛	.94⅛
1890	.89¼	.81⅞	.80⅛	.72⅜	.67¼	.86¾
1891	.64	.58½	.60½	.58¾	.59⅝	.67
1892	.55	.54⅜	.51⅜	.52	.53¼	.55⅝
1893	.58⅞	.64⅝	.70¾	.73⅞	.78¼	.64
1894	.81	.83	.83	.83	.91½	.83⅞
1895	1.26⅛	1.22⅜	1.24¼	1.48⅜	1.42	1.35⅞

From the above table it will be seen that the average price of petroleum in 1895 was higher than it has been since 1877. The year 1895 was one of great fluctuation in the price of oil in the Pennsylvania field, and also marked a revolution in the methods of buying the oil. For many years the price of certificates, by which was meant the certificates issued by the pipe lines representing certain amounts of oil, was taken as the price of the oil. These certificates were bought and sold on the floor of the oil exchange. On January 23, 1895, the following notice was posted at the various offices of what was known as the Seep Purchasing Agency, Mr. Joseph Seep being the purchasing agent for the Standard Oil Company: "From this date the prices quoted are not those of certificate oil, but the price paid by the Seep Purchasing Agency." In the following table is given the range of prices paid producers in the Pennsylvania region since the new system of purchasing oil went into effect, prices being given only for those dates on which changes were made:

Range of prices paid for petroleum in the Pennsylvania oil regions by the Seep Purchasing Agency in 1895.

Date.	Pennsylvania.	Tiona.	Corning.	New Castle.	Barnesville.
Jan. 23	$0.99	$1.05	$0.80	$0.52½	....
Jan. 24	1.00	1.06	.80	.52½	....
Feb. 9	1.03	1.09	.85	.52½	....
Feb. 20	1.03	1.09	.87½	.52½	....
Mar 5	1.03	1.09	.90	.52½	....
Mar. 8	1.05	1.11	.90	.52½	....
Mar. 14	1.07½	1.13½	.92½	.52½	....
Mar. 16	1.10	1.16	.92½	.52½	....
Mar. 18	1.10	1.16	.95	.52½	....
Mar. 23	1.10	1.25	.95	.52½	....
Mar. 26	1.10	1.30	.95	.52½	....
Apr. 4	1.10	1.35	.95	.52½	....
Apr. 8	1.20	1.45	1.05	.52½	....
Apr. 9	1.27	1.55	1.12	.52½	....
Apr. 10	1.35	1.65	1.20	.75	$1.10
Apr. 11	1.50	1.75	1.35	1.00	1.25
Apr. 13	1.75	2.00	1.60	1.35	1.50
Apr. 15	2.00	2.35	1.85	1.75	1.75
Apr. 16	2.25	2.75	2.10	2.00	2.00
Apr. 17	2.50	3.00	2.35	2.25	2.25
Apr. 18	2.60	3.10	3.45	2.35	2.35
Apr. 19	2.40	3.10	2.25	2.15	2.15
Apr. 20	2.25	3.00	2.10	2.00	2.00
Apr. 22	2.10	2.85	1.95	1.85	1.85
Apr. 30	2.00	2.85	1.85	1.75	1.75
May 1	1.90	2.65	1.75	1.65	1.65
May 2	1.80	2.55	1.65	1.55	1.55
May 3	1.70	2.45	1.55	1.45	1.45
May 4	1.60	2.35	1.45	1.35	1.35

Range of prices paid for petroleum in the Pennsylvania oil regions by the Seep Purchasing Agency in 1895—Continued.

Date.	Pennsylvania.	Tiona.	Corning.	New Castle.	Barnesville.
May 6	$1.55	$2.15	$1.40	$1.30	$1.30
May 7	1.50	1.90	1.35	1.25	1.25
May 8	1.50	1.75	1.35	1.25	1.40
May 9	1.55	1.80	1.40	1.30	1.45
May 10	1.60	1.85	1.45	1.35	1.50
May 13	1.65	1.90	1.50	1.40	1.55
May 20	1.67½	1.92½	1.52½	1.42½	1.57½
May 24	1.65	1.90	1.50	1.40	1.55
May 27	1.60	1.85	1.45	1.35	1.50
May 28	1.57½	1.82½	1.42½	1.32½	1.47½
May 29	1.55	1.80	1.40	1.30	1.45
May 31	1.50	1.75	1.35	1.25	1.40
June 4	1.47½	1.72½	1.32½	1.22½	1.37½
June 7	1.45	1.70	1.30	1.20	1.35
June 18	1.50	1.75	1.35	1.25	1.40
June 19	1.55	1.80	1.40	1.30	1.45
June 21	1.60	1.85	1.45	1.35	1.50
June 26	1.55	1.80	1.40	1.30	1.45
July 1	1.50	1.75	1.35	1.25	1.40
July 5	1.47½	1.72½	1.32½	1.22½	1.37½
July 6	1.45	1.70	1.30	1.20	1.35
July 12	1.47½	1.72½	1.32½	1.22½	1.37½
July 15	1.50	1.75	1.35	1.25	1.40
July 19	1.52½	1.77½	1.37½	1.27½	1.42½
July 25	1.45	1.70	1.30	1.20	1.35
July 26	1.37½	1.62½	1.22½	1.12½	1.27½
July 27	1.30	1.55	1.15	1.05	1.20
July 28	1.25	1.50	1.10	1.00	1.15
Nov. 5	1.30	1.50	1.15	1.05	1.20
Nov. 7	1.33	1.50	1.18	1.08	1.23
Nov. 11	1.38	1.55	1.23	1.13	1.28
Nov. 12	1.40	1.50	1.25	1.15	1.30
Nov. 13	1.42	1.52	1.27	1.17	1.32
Nov. 14	1.45	1.55	1.30	1.20	1.35
Nov. 15	1.48	1.58	1.33	1.23	1.38
Nov. 16	1.50	1.60	1.35	1.25	1.40
Nov. 21	1.55	1.65	1.40	1.30	1.45
Nov. 27	1.50	1.60	1.35	1.25	1.40
Nov. 29	1.47	1.57	1.32	1.22	1.37
Nov. 30	1.45	1.55	1.30	1.20	1.35
Dec. 2	1.40	1.50	1.25	1.15	1.30

Range of prices paid for petroleum in the Pennsylvania oil regions by the Seep Purchasing Agency in 1895—Continued.

Date.	Pennsylvania.	Tiona.	Corning.	New Castle.	Barnesville.
Dec. 5	$1.38	$1.48	$1.23	$1.13	$1.28
Dec. 10	1.43	1.53	1.28	1.18	1.33
Dec. 11	1.48	1.58	1.33	1.23	1.38
Dec. 12	1.50	1.60	1.35	1.25	1.40
Dec. 19	1.47	1.57	1.32	1.22	1.37
Dec. 20	1.40	1.50	1.25	1.15	1.30
Dec. 21	1.35	1.45	1.20	1.10	1.25
Dec. 24	1.40	1.50	1.25	1.15	1.30
Dec. 27	1.45	1.55	1.30	1.20	1.35
Dec. 30	1.50	1.60	1.35	1.25	1.40

WELL RECORDS IN THE APPALACHIAN OIL FIELD.

In the following table will be found statements showing the well records in the Appalachian field—that is, the number of wells completed in the Appalachian field during each month of 1895, by months and districts, and the wells completed in each year from 1891 to 1894, by months, as well as the initial daily production of new wells by months and districts for 1895, and by months from 1891 to 1895:

Total number of wells completed in the Appalachian oil fields in 1895.

Month.	Bradford.	Allegany.	Middle field.	Venango and Clarion.	Butler and Armstrong.	Southwest district.	Macksburg.	Total, entire field.
January	19	5	18	63	63	103	25	296
February	15	3	10	28	61	78	17	212
March	27	5	12	70	80	130	31	355
April	32	11	18	120	98	146	37	462
May	54	25	42	175	112	193	57	658
June	71	32	43	239	153	216	56	810
July	62	46	39	219	164	242	50	822
August	60	44	55	206	123	278	48	814
September	69	33	41	189	126	277	40	775
October	66	26	45	185	134	230	41	727
November	53	15	44	171	97	233	25	638
December	50	13	34	118	81	238	33	567
Total	578	258	401	1,783	1,292	2,364	460	7,136

The increase in the number of wells completed in each month during the last year will be noted. The total number of wells completed in the entire field increased from 3,763 in 1894 to 7,136 in 1895, nearly double. The largest number of wells completed in any one month was 822 in July. The largest number of wells completed in any one district during the year was 2,364 in the Southwest district, as compared with 1,481 in 1894.

In order that the comparative work done in this field in 1894 and 1895 may be observed, we give the following table:

Total number of wells completed in the Appalachian oil field in 1894 and 1895.

District.	Wells completed.	
	1894.	1895.
Bradford	284	578
Allegany	82	258
Middle field	215	401
Venango and Clarion	731	1,783
Butler and Armstrong	755	1,292
Southwest	1,481	2,364
Macksburg	215	460
Total	3,763	7,136

The following table, giving a statement of the number of wells completed in the Appalachian oil field for each month during the years 1891 to 1895, will make still more evident the great activity in drilling wells in 1895. The number of wells completed in 1895 is nearly double the number completed in 1894, and nearly four times the number completed in 1893.

Number of wells completed in the Appalachian oil field each month from 1891 to 1895, by months and years.

Month.	1891.	1892.	1893.	1894.	1895.
January	310	182	135	189	296
February	243	180	99	176	212
March	275	149	143	217	355
April	288	174	146	278	462
May	314	174	196	324	658
June	304	162	228	370	810
July	334	179	219	342	822
August	333	143	163	359	814
September	281	146	179	381	775
October	246	160	154	394	727
November	255	174	144	390	638
December	205	145	174	343	567
Total	3,388	1,968	1,980	3,763	7,136

The tables given do not include any wells drilled in the Franklin lubricating oil district of Pennsylvania, nor the wells drilled in the Volcano and Burning Springs districts of West Virginia that produce lubricating oil, nor will the statement given below include any of the initial production of the wells drilled in these several districts.

In the following table is given the initial daily production of new wells in the Appalachian oil field in 1895, by districts and months. By initial daily production is meant the production of the well when it is first drilled into the sand and begins producing:

Initial daily production of new wells in the Appalachian oil field in 1895.

[Barrels of 42 gallons.]

Month.	Bradford.	Allegany.	Middle field.	Venango and Clarion.	Butler and Armstrong.	Southwest district.	Macksburg.	Total, entire field.
January	88	10	76	286	2,084	3,007	387	5,938
February	56	19	82	116	1,447	1,594	348	3,662
March	187	8	101	284	1,547	3,343	680	6,150
April	217	56	190	405	1,340	3,674	506	6,388
May	326	91	272	688	2,009	3,725	748	7,859
June	432	136	311	852	1,828	5,885	465	9,909
July	330	261	281	915	1,612	4,859	528	8,786
August	419	206	289	710	1,625	8,549	406	12,204
September	376	189	206	738	1,244	11,577	398	14,728
October	408	120	271	640	1,312	6,896	269	9,916
November	342	92	351	520	1,184	7,601	284	10,374
December	250	89	261	357	841	4,974	317	7,089
Total	3,431	1,277	2,691	6,511	18,073	65,684	5,336	103,003

For comparison we give below a statement showing the initial daily production of all the producing wells drilled in the Appalachian oil field in 1894 and 1895:

Initial daily production of new wells in the Appalachian oil field in 1894 and 1895.

[Barrels.]

District.	1894.	1895.
Bradford	2,296	3,431
Allegany	326	1,277
Middle field	1,953	2,691
Venango and Clarion	3,815	6,511
Butler and Armstrong	16,592	18,073
Southwest	64,364	65,684
Macksburg	2,698	5,336
Total	92,044	103,003

Comparing the above table with the table showing the total number of wells completed, it will be seen that, notwithstanding the number of wells completed is nearly double, the total initial daily production of these new wells has only increased about 10,000 barrels, or about one-ninth. This great difference in initial daily production per well is shown in a more marked manner in the table giving the average daily initial production of new wells, excluding from the number of completed wells those that were dry holes.

Average daily production of new wells in the Appalachian oil field in 1894 and 1895, by districts.

[Barrels.]

District.	1894.	1895.
Bradford	9.6	6.8
Allegany	6	5.8
Middle field	10.6	7.8
Venango and Clarion	6.3	4.3
Butler and Armstrong	30.11	19.3
Southwest	57.26	38.4
Macksburg	20.75	15.9

We need not comment upon the falling off in initial daily production of the several fields. Even the older fields, which in previous years have shown little decline in initial daily production, now show a marked decrease.

The total daily initial production of new wells completed in the Appalachian oil field from 1891 to 1895, as far as it could be ascertained, is as follows:

Total daily initial production of new wells in the Appalachian oil field from 1891 to 1895, by months.

[Barrels.]

Month.	1891.	1892.	1893.	1894.	1895.
January	13,364	12,249	5,910	8,667	5,938
February	6,618	9,992	6,982	5,914	3,662
March	7,751	8,661	7,650	6,100	6,150
April	7,710	6,751	6,962	7,584	6,388
May	7,875	7,793	8,176	7,430	7,859
June	5,263	9,585	10,815	11,443	9,909
July	6,543	10,669	7,662	9,009	8,786
August	13,536	7,861	8,733	7,691	12,204
September	18,118	6,347	6,640	6,912	14,728
October	46,748	8,833	4,510	7,838	9,916
November	33,660	6,932	6,495	7,507	10,374
December	15,538	7,580	7,840	5,949	7,089

This table shows that the average number of rigs building in the Appalachian oil field at the close of each month in 1895 was exactly double the average number in 1894, it being 233 in 1894 and 466 in 1895. The smallest number of rigs building at the close of any one month was 270 in January; the largest number was 599, at the close of May, while at the close of December the number of rigs building was 476, as compared with 248 building at the close of 1894.

In the following table will be found a statement of the number of rigs building in the entire Appalachian oil field at the close of each month from 1891 to 1895:

Rigs building in the Appalachian oil field from 1891 to 1895.

Month.	1891.	1892.	1893.	1894.	1895.
January	233	110	108	166	270
February	195	132	107	180	353
March	218	111	132	187	380
April	186	100	159	233	457
May	208	108	144	237	599
June	234	89	135	238	564
July	182	96	116	245	576
August	188	74	114	292	490
September	131	98	91	254	486
October	156	108	110	269	464
November	142	130	143	248	472
December	112	122	193	248	476
Average	182	107	129	233	466

In the following tables will be found statements regarding the number of wells drilling but not completed at the close of each month of 1895, by districts, and also in the entire Appalachian oil field for each month from 1891 to 1895. At the close of the year there were 716 wells drilling, as compared with 456 drilling in December, 1894.

Wells in process of drilling in the Appalachian oil field in 1895.

Month.	Bradford.	Allegany.	Middle field.	Venango and Clarion.	Butler and Armstrong.	Southwest district.	Macksburg.	Total.
January	20	8	17	31	117	206	19	418
February	25	4	14	43	119	214	21	440
March	20	8	16	63	128	216	16	467
April	50	13	32	90	164	252	34	635
May	81	28	46	123	194	320	32	824
June	80	34	53	127	227	382	38	941

Wells in process of drilling in the Appalachian oil field in 1895—Continued.

Month.	Bradford.	Allegany.	Middle field.	Venango and Clarion.	Butler and Armstrong.	Southwest district.	Macksburg.	Total.
July	75	44	56	121	192	379	35	902
August	70	33	43	123	182	374	41	866
September	67	34	51	109	167	356	35	819
October	65	30	57	101	155	359	27	794
November	58	25	40	86	152	366	33	760
December	43	29	42	94	144	331	33	716
Average	54	24	39	93	162	313	30	715

Number of wells drilling in the Appalachian oil field at the close of each month from 1891 to 1895, by months and years.

Month.	1891.	1892.	1893.	1894.	1895.
January	407	264	188	269	418
February	410	273	214	282	440
March	401	251	206	330	467
April	387	230	269	345	635
May	380	233	291	410	824
June	407	258	305	430	941
July	420	204	266	498	902
August	406	244	248	484	866
September	397	236	233	489	819
October	386	246	219	469	794
November	351	228	277	451	760
December	286	238	233	456	716
Average	386	242	246	409	715

In the following table is given the well statement, showing the wells completed, the initial production, the dry holes, wells drilling, and rigs building in the Appalachian field in 1895:

Well record in the Appalachian field in 1895.

Month.	Wells completed.	Initial production.	Dry holes.	Wells drilling.	Rigs building.
		Barrels.			
January	296	5,938	76	418	270
February	212	3,662	55	440	353
March	355	6,150	87	467	380

Production of crude petroleum in Pennsylvania and New York in 1895, by districts and months—Continued.

[Barrels of 42 gallons.]

District.	October.	November.	December.	Total.
Allegany, N. Y.	48,217	55,966	57,835	637,139
Bradford, Pa.	267,865	271,955	287,763	3,244,808
Clarendon and Warren	31,354	30,570	32,693	369,747
Middle district	97,102	68,957	75,778	1,149,404
Tiona	29,083	25,874	27,816	325,843
Tidioute and Titusville				50,129
Grand Valley				20,988
Lower district	606,724	618,489	629,082	6,904,355
Second Sand				260,872
Washington County	130,292	142,875	172,379	1,676,676
Allegheny County, Pa.	355,056	331,074	357,909	3,864,111
Beaver County	39,941	37,571	36,199	472,276
Greene County	11,726	7.498	10,882	116,931
Total	1,617,360	1,590,829	1,688,336	19,093,279
Franklin district	3,656	3,744	3,476	48,711
Smiths Ferry district	200	200	200	*a*2,400
Grand total	1,621,216	1,594,773	1,692,012	19,144,390

a This production only represents dump oil, the pipe-line runs of this district being included in runs of Beaver County.

The production of New York includes all the oil produced in the Allegany district and about 8½ per cent of that produced in the Bradford district, this percentage being the production of Cattaraugus County, N. Y. On this basis the total production of crude petroleum in the State of New York would be 912,948 barrels. The remainder of the 19,144,390 barrels of production shown in the previous table should be credited to Pennsylvania, which makes the total production of this State, including the Franklin district and Smiths Ferry dump oil, 18,231,442 barrels.

This table shows remarkable increases in certain districts and remarkable decreases in others. For instance, the Lower district increased from 5,760,574 barrels in 1894 to 6,904,355 barrels in 1895. Washington County and the Bradford district about maintain their production of 1894, but Allegheny County has dropped from 4,559,342 barrels in 1894 to 3,864,111 barrels in 1895. The total production remains about the same, the increase being only from 19,019,990 barrels in 1894 to 19,144,390 barrels in 1895, or 124,400 barrels.

In the following table is given the total production of crude petroleum in the Pennsylvania and New York oil fields for the twenty-five years from 1871 to 1895.

Wells in process of drilling in the Appalachian oil field in 1895—Continued.

Month.	Brad-ford.	Alle-gany.	Mid-dle field.	Venan-go and Clarion.	Butler and Arm-strong.	South-west dis-trict.	Macks-burg.	Total.
July	75	44	56	121	192	379	35	902
August	70	33	43	123	182	374	41	866
September	67	34	51	109	167	356	35	819
October	65	30	57	101	155	359	27	794
November	58	25	40	86	152	366	33	760
December	43	29	42	94	144	331	33	716
Average	54	24	39	93	162	313	30	715

Number of wells drilling in the Appalachian oil field at the close of each month from 1891 to 1895, by months and years.

Month.	1891.	1892.	1893.	1894.	1895.
January	407	264	188	269	418
February	410	273	214	282	440
March	401	251	206	330	467
April	387	230	269	345	635
May	380	233	291	410	824
June	407	258	305	430	941
July	420	204	266	498	902
August	406	244	248	484	866
September	397	236	233	489	819
October	386	246	219	469	794
November	351	228	277	451	760
December	286	238	233	456	716
Average	386	242	246	409	715

In the following table is given the well statement, showing the wells completed, the initial production, the dry holes, wells drilling, and rigs building in the Appalachian field in 1895:

Well record in the Appalachian field in 1895.

Month.	Wells com-pleted.	Initial pro-duction.	Dry holes.	Wells drilling.	Rigs building.
		Barrels.			
January	296	5,938	76	418	270
February	212	3,662	55	440	353
March	355	6,150	87	467	380

Well record in the Appalachian field in 1895—Continued.

Month.	Wells completed.	Initial production.	Dry holes.	Wells drilling.	Rigs building.
		Barrels.			
April	462	6,388	110	635	457
May	658	7,859	119	824	599
June	810	9,909	170	941	564
July	822	8,786	181	902	576
August	814	12,204	185	866	490
September	775	14,728	169	819	486
October	727	9,916	176	794	464
November	638	10,374	139	760	472
December	567	7,089	121	716	476
Total	7,136	103,003	1,588	*a* 715	*a* 466

a Average.

PENNSYLVANIA-NEW YORK OIL FIELD.

PRODUCTION.

In the statistics of production, shipments, stocks, etc., of the Appalachian oil field previously given are included the statistics of Pennsylvania and New York, as well as West Virginia and eastern Ohio, these four localities making up the Appalachian field. It is both interesting and important, so far as it can be done, to give the statistics of production for each of these States. This is especially necessary regarding Pennsylvania and New York, as for many years the statistics of petroleum in the United States were practically those of the production in these two States. Therefore, a comparison of the increase or decrease in production should be made on the basis of the ascertained statistics of production in these two States. What has been stated already regarding the difficulty of ascertaining the exact figures for the several States separately for certain items should be recalled. There is but little difficulty in ascertaining the production of the several States, but it has been found impossible in some cases to separate the stocks, shipments, etc., of the four States comprising this field.

In the following table is given a statement of the production of crude petroleum in New York and Pennsylvania in 1895, by districts and months.

Production of crude petroleum in Pennsylvania and New York in 1895, by districts and months.

[Barrels of 42 gallons.]

District.	January.	February.	March.	April.	May.
Allegany, N. Y	49,457	37,162	57,374	64,478	52,567
Bradford, Pa	268,333	218,758	270,608	290,237	274,177
Clarendon and Warren	30,504	24,014	31,242	33,312	31,309
Middle district	92,144	79,074	95,066	92,119	100,382
Tiona	26,608	21,449	29,218	30,699	28,075
Tidioute and Titusville	12,000	10,500	11,500	12,854	3,275
Grand Valley	3,000	2,500	5,000	6,611	3,877
Lower district	570,720	483,045	553,614	582,371	582,144
Second Sand	27,320	21,324	31,122	51,949	31,227
Washington County	127,997	182,482	119,991	118,765	127,872
Allegheny County, Pa	315,364	196,048	322,816	317,813	338 640
Beaver County	38,362	31,391	41,275	42,166	43,332
Greene County	5,931	7,908	10,969	7,980	9,771
Total	1,567,740	1,315,655	1,579,795	1,651,354	1,626,648
Franklin district	2,802	2,467	5,892	4,882	3,981
Smiths Ferry district	200	200	200	200	200
Grand total	1,570,742	1,318,322	1,585,887	1,656,436	1,630,829

District.	June.	July.	August.	September.
Allegany, N.Y	53,034	53,132	55,365	52,552
Bradford, Pa	264,236	281,237	286,085	263,554
Clarendon and Warren	31,412	32,576	31,260	29,501
Middle district	106,247	113,169	115,872	113,494
Tiona	27,106	27,578	27,509	24,828
Tidioute and Titusville	....	....	....	....
Grand Valley	....	....	....	....
Lower district	552,506	581,900	569,377	574,383
Second Sand	31,571	31,827	34,532	....
Washington County	128,309	143,606	145,567	136,541
Allegheny County, Pa	319,989	304,644	360,197	344,561
Beaver County	40,344	41,866	42,067	37,762
Greene County	15,955	9,995	9,874	8,442
Total	1,570,709	1,621,530	1,677,705	1,585,618
Franklin district	5,031	4,228	3,674	4,878
Smiths Ferry district	200	200	200	200
Grand total	1,575,940	1,625,958	1,681,579	1,590,696

Production of crude petroleum in Pennsylvania and New York in 1895, by districts and months—Continued.

[Barrels of 42 gallons.]

District.	October.	November.	December.	Total.
Allegany, N. Y.	48,217	55,966	57,835	637,139
Bradford, Pa.	267,865	271,955	287,763	3,244,808
Clarendon and Warren	31,354	30,570	32,693	369,747
Middle district	97,102	68,957	75,778	1,149,404
Tiona	29,083	25,874	27,816	325,843
Tidioute and Titusville	....	....	....	50,129
Grand Valley	....	....	....	20,988
Lower district	606,724	618,489	629,082	6,904,355
Second Sand	....	....	....	260,872
Washington County	130,292	142,875	172,379	1,676,676
Allegheny County, Pa.	355,056	331,074	357,909	3,864,111
Beaver County	39,941	37,571	36,199	472,276
Greene County	11,726	7,498	10,882	116,931
Total	1,617,360	1,590,829	1,688,336	19,093,279
Franklin district	3,656	3,744	3,476	48,711
Smiths Ferry district	200	200	200	a2,400
Grand total	1,621,216	1,594,773	1,692,012	19,144,390

a This production only represents dump oil, the pipe-line runs of this district being included in runs of Beaver County.

The production of New York includes all the oil produced in the Allegany district and about 8½ per cent of that produced in the Bradford district, this percentage being the production of Cattaraugus County, N. Y. On this basis the total production of crude petroleum in the State of New York would be 912,948 barrels. The remainder of the 19,144,390 barrels of production shown in the previous table should be credited to Pennsylvania, which makes the total production of this State, including the Franklin district and Smiths Ferry dump oil, 18,231,442 barrels.

This table shows remarkable increases in certain districts and remarkable decreases in others. For instance, the Lower district increased from 5,760,574 barrels in 1894 to 6,904,355 barrels in 1895. Washington County and the Bradford district about maintain their production of 1894, but Allegheny County has dropped from 4,559,342 barrels in 1894 to 3,864,111 barrels in 1895. The total production remains about the same, the increase being only from 19,019,990 barrels in 1894 to 19,144,390 barrels in 1895, or 124,400 barrels.

In the following table is given the total production of crude petroleum in the Pennsylvania and New York oil fields for the twenty-five years from 1871 to 1895.

Total product of crude petroleum in the Pennsylvania and New York oil fields from 1871 to 1895, by months and years.

[Barrels of 42 gallons.]

Year.	January.	February.	March.	April.	May.
1871......	418, 407	372, 568	400, 334	385, 980	408, 797
1872......	583, 575	462, 985	461, 590	462, 090	537, 106
1873......	632, 617	608, 300	665, 291	641, 520	776, 364
1874......	1, 167, 243	835, 492	883, 438	778, 740	895, 745
1875......	852, 159	719, 824	789, 539	675, 060	696, 508
1876......	712, 225	668, 885	718, 177	701, 490	735, 351
1877......	842, 890	783, 216	901, 697	972, 810	1, 127, 594
1878......	1, 203, 296	1, 094, 856	1, 208, 380	1, 195, 890	1, 264, 862
1879......	1, 369, 921	1, 261, 935	1, 499, 315	1, 530, 450	1, 644, 922
1880......	1, 904, 113	1, 870, 008	2, 015, 992	2, 015, 700	2, 228, 931
1881......	2, 244, 090	1, 913, 128	2, 274, 532	2, 205, 780	2, 393, 293
1882......	2, 353, 551	2, 131, 332	2, 482, 170	2, 402, 790	2, 486, 572
1883......	1, 948, 319	1, 756, 188	1, 830, 674	1, 816, 530	1, 962, 052
1884......	1, 825, 838	1, 880, 650	2, 052, 262	2, 065, 860	2, 381, 854
1885......	1, 652, 176	1, 437, 884	1, 638, 133	1, 780, 290	1, 771, 371
1886......	1, 748, 958	1, 604, 848	1, 928, 448	1, 938, 360	2, 178, 373
1887......	1, 990, 851	1, 827, 924	2, 007, 196	1, 960, 860	1, 993, 517
1888......	1, 155, 937	1, 290, 718	1, 338, 877	1, 349, 403	1, 473, 362
1889......	1, 542, 806	1, 332, 482	1, 628, 661	1, 635, 933	1, 821, 776
1890......	2, 108, 248	2, 055, 424	2, 313, 189	2, 328, 870	2, 378, 382
1891......	2, 830, 081	2, 287, 320	2, 360, 011	2, 337, 498	2, 288, 656
1892......	2, 786, 528	2, 703, 663	2, 657, 432	2, 574, 814	2, 485, 040
1893......	1, 723, 918	1, 671, 620	1, 900, 363	1, 682, 271	1, 763, 655
1894......	1, 579, 420	1, 432, 251	1, 662, 595	1, 537, 500	1, 628, 149
1895......	1, 570, 742	1, 318, 322	1, 585, 887	1, 656, 436	1, 630, 829

Year.	June.	July.	August.	September.
1871......	410, 340	456, 475	462, 582	461, 940
1872......	491, 130	517, 762	549, 909	500, 430
1873......	793, 470	867, 473	936, 138	954, 270
1874......	621, 750	1, 033, 447	931, 519	840, 630
1875......	696, 210	788, 361	718, 766	698, 940
1876......	723, 600	763, 623	782, 223	780, 600
1877......	1, 130, 790	1, 189, 005	1, 273, 759	1, 214, 910
1878......	1, 217, 250	1, 283, 865	1, 341, 928	1, 315, 710
1879......	1, 675, 650	1, 637, 767	1, 892, 302	1, 856, 700
1880......	2, 158, 440	2, 248, 430	2, 341, 027	2, 346, 300
1881......	2, 377, 860	2, 372, 678	2, 331, 727	2, 193, 420
1882......	2, 825, 940	3, 258, 162	3, 104, 495	2, 620, 380
1883......	1, 977, 900	2, 020, 394	1, 879, 437	1, 913, 370

Total product of crude petroleum in the Pennsylvania and New York oil fields, etc.—Cont'd.

[Barrels of 42 gallons.]

Year.	June.	July.	August.	September.
1884......	1, 862, 190	2, 059, 950	2, 099, 165	1, 948, 260
1885......	1, 767, 210	1, 775, 804	1, 705, 961	1, 712, 790
1886......	2, 335, 380	2, 418, 961	2, 413, 206	2, 418, 540
1887......	1, 912, 860	1, 899, 525	1, 848, 877	1, 779, 930
1888......	1, 450, 703	1, 394, 847	1, 382, 077	1, 273, 080
1889......	1, 811, 485	1, 954, 168	1, 964, 227	1, 867, 610
1890......	2, 370, 001	2, 524, 206	2, 514, 968	2, 584, 949
1891......	2, 316, 988	2, 289, 089	2, 473, 398	2, 837, 562
1892......	2, 439, 346	2, 360, 886	2, 328, 596	2, 125, 511
1893......	1, 780, 836	1, 720, 088	1, 691, 652	1, 614, 021
1894......	1, 663, 964	1, 624, 767	1, 612, 212	1, 512, 116
1895......	1, 575, 940	1, 625, 958	1, 681, 579	1, 590, 696

Year.	October.	November.	December.	Total.
1871......	485, 243	464, 610	477, 958	5, 205, 234
1872......	442, 432	638, 610	645, 575	6, 293, 194
1873......	942, 493	991, 470	1, 084, 380	9, 893, 786
1874......	919, 739	861, 060	858, 142	10, 926, 945
1875......	731, 073	700, 200	720, 874	8, 787, 514
1876......	809, 162	786, 480	787, 090	8, 968, 906
1877......	1, 269, 326	1, 173, 420	1, 256, 058	13, 135, 475
1878......	1, 369, 797	1, 348, 950	1, 318, 678	15, 163, 462
1879......	1, 836, 378	1, 710, 480	1, 769, 356	19, 685, 176
1880......	2, 385, 636	2, 274, 420	2, 238, 634	26, 027, 631
1881......	2, 323, 171	2, 266, 830	2, 480, 000	27, 376, 509
1882......	2, 297, 658	2, 192, 940	1, 897, 510	30, 053, 500
1883......	2, 076, 659	1, 958, 340	1, 988, 526	23, 128, 389
1884......	1, 961, 866	1, 811, 700	1, 822, 614	23, 772, 209
1885......	1, 874, 105	1, 761, 660	1, 898, 657	20, 776, 041
1886......	2, 408, 111	2, 222, 790	2, 181, 625	25, 798, 000
1887......	1, 843, 291	1, 125, 450	1, 288, 602	*a* 21, 478, 883
1888......	1, 304, 518	1, 442, 405	1, 582, 741	16, 488, 668
1889......	1, 959, 169	1, 913, 871	2, 055, 247	21, 487, 435
1890......	2, 750, 698	2, 575, 941	2, 626, 035	*b* 29, 130, 910
1891......	3, 575, 911	3, 834, 262	3, 578, 460	33, 009, 236
1892......	2, 072, 022	1, 950, 553	1, 937, 986	28, 422, 377
1893......	1, 616, 391	1, 533, 555	1, 616, 143	20, 314, 513
1894......	1, 640, 982	1, 527, 752	1, 598, 282	19, 019, 990
1895......	1, 621, 216	1, 594, 773	1, 692, 012	19, 144, 390

a Not including 877,310 barrels dump oil and oil shipped by private lines.
b Pipe-line runs.

In the following table is given a statement of the average daily production of crude petroleum in the Pennsylvania and New York oil fields for each month, from 1871 to 1895. We desire to repeat that this table is not the same as the daily average receipts published by the pipe lines, but the daily average production, the total production including some oil that is not reported in the daily returns of the pipe lines. The averages are obtained by dividing the product of each month, in the table given elsewhere, by the number of days in each month, and the production of the year by 365 or 366, as the case may be.

Average daily product of crude petroleum in the Pennsylvania and New York fields each month for the years 1871–1895, by months and years.

[Barrels.]

Year.	January.	February.	March.	April.	May.	June.
1871....	13,497	13,306	12,914	12,866	13,187	13,678
1872....	18,825	15,965	14,890	15,403	17,326	16,371
1873....	20,407	21,725	21,461	21,384	25,044	26,449
1874....	37,653	29,839	28,598	25,958	28,895	30,725
1875....	27,489	25,708	25,469	22,502	22,468	23,207
1876....	22,975	23,065	23,167	23,383	23,721	24,120
1877....	27,190	27,979	29,087	32,427	36,374	37,693
1878....	38,816	39,102	38,980	39,863	40,802	40,575
1879....	44,191	43,515	48,365	51,015	53,062	55,855
1880....	61,423	64,552	65,032	67,190	71,901	71,948
1881....	72,390	68,326	73,372	73,526	77,203	79,262
1882....	75,921	76,119	80,070	80,093	80,212	94,198
1883....	62,849	62,721	59,054	60,551	63,292	65,930
1884....	58,898	64,850	66,202	68,862	76,834	62,073
1885....	53,296	51,353	52,843	59,343	59,141	58,907
1886....	56,418	57,316	62,208	64,612	70,283	77,846
1887....	64,221	65,283	64,716	65,372	64,307	63,762
1888....	37,228	44,508	43,190	44,980	47,528	48,357
1889....	49,768	47,589	52,537	54,531	58,767	60,382
1890....	68,008	73,408	74,619	77,629	76,722	79,000
1891....	91,293	81,690	76,129	77,917	73,828	77,233
1892....	89,888	93,230	85,724	85,827	80,163	81,312
1893....	55,610	59,701	61,302	56,076	56,505	59,361
1894....	50,949	51,152	53,632	51,250	52,521	55,465
1895....	50,669	47,083	51,093	55,215	52,607	52,531

Average daily product of crude petroleum in the Pennsylvania and New York fields each month for the years 1871-1895, by months and years—Continued.

[Barrels.]

Year.	July.	August.	September.	October.	November.	December.	Yearly averages.
1871....	14,725	14,922	15,398	15,653	15,487	15,418	14,261
1872....	16,702	17,739	16,681	14,272	21,287	20,825	17,194
1873....	27,983	30,198	31,809	30,403	33,049	34,980	27,106
1874....	33,337	30,049	28,021	29,669	28,702	27,682	29,937
1875....	25,431	23,186	23,298	23,583	23,340	23,254	24,075
1876....	24,633	25,233	26,020	26,102	26,216	25,390	24,505
1877....	38,335	41,089	40,497	40,946	39,114	40,518	35,988
1878....	41,415	43,288	43,857	44,187	44,965	42,538	41,544
1879....	56,057	61,042	61,890	59,238	57,016	57,076	54,206
1880....	72,530	75,517	78,210	76,956	75,814	72,214	71,114
1881....	76,538	75,217	73,114	74,941	75,561	80,000	75,004
1882....	105,102	100,145	87,346	74,118	73,098	61,210	82,338
1883....	65,174	60,627	63,779	66,989	65,278	64,146	63,365
1884....	66,450	67,715	64,942	63,286	60,390	58,794	65,129
1885....	57,284	55,031	57,093	60,455	58,722	61,247	56,921
1886....	78,031	78,426	80,618	77,681	74,093	70,375	70,679
1887....	61,275	59,641	59,321	61,822	37,515	41,568	58,846
1888....	44,995	44,661	42,436	43,694	48,080	51,057	45,058
1889....	63,037	63,362	62,254	63,199	63,796	66,298	58,869
1890....	81,426	81,128	86,165	88,732	85,865	84,710	79,810
1891....	73,842	79,787	94,585	115,352	127,809	115,434	90,436
1892....	76,158	75,116	70,850	66,839	65,018	62,516	77,657
1893....	55,487	54,569	53,801	52,142	51,119	52,133	55,656
1894....	52,412	52,007	50,404	52,935	50,925	51,557	52,110
1895....	52,450	54,244	53,023	52,299	53,159	54,581	52,450

NOTE.—Yearly average is the total product divided by the number of days in the year, not an average of monthly averages.

SHIPMENTS OF PETROLEUM FROM PENNSYLVANIA AND NEW YORK.

The following table gives a statement of the number of barrels of crude pretroleum, or, in the early history of the oil field, refined petroleum reduced to its equivalent, shipped out of the New York and Pennsylvania oil regions, either by pipe lines, river, or railway, from 1871 to 1895, inclusive. In some years, especially in the earlier ones covered by this table, a considerable portion of the oil was shipped as refined. When the tables were prepared for these years, the oil shipped was reduced to its equivalent in crude, a barrel of crude being regarded as yielding three-fourths of a barrel of refined, or a barrel of refined was regarded as being produced from $1\frac{1}{3}$ barrels of crude.

Shipments of crude and refined petroleum, reduced to crude equivalent, out of the Pennsylvania and New York oil fields from 1871 to 1895, by months and years.

[Barrels of 42 gallons.]

Year.	January.	February.	March.	April.	May.
1871......	437, 691	347, 718	383, 890	389, 147	587, 375
1872......	476, 966	407, 606	276, 220	428, 512	510, 417
1873......	573, 124	527, 440	668, 374	708, 191	768, 176
1874......	843, 663	501, 220	518, 246	803, 409	899, 027
1875......	453, 095	327, 776	693, 918	729, 581	681, 679
1876......	677, 289	519, 193	623, 762	603, 037	646, 150
1877......	743, 461	484, 904	913, 919	903, 526	1, 234, 324
1878......	775, 791	774, 234	3, 741, 512	846, 632	960, 894
1879......	663, 998	702, 729	973, 879	1, 136, 188	1, 331, 469
1880......	1, 650, 409	1, 395, 151	1, 613, 371	842, 268	1, 095, 259
1881......	1, 061, 617	915, 028	1, 276, 746	1, 348, 398	1, 563, 436
1882......	1, 657, 067	1, 787, 909	1, 718, 956	1, 678, 134	1, 827, 356
1883......	1, 357, 815	1, 250, 824	1, 641, 899	1, 908, 379	1, 995, 634
1884......	1, 686, 961	1, 723, 261	1, 873, 890	1, 643, 336	1, 899, 329
1885......	1, 804, 028	1, 895, 021	1, 887, 034	1, 823, 726	2, 097, 099
1886......	1, 991, 561	2, 032, 794	2, 055, 750	2, 070, 468	2, 032, 672
1887......	2, 312, 067	1, 995, 757	2, 332, 324	1, 938, 278	2, 328, 564
1888......	2, 265, 109	2, 163, 957	1, 979, 753	1, 928, 435	1, 773, 994
1889......	2, 388, 609	2, 272, 060	2, 263, 009	2, 236, 004	2, 256, 120
1890......	2, 637, 339	2, 146, 108	2, 148, 977	2, 317, 410	2, 474, 966
1891......	2, 421, 419	2, 133, 068	2, 384, 720	2, 123, 461	2, 022, 510
1892......	2, 363, 380	2, 391, 162	2, 534, 230	2, 314, 082	2, 246, 579
1893......	2, 910, 650	2, 534, 311	2, 808, 577	2, 643, 906	2, 965, 269
1894......	3, 106, 572	2, 613, 677	2, 880, 354	2, 824, 620	2, 788, 972
1895......	3, 081, 219	2, 765, 469	2, 554, 109	2, 734, 478	2, 834, 232

Year.	June.	July.	August.	September.
1871......	501, 754	541, 137	528, 134	551, 075
1872......	529, 228	591, 238	621, 954	541, 607
1873......	696, 414	814, 449	864, 768	952, 955
1874......	815, 413	940, 281	793, 865	1, 014, 570
1875......	745, 986	904, 537	882, 089	1, 109, 392
1876......	921, 862	1, 228, 539	1, 203, 402	1, 154, 549
1877......	1, 391, 124	1, 096, 951	1, 425, 943	1, 563, 797
1878......	1, 135, 119	1, 330, 454	1, 655, 651	1, 434, 225
1879......	1, 369, 314	1, 625, 035	1, 808, 239	1, 627, 120
1880......	975, 083	1, 231, 611	1, 394, 129	1, 252, 635
1881......	1, 729, 697	1, 925, 532	2, 214, 877	2, 131, 950
1882......	2, 172, 685	2, 402, 970	2, 047, 545	1, 992, 171

Shipments of crude and refined petroleum, reduced to crude equivalent, out of the Pennsylvania and New York oil fields from 1871 to 1895, by months and years—Continued.

[Barrels of 42 gallons.]

Year.	June.	July.	August.	September.
1883	1,747,789	1,634,407	2,086,478	2,325,574
1884	1,827,553	1,740,021	2,000,371	2,292,087
1885	2,034,025	1,961,152	2,049,099	2,116,659
1886	2,117,489	2,418,961	2,059,299	2,157,323
1887	2,165,439	2,000,173	2,220,768	2,342,227
1888	1,956,115	2,098,531	2,223,263	2,289,486
1889	2,268,280	2,949,597	2,625,825	2,567,459
1890	2,486,205	2,640,668	2,538,224	3,648,418
1891	2,086,985	2,212,908	2,445,092	2,648,522
1892	2,017,080	2,261,716	2,582,075	2,717,104
1893	3,025,473	3,264,391	3,200,585	2,962,345
1894	2,869,592	2,890,581	3,208,909	2,938,593
1895	2,814,638	2,634,173	2,422,594	2,330,147

Year.	October.	November.	December.	Total.
1871	505,071	480,977	410,822	5,664,791
1872	607,468	477,945	430,786	5,899,947
1873	1,010,852	959,589	955,443	9,499,775
1874	543,341	546,117	602,348	8,821,500
1875	871,917	671,066	871,902	8,942,938
1876	524,190	871,496	1,190,983	10,164,452
1877	1,268,971	1,205,634	600,019	12,832,573
1878	1,747,390	1,281,410	992,688	13,676,000
1879	1,662,269	1,453,645	1,532,585	15,886,470
1880	1,665,933	1,226,030	1,335,613	15,677,492
1881	2,080,467	2,066,906	1,969,581	20,284,235
1882	2,089,428	1,404,640	1,121,453	21,900,314
1883	2,215,421	2,065,602	1,749,547	21,979,369
1884	2,510,283	2,078,261	2,382,244	23,657,597
1885	2,050,150	1,857,080	2,138,253	23,713,326
1886	2,441,848	2,724,796	2,550,891	26,653,852
1887	2,573,008	3,462,082	2,608,341	27,279,028
1888	1,558,115	2,503,491	2,397,782	25,138,031
1889	2,747,284	2,393,131	2,671,518	29,638,898
1890	2,725,341	2,662,898	2,889,525	30,116,075
1891	2,740,859	2,539,848	2,725,993	28,485,385
1892	2,759,516	2,860,266	2,925,671	29,972,861
1893	3,269,325	3,039,318	3,105,047	35,729,197
1894	3,222,241	3,160,448	3,246,019	35,750.578
1895	2,569,552	2,648,609	2,406,751	31,795,971

This table is not accurate, as it includes some oil shipped from West Virginia and eastern Ohio. Possibly three-fourths of a million barrels would cover the oil so shipped. For the latter years covered in the above table the shipments are pipe-line deliveries and do not include any dump oil or oil delivered to refiners or other parties without passing through the pipe lines.

DRILLING WELLS IN THE PENNSYLVANIA AND NEW YORK OIL REGIONS.

In the following table will be found a statement of the number of drilling wells completed in each month from January, 1872, to the close of 1895, in Pennsylvania, New York, Ohio, and West Virginia, by months and years. It has not been possible to separate the wells drilling in West Virginia in all cases from those drilling in Pennsylvania and Ohio:

Number of drilling wells completed in the Pennsylvania, New York, and northern West Virginia oil fields each month from 1872 to 1895.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1872 ..	37	120	89	121	135	84	128	118	82	100	64	105	1,183
1873 ..	93	94	100	105	102	130	114	120	106	101	100	98	1,263
1874 ..	102	104	110	113	109	101	121	107	104	120	106	120	1,317
1875 ..	190	187	195	186	172	190	200	210	201	220	217	230	2,398
1876 ..	240	231	242	200	202	261	248	270	209	273	272	272	2,920
1877 ..	281	241	291	269	320	403	317	255	322	467	391	382	3,929
1878 ..	274	226	211	409	470	269	203	186	174	229	248	165	3,064
1879 ..	136	132	238	270	402	330	327	283	210	232	227	261	3,048
1880 ..	320	230	367	500	426	310	338	368	356	364	336	302	4,217
1881 ..	222	220	271	316	406	374	336	332	312	322	363	406	3,880
1882 ..	347	340	385	432	469	340	185	253	164	117	150	122	3,304
1883 ..	125	126	142	209	231	228	261	309	321	321	302	272	2,847
1884 ..	229	227	256	298	311	244	268	145	89	59	73	66	2,265
1885 ..	64	62	82	116	213	242	217	283	356	397	384	345	2,761
1886 ..	270	280	291	328	343	365	357	313	253	272	221	185	3,478
1887 ..	158	162	138	160	148	162	159	142	134	100	101	96	1,660
1888 ..	57	52	56	49	56	97	82	96	132	229	307	302	1,515
1889 ..	284	288	353	401	431	537	549	508	478	559	540	471	*a*5,435
1890 ..	553	482	522	556	534	571	555	579	571	567	520	348	6,358
1891 ..	310	243	275	288	314	304	334	333	281	237	245	197	3,361
1892 ..	175	171	137	167	170	154	174	141	142	158	160	143	1,892
1893 ..	125	84	130	127	172	213	193	145	158	139	137	167	1,790
1894 ..	180	170	202	261	307	349	319	341	362	373	368	316	3,548
1895 ..	271	195	324	425	601	754	772	766	735	686	613	534	6,676

a Including 36 wells drilled in Franklin district data for which by months were not obtainable.

WEST VIRGINIA.

The oil fields of West Virginia are extensions of the New York-Pennsylvania field, and the conditions under which the oil is found, not only in West Virginia, but in eastern Ohio, are similar to those under which it occurs in southwestern Pennsylvania. It is also true, as a rule, that the character of the petroleum is identical with that from Pennsylvania, except a portion of that from the Volcano and Petroleum districts, where a lubricating oil of high grade is produced.

As nearly as can be ascertained the production of West Virginia in 1895 was 8,120,125 barrels, of which 8,109,782 barrels are classed as illuminating and 10,343 barrels as lubricating oil. The total value of this product was $11,038,770, an average of $1.36 a barrel. The average value per barrel of the illuminating oil is given as $1.35\frac{6}{7}$ and the lubricating as $2.04.

The production of crude petroleum in West Virginia, by months, from 1890 to 1895 is shown in the following table:

Total production of crude petroleum in West Virginia, by months, from 1890 to 1895.

Month.	1890.	1891.	1892.	1893.	1894.	1895.
January	38, 644	48, 902	195, 512	577, 933	838, 400	647, 220
February	38, 061	123, 841	186, 455	468, 794	684, 532	541, 511
March	44, 842	229, 966	185, 468	630, 877	754, 398	642, 222
April	39, 804	226, 020	181, 708	594, 190	688, 458	616, 862
May	39, 160	232, 076	206, 142	705, 714	742, 701	670, 330
June	35, 610	223, 734	261, 900	682, 040	699, 498	621, 733
July	34, 096	221, 127	328, 485	724, 494	767, 728	742, 326
August	31, 505	238, 451	411, 114	843, 706	717, 844	734, 517
September	50, 342	219, 528	420, 882	847, 558	674, 791	717, 170
October	46, 387	220, 076	451, 157	792, 719	694, 187	713, 138
November	45, 062	207, 477	467, 446	757, 170	654, 887	721, 411
December	49, 065	215, 020	513, 817	820, 217	660, 200	721, 685
Total	492, 578	2, 406, 218	3, 810, 086	8, 445, 412	8, 577, 624	8, 120, 125

In the following table is given the production of petroleum in West Virginia in the years 1894 and 1895, by districts.

Total amount and value of petroleum produced in West Virginia in 1894 and 1895.

District.	1894.								
	Illuminating.			Lubricating.			Total.		
	Production.	Value.	Price per barrel.	Production.	Value.	Price per barrel.	Production.	Value.	Price per barrel.
	Barrels.			*Barrels.*			*Barrels.*		
West Virginia	8,553,046	\$7,173,867	\$0.83$\frac{7}{8}$	....	....	....	8,553,046	\$7,173,867	\$0.83$\frac{7}{8}$
Volcano	2,560	2,176	.85	12,000	\$36,000	\$3.00	14,560	38,176	2.62
Petroleum	8,348	6,751	.80$\frac{7}{8}$	1,670	2,923	1.75	10,018	9,674	.96$\frac{1}{2}$
Total	8,563,954	7,182,794	.83$\frac{9}{10}$	13,670	38,923	2.85	8,577,624	7,221,717	.84

District.	1895.								
	Illuminating.			Lubricating.			Total.		
	Production.	Value.	Price per barrel.	Production.	Value.	Price per barrel.	Production.	Value.	Price per barrel.
	Barrels.			*Barrels.*			*Barrels.*		
West Virginia	8,105,341	\$11,013,132	\$1.35$\frac{7}{8}$	....	....	....	8,105,341	\$11,013,132	\$1.35$\frac{7}{8}$
Volcano	260	338	1.30	9,910	\$19,820	\$2.00	10,170	20,158	1.98
Petroleum	4,181	4,181	1.00	433	1,299	3.00	4,614	5,480	1.19
Total	8,109,782	11,017,651	1.35$\frac{6}{7}$	10,343	21,119	2.04	8,120,125	11,038,770	1.36

In the following table is given the production of oil in West Virginia from the beginning of operations, so far as obtainable:

Production of petroleum in West Virginia.

Year.	Barrels.	Year.	Barrels.
Previous to 1876.	3, 000, 000	1887	145, 000
1876	120, 000	1888	119, 448
1877	172, 000	1889	544, 113
1878	180, 000	1890	492, 578
1879	180, 000	1891	2, 406, 218
1880	179, 000	1892	3, 810, 086
1881	151, 000	1893	8, 445, 412
1882	128, 000	1894	8, 577, 624
1883	126, 000	1895	8, 120, 125
1884	90, 000	Total	37, 179, 604
1885	91, 000		
1886	102, 000		

OHIO.

The oil-producing territory of Ohio can be divided into four distinct districts. These districts, naming them in the order of their importance as producers, are (1) the Lima, (2) the Eastern Ohio, (3) the Mecca, and (4) the Belden. As the production of the latter two districts is quite small, for statistical purposes they are united, and known as the Mecca-Belden district.

The total amount of petroleum produced in Ohio in 1895, as will be seen from the following table, was 19,545,233 barrels, as compared with 16,792,154 barrels in 1894. The production of the Lima district in 1895 was 15,850,609 barrels, as compared with 13,607,844 barrels in 1894. Macksburg and Eastern Ohio produced 3,693,248 barrels in 1895, as compared with 3,183,370 barrels in 1894, while the production of the Mecca-Belden district increased from 940 barrels in 1894 to 1,376 barrels in 1895.

The total value of the production of oil in 1895 was $16,399,242, as compared with $9,206,293 in 1894. The average price per barrel of Lima oil for 1895 was 71¾ cents, being 23¾ cents higher than in 1894. The average price per barrel of eastern oil advanced from 83⅞ cents in 1894 to $1.35⅞ in 1895, while the value of the Mecca-Belden oil advanced from $4.76 per barrel in 1894 to $5.98 per barrel in 1895. The average price of all oil produced in this State in 1895 was 83.9 cents a barrel, as compared with 54.8 cents in 1894.

The total amount and value of crude pretroleum produced in Ohio in 1894 and 1895 is shown in the following table:

Total amount and value of crude petroleum produced in Ohio in 1894 and 1895.

District.	1894.			1895.		
	Total production.	Total value.	Price per barrel.	Total production.	Total value.	Price per barrel.
	Barrels.			*Barrels.*		
Lima	13, 607, 844	$6, 531, 765	$0. 48	15, 850, 609	$11, 372, 812	$0. 71$\frac{3}{4}$
Eastern	3, 183, 370	2, 670, 052	. 83$\frac{7}{8}$	3, 693, 248	5, 018, 201	1. 35$\frac{7}{8}$
Mecca-Belden	940	4, 476	4. 76	1, 376	8, 229	5. 98
Total	16, 792, 154	9, 206, 293	. 54$\frac{8}{10}$	19, 545, 233	16, 399, 242	. 839

In the following tables will be found statements of the total production of crude petroleum in Ohio in 1895, by months and districts. In determining the total by months an average production for each month in the Mecca-Belden district has been assumed:

Total production of crude petroleum in Ohio in 1895, by months and districts.

[Barrels of 42 gallons.]

Month.	Lima.	Eastern Ohio.	Mecca-Belden.	Total.
January	1, 034, 489	251, 865	....	1, 286, 468
February	900, 530	223, 140	....	1, 123, 784
March	1, 111, 346	276, 422	....	1, 387, 882
April	1, 194, 799	285, 314	....	1, 480, 228
May	1, 287, 167	285, 436	....	1, 572, 718
June	1, 300, 058	290, 763	....	1, 590, 936
July	1, 474, 115	305, 222	....	1, 779, 452
August	1, 540, 149	337, 206	....	1, 877, 470
September	1, 527, 085	377, 785	....	1, 904, 985
October	1, 579, 693	383, 489	....	1, 963, 297
November	1, 494, 985	345, 402	....	1, 840, 501
December	1, 406, 193	331, 204	....	1, 737, 512
Total	15, 850, 609	3, 693, 248	1, 376	19, 545, 233

The total amount and value of crude petroleum produced in Ohio from 1889 to 1895, inclusive, by districts, is shown in the following table:

Total amount and value of crude petroleum produced in Ohio from 1889 to 1895.

Year.	Lima district.		Eastern Ohio district.	
	Production.	Value.	Production.	Value.
	Barrels.		*Barrels.*	
1889........	12, 153, 189	$1, 822, 978	317, 037	$340, 683
1890........	15, 014, 882	4, 504, 465	1, 108, 334	1, 127, 730
1891........	17, 315, 978	5, 281, 373	422, 883	283, 332
1892........	15, 169, 507	5, 555, 832	1, 190, 302	662, 106
1893........	13, 646, 804	6, 448, 115	2, 601, 394	1, 664, 892
1894........	13, 607, 844	6, 531, 765	3, 183, 370	2, 670, 052
1895........	15, 850, 609	11, 372, 812	3, 693, 248	5, 018, 201

Year.	Mecca-Belden district.		Total.	
	Production.	Value.	Production.	Value.
	Barrels.		*Barrels.*	
1889........	1, 240	$10, 334	12, 471, 466	$2, 173, 995
1890........	1, 440	12, 000	16, 124, 656	5, 644, 195
1891........	1, 440	12, 000	17, 740, 301	5, 576, 705
1892........	3, 112	21, 101	16, 362, 921	6, 239, 039
1893........	1, 571	11, 335	16, 249, 769	8, 124, 342
1894........	940	4, 476	16, 792, 154	9, 206, 293
1895........	1, 376	8, 229	19, 545, 233	16, 399, 242

In the following table is given the total production of crude petroleum in Ohio for the years 1888 to 1895, by months:

Total productions of crude petroleum in Ohio from 1888 to 1895, by months.

[Barrels.]

Year.	January.	February.	March.	April.	May.
1888......	444, 804	507, 686	612, 830	656, 186	774, 267
1889......	1, 041, 655	944, 506	1, 016, 278	1, 029, 780	1, 115, 703
1890......	948, 780	929, 810	1, 008, 933	1, 101, 773	1, 223, 241
1891......	1, 561, 039	1, 396, 474	1, 484, 045	1, 500, 142	1, 475, 339
1892......	1, 124, 194	1, 160, 634	1, 242, 936	1, 173, 952	1, 216, 416
1893......	1, 227, 363	1, 195, 698	1, 399, 648	1, 289, 982	1, 384, 090
1894......	1, 326, 282	1, 187, 891	1, 431, 894	1, 368, 268	1, 486, 678
1895......	1, 286, 468	1, 123, 784	1, 387, 882	1, 480, 228	1, 572, 718

Total productions of crude petroleum in Ohio from 1888 to 1895, by months—Continued.

[Barrels.]

Year.	June.	July.	August.	September.
1888......	889,066	939,287	1,022,009	1,005,422
1889......	1,074,384	1,052,430	1,075,008	1,060,982
1890......	1,274,209	1,472,974	1,544,291	1,700,227
1891......	1,516,362	1,545,298	1,538,210	1,523,826
1892......	1,266,712	1,370,135	1,572,657	1,574,336
1893......	1,419,758	1,444,572	1,480,285	1,402,213
1894......	1,439,144	1,398,304	1,487,528	1,369,409
1895......	1,590,936	1,779,452	1,877,470	1,904,985

Year.	October.	November.	December.	Total.
1888......	1,064,688	1,017,362	1,077,261	10,010,868
1889......	1,048,448	1,030,795	981,497	12,471,466
1890......	1,798,413	1,608,883	1,513,122	16,124,656
1891......	1,527,490	1,299,737	1,372,339	17,740,301
1892......	1,586,173	1,517,198	1,557,578	16,362,921
1893......	1,397,125	1,306,883	1,302,152	16,249,769
1894......	1,469,457	1,424,926	1,402,373	16,792,154
1895......	1,963,297	1,840,501	1,737,512	19,545,233

The following table gives the production of petroleum in Ohio from the beginning of operations in that State to the close of 1895:

Production of petroleum in Ohio.

Year.	Barrels.	Year.	Barrels.
Previous to 1876..	200,000	1886..............	1,782,970
1876..............	31,763	1887..............	5,022,632
1877..............	29,888	1888..............	10,010,868
1878..............	38,179	1889..............	12,471,466
1879..............	29,112	1890..............	16,124,656
1880..............	38,940	1891..............	17,740,301
1881..............	33,867	1892..............	16,362,921
1882..............	39,761	1893..............	16,249,769
1883..............	47,632	1894..............	16,792,154
1884..............	90,181	1895..............	19,545,233
1885..............	661,580		

LIMA DISTRICT.

In the following table is given the production of petroleum in the Lima oil field from 1886 to 1895. It will be seen that with one exception the production of 1895 was the largest in the history of this oil district, it only being exceeded in 1891, when 17,315,978 barrels were produced. The production of 1895 has also increased some 2,250,000 barrels over the production of 1894.

Production of petroleum in the Lima (Ohio) district from 1886 to 1895.

Year.	Barrels.	Year.	Barrels.
1886	1,064,025	1891	17,315,978
1887	4,650,375	1892	15,169,507
1888	9,682,683	1893	13,646,804
1889	12,153,189	1894	13,607,844
1890	15,014,882	1895	15,850,609

In the following table is found the production of petroleum in the Lima (Ohio) field from 1887 to 1895, by months, so far as the same was obtainable:

Production of petroleum in the Lima (Ohio) field from 1887 to 1895.

[Barrels of 42 gallons.]

Year.	January.	February.	March.	April.	May.
1887	131,011	206,026	303,084	352,798	449,062
1888	422,125	479,824	586,781	629,932	745,896
1889	1,016,697	921,185	989,793	1,004,969	1,090,638
1890	911,947	888,978	955,620	1,040,924	1,142,954
1891	1,471,858	1,355,734	1,455,628	1,470,661	1,446,284
1892	1,090,173	1,127,481	1,200,305	1,128,253	1,165,750
1893	1,037,358	985,620	1,161,384	1,072,850	1,179,808
1894	1,116,979	974,091	1,177,837	1,099,453	1,203,229
1895	1,034,489	900,530	1,111,346	1,194,799	1,287,167

Year.	June.	July.	August.	September.
1887	474,535	389,997	490,862	465,743
1888	862,106	905,218	995,938	979,943
1889	1,050,269	1,029,707	1,050,152	1,038,072
1890	1,175,821	1,354,672	1,411,998	1,559,473
1891	1,491,228	1,514,607	1,509,262	1,492,115
1892	1,210,523	1,300,197	1,461,020	1,422,534
1893	1,213,521	1,231,010	1,258,289	1,181,493
1894	1,165,190	1,131,081	1,212,090	1,090,626
1895	1,300,058	1,474,115	1,540,149	1,527,085

Production of petroleum in the Lima (Ohio) field from 1887 to 1895—Continued.

[Barrels of 42 gallons.]

Year.	October.	November.	December.	Total.
1887......	444, 941	458, 612	483, 704	4, 650, 375
1888......	1, 036, 712	988, 997	1, 049, 211	9, 682, 683
1889......	1, 019, 961	997, 825	943, 921	12, 153, 189
1890......	1, 660, 069	1, 495, 099	1, 417, 327	15, 014, 882
1891......	1, 499, 834	1, 271, 189	1, 337, 578	17, 315, 978
1892......	1, 379, 909	1, 328, 548	1, 354, 814	15, 169, 507
1893......	1, 154, 641	1, 084, 324	1, 086, 506	13, 646, 804
1894......	1, 165, 938	1, 146, 686	1, 124, 644	13, 607, 844
1895......	1, 579, 693	1, 494, 985	1, 406, 193	15, 850, 609

PIPE-LINE RUNS IN THE LIMA-INDIANA FIELD.

There are no statements of the pipe-line runs and shipments in the Lima-Indiana field that distinguish between oil produced in Ohio and that produced in Indiana. Therefore the following statement of pipe-line runs and shipments, which are those of the Buckeye Pipe Line, will include reports for both Lima and Indiana. As has been so often stated in this report, pipe-line runs are not production. This is especially true of the Lima-Indiana field. The production of petroleum in the Lima-Indiana field, distributed between the States, is quite accurately given in our statement of production:

Pipe-line runs, Lima-Indiana field, from 1887 to 1895.

[Barrels of 42 gallons.]

Year.	January.	February.	March.	April.	May.
1887......	164, 474	207, 026	303, 084	352, 798	449, 062
1888......	359, 860	428, 008	534, 588	587, 043	705, 045
1889......	973, 980	800, 828	830, 559	845, 377	932, 067
1890......	683, 750	622, 799	676, 175	842, 416	887, 590
1891......	1, 241, 154	1, 147, 947	1, 255, 611	1, 202, 583	1, 191, 147
1892......	971, 607	1, 008, 069	1, 083, 801	1, 042, 087	1, 064, 478
1893......	1, 049, 778	974, 944	1, 163, 641	1, 074, 290	1, 187, 939
1894......	1, 265, 267	1, 106, 493	1, 353, 591	1, 295, 619	1, 424, 182
1895......	1, 213, 841	1, 029, 385	1, 291, 355	1, 405, 424	1, 540, 972

Pipe-line runs, Lima-Indiana field, from 1887 to 1895—Continued.

[Barrels of 42 gallons.]

Year.	June.	July.	August.	September.	October.
1887......	474, 535	389, 997	490, 162	465, 743	444, 941
1888......	774, 710	896, 034	975, 235	868, 826	939, 468
1889......	843, 844	805, 744	968, 449	875, 201	850, 077
1890......	916, 289	1, 105, 885	1, 149, 877	1, 289, 577	1, 342, 158
1891......	1, 207, 884	1, 236, 291	1, 240, 841	1, 252, 375	1, 257, 986
1892......	1, 099, 145	1, 190, 015	1, 346, 949	1, 232, 385	1, 264, 536
1893......	1, 245, 880	1, 289, 991	1, 390, 894	1, 315, 933	1, 302, 295
1894......	1, 402, 417	1, 366, 310	1, 469, 372	1, 325, 352	1, 405, 042
1895......	1, 541, 221	1, 713, 937	1, 752, 150	1, 778, 653	1, 822, 002

Year.	November.	December.	Total.	Average.
1887......	458, 613	483, 704	4, 684, 139	390, 345
1888......	891, 999	938, 188	8, 899, 004	741, 584
1889	774, 073	755, 553	10, 255, 752	854, 646
1890......	1, 215, 960	1, 186, 434	11, 918, 910	993, 243
1891......	1, 070, 131	1, 211, 820	14, 515, 770	1, 209, 648
1892......	1, 209, 953	1, 244, 712	13, 657, 737	1, 138, 145
1893......	1, 230, 658	1, 224, 952	14, 451, 195	1, 204, 266
1894......	1, 334, 334	1, 326, 371	16, 074, 350	1, 339, 529
1895......	1, 705, 506	1, 621, 184	18, 415, 630	1, 534, 636

SHIPMENTS FROM THE LIMA-INDIANA FIELD.

In the following table is given the statement of the shipments of crude petroleum from the Lima-Indiana field as reported by the Buckeye Pipe Line Company from 1887 to 1895, by months and years. Here also it should be remarked that pipe-line shipments and consumption are not the same:

Shipments of crude petroleum from the Lima-Indiana field from 1887 to 1895.

[Barrels of 42 gallons.]

Year.	January.	February.	March.	April.	May.
1887......	....	10, 957	32, 613	77, 900	101, 306
1888......	81, 569	207, 040	243, 964	210, 725	159, 620
1889......	367, 524	862, 807	391, 026	340, 889	309, 238
1890......	156, 085	111, 604	123, 125	115, 223	169, 662
1891......	968, 887	837, 928	330, 448	336, 854	1, 078, 489
1892......	1, 355, 362	1, 346, 541	1, 532, 606	1, 512, 358	1, 427, 753
1893......	1, 306, 612	1, 270, 595	1, 390, 646	1, 205, 748	1, 321, 782
1894......	1, 199, 752	1, 109, 110	1, 247, 295	1, 210, 391	1, 150, 298
1895......	1, 473, 730	1, 289, 686	1, 409, 761	1, 206, 172	1, 212, 061

Shipments of crude petroleum from the Lima-Indiana field from 1887 to 1895—Continued.

[Barrels of 42 gallons.]

Year.	June.	July.	August.	September.	October.
1887......	104,440	174,824	20,019	30,944	43,168
1888......	179,192	227,707	401,175	301,316	370,378
1889......	352,886	361,694	464,325	626,207	715,386
1890......	700,422	874,121	846,360	813,817	723,725
1891......	923,605	997,681	1,166,054	1,260,598	1,408,343
1892......	1,492,543	1,389,501	1,342,949	1,125,335	1,315,994
1893......	1,235,843	1,152,374	1,040,860	1,038,819	1,196,018
1894......	1,303,957	1,023,316	1,238,183	1,023,232	1,198,801
1895......	1,279,618	1,302,596	1,298,502	1,452,640	1,507,992

Year.	November.	December.	Total.	Average.
1887......	78,827	76,327	751,325	68,302
1888......	287,934	382,448	3,053,068	254,422
1889......	759,702	750,244	5,801,928	483,494
1890......	657,614	907,548	6,199,306	516,609
1891......	1,391,400	1,454,578	12,154,865	1,012,905
1892......	1,323,204	1,340,734	16,504,880	1,375,407
1893......	1,262,130	1,230,216	14,651,643	1,220,970
1894......	1,285,861	1,463,566	14,453,762	1,204,480
1895......	1,587,449	1,810,159	16,830,366	1,402,531

STOCKS OF CRUDE PETROLEUM IN THE LIMA-INDIANA FIELD.

In the following table is given a statement of the stocks of crude petroleum in the Lima-Indiana field at the close of each month from 1887 to 1895, as reported by the Buckeye Pipe Line Company:

Total stocks of crude petroleum in the Lima-Indiana field at close of each month from 1887 to 1895.

[Barrels of 42 gallons.]

Year.	January.	February.	March.	April.	May.
1887....	....	847,817	1,118,288	1,393,186	1,740,942
1888....	4,367,355	4,588,323	4,949,446	5,367,401	5,980,283
1889....	10,415,880	10,852,202	11,288,793	11,792,707	12,413,137
1890....	14,104,018	14,180,090	14,241,340	14,153,259	14,298,966
1891....	21,233,645	21,537,789	21,957,948	22,319,191	22,424,364
1892....	21,692,318	21,350,912	20,896,185	20,425,914	20,062,639
1893....	18,355,492	18,059,846	17,877,265	17,747,249	17,616,527
1894....	18,565,823	18,566,158	18,675,275	18,763,242	19,041,624
1895....	19,898,378	19,642,870	19,524,463	19,723,715	20,052,627

Total stocks of crude petroleum in the Lima-Indiana field at close of each month from 1887 to 1895—Continued.

[Barrels of 42 gallons.]

Year.	June.	July.	August.	September.
1887....	2, 111, 037	2, 326, 211	2, 632, 828	2, 957, 900
1888....	6, 593, 165	7, 282, 088	7, 852, 705	8, 392, 493
1889....	12, 902, 628	13, 344, 795	13, 846, 765	14, 092, 706
1890....	14, 513, 553	14, 744, 004	19, 086, 736	19, 843, 950
1891....	22, 704, 034	22, 930, 048	22, 993, 496	22, 975, 470
1892....	19, 668, 894	19, 467, 900	19, 505, 399	19, 150, 058
1893....	17, 642, 117	17, 779, 733	18, 129, 767	18, 408, 814
1894....	19, 142, 598	19, 504, 651	19, 736, 628	20, 040, 748
1895....	20, 314, 230	20, 725, 571	21, 179, 219	21, 351, 757
Year.	**October.**	**November.**	**December.**	**Average.**
1887....	3, 359, 674	3, 739, 459	4, 148, 469	2, 397, 801
1888....	8, 920, 086	9, 499, 482	9, 810, 714	6, 966, 962
1889....	14, 224, 747	14, 554, 662	14, 105, 149	12, 819, 514
1890....	20, 442, 065	20, 967, 258	20, 971, 395	16, 795, 553
1891....	22, 722, 465	22, 375, 030	22, 103, 705	22, 456, 438
1892....	18, 800, 715	18, 687, 464	18, 604, 442	19, 859, 403
1893....	18, 527, 901	18, 499, 669	18, 497, 340	18, 095, 143
1894....	20, 246, 989	20, 295, 461	20, 158, 266	19, 394, 788
1895....	21, 565, 766	21, 683, 823	21, 494, 848	20, 596, 439

In the following table is given the average monthly prices of Lima (Ohio) and Indiana crude petroleum per barrel of 42 gallons each in the year 1895:

Average monthly prices of Ohio and Indiana crude petroleum per barrel of 42 gallons in 1895.

1895.	North Lima.	South Lima.	Indiana.
	Cents.	*Cents.*	*Cents.*
January	56	51	51
February	60	55⅛	55
March	66	61	59½
April	96	93	84
May	79	77	66
June	76	74⅓	65½
July	74	72	64
August	71	69⅛	62
September	67	65	58
October	65	63	56
November	82	79	72
December	90	80	75
Average	73½	70	64
Average of North and South Lima.	71¾		

In the following table are given the fluctuations in prices for the various grades of Lima oil in 1895. The dates given are those on which changes in prices were made:

Fluctuation in prices of Lima (Ohio) and Indiana crude petroleum in 1895.

Date.	North Lima.	South Lima.	Indiana.
January 1	$0.55	$0.50	$0.50
January 18	.57½	.52½	.52½
February 9	.60	.55	.55
February 20	.62½	.57½	.57½
March 8	.67½	.62½	.60
April 9	.72½	.67½	.65
April 10	.77½	.72½	.70
April 11	.82½	.77½	.72½
April 13	1.07	1.05	.97
April 15	1.17	1.15	1.05
April 16	1.27	1.25	1.15
April 20	1.17	1.15	1.00
April 22	1.07	1.05	.90
April 30	1.02	1.00	.85
May 1	.97	.95	.80
May 2	.92	.90	.75
May 3	.87	.85	.70
May 4	.82	.80	.67
May 6	.79½	.77½	.64½
May 7	.77	.75	.64½
June 4	.75	.73	.64½
June 19	.77	.75	.66
June 21	.79	.77	.68
June 26	.77	.75	.66
July 1	.75	.73	.64
July 12	.73	.71	.64
August 21	.70	.68	.61
August 23	.68	.66	.59
September 20	.65	.63	.56
November 5	.70	.68	.61
November 7	.75	.73	.66
November 12	.80	.78	.71
November 14	.85	.83	.76
November 16	.90	.88	.81
November 25	.90	.85	.80
November 27	.90	.82	.77
December 2	.90	.80	.75

WELL RECORD IN THE LIMA DISTRICT.

The number of wells completed in the Lima district in 1895 was 4,489, as compared with 2,472 in 1894, an average of 374 per month in 1895, as compared with 206 a month in 1894. This increase was distributed throughout all of the districts, the number of wells completed in Allen County having increased from 63 in 1894 to 215 in 1895; in Auglaize County from 348 to 482; in Hancock County from 340 to 493; in Sandusky County from 543 to 994; in Wood County from 885 to 1,646, and in Mercer County from 247 to 387. Van Wert County appears for the first time with 130 wells, while the number of wells in the miscellaneous fields increased from 46 in 1894 to 142 in 1895.

Total number of wells completed in the Lima (Ohio) district in 1895.

Month.	Allen.	Auglaize.	Hancock.	Sandusky.	Wood.	Mercer.	Van Wert.	Miscellaneous.	Total.
January	7	21	21	44	71	33	2	1	200
February	4	17	24	40	47	22	0	4	158
March	18	23	34	54	81	29	0	5	244
April	18	25	44	79	113	30	0	7	316
May	23	48	52	74	168	36	2	9	412
June	26	50	50	93	180	41	3	18	461
July	24	66	58	99	184	35	6	12	484
August	22	59	50	131	188	45	13	11	519
September	18	42	52	105	170	28	28	19	462
October	16	48	38	91	160	24	33	17	427
November	21	48	34	123	160	33	27	24	470
December	18	35	36	61	124	31	16	15	336
Total	215	482	493	994	1,646	387	130	142	4,489

From the following table it will be seen that the total initial daily production of the 4,489 wells completed in 1895 was 90,383 barrels, or a little over 20 barrels a day, while the total initial daily production of the 2,472 wells completed in 1894 was 70,111 barrels, or 28 barrels a day. From this it will be readily inferred that the wells drilled in the Lima region in 1895 were not as great producers as those drilled in 1894, and the same is true of 1893. This reduction in initial daily production is manifest in all districts, no one district in this respect being in advance of the others, the wells of every county showing a falling off in the initial daily production.

Initial daily production of wells completed in the Lima (Ohio) district in 1895.

[Barrels.]

Month.	Allen.	Au-glaize.	Han-cock.	San-dusky.	Wood.	Mercer.	Van Wert.	Miscel-lane-ous.	Total.
January	144	396	365	1, 057	1, 638	823	4	5	4, 432
February	90	524	415	1, 155	829	670	0	70	3, 753
March	248	791	623	1, 101	1, 733	757	0	28	5, 281
April	342	488	819	1, 467	2, 175	732	0	185	6, 208
May	238	855	757	1, 665	3, 424	1, 112	55	55	8, 161
June	373	1, 532	800	2, 365	3, 302	1, 080	95	225	9, 772
July	435	1, 406	802	2, 300	2, 858	865	175	170	9, 011
August	495	1, 524	630	2, 190	3, 364	1, 160	490	172	10, 025
September	287	726	1, 000	1, 520	3, 940	855	715	132	9, 175
October	196	925	762	2, 258	2, 700	595	765	385	8, 586
November	372	945	710	2, 640	2, 896	750	735	647	9, 695
December	194	990	640	1, 071	1, 947	662	450	330	6, 284
Total	3, 414	11, 102	8, 323	20, 789	30, 806	10, 061	3, 484	2, 404	90, 383

It will be seen from the following table that of the 4,489 wells completed in the Lima district in 1895, 564 were dry holes; in 1894 of the 2,472 wells completed 384 were dry holes; in 1893 of the 1,569 wells completed 203 were dry holes. It appears from this that the proportion of dry holes to wells completed in the last three years has differed somewhat.

Total number of dry holes drilled in the Lima (Ohio) district in 1895.

Month.	Allen.	Au-glaize.	Han-cock.	San-dusky.	Wood.	Mer-cer.	Van Wert.	Miscel-lane-ous.	Total.
January	0	3	5	3	16	5	1	0	33
February	1	2	5	1	7	1	0	2	19
March	5	2	7	5	13	4	0	2	38
April	3	4	5	5	13	0	0	3	33
May	8	7	13	6	21	5	0	6	66
June	9	5	7	9	24	2	1	8	65
July	4	11	13	4	31	3	0	4	70
August	4	7	5	10	14	6	0	2	48
September	3	6	9	11	17	4	1	8	59
October	3	7	5	6	18	3	4	2	48
November	3	10	5	8	14	3	4	2	49
December	4	4	5	2	15	4	2	0	36
Total	47	68	84	70	203	40	13	39	564

The number of rigs building and wells drilling in the Lima district at the close of each month in 1895 is shown in the two following tables. These show a marked increase in activity in the Lima oil field in 1895, as compared with 1894. At the close of 1895 there were 195 rigs building in this field, as compared with 110 at the close of 1894, while at the close of 1895 there were 331 wells drilling, as compared with 140 at the close of 1894. The average number of rigs building at the close of each month in 1895 was 244, as compared with an average of 87 in 1894. The average number of wells drilling at the close of each month in 1895 was 312, as compared with 131 in 1894.

Total number of rigs building in the Lima (Ohio) field in 1895.

Month.	Allen.	Au-glaize.	Han-cock.	San-dusky.	Wood.	Mer-cer.	Van Wert.	Miscel-lane-ous.	Total.
January	6	8	16	22	43	15	0	4	114
February	7	13	20	32	74	21	0	4	171
March	2	19	20	43	98	17	1	8	208
April	12	31	24	37	116	16	1	8	245
May	10	30	34	57	151	11	1	11	305
June	3	39	32	63	152	34	3	8	339
July	6	36	33	62	127	38	8	7	317
August	9	34	25	59	109	29	8	9	282
September	10	27	23	66	111	24	22	11	294
October	9	18	22	64	106	25	13	7	264
November	10	11	27	36	85	9	8	8	194
December	8	16	20	43	78	7	14	9	195
Average	8	24	25	49	104	20	6	8	244

Total number of wells drilling in the Lima (Ohio) field in 1895.

Month.	Allen.	Au-glaize.	Han-cock.	San-dusky.	Wood.	Mer-cer.	Van Wert.	Miscel-lane-ous.	Total.
January	7	11	23	28	39	17	0	7	132
February	12	10	24	39	65	17	0	9	176
March	14	13	40	46	74	17	0	10	214
April	14	23	44	54	104	16	0	14	269
May	16	29	47	65	111	17	1	16	302
June	17	43	57	74	137	21	6	14	369
July	22	50	50	81	137	27	9	21	397
August	23	56	56	81	125	25	20	27	413
September	19	52	43	78	145	28	18	21	404
October	16	62	42	93	144	32	19	27	435
November	8	26	28	54	128	25	10	27	306
December	21	24	29	73	115	22	17	30	331
Average	16	33	40	64	110	22	8	19	312

In the following tables are given the well records in the Lima (Ohio) district from 1890 to 1895:

Number of wells completed in the Lima (Ohio) district from 1890 to 1895, by months.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1890..	44	62	.....	.....	147	165	224	271	307	319	243	187	1,969
1891..	142	123	129	156	116	143	144	138	157	134	104	88	1,574
1892..	67	82	93	93	93	121	134	166	171	174	147	105	1,446
1893..	100	85	163	135	128	160	152	133	131	120	132	130	1,569
1894..	130	175	179	205	248	230	233	219	204	226	214	209	2,472
1895..	200	158	244	316	412	461	484	519	462	427	470	336	4,489

Initial daily production of new wells in the Lima (Ohio) district from 1890 to 1895, by months.

[Barrels.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1890	....	....	....	....	....	....	....
1891	5,858	5,474	4,428	6,543	4,411	6,667	8,461
1892	2,853	4,485	3,973	4,665	4,750	8,314	11,648
1893	5,510	4,809	6,241	5,477	6,858	9,701	9,588
1894	3,853	4,211	4,486	5,586	7,291	6,391	5,637
1895	4,432	3,753	5,281	6,208	8,161	9,772	9,011

Year.	Aug.	Sept.	Oct.	Nov.	Dec.	Average.
1890	18,944	16,309	17,426	13,779	8,424	14,976
1891	8,427	7,855	8,033	5,592	2,989	6,228
1892	14,631	12,908	13,772	7,554	4,907	7,872
1893	5,124	6,752	4,223	4,205	3,275	5,980
1894	5,642	5,020	5,991	10,464	5,539	5,843
1895	10,025	9,175	8,586	9,695	6,284	7,532

Total number of dry holes drilled in the Lima (Ohio) district, from 1890 to 1895, by months.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1890..	3	2	.....	.....	4	11	10	23	30	32	37	41	193
1891..	28	27	23	28	14	18	22	14	26	20	17	13	250
1892..	9	9	8	13	10	18	16	18	27	22	18	15	183
1893..	12	15	20	24	18	19	18	12	14	16	13	22	203
1894..	17	41	37	27	32	41	30	34	35	27	28	35	384
1895..	33	19	38	33	66	65	70	48	59	48	49	36	564

Number of wells drilling in the Lima (Ohio) district, at the close of each month, from 1890 to 1895.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Average.
1890..	47	59	.....	.....	135	188	237	182	238	294	148	111	164
1891..	90	105	94	82	79	90	90	93	85	88	67	53	85
1892..	61	78	76	51	64	95	101	112	120	114	106	81	88
1893..	72	78	88	92	117	119	103	101	89	102	118	114	99
1894..	120	113	127	138	127	139	117	138	136	136	138	140	131
1895..	132	176	214	269	302	369	397	413	404	435	306	331	312

Rigs building in the Lima (Ohio) district, from 1890 to 1895, by months.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Average.
1890..	56	69	.....	.....	173	239	248	212	210	194	149	109	166
1891..	120	137	155	117	115	123	137	120	117	106	91	99	120
1892..	95	115	106	112	113	104	128	126	121	112	112	49	108
1893..	62	70	63	58	90	72	52	52	61	76	66	69	66
1894..	60	83	90	88	85	76	68	95	86	92	112	110	87
1895..	114	171	208	245	305	339	317	282	294	264	194	195	244

In the following table is given the well statement, showing the wells completed, the initial production, the dry holes, wells drilling, and rigs building in the Lima (Ohio) district in 1895:

Well record in the Lima (Ohio) district in 1895.

Month.	Wells completed.	Initial production.	Dry holes.	Wells drilling.	Rigs building.
		Barrels.			
January...........	200	4,432	33	132	114
February.........	158	3,753	19	176	171
March............	244	5,281	38	214	208
April.............	316	6,208	33	269	245
May..............	412	8,161	66	302	305
June.............	461	9,772	65	369	339
July..............	484	9,011	70	397	317
August...........	519	10,025	48	413	282
September.......	462	9,175	59	404	294
October..........	427	8,586	48	435	264
November........	470	9,695	49	306	194
December........	336	6,284	36	331	195
Total.......	4,489	90,383	564	a 312	a 244

a Average.

EASTERN OHIO DISTRICT.

In this district are included the old Macksburg field and the new developments in the territory adjacent in West Virginia and western Pennsylvania, in addition to the Macksburg, Corning, Steubenville, and Marietta districts.

The production of the Eastern Ohio district for the last eleven years is given in the following table:

Production of petroleum in the Eastern Ohio district, from 1885 to 1895.

Year.	Barrels.	Year.	Barrels.
1885	661,580	1891	422,883
1886	703,945	1892	1,190,302
1887	372,257	1893	2,601,394
1888	297,774	1894	3,183,370
1889	317,037	1895	3,693,248
1890	1,108,334		

Prior to 1891 the figures given in the above table are chiefly the production of the Macksburg field. In the following table is given the total production of crude petroleum in the Eastern and Southern Ohio and Macksburg districts, from 1888 to 1895, by months:

Total production of crude petroleum in the Eastern Ohio district from 1888 to 1895, by months.

[Barrels.]

Year.	January.	February.	March.	April.	May.	June.	July.
1888	20,144	25,327	23,515	23,720	25,837	24,426	31,535
1889	24,855	23,218	26,382	24,708	24,961	24,011	22,619
1890	36,713	40,712	53,193	60,729	80,167	98,268	118,182
1891	89,061	40,620	28,297	29,361	28,935	25,014	30,571
1892	33,762	32,894	42,371	45,439	50,407	55,930	69,678
1893	189,874	209,948	238,133	217,001	204,151	206,106	213,431
1894	209,225	213,721	253,979	268,736	283,371	273,876	267,144
1895	251,865	223,140	276,422	285,314	285,436	290,763	305,222

Year.	August.	September.	October.	November.	December.	Total.
1888	23,537	22,945	25,442	25,831	25,515	297,774
1889	24,752	22,807	28,384	32,867	37,473	317,037
1890	132,173	140,634	138,224	113,664	95,675	1,108,334
1891	28,828	31,591	27,536	28,428	34,641	422,883
1892	111,377	151,543	206,005	188,391	202,505	1,190,302
1893	221,865	220,589	242,353	222,428	215,515	2,601,394
1894	275,360	278,704	303,441	278,162	277,651	3,183,370
1895	337,206	377,785	383,489	345,402	331,204	3,693,248

In the following table the pipe-line runs and the shipments from the Macksburg district are given from 1885 to 1895:

Pipe-line runs in the Macksburg district from 1885 to 1895.

[Barrels of 42 gallons.]

Year.	January.	February.	March.	April.	May.	June.	July.
1885	11,894	20,626	27,066	40,527	58,258	64,982	75,737
1886	54,806	46,694	58,795	64,137	58,596	65,379	56,966
1887	37,134	28,514	33,995	29,796	30,601	29,586	22,413
1888	16,257	18,861	17,283	21,187	21,349	21,511	21,785
1889	18,174	16,239	19,676	20,144	20,283	18,536	16,705
1890	29,872	34,022	45,362	53,905	72,158	90,827	111,584
1891	86,058	45,618	23,055	25,070	24,263	21,689	24,858
1892	24,801	27,620	39,010	40,424	43,569	50,007	64,107
1893	183,781	211,658	235,177	211,102	199,929	146,626	148,622
1894	138,172	121,627	150,095	190,677	239,912	228,267	221,999
1895	94,999	181,155	220,883	229,159	225,816	227,643	251,003

Year.	August.	September.	October.	November.	December.	Total.	Average.
1885	74,228	68,110	63,619	60,926	61,113	627,086	52,257
1886	57,492	48,918	46,937	41,359	40,578	640,657	53,388
1887	26,659	22,903	20,458	19,902	17,079	319,040	26,587
1888	18,558	22,058	18,809	20,802	20,950	239,410	19,951
1889	16,607	16,875	21,555	25,415	28,567	238,776	19,898
1890	121,349	138,310	129,717	106,552	87,955	1,021,613	85,134
1891	24,432	27,006	23,428	23,073	28,682	377,232	31,436
1892	106,082	135,353	212,470	176,852	196,852	1,117,147	93,096
1893	152,912	156,124	149,773	134,923	144,488	2,075,115	172,926
1894	249,472	202,364	220,557	199,787	199,774	2,362,703	196,892
1895	279,602	310,400	322,439	286,932	324,447	2,954,478	246,207

Shipments of crude petroleum and refined petroleum reduced to crude equivalent from Macksburg district from 1886 to 1895.

[Barrels of 42 gallons.]

Year.	January.	February.	March.	April.	May.	June.	July.
1886	60,119	42,525	32,277	23,578	28,986	40,211	28,832
1887	52,065	23,908	17,593	16,558	16,002	17,384	16,504
1888	40,076	30,045	4,122	14,920	15,275	15,630	9,083
1889	11,847	16,168	23,939	8,611	9,027	8,934	15,269
1890	44,306	38,898	35,041	30,975	13,070	22,851	46,394
1891	54,363	27,160	1,040	2,094	1,060	41,725	820
1892	2,594	2,200	1,763	1,600	252	37,989	1,834
1893	7,174	6,556	8,218	5,906	2,338	1,123	1,025
1894	3,366	3,932	2,874	2,272	1,998	959	2,569
1895	4,370	3,106	3,154	1,130	869	1,756	583

Shipments of crude petroleum and refined petroleum reduced to crude equivalent from Macksburg district from 1886 to 1895—Continued.

[Barrels of 42 gallons.]

Year.	August.	September.	October.	November.	December.	Total.	Average.
1886......	45,882	47,992	53,156	51,608	49,260	504,426	42,036
1887......	27,719	35,030	37,978	34,508	39,654	334,903	27,909
1888......	6,989	32,698	47,572	47,066	26,940	290,416	24,201
1889......	14,507	22,669	50,447	47,924	47,090	276,432	23,036
1890......	107,175	73,469	57,780	54,540	53,704	578,203	48,184
1891......	2,318	3,283	3,040	2,700	2,236	141,839	11,820
1892......	1,555	2,102	3,773	4,358	6,443	66,463	5,539
1893......	586	1 964	2,524	4,538	2,563	44,515	3,710
1894......	2,309	3,839	4,377	4,264	3,999	36,758	3,063
1895......	1,874	2,124	4,177	6,716	3,332	33,191	2,766

In the following table will be found certain figures regarding stocks of crude petroleum in eastern Ohio at the close of each month from 1886 to 1895. This by no means represents all the stocks of crude petroleum produced in this district, but they form the best statement we can get as to stocks held by pipe lines that derived most of their oil from eastern Ohio:

Total stocks of crude petroleum in the Macksburg district at close of each month from 1886 to 1895, by months and years.

[Barrels of 42 gallons.]

Year.	January.	February.	March.	April.	May.	June.	July.
1886......	324,483	332,322	362,923	407,212	440,329	467,599	468,796
1887......	404,315	408,926	425,325	438,562	453,162	465,363	472,273
1888......	380,551	386,293	400,602	407,086	413,858	420,631	434,573
1889......	363,620	357,527	360,121	364,796	376,052	397,718	387,089
1890......	296,413	291,536	301,856	324,786	388,874	451,851	517,042
1891......	685,120	503,284	480,618	480,364	453,809	433,773	401,358
1892......	461,616	468,861	460,750	462,383	475,768	447,685	457,176
1893......	410,715	418,513	397,127	404,951	407,715	421,222	413,935
1894......	390,977	388,341	379,037	376,883	325,664	294,427	271,801
1895......	172,461	193,935	236,022	242,317	204,030	211,740	184,784

Year.	August.	September.	October.	November.	December.	Average.
1886......	456,621	461,842	437,299	427,950	419,248	417,219
1887......	471,214	459,085	441,563	426,957	404,382	439,261
1888......	444,006	427,797	394,807	365,873	351,128	402,267
1889......	389,189	383,393	354,498	331,939	310,848	364,732
1890......	531,215	596,056	660,573	703,031	698,129	480,113
1891......	378,857	388,855	431,450	461,037	454,232	462,730
1892......	462,306	441,494	434,560	432,283	422,142	452,252
1893......	426,552	443,669	458,692	446,503	415,900	422,124
1894......	241,439	197,660	179,867	152,200	147,318	278,801
1895......	182,209	169,850	192,060	211,591	231,048	202,671

WELL RECORDS IN THE EASTERN OHIO DISTRICT.

In the following tables are given statistics of the total number of wells completed, the initial daily production of wells drilled, total number of dry holes drilled, total number of wells drilling, and total number of rigs building in the Eastern Ohio district during the year 1895, by months.

Total number of wells completed in the Eastern Ohio district in 1895.

Month.	Corning.	Macksburg.	Steubenville.	Marietta.	Miscellaneous.	Total.
January	10	5	6	4	0	25
February	6	2	5	4	0	17
March	13	5	6	7	0	31
April	17	6	4	10	0	37
May	30	10	7	10	0	57
June	27	7	10	12	0	56
July	26	9	4	7	4	50
August	20	5	5	14	4	48
September	15	12	4	9	0	40
October	14	7	4	12	4	41
November	4	7	2	9	3	25
December	15	5	5	4	4	33
Total	197	80	62	102	19	460

Initial daily production of wells completed in the Eastern Ohio district in 1895.

[Barrels.]

Month.	Corning.	Macksburg.	Steubenville.	Marietta.	Miscellaneous.	Total.
January	172	10	80	125	0	387
February	88	0	135	125	0	348
March	270	80	185	145	0	680
April	197	24	130	155	0	506
May	370	38	195	145	0	748
June	286	48	60	71	0	465
July	291	53	85	47	52	528
August	192	22	90	57	45	406
September	187	68	28	115	0	398
October	183	36	15	35	0	269
November	65	36	85	63	35	284
December	167	20	75	10	45	317
Average	206	36	97	91	15	445

Total number of dry holes drilled in the Eastern Ohio district in 1895.

Month.	Corning.	Macks-burg.	Steuben-ville.	Mari-etta.	Miscel-laneous.	Total.
January	2	4	3	2	0	11
February	1	2	0	0	0	3
March	2	2	1	1	0	6
April	2	4	0	3	0	9
May	2	5	1	1	0	9
June	3	3	5	7	0	18
July	4	2	1	3	1	11
August	4	1	2	6	1	14
September	1	2	2	2	0	7
October	2	3	3	8	4	20
November	0	2	0	1	2	5
December	4	3	2	2	1	12
Total	27	33	20	36	9	125

Total number of wells drilling in the Eastern Ohio field in 1895.

Month.	Corning.	Macks-burg.	Steuben-ville.	Mari-etta.	Miscel-laneous.	Total.
January	4	5	5	5	0	19
February	1	7	5	8	0	21
March	4	5	2	5	0	16
April	11	9	3	11	0	34
May	15	10	4	3	0	32
June	14	9	3	12	0	38
July	8	11	4	7	5	35
August	10	14	5	7	5	41
September	9	12	5	2	7	35
October	4	7	3	5	8	27
November	10	5	6	3	9	33
December	7	13	2	4	7	33
Average	8	9	4	6	3	30

Total number of rigs building in the Eastern Ohio field in 1895.

Month.	Corning.	Macks-burg.	Steuben-ville.	Mari-etta.	Miscel-laneous.	Total.
January	8	5	1	2	0	16
February	14	2	2	5	0	23
March	15	2	3	1	0	21
April	12	5	5	4	0	26
May	12	5	6	1	0	24

Total number of rigs building in the Eastern Ohio field in 1895—Continued.

Month.	Corning.	Macksburg.	Steubenville.	Marietta.	Miscellaneous.	Total.
June	15	7	2	4	0	28
July	10	6	3	3	3	25
August	10	10	3	4	3	30
September	9	6	5	3	1	24
October	12	8	4	0	0	24
November	14	12	3	5	4	38
December	9	9	4	7	2	31
Average	12	6	4	3	1	26

In the following tables are given the well records in the Eastern Ohio district from 1891 to 1895:

Number of wells completed in the Eastern Ohio district from 1891 to 1895, by months.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1891	.....	.....	.....	.....	.....	.....	.....	.....	.....	9	10	8	27
1892	7	9	12	7	4	8	5	2	4	2	14	2	76
1893	10	15	13	19	24	15	26	18	21	15	7	7	190
1894	9	6	15	17	17	21	23	18	19	21	22	27	215
1895	25	17	31	37	57	56	50	48	40	41	25	33	460

Initial daily production of new wells in the Eastern Ohio district from 1891 to 1895, by months.

[Barrels.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1891	.....	.....	.....	.....	.....	.....	.....	.....	.....	36	265	70	371
1892	60	152	393	65	291	25	43	2	0	20	117	0	1, 168
1893	209	168	109	254	350	210	323	398	240	234	37	78	2, 610
1894	143	50	74	172	246	223	262	232	180	468	215	433	2, 698
1895	387	348	680	506	748	465	528	406	398	269	284	317	5, 336

Total number of dry holes drilled in the Eastern Ohio district from 1891 to 1895, by months.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1891	.....	.....	.....	.....	.....	.....	.....	.....	.....	5	5	4	14
1892	2	3	4	4	4	5	1	0	4	1	4	2	34
1893	0	2	4	3	8	2	7	3	7	4	4	2	46
1894	3	2	8	7	5	9	8	8	7	8	11	9	85
1895	11	3	6	9	9	18	11	14	7	20	5	12	125

Number of wells drilling in the Eastern Ohio district at the close of each month from 1891 to 1895, by months.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Average.
1891	.....	.....	.....	.....	.....	.....	.....	.....	.....	15	14	10	13
1892	15	15	12	9	14	9	6	6	6	10	7	9	10
1893	14	10	15	15	13	15	13	19	12	8	9	12	13
1894	11	4	19	5	17	15	18	18	16	15	19	22	15
1895	19	21	16	34	32	38	35	41	35	27	33	33	30

Rigs building in the Eastern Ohio district from 1891 to 1895, by months.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Average.
1891	.....	.....	.....	.....	.....	.....	.....	.....	.....	20	20	4	15
1892	18	17	14	13	21	10	8	11	13	16	13	13	14
1893	16	17	23	11	4	9	12	9	13	9	13	13	12
1894	9	13	13	9	13	13	18	18	15	27	19	17	15
1895	16	23	21	26	24	28	25	30	24	24	38	31	26

In the following table is given the well statement, showing the wells completed, the initial production, the dry holes, wells drilling, and rigs building in the Macksburg district of the Eastern Ohio field in 1895:

Well record in the Macksburg (Ohio) district in 1895.

Month.	Wells completed.	Initial production.	Dry holes.	Wells drilling.	Rigs building.
		Barrels.			
January	25	387	11	19	16
February	17	348	3	21	23
March	31	680	6	16	21
April	37	506	9	34	26
May	57	748	9	32	24
June	56	465	18	38	28
July	50	528	11	35	25
August	48	406	14	41	30
September	40	398	7	35	24
October	41	269	20	27	24
November	25	284	5	33	38
December	33	317	12	33	31
Total	460	5,336	125	*a* 30	*a* 26

a Average.

It should be noted that the above well records, pipe-line runs, etc., include only those of the Macksburg district of the Eastern Ohio field.

The well records of the other districts of the Eastern Ohio district are included in the Southwest district of the Appalachian oil field report.

MECCA-BELDEN DISTRICT.

As has been stated, the wells in this district are located near Mecca, in Trumbull County, and Belden, in Lorain County. The oil is a lubricating oil produced from a few shallow wells. There were but 13 wells producing at the close of 1892, 10 at the close of 1893, 9 at the close of 1894, and 8 at the close of 1895.

In the following tables are given the production and stocks and value of the crude petroleum in this district from 1892 to 1895:

Production and value of crude petroleum in the Mecca-Belden district of Ohio from 1892 to 1895.

District.	1892.			1893.		
	Barrels of 42 gallons.	Value.	Price per barrel.	Barrels of 42 gallons.	Value.	Price per barrel.
Belden, Lorain County	1,732	$9,280	$5.36	1,120	$8,014	$7.15
Mecca, Trumbull County	1,380	11,821	8.57	451	3,321	7.36
Total	3,112	21,101	6.78	1,571	11,335	7.21½

District.	1894.			1895.		
	Barrels of 42 gallons.	Value.	Price per barrel.	Barrels of 42 gallons.	Value.	Price per barrel.
Belden, Lorain County	740	$3,276	$4.43	833	$4,200	$5.04
Mecca, Trumbull County	200	1,200	6.00	543	4,029	7.42
Total	940	4,476	4.76	1,376	8,229	5.98

Stocks at wells in the Mecca-Belden district of Ohio.

Year ending December 31—	Barrels.	Year ending December 31—	Barrels.
1891	4,048	1894	225
1892	161	1895	390
1893	403		

INDIANA.

With the exception of a small amount of oil produced in Terre Haute, Vigo County, all of the oil production in Indiana is from the Trenton limestone, this field being an extension of the Lima district of Ohio.

In the following table will be found a statement of the production of petroleum in Indiana from 1889 to 1895:

Production of petroleum in Indiana from 1889 to 1895.

	1889.	1890.	1891.	1892.	1893.	1894.	1895.
Total production (barrels of 42 gallons)	33,375	63,496	136,634	698,068	2,335,293	3,688,666	4,386,132
Total value at wells of all oils produced, excluding pipage	$10,881	$32,462	$54,787	$260,620	$1,050,882	$1,774,260	$2,807,124
Value per barrel	$0.32⅝	$0.51⅛	$0.40	$0.37	$0.45	$0.48	$0.64

In the following table is shown the total production of petroleum in Indiana by months from 1891 to 1895. The largest production in any one month seems to have been in July, 1895, when 434,376 barrels were produced.

Total production of petroleum in Indiana from 1891 to 1895, by months.

[Barrels.]

Month.	1891.	1892.	1893.	1894.	1895.
January	6,171	15,841	111,824	259,000	300,568
February	5,981	18,946	96,025	232,107	230,559
March	5,159	24,794	134,549	282,376	310,303
April	4,973	26,184	146,493	287,330	352,077
May	5,757	31,033	186,939	321,502	397,001
June	8,136	40,888	209,616	333,479	403,569
July	10,809	49,203	221,666	327,349	434,376
August	11,603	56,109	248,353	345,031	420,132
September	16,500	66,034	245,615	319,588	409,169
October	19,029	95,699	252,568	339,424	393,153
November	20,801	129,270	245,607	304,030	373,789
December	21,715	144,067	236,038	337,450	361,436
Total	136,634	698,068	2,335,293	3,688,666	4,386,132

In the following tables are given statistics of the total number of producing wells drilled, total number of new wells completed, total number of dry holes, and total number of wells drilling and rigs building in the Indiana oil fields for each month in 1895:

Total number of wells completed in Indiana in 1895, by counties.

Month.	Adams.	Black-ford.	Grant.	Hunt-ington.	Jay.	Wells.	Mis-cella-neous.	Total.
January	4	4	6	1	11	35	0	61
February	3	3	3	1	8	27	0	45
March	8	9	2	2	18	41	1	81
April	8	12	3	5	33	49	1	111
May	14	16	4	2	25	61	0	122
June	18	12	5	2	33	83	0	153
July	13	8	11	0	25	75	0	132
August	14	8	10	5	28	73	2	140
September	12	14	18	3	25	56	1	129
October	9	11	17	1	18	50	0	106
November	3	13	15	1	13	57	0	102
December	4	12	17	3	8	41	0	85
Total	110	122	111	26	245	648	5	1,267

Initial daily production of wells completed in Indiana in 1895, by counties.

[Barrels.]

Month.	Adams.	Black-ford.	Grant.	Hunt-ing-ton.	Jay.	Wells.	Mis-cel-lane-ous.	Total.
January	250	65	95	20	300	1,402	0	2,132
February	43	35	80	15	180	1,060	0	1,413
March	325	163	40	30	355	1,576	15	2,504
April	335	295	125	90	728	1,900	0	3,473
May	320	150	105	30	585	1,845	0	3,035
June	620	213	170	40	1,155	2,725	0	4,923
July	400	140	340	0	655	1,532	0	3,067
August	315	150	300	15	570	1,400	10	2,760
September	200	370	475	45	665	1,400	20	3,175
October	365	255	400	25	400	1,206	0	2,651
November	55	262	425	20	345	1,453	0	2,560
December	120	350	265	20	160	1,110	0	2,025
Average	279	204	235	29	508	1,551	4	2,810

Total number of dry holes drilled in Indiana in 1895, by counties.

Month.	Adams.	Black-ford.	Grant.	Hunt-ington.	Jay.	Wells.	Mis-cella-neous.	Total.
January	0	0	1	0	3	3	0	7
February	0	0	0	0	3	1	0	4
March	1	0	1	0	8	3	0	13
April	0	0	0	1	10	4	1	16
May	3	4	0	1	8	6	0	22
June	3	1	0	1	8	7	0	20
July	4	1	0	0	3	7	0	15
August	1	0	0	3	9	9	1	23
September	0	1	0	0	7	4	0	12
October	0	1	1	0	6	4	0	12
November	0	1	3	0	2	3	0	9
December	0	3	1	1	4	4	0	13
Total	12	12	7	7	71	55	2	166

Total number of wells drilling in Indiana in 1895, by counties.

Month.	Adams.	Black-ford.	Grant.	Hunt-ington.	Jay.	Wells.	Mis-cella-neous.	Total.
January	1	7	2	3	17	36	0	66
February	6	5	1	2	13	25	0	52
March	4	3	3	3	20	29	0	62
April	8	9	3	1	19	42	0	82
May	11	8	6	2	26	59	0	112
June	9	4	9	1	26	52	0	101
July	11	4	6	3	32	53	0	109
August	13	9	19	3	23	42	1	110
September	11	3	21	1	22	45	0	103
October	7	7	22	3	15	47	1	102
November	3	6	17	4	12	36	0	78
December	3	7	12	3	15	41	0	81
Average	7	6	10	3	20	42	0	88

Total number of rigs building in Indiana in 1895, by counties.

Month.	Adams.	Black-ford.	Grant.	Hunt-ington.	Jay.	Wells.	Mis-cella-neous.	Total.
January	2	1	2	0	8	24	0	37
February	4	2	2	2	15	25	0	50
March	7	4	3	2	17	39	1	73
April	6	3	0	4	20	56	0	89

Total number of rigs building in Indiana in 1895, by counties—Continued.

Month.	Adams.	Black-ford.	Grant.	Hunt-ington.	Jay.	Wells.	Mis-cella-neous.	Total.
May	9	2	7	0	25	59	0	102
June	51	2	7	2	19	46	0	91
July	12	1	7	4	13	41	0	78
August	7	1	8	2	12	39	0	69
September	11	6	7	1	14	43	1	83
October	7	4	10	0	11	38	0	70
November	7	6	9	2	6	31	0	61
December	18	5	11	3	8	35	0	80
Average	9	3	6	2	14	40	0	74

In the following tables are given the well records in the Indiana oil fields from 1891 to 1895:

Number of wells completed in the Indiana oil fields from 1891 to 1895, by months.

Year.	Jan.	Feb.	Mar.	Apr.	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

Initial daily production of new wells in Indiana oil fields from 1891 to 1895, by months.

[Barrels.]

Month.	1891.	1892.	1893.	1894.	1895.
January	....	342	1, 020	2, 361	2, 132
February	....	250	913	2, 935	1, 413
March	....	289	2, 805	3, 395	2, 504
April	....	316	4, 135	3, 175	3, 473
May	....	505	3, 155	4, 450	3, 035
June	....	545	5, 595	4, 886	4, 923
July	253	595	3, 880	3, 530	3, 067
August	135	1, 295	4, 184	3, 435	2, 760
September	875	2, 145	2, 055	3, 149	3, 175
October	330	4, 155	3, 442	3, 455	2, 651
November	390	3, 050	2, 305	3, 323	2, 560
December	175	3, 160	2, 968	2, 654	2, 025
Total	2, 158	16, 647	36, 457	40, 748	33, 718

Total number of dry holes drilled in Indiana oil fields from 1891 to 1895, by months.

Year.	Jan.	Feb.	Mar.	Apr.	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

Number of wells drilling in the Indiana oil fields at the close of each month from 1891 to 1895, by months.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Average.
1891....	....	....	.....	.....	.....	.....	5	13	12	8	4	12	9
1892....	17	15	11	12	13	16	11	16	23	23	26	24	17
1893....	24	19	22	18	20	28	29	45	27	50	36	50	31
1894....	63	71	37	56	60	61	71	64	58	62	62	58	60
1895....	66	52	62	82	112	101	109	110	103	102	78	81	88

Rigs building in the Indiana oil fields from 1891 to 1895, by months.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Average.
1891....	....	....	.....	.....	.....	.....	7	2	12	8	6	6	7
1892....	8	18	23	23	17	21	16	15	29	31	39	19	22
1893....	12	15	17	14	17	26	32	28	9	25	27	30	21
1894....	36	39	34	40	35	30	32	35	35	57	38	32	37
1895....	37	50	73	89	102	91	78	69	83	70	61	80	74

In the following table is given the well statement, showing the wells completed, the initial production, the dry holes, wells drilling, and rigs building in Indiana in 1895:

Well record in Indiana in 1895.

Month.	Wells completed.	Initial production.	Dry holes.	Wells drilling.	Rigs building.
		Barrels.			
January...........	61	2,132	7	66	37
February.........	45	1,413	4	52	50
March............	81	2,504	13	62	73
April.............	111	3,473	16	82	89
May..............	122	3,035	22	112	102
June.............	153	4,923	20	101	91
July.............	132	3,067	15	109	78

Well record in Indiana in 1895—Continued.

Month.	Wells completed.	Initial production.	Dry holes.	Wells drilling.	Rigs building.
		Barrels.			
August	140	2,760	23	110	69
September	129	3,175	12	103	83
October	106	2,651	12	102	70
November	102	2,560	9	78	61
December	85	2,025	13	81	80
Total	1,267	*a* 2,810	166	*a* 88	*a* 74

a Average.

COLORADO.

All the oil produced in Colorado is from what is known as the Florence field, the geological conditions of which are thoroughly described in Mineral Resources for 1892

The total production of petroleum in Colorado in 1895 was 529,482 barrels, the value of which was $399,313, or 75.4 cents a barrel.

In the following table will be found a statement of the production of crude oil in Colorado from 1887 to 1895:

Product of crude oil in Colorado from 1887 to 1895.

Year.	Barrels.	Year.	Barrels.
1887	76,295	1892	824,000
1888	297,612	1893	594,390
1889	316,476	1894	515,746
1890	368,842	1895	529,482
1891	665,482		

CALIFORNIA.

Professor Peckham so thoroughly described the oil fields of California in our report for 1894 that we need not repeat what he so well said.

During the year considerable attention has been paid to the use of petroleum for fuel, and quite large contracts have been made with the railroads and others for a supply of petroleum for a number of years. The Atchison, Topeka and Santa Fe Railroad has already altered and is altering a number of its coal locomotives to use oil as fuel, their experiments having demonstrated its great value.

In the following table will be found a statement of the production of petroleum in California from the beginning of operations in this State up to 1895. The remarkable increase in the production since 1889 will be noted, the production of 1895 being practically four times that of 1889.

Production of petroleum in California.

Year.	Barrels.	Year.	Barrels.
Previous to 1876	175,000	1886	377,145
1876	12,000	1887	678,572
1877	13,000	1888	690,333
1878	15,227	1889	303,220
1879	19,858	1890	307,360
1880	40,552	1891	323,600
1881	99,862	1892	385,049
1882	128,636	1893	470,179
1883	142,857	1894	705,969
1884	262,000	1895	1,208,482
1885	325,000		

KANSAS.

The petroleum-producing territory of Kansas remains as it has been described in previous volumes of Mineral Resources. The only important feature in connection with the production of petroleum in this State in 1895 has been the purchasing by parties representing the Standard Oil Company of the producing territory of Messrs. Guffey & Galey.

The total product of oil in Kansas, so far as records have been obtained, is as follows:

Production of petroleum in Kansas.

Year.	Barrels.	Year.	Barrels.
1889	500	1893	18,000
1890	1,200	1894	40,000
1891	1,400	1895	44,430
1892	....		

TENNESSEE.

Probably the most important of the oil-producing districts of Tennessee are those on the Rugby lands, in this State. In 1891 a well was put down on this property 2 miles west of Glen Mary, and oil, green in color, of 42° specific gravity Baumé, was found at a depth of 1,236 feet. The derrick floor was 30 feet above the top of the Big Conglomerate and 1,280 feet above the sea level. This is claimed to be the first well put down through the Cumberland table-lands. It filled up with oil 164½ feet within a few hours after oil was struck, and was then plugged and the casing pulled. Other wells, it is stated, were put down by the

Forest Oil Company on this same land. In No. 1 and No. 2 wells the same kind of oil was struck as in the well referred to above, which is known as the "Strubbe Well," from Mr. W. G. Strubbe, who put down this well and to whom we are indebted for this information. In No. 1 well the oil was struck at 1,340 feet, and in No. 2 at 1,235 feet, but in lesser quantities.

Considerable developments have also taken place in Pickett County. Two wells have been drilled, the oil being reported to be green in color, of from 38.6° to 43.6° specific gravity Baumé, and free from sulphur. One of these wells, which was brought in in July, flowed some 4,000 barrels; the other, brought in in October, some 50 barrels, but they were plugged. The indications are that 1896 will show some important developments in this State.

KENTUCKY.

Reports have been received of quite extensive explorations that have been undertaken in Kentucky, especially in the eastern part of this territory, in the hope of discovering oil in large quantities. We are advised that petroleum has been found in Wayne, Clinton, Cumberland, Russell, and Adair counties, the reservoirs in a majority of the producing wells in these counties being located in beds of the Waverly sandstone, others in the Hudson River rocks of the Upper Silurian just below the Devonian, while one or two wells probably draw their supply from the Trenton. The wells are shallow, from 700 to 1,100 feet, the oil ranging in specific gravity from 34° to 38°.

I have received under date of May 30, 1896, from Mr. W. G. Strubbe, a letter in which he predicts a large production of oil in Kentucky in the near future, and gives the following list of wells being drilled north and east of Pineknot, Ky., and the depth to which they have been drilled:

List of wells drilling north and east of Pineknot, Ky., in May, 1895.

Location, etc.	Depth.
	Feet.
At Log Cabin, Bell County, Ky., Guffey, Galey & Hull, drilling	200
At Flatlick, Knox County, Ky., Guffey, Galey & Hull	Rig.
At Barboursville, Knox County, Ky., W. Welsh, Pittsburg	Rig.
At Brummetts Station, Whitley County, Ky., a home oil company (Joseph Siler, president) drilling	1,000
At Greenwood, Pulaski County, Ky., Bradford and Kentucky Oil and Gas Company, drilling	1,100
At Winfield, Scott County, Tenn., Hydetown Oil and Gas Company, of Pennsylvania	Rig.

No commercial production is reported. We have already described the oil fields in the other parts of this State. They have not yet assumed any importance.

The total production of oil in Kentucky, so far as we have been able to ascertain the same with any details, is as follows:

Production of petroleum in Kentucky, 1883–1895.

[Barrels.]

Year.	Production.	Year.	Production.
1883	4,755	1890	6,000
1884	4,148	1891	9,000
1885	5,164	1892	6,500
1886	4,726	1893	3,000
1887	4,791	1894	1,500
1888	5,096	1895	1,500
1889	5,400		

TEXAS.

But little can be added to the statement regarding the occurrence of petroleum in Texas. As yet this State has assumed no importance as a producing territory. Practically all of the oil produced in the State in 1895 was from the wells of Mr. George Dullnig, near San Antonio, in Bexar County.

During the year 1895 a well was completed at Sourlake, Tex., which gave a small supply of 16° lubricating oil. In drilling a well in Corsicana, at a depth of 1,035 feet, an oil sand some 20 feet in thickness was found, and some 2¾ barrels of oil per day has been produced. This, however, has been since the 1st of January, 1896, and this production is not, therefore, included in this report.

The production of petroleum in this State since 1889 has been as follows:

Production of petroleum in Texas from 1889 to 1895.

Year.	Barrels.	Year.	Barrels.
1889	48	1893	50
1890	54	1894	60
1891	54	1895	50
1892	45		

ILLINOIS.

The only oil produced in Illinois commercially is that found in Litchfield, Montgomery County.

The production of petroleum in this State since 1889 has been as follows:

Production of petroleum in Illinois from 1889 to 1895.

Year.	Barrels.	Year.	Barrels.
1889	1,460	1893	400
1890	900	1894	300
1891	675	1895	200
1892	521		

INDIAN TERRITORY.

Nothing can be added to what has been said for this report regarding the production of oil in Indian Territory.

The total production since 1891 has been as follows:

Production of petroleum in Indian Territory from 1891 to 1895.

Year.	Barrels.	Year.	Barrels.
1891	30	1894	130
1892	80	1895	37
1893	10		

MISSOURI.

The conditions under which petroleum is found in this State are similar to those that exist in Kansas, and need not be described here.

In the following table is given the production of crude petroleum in Missouri from 1889 to 1895:

Production of petroleum in Missouri from 1889 to 1895.

Year.	Barrels.	Year.	Barrels.
1889	20	1893	50
1890	278	1894	8
1891	25	1895	10
1892	10		

WYOMING.

Regarding the petroleum fields of Wyoming, we condense the following statement from a paper contributed by Prof. Wilber C. Knight to the American Manufacturer:

EARLY HISTORY AND DEVELOPMENT.

The discovery of petroleum in Wyoming dates back for over a half century. In early days oil was collected and sold to local consumers, but the industry was never of much importance and always of short duration. Frontiersmen gathered oil from the springs on Oil Mountain and sold it for wagon grease to the overland traveler who passed up the Sweetwater Valley. Shortly after the completion of the transcontinental railroad oil was collected from the springs in Uinta County and sold to the Union Pacific Railroad for lubricating purposes, and for use in the coal mines at Rock Springs and Carbon. After mining operations were started in the Black Hills a company made a business of collecting oil from many oil springs in Crook County, and, freighting it to the mines, sold it as a lubricant. This enterprise lasted until Eastern oil was laid down cheaper than the cost of freighting the Wyoming product. During this early period some persons attempted to drill wells, but were disappointed in their undertakings, since they did not understand well drilling nor the proper location for an oil well.

In 1884 Dr. Graft, of Omaha, organized a company, purchased the proper machinery, and drilled three wells on the Little Popo Agie River, some 10 miles southeast of Lander, and at the very spring that Bonneville visited in 1833. The wells drilled were all producers and had an estimated capacity of 200 barrels each per day. Various inducements were offered capitalists to construct either a railroad or a pipe line to convey the oil to market. All attempts failed, however, and the company packed their wells and have since awaited transportation. Although the State has developed various resources during the last ten years, no attempt has been made to reach this oil district, which is about 100 miles from any railroad. The success of the Dr. Graft Company in securing a good flow of oil induced many other companies to organize and drill wells in other oil fields. With one exception the attempts proved failures, either because they did not locate in the proper place or because they did not make the proper estimation for depth. In all of the districts where these wells were drilled oil was flowing from springs, but the men who furnished the money for developments could not be induced to drill deeper. This unfortunate step stopped the development of the oil until the Pennsylvania Oil Company, in 1889, located in the Salt Creek Basin. In 1890 this company drilled a producing well, and since that time they have added five more to the list. These six wells produce from 60 to 70 barrels per day of very high-grade lubricating oil. Two more companies are now drilling in the field, one of which has reached the oil sand. Since four of the producing wells were drilled this year the output for 1895 will not be very large, but at the present rate of increase it will reach the 50,000-barrel mark for 1896.

THE OIL DISTRICTS.

There are now known to exist in Wyoming 18 oil districts, or oil basins, as they are sometimes called. Twelve of these are located in the central portion of the State, two in the northeastern part, and four in the southwestern. These districts are known by the following names: Salt Creek, Powder, Oil Mountain, Argo, Rattlesnake, Dutton, Beaver, Popo Agie, Lander, Shoshone, Bonanza, Belle Fourche, Newcastle, Douglas, Sulphur Creek, Carter, Twin Creek, and Fossil. Several other localities have been reported as oil bearing, and it is very likely that new districts may be added at any time. Owing to the meager study of the various districts no boundary lines have yet been established and no attempt has been made to map the producing area. Judging from the oil springs and the extensive outcroppings of oil-saturated sandstone, the districts are quite extensive. It has been stated that Fremont County has more than 40 oil springs, and that Natrona County has upwards of 100. One can form a very good idea of the extent of these fields by referring to the amount of land located as oil claims. In the Oil Mountain, Argo, and Rattlesnake districts the recorder, Mr. J. E. Ervay, states that over 600,000 acres of land have been located as oil claims. In the Salt Creek district over 300,000 acres are claimed. The lands in the oil fields belong to the General Government, and the oil claims are located under the placer act. A person can locate a claim of 20 acres, but usually eight or more form themselves into a company and locate a large tract in claims of 160 acres each. The claimants hold their claims as long as they comply with the law and do their annual assessment of $100 worth of work upon each claim. When $500 worth of work has been performed upon a claim the owner can, by making proof and paying $2.50 per acre, obtain a patent. The dealings thus far have been chiefly in quitclaim deeds, since but very little oil land has been patented. Large holdings are now controlled by companies for speculative purposes, but the prices thus far have been very reasonable.

THE GEOLOGY.

The geology of the fields is imperfectly known, but sufficient progress has been made to refer the most of the districts to their proper geological horizon. Unlike the east, the oil is found principally in Mesozoic rocks, but it also occurs in Paleozoic and Cenozoic formations. The lowest strata that produce oil belong to the Upper Carboniferous age. Springs of oil are found in the Triassic red sandstone, but the oil in all probability comes from Carboniferous rocks. The Cretaceous groups are all oil bearing, and some springs of oil and oil-saturated sandstone exist in Eocene Tertiary rocks. The following tables will give the names of the formations present in the oil fields. Groups and higher terms not otherwise designated are oil bearing.

Cenozoic...	Tertiary.	Eocene.	Wasatch.
Mesozoic...	Cretaceous...		Laramie.
		Montana...	Fox Hills.
			Fort Pierre.
		Colorado...	Niobrara.
			Fort Benton.
			Dakota.
	Jurassic (barren).		
	Triassic (oil springs).		
Paleozoic..	Carboniferous.	Upper Carboniferous.	

From the lowest to the highest oil horizon the aggregate thickness of rocks varies from 10,000 to 15,000 feet. In some of the fields the entire series of rocks as above named are found, but all of them are not oil bearing. The rocks composing these formations are sandstone, shales, marls, clays, and limestones; the latter is of rare occurrence except in the lowest measures. As a rule, the oil fields are found along the axis of anticlinal folds. The springs and the outcropping oil sand follow the trend of the axis. Some of the anticlinal folds are very extensive, forming mountains of considerable magnitude, while others less sharply inclined and not so high only expose the upper rocks. The depth necessary to drill to reach the oil varies as the distance from the axis of the anticlinal. The wells vary in depth from 300 to 1,500 feet. In many localities wells will have to be drilled to a depth varying from 2,000 to 3,000 feet, and along the border of some of the best fields the oil will be found too deep for a drill to penetrate.

NATURE OF THE OILS.

The oils are principally lubricating, but light oils containing considerable kerosene are also found. The most of the oils have a specific gravity above 0.9000 and one from the Rattlesnake has a gravity of 0.9950. Light oils are found at Bonanza and Lander that have a gravity below 0.9000. Many of the oils that have been analyzed have yielded large percentages of lubricating oils with gravities ranging from 0.9100 to 0.9500. The heavy oils have a high flashing point, a low cold test, and are very viscous. One peculiar feature associated with these fields is that you can not judge the oil by knowing from what geological horizon it comes. The Rattlesnake oil having a gravity of 0.9950 and the Bonanza oil of 0.8544 occur in the same group, but are widely separated. Some allowance must be made for most of the oils reported in the tabulated statement. The oils taken from the springs are very much heavier than those taken from wells. This is due to the lighter constituents having evaporated upon exposure. For further information regarding the oils see the tabulated statement.

Characteristics of Wyoming petroleum.

Name of oil field.	County.	Specific gravity.	°B.	Flashing point (°F.).	Color of oil.	Geological horizon.	Number of producing wells.	Product in barrels per 24 hours.	Natural occurrence.	Remarks.
Salt Creek	Natrona and Johnson.	.9100	24.5	221	Green	Lower Fox Hills or Upper Pierre.	6	60 to 70	Springs	Regular shipments of oil.
Powder	do	.9241	22	311	do	Dakota			do	
Oil Mountain	Natrona	.9100	24.5	234	do	do			do	Oil darkens on exposure at spring.
Argo	do					do			do	The same nature as the Rattlesnake.
Rattlesnake	do	.9950 to .9873	12.1		Black	Fox Hills, Niobrara, Benton, Dakota.			do	Oil exposed on surface of water in spring soon sinks.
Dutton	Natrona and Fremont.	.9220	22.5			Eocene, Niobrara, Benton, Dakota.			Oil sand	Oil distilled from sand.
Beaver	Fremont	.9650	15.2	278	Dark brown.	Cretaceous (?)			Springs	
Popo Agie	do	.9210	22.6	168	Black	Carboniferous	3	600	do	Wells packed since being drilled.
Lander	do	.8635	33.1		Green	Cretaceous (?)			do	Rich in kerosene.
Shoshone	do				Black	Carboniferous			do	The same as Popo Agie oil.
Bonanza	Big Horn	.8544	34.9	133	Green	Dakota			do	Rich in kerosene.
Belle Fourche	Crook	.9285	21.3	211	do	do	1	5	do	Darkens on exposure at spring.
Newcastle	Weston	.9200	22.7	259	do	Benton (?)			do	
Douglas	Converse	.9210	22.6			Cretaceous (?)			Oil sand	Oil distilled from sand.
Twin Creek	Uinta				Black	Laramie (?)			Springs?	Location not known.
Carter	do					Eocene (?)			do	
Sulphur Creek	do				Black	Laramie (?)			do	Do.
Fossil	do									

THE INDUSTRY AND ITS FUTURE.

The industry is now in its early infancy. The Pennsylvania Oil Company is the only producer and shipper. Within the next few months two more companies will be added to the list. All of this work is, however, being done in a single district, and it can not go much beyond on account of the great distance from the railroad. Even in the Salt Creek field the companies will have to do as the Pennsylvania Company—haul the oil over 50 miles by wagon. With one exception, the rest of the central districts are less favored than Salt Creek, and the outlying fields are at least 150 miles from the nearest railroad station. There are now four great railroad systems operating and building in the State, but none of them seem inclined to build into or near to the oil fields in the central part. As soon as the fields are furnished with transportation and a proper market for the oil, the industry will become one of the leading ones in the State. There are several reasons for predicting a great future for Wyoming oil. There are many fields, the acreage is very large, the springs and exposed sands signify a good flow, and the oils are of the greatest variety. With facilities to operate, it would be only a short time until excitement of early days in Pennsylvania would be duplicated in Wyoming. On the other hand, should transportation not be given, the industry will continue on a small scale as compared with the East for some years to come.

The production of petroleum in Wyoming in 1894 and 1895, so far as we have ascertained, is given in the following table:

Production of petroleum in Wyoming in 1894 and 1895.

Year.	Barrels.
1894	2,369
1895	3,455
Total	5,824

CANADA.

The occurrence of petroleum in Canada has been so frequently described in these reports that nothing need be said here regarding it.

The statistics of the production in the Petrolia, Ontario, oil field are not at all satisfactory. In the following table will be found a statement of the shipments of petroleum from Petrolia, Ontario, for each month for the years 1894 and 1895. These statements are by no means satisfactory, part of the oil being shipped as crude and part as refined. The refined shipped is reduced to crude or its equivalent and added to the amount of oil shipped as crude, giving the total crude equivalent. The shipments are given in barrels of 35 imperial gallons, this being practically the equivalent of the American barrel of 42 Winchester gallons. It will be noted that this statement of shipments shows a production in excess of the statement compiled by the geological survey department of Canada, and would indicate that these reports of shipments are in excess of the actual production from year to year, probably the result of duplications:

Shipments of crude petroleum and refined petroleum reduced to crude equivalent from Canada in 1894 and 1895.

[Barrels of 35 imperial gallons.]

Month.	1894.			1895.		
	Crude.	Refined.	Crude equivalent.	Crude.	Refined.	Crude equivalent.
January	25,575	32,605	107,087	21,155	27,323	89,462
February	20,295	22,355	76,182	18,810	25,875	83,497
March	16,935	17,490	60,660	17,380	19,825	66,943
April	15,125	19,335	63,463	15,400	17,955	60,287
May	18,756	19,445	67,369	18,165	18,382	64,120
June	15,655	16,870	57,830	15,670	17,725	59,982
July	20,536	19,620	69,586	18,985	17,370	62,410
August	18,420	27,170	86,345	17,335	24,335	78,173
September	18,135	36,735	109,973	20,772	32,615	102,309
October	26,575	51,835	156,162	24,970	46,727	141,787
November	23,675	39,535	122,513	19,890	32,484	101,100
December	23,375	27,640	92,475	23,750	31,346	102,115
Total	243,057	330,635	1,069,645	232,282	311,962	1,012,185

From Mr. Kerr, secretary of the Petrolia Oil Exchange, we had the following statement regarding the shipments and production of oil in 1894 and 1895. These are the shipments by railroad, and are given in barrels of 35 gallons each, by months.

Shipments of crude petroleum from the Petrolia (Ontario) oil field in 1894 and 1895.

[Barrels of 35 imperial gallons.]

Month.	1894.	1895.
January	101,570	89,462
February	76,183	83,497
March	60,661	66,943
April	73,463	58,187
May	67,369	64,120
June	57,830	59,980
July	69,586	62,410

Shipments of crude petroleum from the Petrolia (Ontario) oil field in 1894 and 1895—Continued.

[Barrels of 35 imperial gallons.]

Month.	1894.	1895.
August	86,345	78,173
September	109,973	102,309
October	156,163	141,787
November	122,513	101,100
December	97,170	102,215
Total	1,078,826	1,010,183
Shipped by pipe line	10,000	0
Total	1,088,826	1,010,183
Stocks in tanks—		
January 1	77,000	40,898
December 31	40,000	27,987
Decrease in stocks	37,000	12,911
Approximate production	1,051,826	997,272

Mr. Kerr states: I believe the foregoing estimate is too great by at least 10 per cent on the shipments, which are estimated from refined and converted into crude equivalent. By-products are liable to be duplicated in such a calculation. I would therefore estimate that the total net production in 1894 and 1895 would be as follows, allowing 10 per cent reduction on shipments:

Estimated production of petroleum in Canada in 1894 and 1895, by Mr. James Kerr.

[Barrels of 35 imperial gallons.]

	1894.	1895.
Shipped by road	970,943	909,165
Shipped by pipe line	10,000	....
Total	980,943	909,165
Less reduction of stocks	37,000	12,911
Making the production	943,943	896,254

In the following table is given a statement of the production of petroleum in Canada in the years 1886 to 1895, and the value of the same. These figures, it is stated, are calculated from the official inspection returns, and the values are computed at the average yearly price per barrel of 35 imperial gallons.

Production and value of petroleum in Canada from 1886 to 1895.

[Barrels of 35 imperial gallons.]

Year.	Production.	Value.
1886	486,441	$437,797
1887	763,933	595,868
1888	733,564	755,571
1889	639,991	612,101
1890	765,029	902,734
1891	755,298	1,004,596
1892	779,753	982,489
1893	798,406	834,344
1894	829,104	835,322
1895	802,574	1,201,186

The average closing prices of petroleum for each year from 1885 to 1895 at the Petrolia Oil Exchange, together with the total sales for the year on this exchange, are as follows:

Average price and sales of crude petroleum in the Petrolia Oil Exchange from 1885 to 1895.

Year.	Price.	Sales.
		Barrels.
1885	$0.82¼	871,500
1886	.86¾	782,570
1887	.78	406,203
1888	1.02¾	516,007
1889	.92¾	400,932
1890	1.18	394,924
1891	1.33¾	377,453
1892	1.26¼	165,315
1893	1.09½	20,941
1894	1.00¾	32,348
1895	1.49⅔	9,755

The great decrease in sales on the exchange for the last three years will be noted. This does not imply a decrease of actual business in the oil field, but simply that the petroleum went direct to the refiners, instead of being sold through the brokers on the exchange. The exchange prices, however, show the value of the petroleum in the markets.

In the following table will be found a statement of the average closing prices for crude oil on the Petrolia Oil Exchange for each month from 1892 to 1895.

Average closing price of crude petroleum on the Petrolia Oil Exchange from 1892 to 1895, by months.

Month.	1892.	1893.	1894.	1895.
January	$1.29¼	$1.18¼	$1.01¼	$1.16
February	1.29	1.18¾	1.01	1.19⅞
March	1.27¾	1.19	1.01	1.27
April	1.26¼	1.19	.99½	1.55¾
May	1.25¾	1.07	.92	1.67¼
June	1.27½	1.07	.92¾	1.52
July	1.26¾	1.06	.94	1.52¼
August	1.26	1.05	.96	1.54
September	1.26	1.04½	.98	1.55½
October	1.26¾	1.04	1.06	1.59⅞
November	1.25	1.04	1.12¼	1.64½
December	1.18½	1.02	1.13½	1.72⅜
Average	1.26¼	1.09½	1.00¾	1.49⅜

The following statement is given of the operations of the refineries of Canada for the years 1890 to 1895:

Production of Canadian oil refineries from 1890 to 1895.

[Imperial gallons.]

Product.	1890.		1891.	
	Quantity.	Value.	Quantity.	Value.
Illuminating oils .... gallons	11,129,277	$1,264,677	10,427,040	$1,170,241
Benzine and naphtha .... do	636,247	37,026	603,971	36,790
Paraffin oils .... do	446,888	64,713	622,287	75,772
Gas and fuel oils .... do	4,246,447	84,752	3,373,720	89,267
Lubricating oils and tar ... do	2,877,388	130,349	2,500,000	101,752
Paraffin wax .... pounds	913,730	56,903	741,611	60,687
Total		1,638,420		1,534,509

Product.	1892.		1893.	
	Quantity.	Value.	Quantity.	Value.
Illuminating oils .... gallons	10,806,806	$1,176,720	11,100,810	$1,073,738
Benzine and naphtha .... do	793,263	60,130	721,192	54,760
Paraffin oils .... do	1,051,163	127,351	1,243,924	116,233
Gas and fuel oils .... do	6,343,589	202,047	7,559,489	217,740
Lubricating oils and tar ... do	3,177,853	133,336	1,876,633	92,616
Paraffin wax .... pounds	876,570	82,781	1,659,167	120,697
Total		1,782,365		1,675,784

Production of Canadian oil refineries from 1890 to 1895—Continued.

[Imperial gallons.]

Product.	1894.		1895.	
	Quantity.	Value.	Quantity.	Value.
Illuminating oils ....gallons..	11, 289, 741	$1, 003, 973	10, 924, 826	$1, 237, 328
Benzine and naphtha......do....	645, 031	54, 515	7, 081, 717	285, 308
Paraffin oils...............do....	1, 282, 749	148, 053	1, 964, 228	86, 608
Gas and fuel oils ....do....	7, 323, 374	197, 193	2, 213, 639	79, 589
Lubricating oils and tar...do....	1, 801, 174	74, 309	2, 400, 404	205, 591
Paraffin wax ....pounds..	1, 950, 172	119, 091	1, 964, 228	86, 608
Total.....................	....	1, 567, 134	....	1, 981, 032

At the refineries producing the above amount of oil in 1895, 355 persons were employed, the total wages paid for labor being $190,007.

The following table shows the amount of Canadian oils and naphtha inspected, together with the amount of crude that is assumed as the equivalent of the refined oils and the ratio of crude to refined:

Canadian oils and naphtha inspected, and corresponding quantities of crude oil.

Fiscal year.	Refined oils inspected.	Crude equivalent calculated.	Ratio of crude to refined.
	Gallons.	*Gallons.*	
1881..................	6, 406, 783	12, 813, 566	100:50
1882..................	5, 910, 787	13, 134, 998	100:45
1883..................	6, 970, 550	15, 490, 111	100:45
1884..................	7, 656, 011	19, 140, 027	100:40
1885..................	7, 661, 617	19, 154, 042	100:40
1886..................	8, 149, 472	21, 445, 979	100:38
1887..................	8, 243, 962	21, 694, 637	100:38
1888..................	9, 545, 895	25, 120, 776	100:38
1889..................	9, 462, 834	24, 902, 195	100:38
1890..................	10, 121, 210	26, 634, 763	100:38
1891..................	10, 270, 107	27, 026, 597	100:38
1892..................	10, 370, 707	27, 291, 334	100:38
1893..................	10, 618, 804	27, 944, 221	100:38
1894..................	11, 027, 082	29, 018, 637	100:38
1895..................	10, 674, 232	28, 090, 084	100:38

AUSTRIA-HUNGARY.

The only oil-producing field in Austria-Hungary is in Galicia. The Galician oil belt, so far as it has been defined, extends in a general northeasterly and southwesterly direction along the northern slopes of the Carpathian Mountains for a distance of 220 miles, and is from 40 to 60 miles in breadth. According to Mr. Boverton Redwood, the unworked oil deposits in Bukowina and in Transylvania, as well as the important Roumanian oil fields occupying the southeastern and southern slopes of the southern Carpathians, form an extension of the Galician deposits.

The formation in Galicia is usually considered to belong to the latest portion of the Cretaceous or to the Eocene period. The formation in Bukowina appears to be Cretaceous. In Roumania the oil occurs mainly in Miocene strata, though it is also found in the Eocene and apparently in the underlying Cretaceous. The depth to which wells have to be sunk and the daily production of the wells vary in the different districts. The depth is from 60 to 350 meters (197 to 1,148 feet).

The localities in which the principal amounts of oil were produced in 1894 are given by Mr. Redwood as follows:

Approximate estimate of production per month of the Galician oil fields.

Locality.	Barrels.
Potok	24,000
Wietrzno, Bobrka, Rowne	15,000
Schodnica	12,000
Sloboda Rungurska	9,000
Ropienka, Wankowa, Brelikow	7,800
Gorlico and district	6,000
Weglowa	4,800
Iwonicz, Lezyny, Harklowa	3,000

The petroleum from the important Galician fields ranges in specific gravity from 0.870 to 0.885, though some of the oils are as low as 0.800, and others 0.898. The production of Galicia is usually given in metric centners or the metric quintal of 100 kilos, or 220.462 pounds, each. If we assume that the Galician petroleum ranges in specific gravity from 0.870 to 0.885, and the number of pounds in a gallon is 7.3, a barrel of 42 United States gallons would weigh 306.6 pounds. These figures will be used in stating the production of Galician petroleum.

The production of crude petroleum in Galicia since 1883, according to the official reports, is given in the following table (page 98).

Production of crude petroleum in Galicia from 1883 to 1894.

Year.	Barrels of 1⅛ metric centners (of 100 kilos) each.	Barrels of 42 United States gallons.
1883	166,500	179,584
1884	233,000	251,309
1885	333,000	359,167
1886	433,000	467,025
1887	532,000	573,805
1888	665,000	717,256
1889	746,000	804,620
1890	816,000	880,121
1891	1,083,168	1,168,283
1892	1,096,242	1,182,385
1893	1,192,016	1,285,685
1894	1,200,000	1,294,296

The above production is from Mr. Redwood's book on Petroleum. The production for 1892 and 1893 differs somewhat from that received from the minister of agriculture of Austria-Hungary. According to his report the production in 1892 was 898,713 metric quintals, or 646,223 barrels of 42 gallons each, while the production in 1893 was 963,312 metric quintals, or 692,673 barrels of 42 gallons each. The total value of the oil produced in 1893 was 3,008,819 florins, which, at 48 cents to a florin, would be $1,444,233, or $2.085 a barrel.

According to the report of the Vienna Chamber of Commerce for 1894, the total amount of mineral oil on which internal revenue was paid by the refineries of Austria-Hungary was 192,958 metric tons in 1894, against 178,288 metric tons in 1893. Estimating that this refined oil had a gravity of 45° B., a gallon would weigh 6.6 pounds, which would make the total production in 1894, 1,533,680 barrels of 42 United States gallons each, and the production in 1893, 1,417,814 barrels. According to the same report, the total consumption of refined oil in Austria-Hungary in 1894 was 197,854 metric tons, of which 105,700 tons were imported and 92,154 tons were Galician oil. On the same estimate of gravity as given above, this would make the total consumption of oil 1,573,172 barrels of 42 United States gallons, of which 840,566 barrels were imported and 732,606 barrels Galician oil. The wholesale price for standard white illuminating oil free on board at Vienna in 1894 was $9 and $9.10 per 100 kilos, while it is reported that Caucasian oil was $9.30 and $9.40 per 100 kilos.

It is interesting to note that notwithstanding this comparatively large production of home oil, the amount of paraffin produced does not equal the demand, and in consequence considerable paraffin had to be imported from the United States, Scotland, and Germany. The imports of paraffin in 1893 and 1894, in metric tons, were as follows.

Imports of paraffin into Austria-Hungary in 1893 and 1894.

[Metric tons.]

Paraffin.	1894.	1893.
Crude	2,725	4,918
Refined	2,998	3,450

GERMANY.

Petroleum has been found in Germany in small quantities. The largest production is in Alsace, while the smallest quantities are produced in the province of Hanover, in Prussia, in Hildesheim (Peine), and Luneberge.

In the following table is given a statement of the amount of petroleum produced in Germany in 1890 to 1894, inclusive, the figures in the first column being metric tons and in the second column the equivalent in American barrels of 42 gallons each:

Production of petroleum in Germany from 1890 to 1894, inclusive.

Year.	Production.	
	Metric tons.	Barrels (42 gallons).
1890	15,226	108,295
1891	15,315	108,927
1892	14,257	103,323
1893	13,974	99,395
1894	17,232	122,563

In reducing the metric tons to barrels we have assumed that the specific gravity of the German oil is that of the Hildesheim oil, viz, 0.888. This equals about 28° B., which is the equivalent of about 7.38 pounds to the gallon.

GREAT BRITAIN.

The mineral statistics of the United Kingdom give the production of petroleum from 1886 to 1894 as follows:

Production of petroleum in Derbyshire, England, from 1886 to 1894.

Year.	Tons (2,240 pounds).	Barrels (42 gallons).
1886	43	314
1887	66	482
1888	35	256
1889	30	219
1890	35	256
1891	100	731
1892	218	1,594
1893	260	1,900
1894	49	322

The tons in the above table have been reduced to barrels on the assumed weight of 7.3 pounds to a gallon and 42 gallons to a barrel.

The quantity and value of oil shale produced in Great Britain from 1890 to 1894 are shown in the following table:

Production and value of oil shale in Great Britain from 1890 to 1894.

Year.	Production.	Value.
	Tons.	
1890	2,212,250	£608,369
1891	2,361,119	707,177
1892	2,089,937	522,484
1893	1,956,520	489,130
1894	1,986,385	496,596

From the above table it appears that the production of oil shale in Great Britain in 1894 was 1,986,385 tons, valued at £496,596, or $2,403,525, as compared with a production of 1,956,520 tons in 1893, valued at £489,130, or $2,367,389.

Most of this shale was produced in Scotland, but 2,602 tons, valued at £651 ($3,151), were produced in England in 1894, and 6,924 tons, valued at £1,731 ($8,378), in 1893. Wales produced in 1894, 1,374 tons, valued at £343 ($1,660), and in 1893, 1,754 tons, valued at £438 ($2,120). The production of Scotland, on the other hand, was 1,982,409 tons, valued at £495,602 ($2,398,714), in 1894, and 1,947,842 tons, valued at £486,961 ($2,356,891), in 1893. With respect to the products derived from a ton of shale, this office is informed by John Fyfe, managing director of Young's Paraffin Light and Mineral Oil Company, Limited, that there is considerable variation in these products, especially in regard to ammonia. He, however, gives the following statement as showing the range:

The crude oil varies from about 20 to 30 imperial gallons per ton of 2,240 pounds; the ammonia water, yielding sulphate of ammonia, from 25 to 65 pounds per ton. The products from crude oil vary to a less extent, and from 100 gallons thereof the following may be considered as about an average yield:

Average yield of 100 gallons of crude shale oil.

	Gallons.
Spirit	5
Burning oil	30
Gas oils, 0.840 to 0.865 sp. gr	8
Heavy oils, 0.875 to 0.895 sp. gr	16
Paraffin scale	14
Total	73

There is also a small residue of tar and coke suitable for burning.

ITALY.

Nothing can be added to what has already been stated in these volumes regarding the occurrence ot petroleum in Italy. From the volumes of Rivista del Servizio Minerario the following statement is extracted regarding the production of petroleum in this country:

Production of petroleum in Italy from 1860 to 1894.

Year.	Number of wells in operation.	Quantity.		Production.				Number of workmen employed.
		Metric tons.	United States barrels.	Unit value.		Total value.		
				Lire.	Dollars.	Lire.	Dollars.	
1860....	3	5	36	800	21.44	4,000	772	5
1861....	5	4	29	800	21.31	3,200	618	8
1862....	4	4	29	800	21.31	3,200	618	9
1863....	7	8	58	800	21.29	6,400	1,235	18
1864....	7	10	72	800	21.41	8,000	1,544	32
1865....	10	315	2,265	209.52	5.62	66,000	12,738	70
1866....	12	138	992	269.86	7.24	37,240	7,187	57
1867....	11	110	791	349.10	9.37	38,400	7,411	58
1868....	9	51	367	435.29	11.67	22,200	4,285	52
1869....	8	20	144	800	21.65	16,000	3,118	45
1870....	6	12	86	800	21.55	9,600	1,853	30
1871....	6	38	273	263.16	7.07	10,000	1,930	40
1872....	6	46	331	208.69	5.60	9,600	1,853	36
1873....	5	65	467	172.31	4.63	11,200	2,162	35
1874....	4	84	604	152.38	4	12,800	2,470	37
1875....	3	113	812	138.05	3.70	15,600	3,011	38
1876....	3	402	2,890	123.38	3.31	49,600	9,573	72
1877....	2	408	2,934	132.35	3.55	54,000	10,422	45
1878....	4	602	4,328	102.99	2.76	62,000	11,966	98
1879....	4	402	2,890	124.37	3.34	50,000	9,650	70
1880....	2	283	2,035	313.05	8.40	88,595	17,099	24
1881....	2	172	1,237	445	11.94	76,540	14,772	24
1882....	4	183	1,316	474.55	11.97	86,844	15,761	121
1883....	5	225	1,618	259.49	6.96	58,387	11,269	92
1884....	6	397	2,854	341.18	9.16	135,452	26,142	110
1885....	6	270	1,941	407.65	10.92	110,066	21,243	136
1886....	7	219	1,575	416.11	11.16	91,130	17,588	145
1887....	7	208	1,497	364.04	9.76	75,720	14,614	135
1888....	5	174	1,251	319.71	8.58	55,630	10,737	75
1889....	7	177	1,273	288.13	7.73	51,000	9,843	70
1890....	9	417	2,998	289.21	7.77	120,603	23,276	177
1891....	7	1,100	7,909	298.91	8.02	328,800	63,458	230
1893....	8	2,652	19,068	299.80	8.05	795,050	153,445	130
1894....	9	2,854	20,520	296.88	7.97	847,260	163,521	194

Of the total production of 2,854 tons, or 20,520 barrels, in 1894, 2,830 tons, or 20,348 barrels, were from the Milan district, and 24 tons, or 172 barrels, from the district of Rome. Of the total production of 2,652 tons, or 19,068 barrels, in 1893, 2,640 tons, or 18,982 barrels, were from the Milan district, and 12 tons, or 86 barrels, from the Rome district.

In 1894 there were in Italy two refineries which produced 1,640 tons of refined oil, valued at 967,600 lire, or $186,747. This would be equivalent to 590 lire, or $113.87, a ton. Reducing this quantity to American measure, the total production of refined oil would be 13,038 barrels, valued at $14.32 per barrel, or a total of $186,747.

In 1893 there were four refineries in operation in Italy, of which two were in the Milan district, one in the Rome district, and one in the Vicenza district. The total production of these refineries was 2,613 tons or 20,773 barrels, valued at 1,293,380 lire, or $249,622. Of this product, 2,546 tons, or 20,241 barrels, valued at 1,273,000 lire, or $245,689, were produced in the Milan district, 16 tons, or 127 barrels, valued at 11,200 lire, or $2,162, in the Rome district, and 51 tons, or 405 barrels, valued at 9,180 lire, or $1,771, in the Vicenza district.

ROUMANIA.

As is stated elsewhere, the petroleum deposits of Roumania are continuous with those of Galicia. According to Mr. Redwood, they are also of the same age and apparently form portions of the petroleum-bearing beds of the Caucasus. The outcrop of possibly petroliferous formation in Roumania is from 15 to 20 miles in width and runs a distance of 400 miles, with a few unimportant breaks, from the Iron Gates to the Galician frontier. Petroleum is found in various localities throughout 300 of these 400 miles. The specific gravity of the crude oil is from 0.839 to 0.896. According to Mr. Redwood, the crude product yields 4 per cent light oils, from 60 to 70 per cent illuminating oils, and from 25 to 35 per cent residuum.

No official records are kept of the Roumania production. According, however, to the report of the Austria-Hungary vice-consulate at Ploesti (see American Manufacturer, October 25, 1895), the production of crude petroleum in Roumania in 1894 was as follows:

Production of crude petroleum in Roumania in 1894.

Locality.	Tank carloads of 100-metric centners.
Baicoi	300
Glodeni	900
Campina	800
Doftaneti and Bustenari	750
Ochisori and Matitza	80
Sarata (Buzeu)	600
Tega	100
Other localities	200
	3,730

The above would indicate a production of 3,730 tank cars of 100 metric centners (10 metric tons) each. On the basis of the assumption as to weight we have made in connection with the report on Galician oil, this would make 268,207 barrels of 42 gallons each.

It is also stated in the same report that there are 85 petroleum refineries operating in Roumania.

The Roumanian department of agriculture, which is interested in the development of the petroleum industry, has taken up the question of the communication between the most important oil fields in Roumania with the Mediterranean ports, and it is possible that a pipe line may be built.

We find in an Austrian paper a condensed report of the statistics compiled by the Roumanian Government regarding petroleum, from which it appears that on January 1, 1896, there were 903 petroleum wells in operation. Of these, 751 were on private property and belonged to 123 producers; 152 were on Government land. The depth of the wells ranged from 180 to 720 feet. The production in 1895 is estimated at 74,600 tons (536,414 United States barrels). The average value per ton (7.19 United States barrels) was 40 francs, or $7.72, making the total value 2,984,000 francs, or $575,912, which would make the value per barrel $1.07. The capital invested is estimated at 4,515,000 francs, or $871,395, which would make the average cost for drilling a well 5,000 francs, or $965. The richest oil field in production in 1895 was that of Prahova, which produced nearly 50 per cent of the total output of Roumania. Dimbovitza, Bacau, and Buzeu produced the remainder, in nearly equal quantities.

From our Austrian exchanges the following statement is obtained regarding the production of crude petroleum in Roumania from 1874 to 1895, inclusive, the statement being in tank cars of 10 metric tons each:

Production of crude petroleum in Roumania from 1874 to 1895.

Year.	District.				Total.	
	Prahova.	Buzeu.	Bacau.	Dimbovitza.	Tank cars.	Barrels (42 U. S. gallons).
1874....	155	780	220	280	1,435	103,176.5
1875....	160	820	230	300	1,510	108,569
1876....	150	760	280	320	1,510	108,569
1877....	180	760	250	320	1,510	108,569
1878....	210	750	250	300	1,510	108,569
1879....	250	700	280	300	1,530	110,007
1880....	290	710	300	290	1,590	114,321
1881....	350	740	300	300	1,690	121,511
1882....	540	700	310	350	1,900	136,610
1883....	570	700	320	350	1,940	139,486
1884....	1,560	700	300	370	2,930	210,667

Production of crude petroleum in Roumania from 1874 to 1895—Continued.

Year.	District.				Total.	
	Prahova.	Buzeu.	Bacau.	Dimbo-vitza.	Tank cars.	Barrels (42 U. S. gallons).
1885....	1,350	700	300	340	2,690	193,411
1886....	880	750	290	425	2,345	168,605.5
1887....	950	800	280	500	2,530	181,907
1888....	890	840	360	950	3,040	218,576
1889....	950	1,010	380	1,800	4,140	297,666
1890....	1,030	1,100	600	2,600	5,330	383,227
1891....	1,150	1,050	790	3,800	6,790	488,201
1892....	1,600	1,100	850	4,700	8,250	593,175
1893....	1,700	950	1,300	3,500	7,450	535,655
1894....	2,600	925	1,650	1,880	7,055	507,254.5
1895....	3,714	904	1,838	1,544	8,000	575,200

In connection with the above, it is stated that the export of crude petroleum in 1895 amounted to 1,400 tank cars (100,660 barrels), the export of distillate to 700 tank cars (50,330 barrels), and the import of crude petroleum to 1,500 tank cars.

INDIA.

The production of petroleum in India from 1889 to 1893, the last year for which we have any definite statistics, is shown in the following table:

Production of petroleum in India from 1889 to 1893.

Year.	Production.	
	Gallons.	Barrels (42 U.S. gallons).
1889	3,298,737	94,250
1890	4,931,093	140,888
1891	6,136,495	175,328
1892	8,725,331	249,295
1893	10,359,812	295,994

The gallons in the above table are imperial gallons, and are equivalent to 1.2 Winchester gallons, which are used in this report. A barrel of 35 imperial gallons is, therefore, equivalent to a barrel of 42 Winchester gallons. It is on this basis that the production in gallons has been reduced above to production in barrels.

JAPAN.

The occurrence of petroleum in Japan was discussed quite thoroughly in the report for 1894, to which we refer those desiring information regarding this subject.

The reports of the chief of the section of general statistics of Japan, showing the production of petroleum in that Empire, give only the production of refined petroleum (quantité fondue ou préparée). From these reports for 1893 and 1894 the figures in the first column of production in the following table are taken. This production is given in kwan of 8.2817 pounds avoirdupois. For the second column under "Production" we have assumed that Japanese refined petroleum will weigh 7¼ pounds to a gallon. The table of production in the third column, up to and including 1890, is the production of crude given in the statement made for this report by Mr. K. Wakashina, geologist for the geological survey of Japan. The figures for 1891, 1892, and 1893 are on the basis of the relation between the production of crude and the production of refined, as given in the tables in previous years:

Production of petroleum in Japan from 1881 to 1893.

Year.	Production.		
	Refined.		Crude (Winchester gallons).
	Kwan.	Winchester gallons.	
1881			703, 217
1882			814, 076
1883			859, 501
1884			246, 647
1885			290, 699
1886			535, 210
1887	353, 197	403, 351	350, 394
1888	180, 445	206, 068	1, 429, 971
1889	283, 865	324, 174	1, 960, 924
1890	447, 214	510, 718	2, 017, 116
1891	520, 480	594, 388	2, 347, 833
1892	537, 240	613, 528	2, 423, 436
1893	437, 640	499, 784	1, 974, 147

JAVA.

In Mineral Resources for 1894 and for previous years is given information regarding the petroleum districts of Java. The two most important are in the residencies of Soerabaya and Rembang, in which the Dordtsche Petroleum Maatschappij possesses drilling rights. The chief workings are in Soerabaya, though the production of Rembang has increased considerably, its production in 1895 being about 40 per cent of the production of Soerabaya.

We are again indebted to the Dordtsche Petroleum Maatschappij for a statement of the production of Java in 1895, which is as follows:

Production of petroleum in Java in 1895.

Residency of Soerabaya:		
Crude	liters..	[1] 33, 750, 000
Refined	cases..	525, 004
Number of producing wells		48
Residency of Rembang:		
Crude	liters..	[2] 12, 941, 000
Refined	cases..	232, 904
Number of producing wells		4

In reducing the liters in the above table to barrels we have assumed the liter to be equal to 1.0567 quarts, or in a barrel of 42 gallons there are 159 liters.

The production of petroleum in Java, so far as we have returns, is shown in the following table:

Production of crude petroleum in Java from 1893 to 1895.

Year.	United States barrels of 42 gallons.
1893	400, 000
1894	168, 000
1895	293, 654

RUSSIA.

In stating the production of crude petroleum in Russia, the figures of the Council of the Congress of Russian Petroleum Producers have been taken, given in millions of poods. In reducing these to barrels it has been assumed that the average gravity of Russian oil is 0.875, and that an American barrel of 42 gallons contains 10.18 poods. In Russian and English publications 8 poods are regarded as equal to 1 barrel, but this is the English Imperial barrel, and not the American barrel of 42 gallons. Two distinct statements of production of Russian crude petroleum are given, one known as "total production," which includes not only the crude collected and refined or sold as fuel oil, but also an estimate of the oil wasted or not collected, as well as that used for fuel for pumping the wells. The second statement shows "profitable production," that is, the amount of crude oil put into tanks or reservoirs.

[1] 212,264 U. S. barrels of 42 gallons.
[2] 81,390 U. S. barrels of 42 gallons.

The total production of crude petroleum on the Apsheron Peninsula and the shipments of the chief petroleum products from Baku from 1880 to 1895 have been as follows:

"Total production" of crude petroleum on the Apsheron Peninsula and shipments of petroleum products from Baku from 1880 to 1895.

[Barrels.]

Year.	Production.	Shipments from Baku.				
		Illuminating.	Lubricating.	Residuum.	Crude oil.	Total.
1880	2,455,000	785,000	....	697,000		1,482,000
1881	3,929,000	1,257,000	....	913,000		2,170,000
1882	4,911,000	1,326.000	30,000	1,768,000		3,124,000
1883	5,893,000	1,473,000	112,000	1,846,000		3,431,000
1884	8,841,000	2,161,000	147,000	2,868,000	....	5,176,000
1885	11,394,000	2,946,000	157,000	3,330,000		6,433,000
1886	14,734,000	3,438,000	167,000	3,555,000		7,160,000
1887	16,208,000	4,322,000	226,000	4,076,000		8,624,000
1888	18,860,000	4,911,000	255,000	5,746,000		10,912,006
1889	20,137,000	6,002,000	324,060	8,703,000	413,000	15,442,000
1890	23,477,000	6,611,000	452,000	9,538,000	638,500	17,239,500
1891	28,290,000	7,269,000	501,000	10,157,000	1,139,509	19,066,500
1892	29,273,000	7,730,000	551,000	11,473,000	1,149,300	20,903,300
1893	33,104,126	8,438,000	570,000	14,096,267	1,198,400	24,302,667
1894	30,383,104	6,994,106	528,684	19,017,682	1,611,000	28,251.472
1895	38,339,882	7,956,778	658,153	17,721,022	1,581,532	27,917,485

This table gives the total production and the total shipments from Baku, both to Russian ports and to other countries, and may be regarded as showing the total production of crude and refined oils and residuum in the district in the years made.

The "profitable production" for the last seven years is shown in the following table:

"Profitable production" of crude petroleum in the Apsheron Peninsula from 1889 to 1895.

[Barrels of 42 gallons.]

Year.	Production.	Year.	Production.
1889	18,889,000	1893	31,894,000
1890	22,229,000	1894	29,223,967
1891	26,074,000	1895	37,072,692
1892	28,143,000		

The divisions of this profitable production among the four subfields on the Apsheron Peninsula are as follows:

"Profitable production" of the several fields of the Apsheron Peninsula from 1889 to 1895

[Barrels.]

Year.	Balakhany.	Saboontchy.	Romany.	Bibi-Eibat.	Total.
1889	6,768,000	10,373,000	....	1,748,000	18,889,000
1890	6,218,000	14,096,000	147,000	1,768,000	22,229,000
1891	7,289,000	16,060,000	1,277,000	2,348,000	26,974,000
1892	5,648,000	15,196,000	4,027,000	3,272,000	28,143,000
1893	5,677,000	14,371,000	7,180,000	4,666,000	31,894,000
1894	5,795,677	14,047,151	6,060,904	3,320,235	29,223,967
1895	6,633,104	14,864,931	10,945,482	4,629,175	37,072,692

WELLS AND THEIR PRODUCTION.

There are two classes of so-called wells in the Baku district, "pumping" and "flowing," or wells worked by "bucketing" and those that flow. In the former, pumping is by means of large, deep buckets or pumps, with valves which are operated by windlass or steam and which bring to the surface at a "stroke" as much as a barrel of crude oil and water. This empties itself into a gutter, and the oil, after separation from the water, is conducted into reservoirs. A shift of workmen at these wells is never less than three.

The flowing wells are the well-known Baku fountains, some of which have given and continue to give some hundred thousand poods a day, say 10,000 barrels.

The production of crude petroleum from pumping and flowing wells in the last seven years is as follows:

Production of crude oil from pumping and flowing wells in Russia from 1889 to 1895.

[Barrels.]

Year.	Pumping.	Flowing.
1889	14,705,000	4,184,000
1890	17,347,000	4,882,000
1891	23,123,000	3,851,000
1892	20,707,000	7,436,000
1893	21,168,000	10,726,000
1894	23,153,240	6,070,727
1895	25,992,141	11,080,550

The total number of wells that produced crude petroleum during any part of the years named was as follows:

Number of producing wells on the Apsheron Peninsula from 1889 to 1895.

Year.	Wells.	Year.	Wells.
1889	278	1893	458
1890	356	1894	532
1891	458	1895	622
1892	448		

The statement of the number of producing wells from 1893 to 1895, by months, is as follows:

Number of producing wells in Russia from 1893 to 1895, by months.

Month.	Number of wells.		
	1893.	1894.	1895.
January	322	332	434
February	326	337	434
March	332	347	437
April	323	355	455
May	325	366	451
June	310	369	....
July	307	373	....
August	294	400	....
September	298	413	....
October	310	420	....
November	316	425	....
December	322	440	....
Total	458	532	622

It should be understood that these figures represent the number of wells in operation during any one month, the total representing the total number of wells that were operated at any time during the year.

The number of wells drilling during each month from 1892 to 1895 and the number completed during the year is given in the following table.

Number of wells drilling and completed in Russia from 1892 to 1895, by months.

Month.	1892.	1893.	1894.	1895.
January	141	62	59	80
February	131	57	60	86
March	127	69	62	86
April	117	64	72	78
May	94	69	81	86
June	84	73	79	89
July	44	69	75	....
August	45	64	73	....
September	52	58	73	....
October	45	59	69	....
November	50	58	71	....
December	58	59	75	....
Total completed	200	175	204	269

In the following table is given a statement of the deep wells drilled in each year from 1890 to 1895, together with the total depth, in sagenes of 7 feet, that the wells were drilled, and the average depth of the wells in feet:

Total number of wells and deep wells drilled in Russia from 1890 to 1895, with length in sagenes and average depth in feet.

Year.	Total number of wells.	Number of deep wells.	Total length in sagenes.	Average depth in feet.
1890	231	50	14,810	449
1891	292	87	19,980	479
1892	200	111	11,670	408
1893	175	102	10,984	439
1894	204	101	12,859	441
1895	269	133	20,762	540

REFINING STATEMENT.

The latest complete statement regarding refining petroleum in Russia is as follows:

Statement of the number of petroleum refineries, their products, etc., in Russia in 1890 and 1891.

At the Apsheron Peninsula.	1890.	1891.
Total number of works	149	135
Number of works active	103	100
Number of works inactive	46	35

Statement of the number of petroleum refineries, their products, etc.—Continued.

At the Apsheron Peninsula.	1890.	1891.
Amount of crude treated at these works, in barrels	21,611,000	24,263,000
Amount of naphtha obtained at these works, in barrels	50,000	50,000
Amount of kerosene of different kinds, in barrels	6,876,000	7,760,000
Amount of lubricating oil obtained	541,000	609,000
Total production of distillation products	7,467,000	8,419,000
Percentage of distillation products obtained	34.5	34.7

Price of Russian refined oil in bulk at Batoum from 1890 to 1893, by months.

[Cents per gallon.]

Month.	1890.	1891.	1892.	1893.
January	5.14	3.92	2.97	2.95
February	5.03	3.53	2.94	2.84
March	4.86	3.53	3.13	2.95
April	4.89	3.44	2.80	....
May	4.57	3.28	2.62	....
June	4.55	3.20	2.46	2.63
July	4.66	2.88	2.47	2.71
August	4.77	2.67	2.50	2.63
September	5.21	2.63	2.77	2.66
October	4.73	2.73	2.71	2.63
November	4.55	2.92	2.65	2.63
December	4.29	....	2.85	2.68

Though, as has been stated heretofore, almost all of the petroleum produced in Russia is from the Baku field, there are a number of other fields which promise largely in the way of production.

SUMATRA.

We have been able to secure but few statistics regarding the production of petroleum in Sumatra. It is stated that the deposits are being rapidly developed and that concessions have been granted by the Dutch Indian Government to both Dutch and English capitalists. These deposits are in the Province of Langkat, in the northern portion of the island, and the product is sometimes reported as Sumatran and at other times as Langkat.

The petroleum trade in the Straits Settlements shows very large imports from Sumatra. In 1892, out of a total of 885,472 cases of refined oil imported into the Straits Settlements, 104,298 cases were from Sumatra. In 1893, out of a total of 1,056,167 cases imported into the Straits Settlements, 276,792 cases were from Sumatra, while 241,229 cases were from the United States.

PERU.

From an article published in La Voz del Sur, Lima, Peru, we translate the following statement by Dr. H. Polakowsky, of Berlin, regarding petroleum in Peru.

Some figures concerning the development of the petroleum industry in the department of Piura, collected by the Government engineer, Federico Moreno, were published in the Boletin de la Sociedad Geografica de Lima, in December, 1893, but the recent revolutionary disturbances delayed the publication of other official statistics. Dr. Middendorf, who, assisted by Moreno, compiled the latest statistics, says, concerning the production of petroleum in Peru: "In 1885, 650,000 liters were produced; in 1888, 1,001,000; and in 1891, 2,802,000. In 1892, 49 wells produced 500,000 barrels of 160 liters each." The Peruvian oil field is located in the department of Piura, near the coast, extending from Punta de Aguja to Tumbes, a distance of more than 400 miles. The country is very sparsely settled, practically an arid waste, with no other vegetation than some short brush called bosques de algarrobos. The region has not yet been thoroughly explored. According to an estimate made by Mr. E. P. Larkin (New York, 1866), an American engineer who lived three years in the Province of Tumbes, the oil district comprises an area of 7,200 square miles. M. Faiville (Petroleum, Paris, 1878) estimated the area of Tumbes at 16,000 square kilometers, while the estimates of F. Hue and B. Creso agree with that of Larkin.

All these explorers locate the oil district between Cabo Blanco, 50 miles north of Paita, and the Charan range, about 10 miles south of the Tumbes River. This district may be considered the greater part of the northern oil region. Moreno estimates the area of all the oil fields of Peru at 32,000 kilometers. It is therefore much larger than the Pennsylvania oil region, which contains but 350 square miles. Petroleum deposits have been found at other points along the coast. The only thing lacking in the development of these natural resources is energy.

The composition of the crude petroleum is as follows: Carbon, 84.9 per cent; hydrogen, 13.7 per cent; oxygen, 1.4 per cent.

Moreno divides the oil territory into three zones:

1. The northern field, in the province of Tumbes.
2. The central field, extending from Punta Toco to Punta de Lobos.
3. The southern field, extending from 400 to 16,000 meters from the coast between 80° 58′ and 81° 11′ longitude, and 5° 41′ and 6° 10′ south latitude. This field is traversed by several mountain ranges of 1,200 feet height, which end at the Punta Pisura, on the Sechura Bay.

In wet years these hills furnish good pasture; there are also several good harbors.

The oil wells in all these fields are less than 800 feet deep. Oil has been found at some places even at a depth of but 30 feet. The wells are located on the side of a hill or in a ravine, so that the oil can be easily collected at some lower place. According to Moreno, it is necessary, to reach the real geological oil strata, to drill to a depth of 1,200 feet, and then definite success can be expected only when gas commences to escape. No pumps are required when the wells are drilled deep. In the Tumbes district the wells are all located in the plain, and when one is exhausted another is drilled. These wells were not very productive, but the producers were forced to adopt this method of working because, until 1888, proper machinery was lacking completely. It is more convenient to drill the wells at the foot of a hill than on the mountains. As soon as the oil commences to flow in abundant quantity tanks must be provided. In some cases, with good wells, it happens that the oil is thrown out intermittently by the force of the gas. Other wells show very little pressure. In other wells, again, the oil is first held back by the gas and then thrown out in spurts to a height of 100 feet, whereby much oil is lost before it can be collected in iron tanks, or the stream is checked by means of a bag filled with linseed, but still kept running. The cost of a refining establishment is estimated at 200,000 soles in silver, or about $100,000 United States money. In the interior the cost would be considerably higher. The cost of a well 1,000 feet deep is estimated at 4,800 soles, or $2,400. Twenty large wells would be required to supply a refinery. Of the 49 wells drilled up to the close of 1892, 44 were very productive. The period of production differs with the different wells. One well in Zorritos has been running seventeen years. The other wells of the Talara establishment at Zorritos produce from 100 gallons to 800 barrels a day.

The Tumbes and the Negritos fields, which are now being explored, are level. The surface strata consist of conglomerate.

The oil works of Zorritos have produced from 1885 to 1891, 10,800,000 liters of crude oil, 5,400,000 liters of refined oil, 2,400,000 liters of dark lubricating oil, 230,000 liters of light lubricating oil, 89,358 liters of benzine, and 54,824 liters of tar. The value of these products was 587,655 soles. The industry is protected by a high tariff. The home product is sold at twice its cost, especially the Talara and Zorritos oil.

The London Pacific Petroleum Company, Limited, at Talara (Paita) has exported within thirty-five months, from November, 1889, to September, 1892, 2,000,000 liters of crude oil, 5,700,000 liters of refined oil, 270,000 liters of lubricating oil, and 11,800,000 liters of benzine. The import of North American petroleum has greatly decreased. In 1889 it amounted to 2,000,000 liters; in 1891 to 840,000 liters. The price of North American oil in 1892 was 8.20 soles per 10 gallons, while Tumbes oil sold at 3.53 soles.

Crude oil, instead of coal, is being used as fuel for the locomotives on all Peruvian railroads, as well as in many manufacturing establishments and gas works. The price is 20 soles per ton. It is a cheap fuel, and has scored a great success as such. Large quantities are exported to Chile for the same purpose. All the companies now engaged in developing the oil fields are strongly organized in a financial respect. The most prominent are: Zorritos, capital £100,000; Talara, £250,000, and Heath, £25,000. There are a number of others of less importance: The Peruvian Petroleum Company, capital £20,000; the Mancora Peru Petroleum, £12,000; the Union Petroleum Syndicate, £10,000. The works nearest to the Tumbes River belong to F. G. Piaggio, to whom a gold medal was awarded at the South American Exposition of 1884. His wells are located around an inlet of the sea, and but 20 miles from Tumbes. Drilling was commenced here in 1883. This field has an area of 450 acres. Piaggio pays to the Government an annual rent of 1,620 soles. For each pertenencia (section of 8 acres) actually entered upon, 30 soles are paid to the Government. The refinery is located on the slope of the coast hills, where a settlement of 105 families, including officers and laborers, is established. Two kilometers from the refinery a public bath has been erected on the beach. The different buildings and wells belonging to the works are connected by a narrow-gauge road, 2 miles long, and lighted at night by the gas from the wells. This gas possesses greater lighting power than the ordinary illuminating gas. The 14 wells of this establishment have been running from six to seventeen years without interruption. The Talara works belong to the London Pacific Petroleum Company, of London, England. The organizer of this company was Dr. Herbert W. C. Tweddle, of London, the owner of the hacienda Pacenos. The greater part of this field is rich in oil, without any interruptions. It has been examined by several English engineers, who pronounced it very productive. The hacienda is bounded on the east by the Amotape range.

The crude oil of Negritos (this is the name of the field) contains 36 per cent of illuminating oil, 40 per cent of heavy oil, and 34 per cent of other substances. The refinery, as well as the other plants, is provided with modern machinery, and the production has increased to 1,000,000 liters.

The Heath Petroleum Company was organized in 1891 by Francisco de Miranda.

These three companies were reorganized recently at London, in order to increase their capital and enlarge the scope of their operations.

The Petroleum Syndicate, Limited, operates in the neighborhood of Punta Aguja, in the department of Sechura. The machinery was imported from the United States. Work was commenced at Garita, about 1,300 feet from the seashore, on June 6, 1891. At a depth of 388 feet, however, work had to be stopped, as the pressure of the sand could not be overcome. This well has cost more money and trouble than any other well in Peru. First a stratum of sand 80 feet thick was pierced, and then 78 feet of conglomerate, when the first oil sand was reached, producing 15 barrels daily. Drilling was continued through a layer of gray sand 6 feet thick and quartz sand to a depth of 200 feet, the last 46 feet being another oil and gas stratum. At a depth of 201 feet oil began to flow again. At a depth of 388 feet a still richer sand was struck, from which much gas developed. Practical investigations on the part of other companies show sufficiently that these fields are very productive. The discovery by the English engineer Chenhall, that by adding to boiled petroleum quillaya root (38 grams root to 1,000 grams oil) the oil can be changed into a solid substance, is deemed of the greatest importance, the transportation being greatly facilitated. Besides, a large quantity of crude oil is being used for fuel. Moreno declares that this discovery will be of great advantage to the oil industry of Peru. Concerning the facilities for working and the excellent results obtained, much credit is due to the English engineers. Moreno concludes his interesting review by observing that men and enterprise are still lacking for the development of those districts, and that Peru itself should devote more energy to the task, as most of the oil lands belong to the Government. He recommends that the petroleum industry be made a State monopoly, as the nitrate production was in 1876.

NATURAL GAS.

By Joseph D. Weeks.

INTRODUCTION.

Among the notable features in connection with the production of natural gas in 1895 may be mentioned:

1. The decreasing pressure in all of the natural-gas fields of the country. As will be seen by reference to the statements under the reports by States, the rate of decrease in pressure varies greatly in the several States, owing to local reasons. In Pennsylvania, for example, this decrease seems to be the greatest, owing to the fact that the gas fields of this State are the oldest and have been the most heavily drawn upon. In Ohio it is the least, the great decline in pressure in this State having taken place some two or three years ago. The shallow-well, low-pressure fields of this State maintain both pressure and production quite uniformly, and though there is some decline in pressure even in this field, the ratio is small. The decline in pressure in the wells in Indiana is midway between the declines in these two States, but if the statement made by the natural-gas inspector of Indiana is true, that when the pressure declines to 200 pounds the wells are usually drowned out by water, the Indiana gas producer will have to contend with a more serious condition of affairs than either the Ohio or Pennsylvania producer.

2. Resulting from the same cause that leads to this decline in pressure, viz, the reduction in the supply of gas stored in the earth's reservoirs, there is a great falling off in production of gas per well. The only way in which the production can be maintained, in view of the reduction in supply and decrease in pressure, is to drill more wells. This is resorted to, where possible, in order that the supply may be maintained.

3. As a further result of the decline in pressure and reduction in supply, the life of the wells, or the time during which a well in a given locality will produce gas in commercial quantities, has been very much reduced. How great this reduction has been in some cases will be seen from an inspection of the reports from the various States. In some cases in western Pennsylvania the average life of a well in a field is but six months; in others, two or three years, though in the latter case with continually decreasing pressure and production.

VALUE OF NATURAL GAS CONSUMED IN THE UNITED STATES.

No statement as to the actual production of natural gas in cubic feet has been obtained, nor is any obtainable. Certain wells have been measured, and the production of these wells for a brief period has been ascertained, and from this production so found an estimate of the total production of these wells and of the field in which they are located has been determined. But it is evident that this is only an estimate concerning which it is impossible to say that it is even approximate. The production of a well varies not only from month to month and week to week, but from hour to hour, so that what would be a fair estimate of the production for a given minute would not be at all a correct estimate for an hour later.

On the basis, then, of the best information obtainable, the conclusion is reached that the total value of natural gas consumed in the United States in 1895 was $13,006,650, as compared with $13,954,400 in 1894, and $14,346,250 in 1893. It may be said here that the consumption of natural gas in the United States in 1895, measured in cubic feet, was considerably less than the amount consumed in 1894; yet, notwithstanding the fact that in many cases much higher prices were charged for gas in 1895 than in 1894, the difference in the value of the gas, or the amount received for it in 1895, as compared with 1894, is not so great as the difference in actual consumption in cubic feet.

In the following table is given the total value of natural gas consumed in the United States from 1886 to 1895, by States:

Value of natural gas consumed in the United States from 1886 to 1895.

Locality.	1886.	1887.	1888.	1889.	1890.
Pennsylvania	$9,000,000	$13,749,500	$19,282,375	$11,593,989	$9,551,025
New York	210,000	333,000	332,500	530,026	552,000
Ohio	400,000	1,000,000	1,500,000	5,215,669	4,684,300
West Virginia	60,000	120,000	120,000	12,000	5,400
Indiana	300,000	600,000	1,320,000	2,075,702	2,302,500
Illinois	4,000	....	....	10,615	6,000
Kentucky	....	....	....	2,580	30,000
Kansas	6,000	....	....	15,873	12,000
Michigan	12,000	....	....	....	....
Missouri	....	....	....	35,687	10,500
Arkansas	....	....	....	375	6,000
Texas	....	....	....	1,728	
Utah	....	....	....	150	
South Dakota	....	....	....	25	
California	....	....	....	12,680	33,000
Elsewhere	20,000	15,000	75,000	1,600,000	1,600,000
Total	10,012,000	15,817,500	22,629,875	21,107,099	18,792,725

Value of natural gas consumed in the United States from 1886 to 1895—Continued.

Locality.	1891.	1892.	1893.	1894.	1895.
Pennsylvania	$7,834,016	$7,376,281	$6,488,000	$6,279,000	$5,852,000
New York	280,000	216,000	210,000	249,000	241,530
Ohio	3,076,325	2,136,000	1,510,000	1,276,100	1,255,700
West Virginia	35,000	500	123,000	395,000	100,000
Indiana	3,942,500	4,716,000	5,718,000	5,437,000	5,203,200
Illinois	6,000	12,988	14,000	15,000	7,500
Kentucky	38,993	43,175	68,500	89,200	98,700
Kansas	5,500	40,795	50,000	86,600	112,400
Missouri	1,500	3,775	2,100	4,500	3,500
Arkansas	250	100	100	100	100
Texas	....	100	50	50	20
Utah	....	....	500	500	20,000
Colorado	....	....	....	12,000	7,000
California	30,000	55,000	62,000	60,350	55,000
Elsewhere	250,000	200,000	100,000	50,000	50,000
Total	15,500,084	14,800,714	14,346,250	13,954,400	13,006,650

From this table it appears that the value of natural gas consumed in the United States was greatest in 1888, when the value was $22,629,875. From that time to 1891 the decrease in value was rapid. Since 1891, however, it has been quite gradual, owing to the fact noted that meters are being used, the amounts consumed measured, and payments made on amounts used.

CONSUMPTION AND DISTRIBUTION OF NATURAL GAS.

There are a great many details regarding the production of natural gas in the United States that would be exceedingly interesting could they be secured. Unfortunately, however, many of the natural-gas companies keep their records in such a way that it is impossible for them to give any information other than the amount of money received for the gas consumed. They do not even know the number of consumers. From quite a number of companies, however, 377 in all, very interesting statistics have been received, which are given in the following table. It should be distinctly understood that this does not indicate all of the companies from which reports have been received, but includes only the reports from the companies in the three States of Pennsylvania, Indiana, and Ohio which have furnished the Survey with all of the information asked. From many other companies the information covers a portion of the items named in the table.

Natural-gas records in 1894 and 1895.

	Pennsylvania.		Indiana.	
	1894.	1895.	1894.	1895.
Amount received for sale of gas or value of gas consumed....	$3, 739, 067	$3, 485, 315	$1, 607, 834	$1, 291, 417
Value of coal or wood displaced.	$3, 545, 340	$3, 677, 129	$2, 028, 448	$1, 942, 276
Domestic fires supplied	163, 510	162, 527	61, 903	60, 679
Iron and steel works supplied.	13	22	15	13
Glass works supplied	26	35	40	39
Other establishments supplied.	195	249	377	309
Total establishments supplied.	234	306	432	361
Total wells producing Jan. 1..	927	987	644	719
Total producing wells drilled.	173	194	98	157
Total wells producing Dec. 31.	987	1, 068	719	784
Total feet of pipe laid	13, 260, 590	14, 348, 901	10, 102, 790	10, 500, 524
Total establishments reporting	85	85	237	237

	Ohio.	
	1894.	1895.
Amount received for sale of gas or value of gas consumed....	$687, 206	$676, 617
Value of coal or wood displaced....	$905, 725	$919, 384
Domestic fires supplied	39, 518	38, 661
Iron and steel works supplied....	0	0
Glass works supplied	0	0
Other establishments supplied	76	124
Total establishments supplied	76	124
Total wells producing Jan. 1....	321	316
Total producing wells drilled....	42	41
Total wells producing Dec. 31....	316	304
Total feet of pipe laid	3, 688, 638	3, 901, 315
Total establishments reporting....	55	55

The above table covers reports from 377 companies, these 377 companies reporting concerning all of the items included in the table, both in 1894 and 1895. From this table it appears that the amount actually received for gas by these 377 companies in 1895 was $5,453,349, and in 1894, $6,034,107, a decrease of $580,758 in 1895, as compared with 1894. All three States show a decrease in the amount received for gas, the decrease in Ohio, however, being very slight.

Although these 377 companies report a decrease in amount received for gas in 1895, as compared with 1894, the value of coal or wood displaced shows an increase of $59,276. In Pennsylvania the increase was $131,789; in Ohio, $13,659, while Indiana shows a decrease of $86,172. A comparison of the Pennsylvania figures shows that though the amount received for gas in 1894 exceeded the value of coal or wood displaced by this gas, in 1895 the value of coal or wood displaced by the gas consumed was $191,814 in excess of the price received for the gas. In Indiana and Ohio, however, the value of the gas consumed in both of the years, 1894 and 1895, is less than the value of the coal or wood displaced by this gas.

An examination of the statement regarding the number of domestic fires supplied in 1895 shows that in all the States there has been a reduction as compared with 1894. In Pennsylvania the reduction was but 983; in Indiana, 1,224, and in Ohio, 857, making a total falling off in the number of fires of 3,064. The total number of establishments supplied with gas by these 377 companies shows an increase of 49. Two of the States—Pennsylvania and Ohio—show increases, the number in Pennsylvania increasing from 234 in 1894 to 306 in 1895, and in Ohio from 76 in 1894 to 124 in 1895. On the other hand, Indiana shows a decrease from 432 to 361.

The number of producing wells owned by the companies reporting on January 1, 1895, in Pennsylvania was 987; at the close of the year it had increased to 1,068. In Indiana, at the beginning of the year, the number of producing wells was 719; at the close of the year, 784. Ohio shows a decrease in producing wells, the number at the beginning of 1895 being 316, and only 304 at the close.

In all the States there has been an increase in the number of feet of pipe laid at the close of 1895 as compared with 1894. In Pennsylvania the increase was from 13,260,590 feet to 14,348,901 feet; in Indiana, from 10,102,790 feet to 10,500,524 feet; and in Ohio, from 3,688,638 feet to 3,901,315 feet; making a total increase for the 377 companies reporting of 1,698,722 feet.

The above statements refer only to the number of companies included in the table, and only to those companies which made full reports for 1894 and 1895, so that comparisons could be made. While complete figures have not been received from all companies as to the number of wells, works supplied, feet of pipe laid, etc., the figures we have received are of sufficient value to justify us in publishing them. From most of the companies we received statements giving the value of the gas consumed. We have not received statements from all companies. With this understanding, we give below the results of the investigation in 1895 as to the number of companies reporting in each State, the amount received for sale of gas, or the value of the gas consumed, the value of coal or wood displaced by this gas, the uses to which natural gas was put, such as the number of fires for cooking and heating, and the number of establishments supplied, the record of wells, and the total number of feet of pipe used in the transportation of gas on December 31, 1895.

In the following table is given the amount received for sale of gas, or the value of the gas consumed in the United States in 1895, as reported by 569 companies or individuals in the several States named, together with the value of the coal or wood displaced by this gas:

Value of natural gas consumed in the United States in 1895, by States, and the value of coal or wood displaced by same, as reported by 569 persons, firms, and corporations.

State.	Companies or individuals reporting.	Amount received for sale of gas, or value of gas consumed.	Value of coal or wood displaced by gas.
Pennsylvania	129	$4,572,620	$4,965,865
Indiana	299	2,034,475	3,034,017
Ohio	86	987,410	1,392,614
New York	18	123,251	140,497
Kentucky	7	77,150	88,710
California	7	30,990	36,428
Kansas	10	85,141	102,399
Illinois	4	5,700	4,050
Missouri	6	3,300	3,500
Texas	1	....	....
Arkansas	2	150	150
Total	569	7,920,187	9,768,230

In the following table is given a statement of the uses to which natural gas produced in the United States in 1895 was put, as reported by 569 companies or individuals, namely, the number of domestic fires supplied, number of iron-rolling mills, steel works, glass works, and other establishments supplied, including machine shops, brick works, potteries, planing mills, etc.:

Uses to which natural gas produced in the United States in 1895 was put, as reported by 569 persons, firms, and corporations.

State.	Companies or individuals reporting.	Domestic fires supplied.	Establishments supplied.				
			Iron mills.	Steel works.	Glass works.	Other establishments.	Total.
Pennsylvania	129	212,834	11	13	36	596	656
Indiana	299	96,113	12	3	44	496	555
Ohio	86	44,366	0	0	1	174	175
New York	18	5,107	0	0	0	3	3
Kentucky	7	6,293	0	0	0	4	4
California	7	1,283	0	0	0	1	1
Kansas	10	3,806	0	0	0	17	17
Illinois	4	290	0	0	0	2	2
Missouri	6	38	0	0	0	2	2
Texas	1	0	0	0	0	0	0
Arkansas	2	0	0	0	0	2	2
Total	569	370,130	23	16	81	1,297	1,417

In the following table is given a statement of the number of natural-gas wells producing in the United States at the beginning and close of 1895, together with the number drilled in 1895, and the total number of feet of pipe laid December 31, 1895, as reported by 569 companies or individuals:

Record of wells and amount of pipe line as reported by 569 persons, firms, and corporations in 1895.

State.	Companies or individuals reporting.	Wells.			Total pipe laid, Dec. 31, 1895.
		Producing Dec. 31, 1894.	Drilled in 1895.	Producing Dec. 31, 1895.	
					Feet.
Pennsylvania	129	1,537	238	1,643	22,379,442
Indiana	299	1,146	286	1,336	13,921,854
Ohio	86	498	65	495	5,726,475
New York	18	193	29	216	1,046,550
Kentucky	7	49	3	45	319,580
California	7	11	0	11	57,340
Kansas	10	59	10	52	331,990
Illinois	4	33	0	20	44,880
Missouri	6	7	0	5	2,030
Texas	1	1	0	0	100
Arkansas	2	3	0	3	....
Total	569	3,537	631	3,826	43,830,241

THE RECORD BY STATES.

PENNSYLVANIA.

During the year 1895 there has been no important extension of the gas-producing fields in Pennsylvania, and in a general way it may be said that they remain as they were at the close of 1894. Practically, the gas-producing territory is coextensive with that which yields petroleum. Most oil wells yield more or less gas. As a rule, the important gas-producing fields are not superimposed over the important oil-producing fields, though the gas is produced from the same geological horizons that produce oil. The gas-bearing portion of a given stratum, however, is, as a rule, in the near vicinity of the oil-producing portion. While the drill in 1895 has somewhat extended the gas-producing territory, it has extended it only within those limits that might justly be regarded as gas-producing territories.

The most important feature in connection with the production of gas in Pennsylvania in 1895 has been the continuation of the reduction of pressure and shortening of the life of wells. So far as has been ascertained—and it is probably generally true—every locality in the State has exhibited this feature of diminishing pressure and shorter life. The initial pressure of new wells drilled in 1895 in a district is almost uniformly less than the initial pressure in the same district five or even two years ago, and even this lower initial pressure begins to decrease at a much earlier period in the life of the well, and the time during which a well yields gas in commercial and profitable quantities—that is, what is known technically as the life of the well—has been very much reduced. In one of the large districts in the neighborhood of Pittsburg one of the largest consumers states "that the initial rock pressure"—by which is meant the highest pressure it is possible to obtain in a well immediately after it is drilled, when no gas is escaping from it—"is from 200 to 380 pounds, the time required for the well to reach this pressure being from fifteen to twenty minutes." When the well is tubed with a 2-inch pipe, the "minute pressure," or the pressure of the well after being closed for a minute, is from 100 to 150 pounds. In this district even this low pressure begins to decrease generally after thirty days' use of the well. The life of a well seldom exceeds two years, and often in six months it is worthless. This statement of decreased pressure and shortened life applies especially to groups of wells as they are usually drilled in a given locality—that is, a short distance apart. On the other hand, a well drilled in a given field so as to have a radius of a mile of territory to draw from will sometimes continue producing for three or four years. When wells are well protected by territory, as this is called—that is, where but few wells have been put down in a large field—not only have they a longer life but the pressure of the wells is maintained. For instance, in what is known as the Middle district of Pennsylvania there are quite a number of wells from seven to ten years old which still maintain as much as 200 pounds rock pressure; but the wells in this case are very well protected, no other wells having been drilled near them.

As showing how great has been the decrease in pressure in certain districts in Pennsylvania during the past year, we have the following statement from a large gas-producing company which has wells in the three districts named:

Reduction of gas pressure at wells in western Pennsylvania.

District.	Pressure, 1894.	Pressure, 1895.
	Pounds.	*Pounds.*
Murrysville	7	3
Texas	70	40
Armstrong	600	60

Where estimates have been made by large producers as to the reduction in production following this decrease in pressure, it is generally estimated at from 15 to 30 per cent per year. Notwithstanding this reduction in pressure and production in a given well, there has not been a very large decrease in value of natural gas produced in Pennsylvania in 1895 as compared with 1894. This is due to the following fact: Though many wells have been abandoned and many companies have gone out of business through failure of the supply of gas, those companies that still produce gas have drilled more wells and in many cases demanded and received an increased price for their gas. As a result, though it is probable that a less number of cubic feet of gas was furnished consumers in Pennsylvania in 1895, the reduction in value of the gas furnished has been only some 6 or 7 per cent, the total value of the production in 1894 being $6,279,000 and in 1895 $5,852,000.

In the following table is given the value of natural gas consumed in Pennsylvania in the years from 1885 to 1895:

Value of natural gas consumed in Pennsylvania from 1885 to 1895.

Year.	Value of gas consumed.	Year.	Value of gas consumed.
1885	$4,500,000	1891	$7,834,016
1886	9,000,000	1892	7,376,281
1887	13,749,500	1893	6,488,000
1888	19,282,375	1894	6,279,000
1889	11,593,989	1895	5,852,000
1890	9,551,025		

OHIO.

No new gas-producing territory was discovered in this State in 1895, and the gas is still found in the four geological horizons named in our previous report; that is, in descending order, the Berea grit, the Ohio shale, the Clinton group, the Trenton limestone.

There is the same story of decreasing pressure of the wells and decreasing production to be told of Ohio as was recorded for Pennsylvania. The conditions, however, of this decreasing pressure and production are somewhat different in Ohio from what they were in Pennsylvania. The decrease in pressure is not so marked in Ohio, and while the life of the well is shortening, the diminution is not so rapid as in Pennsylvania. Possibly it is due to the fact that most of the wells in Ohio are small producers from shallow depths, for these wells, especially those in the Berea grit, while they are but small producers and with low initial pressure, seem to produce more uniformly and through a longer series of years than those, say, from the Trenton limestone, which had an enormous initial pressure and produced very great volumes of gas. The production of these large wells, or, perhaps, better, the production of the territory in which these large wells were situated, gave out some two or three years ago, while the districts in which the small wells are situated still continue producing, with constantly diminishing pressure, to be sure, but diminishing in a very small ratio. For example, the shallow wells drilled eight or ten years ago, from 400 to 800 feet deep in the Berea grit, in certain districts, having an initial pressure of from 60 to 80 pounds, or even less, and being but small producers, are producing to-day practically the same amount of gas, though the pressure is but one-third to one-half the original pressure. On the other hand, but few, if any, of the wells in the Trenton limestone drilled six or eight years ago, and yielding such enormous volumes of gas when first struck, are now producing, while the initial pressure of such wells as are drilled in the Trenton limestone district has fallen from 500 and 600 pounds to 100 pounds, and even to 50 pounds. One well in the Trenton limestone, which has been yielding for seven years, began with an initial pressure of 475 pounds and is now producing at a pressure of 17½ pounds.

It is, however, true that the cold weather has a notable effect upon the pressure of the wells in the shallow-depth and low-pressure field. Reports have been sent us of wells in this field which in warm weather will show a pressure of from 40 to 60 pounds while in cold weather the pressure will be reduced to 5 or 10 pounds.

As will be seen from the following table, the total value of natural gas produced in Ohio in 1895 was $1,255,700, as compared with $1,276,100 in 1894. This small decrease is due to the increase in price received for gas and in the value of the coal displaced.

In the following table will be found a statement of the value of the natural gas consumed in Ohio from 1885 to 1895:

Value of natural gas consumed in Ohio from 1885 to 1895.

Year.	Value of gas consumed.	Year.	Value of gas consumed.
1885	$100,000	1891	$3,076,325
1886	400,000	1892	2,136,000
1887	1,000,000	1893	1,510,000
1888	1,500,000	1894	1,276,100
1889	5,215,669	1895	1,255,700
1890	4,684,300		

INDIANA.

Notwithstanding its enormous supplies of natural gas, and in spite of the fact that its wells have maintained their pressure and production in the last two or three years to a greater extent than those of any other State, still these are both declining, and the asserted inexhaustible supplies of natural gas in this State are evidently limited. The reduction in the pressure of wells and in their production seems to vary greatly in different parts of the State. In some cases we have reports of wells that showed a pressure of 240 pounds in 1894 in which the pressure is now but 80 pounds. Quite a number of reports state that the reduction in pressure is from 10 to 15 per cent a year, but there is still a large quantity of gas territory, and though the pressure declines the production can be maintained by using an increased number of wells.

In his report as State natural-gas inspector of Indiana, Mr. J. C. Leach takes up the question of the decline of rock pressure in the natural-gas fields of the State as well as that of the future of the Indiana natural-gas field. Mr. Leach states that the original rock pressure in Indiana was 325 pounds to the square inch, and that the pressure was practically uniform throughout the Indiana field, some wells showing the maximum pressure instantly while others required hours to reach it. The large draft that has been made upon the Indiana field since its discovery has materially reduced the rock pressure, and this reduction of rock pressure, he states, is admitted to indicate a diminution in the supply. Mr. Leach gives in his report a record of pressures in new wells, showing the maximum pressure in the several fields. The record includes pressures in 35 subfields. This record shows a variation of from 150 to 270 pounds, the average being 230 pounds, a decrease of 95 pounds from the 325 pounds noted as the initial rock pressure in this territory. Mr. Leach draws from these facts this conclusion: "There is but little doubt that the pressure in the field will decrease more rapidly in the future than it has in the past."

As to the future, the question is asked, How long will natural gas last? After recording the belief prevalent in Indiana in the early days of natural-gas production that there could be no exhaustion in the near future, he says: "How long it will continue to honor the enormous drafts that are being made upon it from year to year I can not say. The fact that we have entered upon the period of decline, that the supply is failing and will finally be exhausted, is not questioned. Not only is the evidence of such decline present in the field, but the history of other fields that were limited by conditions similar to the ones with which this field has to contend foretells to some degree the future of the Indiana field.

"The initial rock pressure of this field was 325 pounds to the square inch. The average rock pressure of the gas-producing portion of the original gas area is about 230 pounds at present. This is a decrease of 95 pounds in nine years, or an average decrease of $10\frac{1}{2}$ pounds per year. This decrease, however, has not been uniform. The first three years' consumption affected the rock pressure very slightly, especially in the interior of the field. Since that time, however, the annual decrease has been very noticeable and has increased with the years.

I am not prepared to say what the decrease has been during the past year, but, with the data at hand, will be able to give the effect of this winter's consumption.

"The history of all gas wells in the Indiana field is that they continue to produce gas until the weight of the salt water overcomes the pressure of the gas. When does this occur or what pressure is necessary to hold the salt water back are questions that can not be answered definitely. In some parts of the field the danger point is reached at 200 pounds, while in a few instances wells in which the pressure has been reduced to 50 pounds are producing gas in commercially valuable quantities. The causes of these conditions are uncertain. The increased consumption of gas is undoubtedly a cause of the increase of the diminution of the rock pressure of the field. Other causes are probably present. As to the pressure at which salt water overruns the gas rock, it is possibly effected by the textural and structural conditions of the rock as well as its elevation. The presence of these conditions precludes anything like an accurate prediction concerning the life of natural gas in this field."

One of the interesting features of the production of natural gas in Indiana is the very large number of small producers—that is, of producers having but one or two wells for use in their homes or in the homes of a group of householders who have joined together in putting down the well. Probably of the total number of firms, companies, and persons operating wells more than one-half have but one well.

The total value of natural gas consumed in Indiana in 1895 was $5,203,200, as compared with $5,437,000 in 1894, a very slight decrease.

In the following table will be found a statement of the value of the natural gas consumed in Indiana from 1886 to 1895:

Value of natural gas consumed in Indiana from 1886 to 1895.

Year.	Value of gas consumed.	Year.	Value of gas consumed.
1886	$300,000	1891	$3,942,500
1887	600,000	1892	4,716,000
1888	1,320,000	1893	5,718,000
1889	2,075,702	1894	5,437,000
1890	2,302,500	1895	5,203,200

KENTUCKY.

There have been no material changes in the gas situation in Kentucky during the past year, except that it is one of the States which shows an increase in the value of the product. This, no doubt, is due in part to the fact that the Kentucky Heating Company had in operation during a portion of the year a Rose-Hastings fuel gas plant, which supplied the shortage of natural gas. It is probable that the value of this manufactured gas is included in the value of the natural gas.

From a communication received from Mr. William J. Davis, of Louisville, Ky., we compile the following information regarding the production of natural gas in Kentucky.

Mr. Davis divides the gas-producing territory of Kentucky broadly into two districts: "Western Kentucky," the most important one, the gas wells in this district being in Meade and Breckinridge counties, and "Eastern Kentucky," the wells in the latter district being in Jackson and adjoining counties.

The most important portion of the western Kentucky district is in Meade County, the gas-producing territory being some 9 miles by 3 miles in extent, the wells varying in depth from 400 to 600 feet, with a rock pressure at the present time of 60 pounds. The surface rock is the lower layer of the St. Louis group, the drill as it descends passing through the Keokuk to the Devonian shale, the gas being found in this shale. The gas is piped from this district through an 8-inch pipe to Louisville, some 35 miles distant.

In Breckinridge County, in western Kentucky, the wells are near Cloverport, the gas rock being the same as in Meade County, the wells beginning in the Clinton group and going through the St. Louis and Keokuk members, the gas rock being the Devonian shale. The wells are from 900 to 1,000 feet deep. This gas is used locally.

In the eastern Kentucky district the wells show a high pressure and large production, the pressure being from 250 to 300 pounds, and the depth from 1,800 to 2,200 feet. This gas is not piped.

The production of natural gas in Kentucky from 1889 to 1895 was as follows:

Value of natural gas consumed in Kentucky from 1889 to 1895.

Year.	Value of gas consumed.	Year.	Value of gas consumed.
1889	$2,580	1893	$68,500
1890	30,000	1894	89,200
1891	38,993	1895	98,700
1892	43,175		

ILLINOIS.

The production of natural gas in Illinois is not only quite small, but showed considerable reduction in 1895 as compared with 1894. It is exceedingly difficult to arrive at the value of natural gas consumed, as much of it is consumed by parties owning the wells. From the best information we could obtain, the value of the production in 1895 is estimated at one-half the value of 1894, viz, $7,500.

The production of natural gas in Illinois from 1889 to 1895 was as follows:

Value of natural gas consumed in Illinois from 1889 to 1895.

Year.	Value of gas consumed.	Year.	Value of gas consumed.
1889	$10,615	1893	$14,000
1890	6,000	1894	15,000
1891	6,000	1895	7,500
1892	12,988		

KANSAS.

With the increased production of petroleum in Kansas has also come an increase in the value of the gas consumed. From the best information obtainable, it may be stated that the value of the natural-gas production in Kansas in 1895, including that which was used in the drilling of petroleum and other wells, was $112,400.

The production of natural gas in Kansas from 1889 to 1895 was as follows:

Value of natural gas consumed in Kansas from 1889 to 1895.

Year.	Value of gas consumed.	Year.	Value of gas consumed.
1889	$15,873	1893	$50,000
1890	12,000	1894	86,600
1891	5,500	1895	112,400
1892	40,795		

CALIFORNIA.

In the report for 1894 we quoted quite at length from the Twelfth Annual Report of the State Mineralogist of California regarding the natural-gas fields of that State. In the report of this officer for 1895 the value of natural gas consumed in California in that year is given as $100,000. The reports received at this office would indicate that the production in 1895 was less than in 1894. Certain wells which produced in 1894 were non-producers in 1895. However, as no wells were drilled in 1895, and the production of the old wells seems to have been somewhat less than in 1894, we have accordingly estimated the value of the gas consumed in California in 1895 at $55,000.

The production of natural gas in California from 1889 to 1895 is as follows:

Value of natural gas consumed in California from 1889 to 1895.

Year.	Value of gas consumed.	Year.	Value of gas consumed.
1889	$12,680	1893	$62,000
1890	33,000	1894	60,350
1891	30,000	1895	55,000
1892	55,000		

NEW YORK.

The conditions of the production of natural gas in New York are very similar to those in Pennsylvania. Indeed, much of the gas consumed in this State is from other States and countries, chiefly from Pennsylvania and Canada. From the following table it will be seen that the value of the natural gas consumed in this State in 1895 differs but little from the value of that consumed in 1894. This is due to the fact that the supply of gas has been kept practically uniform.

The value of natural gas consumed in New York from 1885 to 1895 is given in the following table:

Value of natural gas consumed in New York from 1885 to 1895.

Year.	Value.	Year.	Value.
1885	$196,000	1891	$280,000
1886	210,000	1892	216,000
1887	333,000	1893	210,000
1888	332,500	1894	249,000
1889	530,026	1895	241,530
1890	552,000		

WEST VIRGINIA.

It is exceedingly difficult to arrive at the amount or value of natural gas produced in West Virginia, as comparatively little of it is used in that State, a large part of that produced in West Virginia being piped to Pennsylvania and Ohio. One of the most important gas fields that was discovered, or at least utilized, in 1895 is what is known as the "Moses" district, some of the largest wells, both as to pressure and production, that have ever been discovered having been drilled in this district. The Philadelphia Company, of Pittsburg, made large purchases in this territory, and the gas is to be piped to Pittsburg. In accordance with the rule adopted for the Eleventh Census, the value of this gas will be reported at the point of consumption; therefore its value will be given with that of Pennsylvania. From the best data obtainable, it is estimated that the value of natural gas produced in West Virginia and consumed in that State in 1895 was in the neighborhood of $100,000. This does not include the gas sent out of the State, especially into Ohio and Pennsylvania.

MISSOURI.

There are but few natural-gas wells in this State, and the industry is of but small importance. The total value of the gas consumed in 1895 was but $3,500.

COLORADO.

Most of the gas found in Colorado is in the neighborhood of Florence, and is found in connection with the oil production of the district.

The reports, as made to us, indicate that there are some 19 wells producing gas, which is not only used at the wells for drilling, etc., but is piped to Florence and used for fuel. One company has 6 small wells in Florence that formerly produced oil and now produce only gas. The pressure at these wells is some 3 pounds only, and the gas is piped through the town. Other wells, 3 miles distant from Florence, have some 20 pounds' pressure.

It has been quite difficult to get at the actual value of gas produced in Colorado, owing to the same conditions existing in this State as exist in the larger fields in the East, viz, that much of the gas produced is consumed by the producers and no value is put upon it. From information received we estimate the value of the total production of this State in 1895 at $7,000.

UTAH.

Some 12 miles in a northerly direction from Salt Lake City, gas has been found at various depths of from 500 to 750 feet, with a pressure of from 160 to 175 pounds. It is stated that there are 5 wells down, with a total of 20 contemplated, and that the wells can furnish 300,000 cubic feet of gas per day. The Salt Lake and Ogden Gas and Electric Light Company have entered into a contract with the company owning the wells for a term of years to pipe the gas from the wells to Salt Lake City and pay the company 35 per cent of the gross receipts. The Salt Lake and Ogden Company have a franchise from the city which gives them the right to sell gas at 50 cents per 1,000 cubic feet. No illuminating gas is made in Salt Lake, the only gas illuminant used being natural gas unenriched in Welsbach burners. We have not been able to secure from the parties supplying this gas any estimate as to its value, but, from information received from other sources, estimate the total value of the gas consumed in Utah in 1895 at $20,000.

An analysis of the natural gas as furnished by the Salt Lake and Ogden Gas and Electric Light Company is as follows:

Analysis of Utah natural gas.

	Per cent.
Hydrogen	16.6
Marsh gas (CH_4)	22.0
Ethane (C_2H_6)	37.8
Ethalene (C_2H_4)	.6
Carbonic oxide	1.2
Carbonic acid	.8
Nitrogen	20.0
Oxygen	1.0
Total	100.0

CANADA.

We have heretofore described the natural-gas territory of Canada quite thoroughly, and need not repeat what has been said in detail. The larger part of the gas produced is used in the United States, that coming from the neighborhood of Buffalo being piped across the line and used in that city, while that which comes from Essex County, near Detroit, is piped to Detroit. From a communication received from Mr. E. S. Harris, of the Standard Oil and Gas Company of Essex, Limited, we condense the following statement regarding the gas field near Detroit.

The gas field of Essex County comprises the southeastern part of the township of Gosfield, south, and the southwestern part of the township of Mersea, with a tested territory about 2 miles wide and 14 miles long, lying along the shore of Lake Erie, near Kingsville, Ontario, and about 30 miles from Detroit. The productive territory is demonstrated by the tested wells to be about 8 miles long and 2 miles wide, it being the impression, however, of Mr. Harris that the productive territory will be found to be much wider than this, his grounds for this being that a number of very strong wells have been found along the shore of the lake, which is usually an indication that the gas extends under the lake. The gas is found in the Clinton limestone at a total depth of from 1,000 to 1,060 feet, the gas being struck at from 10 to 20 feet in the limestone. This rock seems to be porous, and in some of the wells the cuttings blown out when gas was struck were filled with small crevices. The Clinton limestone in ascending order is followed by the Niagara group, with a varied thickness of from 300 to 350 feet. The interval between the Niagara and Devonian formations is occupied by the Lower Helderberg or Water-lime formation, with a thickness of from

500 to 600 feet, this formation being followed by the Upper Helderberg, or Corniferous limestone, about 100 feet thick, this formation being covered with from 100 to 125 feet of glacial drift. It is believed that this Essex field is a continuation across Lake Erie of the Ohio field, the gas from both fields being identical. The wells are from 1,000 to 1,060 feet in depth, with a closed pressure of 420 pounds and an open pressure of 380 pounds.

This entire territory is controlled by the Ontario Natural Gas and Oil Company, Limited, and the Standard Oil and Gas Company of Essex, Limited, the former having 15 wells and the latter 5. Both companies are engaged in drilling and extending the territory.

Besides Detroit, the towns of Windsor, Walkerville, Kingsville, and Leamington are supplied from this field. The output in 1895 is estimated to be 12,000,000,000 cubic feet, three-fourths of which was consumed in Detroit. There is no trace of oil in the wells.

We have not been able to ascertain in detail the value of the production of natural gas in the several districts, but in the Summary of the Mineral Production of Canada for 1895, published by the Geological Survey of Canada, the total value of natural gas produced in Canada in 1895 is given as $423,032, as compared with $313,754 in 1894 and $367,000 in 1893.

IMPORTS.

In the following table will be found a statement of the value of the natural gas imported into the United States from 1891, when it was first enumerated:

Value of natural gas imported into the United States from 1891 to 1895.

Calendar years.	Value.
1891 (latter half)	$25,540
1892	74,737
1893	90,653
1894	62,523
1895	89,419

ASPHALTUM.

By Edward W. Parker.

PRODUCTION.

The production of asphaltum and bituminous rock in the United States in 1895 was 68,163 short tons, distributed among four States as follows:

Production of asphaltum, etc., in 1895, by States.

State.	Short tons.	Value.
California (*a*)	64,046	$284,086
Kentucky	2,359	11,795
Texas	1,058	29,900
Utah	700	22,500
Total	68,163	348,281

a Not including petroleum residuum.

Compared with 1894 this shows an increase in product of 7,593 short tons and a decrease in value of $5,119. The variance between the product and value of the two years was not due to any material decline in values, but may be understood by comparing the following table showing the production in 1894 with the preceding one:

Production of asphaltum, etc., in 1894, by States.

State.	Short tons.	Value.
California	51,187	$251,991
Kentucky	5,383	21,409
Texas	3,000	45,000
Utah	1,000	35,000
Total	60,570	353,400

It will be seen by this that the output in California increased 12,859 tons, or 25 per cent, in amount, with an increase of $32,095, or 13 per cent, in value. Kentucky's product decreased about 3,000 tons in amount and nearly $10,000 in value. The Texas product was less both in amount and value. The value of the Texas product in 1895 appears greater in proportion than that of 1894. This is due to the fact that the quantity and value in 1895 are for the prepared material, which consisted of 600 tons of mastic and 450 tons of refined gum asphaltum. Utah's output decreased from 1,000 tons of gilsonite, worth $35,000, in 1894 to 700 short tons, valued at $22,500, in 1895.

The varieties of asphaltum are about as numerous as the localities in which they occur. Such forms as gilsonite, elaterite, uintaite, grahamite, courtzilite, etc., are hard and brittle at ordinary temperatures, and from these they vary down to the viscous semifluid maltha and to a liquid form, occurring chiefly in California, which, while having asphaltum and not paraffin for a base, yields illuminating and other petroleum products. Some occur in a comparatively pure state and others as sandstone or limestone impregnated with bitumen. These are known, respectively, as bituminous sandstone or bituminous limestone, and are classed together as bituminous rock. An interesting table is given below in which is shown the amount and value of the different asphaltum products obtained in 1895. All the varieties of hard asphaltum are combined.

Varieties of asphaltum, etc., produced in 1895.

Variety.	Short tons.	Value.
Bituminous rock	41,280	$133,381
Mastic (*a*)	600	7,200
Hard or gum asphaltum (*a*)	22,533	170,200
Maltha or liquid	3,750	37,500
Total	68,163	348,281

a The product from Cline, Tex., is a bituminous limestone. Before marketing it is prepared at the works, part being ground, heated, and pressed into blocks, which are sold as "mastic" for street paving, etc. Part of the product is treated with benzine, dissolving out the bitumen. The benzine is then evaporated, leaving a very pure hard gum. The output of each in 1895 was, respectively, mastic, 600 tons; gum, 450 tons. This latter is known to the trade under the name of "litho-carbon."

The following table shows the annual production of asphaltum and bituminous rock in the United states since 1882:

Production of asphaltum and bituminous rock since 1882.

Year.	Short tons.	Value.	Year.	Short tons.	Value.
1882	3,000	$10,500	1889	51,735	$171,537
1883	3,000	10,500	1890	40,841	190,416
1884	3,000	10,500	1891	45,054	242,264
1885	3,000	10,500	1892	87,680	445,375
1886	3,500	14,000	1893	47,779	372,232
1887	4,000	16,000	1894	60,570	353,400
1888	50,450	187,500	1895	68,163	348,281

PRODUCTION BY STATES.

CALIFORNIA.

The mining of asphaltum in California became an important industry in 1888. In that year about 50,000 tons of bituminous sandstone were produced, all of which was used for street paving. In the following year some attention was given to refining some of the purer grades of the material, the refined product being used as a protective covering for wharf piling and timbers, wood conduits, etc. In 1890 and the two following years the production of bituminous sandstone decreased, due in great part to a reaction from the "boom" output of the preceding years, the producers having had a rather exaggerated idea of what the demand for the new paving material would be. The superior qualities claimed for it had to be demonstrated, and several years' trial was necessary to accomplish the demonstration. That the excellence of asphalt paving on the Pacific Coast has since been established is shown by the increased production in the last three years.

According to the San Francisco Journal of Commerce, California asphaltum for street paving is being introduced in some of the Eastern cities. New York, Philadelphia, Brooklyn, Utica, and Omaha are stated to have contracted for some of the California product. San Francisco is said to be behind other cities of the State, particularly those of the southern portion, in the use of asphalt for street paving. In Los Angeles large quantities have been placed on the streets with satisfactory results.

The material which was shipped to Eastern cities will probably be subjected to comparative tests with Trinidad asphaltum, under similar conditions of climate and use, and before a permanent market is established its equality or superiority to the Trinidad asphaltum must be proved.

The following table gives the annual production of asphaltum and bituminous rock in California since 1888.

Annual production of asphaltum, etc., in California since 1888.

Year.	Bituminous rock.	Hard asphaltum.	Maltha.	Total.	Total value.
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*	
1888	49,300			49,300	$152,500
1889	47,968			47,968	126,885
1890				(a)	(a)
1891	39,962			39,962	154,164
1892	24,000	6,250	1,300	31,550	188,350
1893	33,000	b 9,650		42,650	275,662
1894	45,397	b 5,790		51,187	251,991
1895	38,921	21,375	3,750	64,046	284,086

a Not reported by States.

b Includes maltha, or liquid asphaltum.

KENTUCKY.

The entire product of Kentucky consists of bituminous sandstone, all of which is used for street paving. The product for the last five years has been as follows:

Annual production of bituminous sandstone in Kentucky since 1891.

Year.	Short tons.	Value.
1891	3,000	$6,000
1892	2,680	10,525
1893	1,929	6,570
1894	5,383	21,409
1895	2,359	11,795

TEXAS.

Asphaltum in one form or another occurs in several localities in Texas. Those which have been developed are in Uvalde County, about 6 miles south of Cline Station, on the Southern Pacific Railroad. The asphaltum occurs here impregnating a bed of fossiliferous limestone. The deposit is large and easily mined, as very little overburden has to be removed before the material can be stripped off the surface. Extensive works have been erected for treating the asphalt, which is prepared and sold in two conditions, as mastic and gum. The preparation of the mastic is a simple operation, consisting merely of grinding the crude rock to a desired fineness, after which it is heated and run into molds and it is ready for shipment. This is used for street paving, etc., the other necessary ingredients, sand and petroleum, residuum being added at the place where used. The city of Houston, Tex., has paved a number of streets with asphalt sheets made from the Cline mastic.

The more valuable condition in which the material is sold is that of refined or gum asphaltum. The owners have given this the name of "litho-carbon." It is prepared by dissolving the bitumen out of the rock by benzine. The benzine is distilled off, recondensed, and used over and over again with very little loss. The bitumen is obtained in a very pure state, and is worth $50 per ton free on board cars at New York. Four hundred and fifty tons of litho-carbon were shipped in 1895, and with the increased facilities in the way of new machinery, etc., which were placed on the grounds early in the present year, it is calculated that an output of 6,000 tons of litho-carbon may be produced in a year. The mastic plant is capable of turning out 20 tons a day.

There are also extensive beds of bituminous sandstone in the same county near the town of Uvalde, but they have not been thoroughly prospected, and the interested parties are at present unwilling to make public their plans. Deposits have also been prospected somewhat in

Montague County, but no output of commercial importance had been obtained at the close of 1895.

UTAH.

Utah is exceptionally rich in asphaltum deposits. Bituminous limestone occurs in large quantities, but the excessive cost of transportation militates against its becoming the source of a profitable industry for some time. Gilsonite, one of the purest of crude bitumens, is mined in the Uncompahgre Indian Reservation, from 60 to 90 miles distant from the station of Price, on the Rio Grande Western Railroad, whither it is hauled by wagons. The cost of wagon and railroad transportation makes the expense of getting the gilsonite to market very heavy; but owing to its purity and valuable physical characteristics it is able to bear this expense.

Mr. George H. Eldridge, of the Geological Survey, has been engaged in studying the gilsonite and ozocerite deposits of Utah, and the results of his work are embodied in an interesting paper contained in Part I of the Seventeenth Annual Report of the Survey.

According to Mr. Eldridge, the area in which gilsonite occurs covers a considerable territory in the Uncompahgre Indian Reservation of eastern Utah, and extends a short distance over the State line into Colorado. Elaterite and wurtzilite deposits occur chiefly in the southern portion of the Uinta Indian Reservation. Deposits of ozocerite, or mineral wax, occur in the vicinity of Soldiers Summit, a station on the Rio Grande Western Railroad, and also in the Uinta Reservation. Maltha, or liquid asphaltum, is reported in a number of isolated localities, and bituminous sandstones and limestones are also of frequent occurrence, the latter particularly about 7 miles northwest of Tucker post-office or Clear Creek Station, on the Rio Grande Western Railway.

The principal developments in the State have been on the gilsonite deposits, and to these Mr. Eldridge has given most of his attention. The mineral itself is a black tarry-looking substance of brilliant luster, and exceedingly brittle. Normally it is of absolutely homogeneous texture and has a coarsely conchoidal fracture. In mining it gives off a fine chocolate-colored dust, which is not only very penetrating to the skin and lungs, but also, when mixed in certain proportions of air, highly explosive.

The region in which the gilsonite occurs is in the northern half of the Uncompahgre Reservation, and extends a little beyond its limits both east and west. On the east it extends 4 or 5 miles into Colorado.

There are seven distinct veins in the reservation, which have been named, respectively, the Duchesne, Culmer, Seaboldt, Little Bonanza, Big Bonanza, Cowboy, and Black Dragon. The Duchesne vein is so called on account of its proximity to Fort Duchesne. It is 3 miles east of the post, and is traceable for about 3 miles in a north 40° west direction. The vein is vertical, and has a width of from 3 to 4 feet for about a mile and a half in the middle of the outcrop, tapering gradually toward each end to complete disappearance. This vein has been worked for several years by the Gilson Asphaltum Company of St. Louis, Mo., which controls the greater part of the deposit. It has been opened to a depth of 105 feet, but was accessible only to a level of 65 feet at the time of Mr. Eldridge's visit.

The Culmer and Seaboldt veins cross the western edge of the Uncompahgre Reservation near the fortieth parallel. The veins are parallel, about 100 feet apart, and extend northwest and southeast, with a dip from 85° to 88° west. The two veins are, respectively, 14 and 12 inches in width, and Mr. Eldridge states that the Culmer only is workable. The Cowboy and two Bonanza veins are included by Mr. Eldridge in the Cowboy group. He considers it the most important locality in the State. The three veins are parallel, vertical, with a north 55° west trend. None of the veins have been exploited. The quality and characteristics of the gilsonite here are similar to those of the Duchesne, Culmer, and Seaboldt veins. The Little and Big Bonanza veins have been traced for a distance of 3 miles. They vary considerably in width, but Mr. Eldridge thinks they are of workable thickness at all points. The maximum width of the Little Bonanza is 10 feet 6 inches, and the average from 4 to 5 feet. The Big Bonanza at one point attains a thickness of 13 feet 6 inches. The Cowboy vein is the thickest of the three, having a maximum width of 18 feet, and maintaining an average of from 10 to 12 feet for a distance of 2 or 3 miles.

This group of veins is in the region immediately north and south of the White River, near the eastern edge of the Uncompahgre Reservation.

The Black Dragon vein is located in the region of Upper Evacuation Creek. The southern end is within half a mile of the Colorado-Utah State line and is said to extend 3 or 4 miles in a northwesterly direction (north 55° to 60° west). The vein is vertical, and at one place (when prospected) shows a clean breast of uintaite 8 feet 6 inches in width. The position of the vein is favorable for economical working. A drift from the bottom of the valley in which it is exposed will, according to Mr. Eldridge, pass at least 700 to 1,000 feet below its highest point of outcrop. Timber is more convenient here than at the points on White River, but water is scarce.

In considering the commercial problems Mr. Eldridge says:

TRANSPORTATION ROUTES.

The region within which the uintaite (gilsonite) veins occur is deficient in transportation routes. From the north it is inaccessible except by very indirect roads. To the south it is separated from the valley of the Grand and Price rivers by the rugged Roan or Book Plateau and its canyons, though the travel of to-day is in this direction, the product of the Culmer and Duchesne mines being taken by wagon to Price, on the Rio Grande Western Railway. Up Strawberry Valley and across the Wasatch Range the route is somewhat more difficult than the last, and the distance to railroad is considerably greater. The mines in the edge of Colorado now ship their product by wagon over a circuitous and hilly road, via Meeker to Rifle, on the Denver and Rio Grande Railroad, 125 miles. It is thought possible, however, by those familiar with the country to find a feasible route 50 to 70 miles shorter than this directly southward along the State line. The Bonanza and Cowboy group of veins is a little more remote from Rifle than are the Colorado openings, though perhaps attended with no greater difficulties of transportation. By the way of Fort Duchesne to Price the route from these veins is about 180 miles. The vein of uintaite (gilsonite) on Upper Evacuation Creek is, perhaps, a little more inaccessible than any of the others, unless it should be proved possible to establish a route directly south across the Roan Book Plateau, when it would become the nearest of all the deposits to railroad communication.

The cost of freighting the product of the Duchesne and Culmer mines to rail is now $12 to $15 per ton. Railway freight to Chicago is said to be about $9 per ton. The total cost of mining and placing the material in Chicago or St. Louis is therefore not far from $25 per ton. Office and management expenses may increase this to $30. The present price per ton in Chicago and St. Louis for the best grade is $40 to $50, leaving a net profit of $10 to $20. The factors in a reduction of the price to the trade will be railroad transportation direct from the Uinta Basin, which seems probable at a future day, and competition, which will arise should any equable distribution of mining claims be made among the numerous companies that will doubtless be inclined to work these great deposits.

Ozocerite, or mineral wax, is found in the vicinity of Soldiers Summit, and efforts have been made to develop the property, but the eastern market is supplied with Galician ozocerite at less cost than the Utah material can be placed there profitably, and only a small amount (about 100 tons in 1893) has been shipped.

Utah's production of asphaltum, etc. in the past five years has been as follows:

Annual production of asphaltum, etc., in Utah since 1891.

Year.	Short tons.	Value.
1891	1,732	$82,100
1892	2,700	93,500
1893	*a* 3,200	90,000
1894	*b* 1,000	35,000
1895	*b* 700	22,500

a Includes 100 tons of ozocerite.
b Gilsonite only. There was no product of ozocerite or bituminous limestone reported in 1894 or 1895.

MONTANA.

A considerable deposit of asphaltum of excellent quality has been reported from Park County, Mont. A report on the chemical properties of the mineral by Dr. William C. Day was published in Mineral Resources for 1894. No product of commercial importance has been obtained.

IMPORTS.

The imports of asphaltum into the United States include hard asphaltum from Cuba, Trinidad asphaltum from the Island of Trinidad, off the coast of Venezuela, South America, and bituminous limestone from Neufchatel and Val de Travers, in Switzerland, and Seyssel, in France.

The following table shows the imports of crude asphaltum since 1867:

Crude asphaltum imported into the United States from 1867 to 1895.

Year ended—	Quantity.	Value.	Year ended—	Quantity.	Value.
	Long tons.			*Long tons.*	
June 30, 1867 ..	....	$6,268	June 30, 1882 ..	15,015	$102,698
1868 ..	185	5,632	1883 ..	33,116	149,999
1869 ..	203	10,559	1884 ..	36,078	145,571
1870 ..	488	13,072	1885 ..	18,407	88,087
1871 ..	1,301	14,760	Dec. 31, 1886 ..	32,565	108,528
1872 ..	1,474	35,533	1887 ..	30,808	95,735
1873 ..	2,314	38,298	1888 ..	36,494	84,045
1874 ..	1,183	17,710	1889 ..	61,952	138,163
1875 ..	1,171	26,006	1890 ..	73,861	223,368
1876 ..	807	23,818	1891 ..	102,433	299,350
1877 ..	4,532	36,550	1892 ..	120,255	336,868
1878 ..	5,476	35,932	1893 ..	74,774	196,314
1879 ..	8,084	39,635	1894 ..	102,505	313,680
1880 ..	11,830	87,889	(a) 1895 ..	79,557	210,556
1881 ..	12,883	95,410			

a In addition to the crude asphaltum imported in 1895 there was some manufactured or refined gum asphaltum, valued at $36,664. The quantity was not reported.

The question of what constitutes crude asphaltum came up for adjudication before the officials of the Treasury Department in September, 1895. A cargo of Trinidad asphaltum was received at Galveston, Tex., on September 5, upon which the collector assessed a duty of 20 per cent ad valorem, because the material had been subjected to treatment by steam and heat to drive out the contained moisture. The importers appealed to the Secretary of the Treasury, who referred it to the Board of General Appraisers at New York. The appeal was made on the claim that the asphaltum had been "dried but not otherwise manipulated or treated," and was by law free of duty. The Board of General Appraisers, in a decision rendered January 30, 1896, sustained the appellant, but this decision has been withheld until the matter shall have been passed upon by the United States courts. The asphaltum upon which the duty was assessed, as also some at New Orleans and New York, was released under bond pending final adjudication.

STONE.

By William C. Day.

VALUE OF DIFFERENT KINDS OF STONE PRODUCED IN 1894 AND 1895.

The report on stone for 1894 treated in some detail of the nature, composition, and properties of the different kinds of commercially important stone; also of uses to which they are put, the modes of occurrence in nature, methods of quarrying, dressing, and finishing for their various uses, etc. The present report is limited mainly to the discussion of statistical features. Persons interested in a more complete treatment of the general subject of stone are referred to the report for 1894 as being the most comprehensive one of the series which the writer has prepared for Mineral Resources of the United States.

The following table shows the value of the different kinds of stone produced in the United States in the years 1894 and 1895:

Value of different kinds of stone produced in the United States during the years 1894 and 1895.

Kind.	1894.	1895.
Granite	$10,029,156	$8,894,328
Marble	3,199,585	2,825,719
Slate	2,790,324	2,698,700
Sandstone	3,945,847	4,211,314
Limestone	16,190,118	15,308,755
Bluestone	*a* 900,000	*a* 750,000
Total	37,055,030	34,688,816

a Estimated.

An inspection of this table shows a decrease for all kinds of stone except sandstone, which, having fallen off more than any other kind in 1894, gained a little in 1895. There is, of course, only one fundamental cause for this general decline, and that is the financial depression, which exercised the same kind of effect in 1895 as in the two years previous.

VALUE OF STONE PRODUCT IN 1895, BY STATES.

The following table shows the values of the various kinds of stone produced in 1895, by States:

Value of the various kinds of stone produced in 1895, by States.

State.	Granite.	Sandstone.	Slate.	Marble.	Limestone.	Total
Alabama		$31,930			$222,424	$254,354
Arizona		20,000			24,159	44,159
Arkansas		13,228			47,376	60,604
California	$348,806	11,933	$10,500	$22,000	322,211	715,450
Colorado	35,000	63,237			116,355	214,592
Connecticut	779,361	397,853			154,333	1,331,547
Delaware	73,138					73,138
Florida					10,550	10,550
Georgia	508,481		10,675	689,229	12,000	1,220,385
Idaho	14,560	6,900		2,250	7,829	31,539
Illinois		6,558			1,687,662	1,694,220
Indiana		60,000			1,658,976	1,718,976
Iowa		5,575		13,750	449,501	468,826
Kansas		93,394			316,688	410,082
Kentucky		25,000			154,130	179,130
Maine	1,400,000		140,154		700,000	2,240,154
Maryland	276,020	16,836	60,357	145,000	200,000	698,213
Massachusetts	1,918,894	339,487		2,000	75,000	2,335,381
Michigan		159,075			424,589	583,664
Minnesota	148,596	74,700			218,733	442,029
Missouri	128,987	100,000			897,318	1,126,305
Montana		31,069			95,121	126,190
Nebraska					7,376	7,376
Nevada	3,200					3,200
New Hampshire	480,000					480,000
New Jersey	151,343	111,823	700		150,000	413,866
New Mexico		2,700			3,375	6,075
New York	68,474	415,644	91,875	207,828	1,043,182	1,827,003
North Carolina	75,000	3,500				78,500
Ohio		1,449,659			1,568,713	3,018,372
Oregon	1,728				970	2,698
Pennsylvania	300,000	500,000	1,647,751	59,787	3,055,913	5,563,451
Rhode Island	968,473					968,473
South Carolina	22,083					22,083
South Dakota	33,279	26,100			4,000	63,379
Tennessee				362,277	156,898	519,175
Texas		97,336			62,526	159,862
Utah		5,000			22,503	27,503
Vermont	1,007,718		625,331	1,321,598	300,000	3,254,647

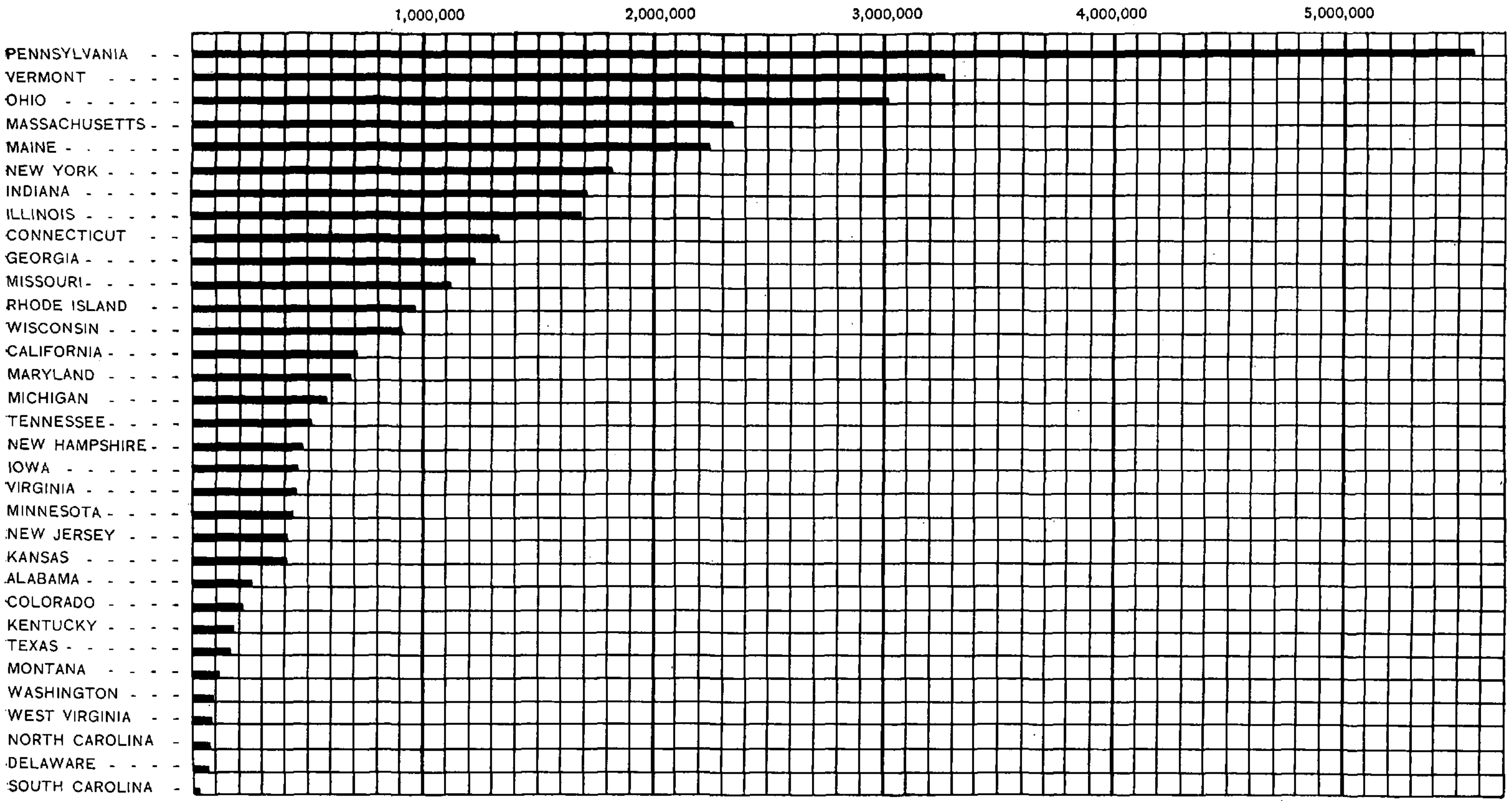

DIAGRAM SHOWING THE VALUE OF THE DIFFERENT KINDS OF STONE PRODUCED IN THE VARIOUS STATES DURING THE YEAR 1895.

(In millions of dollars.)

Value of the various kinds of stone produced in 1895, by States—Continued.

State.	Granite.	Sandstone.	Slate.	Marble.	Limestone.	Total.
Virginia	$70,426	....	$111,357	....	$268,892	$450,675
Washington	....	$14,777	....	....	75,910	90,687
West Virginia	....	40,000	....	....	42,892	82,892
Wisconsin	80,761	78,000	....	....	750,000	908,761
Wyoming	....	10,000	....	....	650	10,650
Total	8,894,328	4,211,314	2,698,700	2,825,719	15,308,755	33,938,816

GRANITE.

The following table shows the value of the granite output in 1895, by States:

Value of granite product in 1895, by States.

State.	Value.	State.	Value.
California	$348,806	New Jersey	$151,343
Colorado	35,000	New York	68,474
Connecticut	779,361	North Carolina	75,000
Delaware	73,138	Orégon	1,728
Georgia	508,481	Pennsylvania	300,000
Idaho	14,560	Rhode Island	968,473
Maine	1,400,000	South Carolina	22,083
Maryland	276,020	South Dakota	33,279
Massachusetts	1,918,894	Vermont	1,007,718
Minnesota	148,596	Virginia	70,426
Missouri	128,987	Wisconsin	80,761
Nevada	3,200	Total	8,894,328
New Hampshire	480,000		

Value of granite paving blocks made in 1895, by States.

State.	Value.	State.	Value.
California	$34,079	New York	$16,443
Connecticut	46,830	North Carolina	1,320
Delaware	16,556	Pennsylvania	69,503
Georgia	232,041	Rhode Island	49,255
Maine	636,063	South Carolina	12,505
Maryland	2,633	South Dakota	20,800
Massachusetts	496,544	Vermont	30,702
Minnesota	4,800	Virginia	8,028
Missouri	22,014	Wisconsin	17,000
New Hampshire	16,823	Total	1,773,328
New Jersey	39,389		

The foregoing table shows a total of $1,773,328 as the value of paving blocks produced in 1895. In 1894 the total was $2,254,587. In the latter year there was undoubtedly an overproduction because of the falling off in demand for building and ornamental granite. This overproduction in 1894 naturally caused a diminished output in 1895, and also caused a lowering in price. Another cause which operates against the production of granite blocks is the increasing tendency in large cities to use paving bricks and asphaltum on streets whose traffic will allow other material than granite. It is not unlikely that the increasing use of the bicycle in large cities is an influence favoring the substitution of smoother forms of pavement than that afforded by granite blocks. A large amount of asphalt pavement and also paving bricks have been laid in Philadelphia during the past two years, and a serious falling off in the granite-block industry of Pennsylvania has been the result in this case at least.

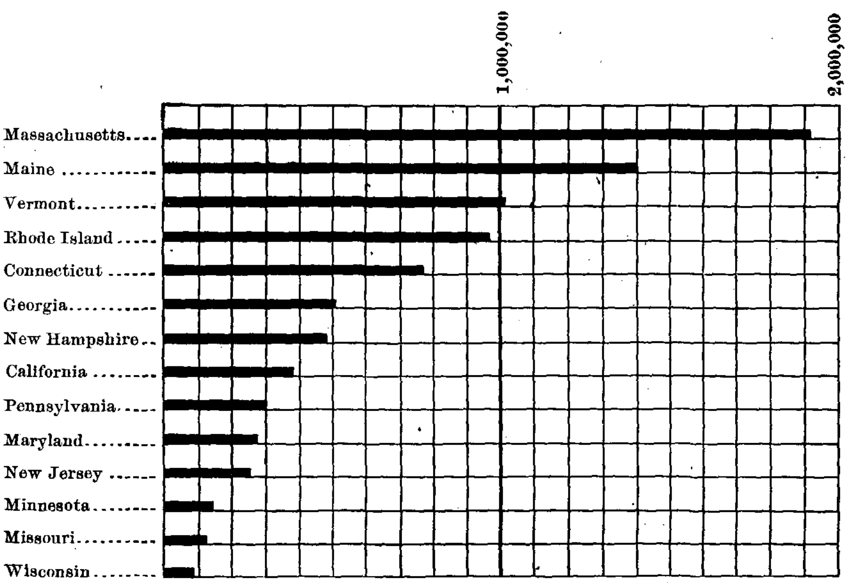

FIG. 2.—Value of granite produced in the various States during the year 1895 (in millions of dollars).

VALUE OF GRANITE PRODUCT, BY STATES, FROM 1890 TO 1895.

The following table gives the value of the granite output, by States, for the years 1890 to 1895:

State.	1890.	1891.	1892.	1893.	1894.	1895.
Arkansas	(a)	$65,000	$40,000		$28,100	
California	$1,329,018	1,300,000	1,000,000	$531,322	307,000	$348,806
Colorado	314,673	300,000	100,000	77,182	49,302	35,000
Connecticut	1,061,202	1,167,000	700,000	652,459	504,390	779,361
Delaware	211,194	210,000	250,000	215,964	173,805	73,138
Georgia	752,481	790,000	700,000	476,387	511,804	508,481
Idaho						14,560
Maine	2,225,839	2,200,000	2,300,000	1,274,954	1,551,036	1,400,000
Maryland	447,489	450,000	450,000	260,855	308,966	276,020
Massachusetts	2,503,503	2,600,000	2,200,000	1,631,204	1,994,830	1,918,894
Minnesota	356,782		360,000	270,296	153,936	148,596
Missouri	500,642	400,000	325,000	388,803	98,757	128,987
Montana	(a)	51,000	36,000	1, 00	5,800	
Nevada	(a)			3,000	1,600	3,200
New Hampshire	727,531	750,000	725,000	442,424	724,702	480,000
New Jersey	425,673	400,000	400,000	373,147	310,965	151,343
New York	222,773	225,000	200,000	181,449	140,618	68,474
North Carolina	146,627		150,000	122,707	108,993	75,000
Oregon	44,150	3,000	6,000	11,255	4,993	1,728
Pennsylvania	623,252	575,000	550,000	206,493	600,000	300,000
Rhode Island	931,216	750,000	600,000	509,799	1,211,439	968,473
South Carolina	47,614	50,000	60,000	95,443	45,899	22,083
South Dakota	304,673	100,000	50,000	27,828	8,806	33,279
Texas	22,550	75,000	50,000	38,991		
Utah	8,700		15,000	590		
Vermont	581,870	700,000	675,000	778,459	893,956	1,007,718
Virginia	332,548	300,000	300,000	103,703	123,361	70,426
Washington	(a)					
Wisconsin	266,095	406,000	400,000	133,220	166,098	80,761
Total	14,464,095	13,867,000	12,642,000	8,808,934	10,029,156	8,894,328

a Granite valued at $76,000 was produced in Arkansas, Montana, Nevada, and Washington together, and this amount is included in the total.

GRANITE INDUSTRY IN THE VARIOUS STATES.

California.—In 1894 the granite output was valued at $307,000; in 1895, at $348,806. The gain of $40,000 is quite noteworthy, in view of the fact that in some other industries the year did not come up to 1894 in prosperity. Some of the producers speak encouragingly of the prospects for 1896. The paving-block industry is at present suffering from the increasing use of the bituminous rocks mined in the State; furthermore, overproduction of blocks in 1893 and 1894 told decidedly on the output of 1895, and, as a further consequence of carrying old stock, prices were reduced. Collections are still slow, and frequently three or four months' time had to be given in order to make sales.

Colorado.—The output of granite fell off somewhat in 1895, owing to the shutting down of a number of quarries, leaving but few active producers. These, however, speak somewhat encouragingly of the prospects for 1896.

Connecticut.—Production in Connecticut, as shown by the increase from $504,390 to $779,361, has been quite active during the past year. The product for 1895 is the largest since 1891, when it amounted to $1,167,000. Prospects for 1896 are very good.

Delaware.—Quite a falling off in output is the result of operations in 1896. General depression is given as the cause.

Georgia.—This State has managed to hold its own in the production of granite as well as marble. The figures for 1894 and 1895 are, respectively, $511,804 and $508,481. About one-half the output was in the form of paving blocks, for which there has been a pretty fair demand, although prices have had to come down somewhat to suit the hard times. The disposition of granite in its natural occurrence in Stone Mountain is such as to render quarrying easy and much cheaper than in many other places.

Maine.—The granite output in Maine declined from $1,551,036 in 1894 to $1,400,000 in 1895. Quite a large number of small quarries ceased operations altogether for the time, but they will probably resume when general business improves. Operators who have continued through the past three years without interruption have complained of poor business and constantly lowering prices, particularly in the case of paving blocks. The increasing use of asphaltum pavement and of various kinds of paving bricks is beginning to be felt by producers of Belgian blocks, which, on being thrown out in large cities, have declined in price sufficiently to allow of their use in some towns that have heretofore been content with macadam or similar cheap paving material. Some of the producers of the finer kinds of granite are complaining of competition with Scotch granite, which, they say, is more profitable to dealers than the American.

Maryland.—The value of the output in 1894 was $308,966 and in 1895 $276,020, thus showing a decrease. The industry generally was dull.

A few large orders were filled by some of the leading producers, but these constituted almost the entire business for the year.

Massachusetts.—This State still stands at the head of the list of those producing granite. The reason for this preeminence is mainly that stone of all grades is to be found in the State, from the finest ornamental stock to such material as is adapted only to road metal or paving blocks. The quarrymen can thus adapt themselves to changing demands, as well as to periods of financial depression better than those of other regions in which the stone is restricted to fewer uses. The product in 1894 was valued at $1,994,830, in 1895 at $1,918,894; so that while there has been some decrease, it is not proportionately large. The general complaint of lower prices for paving blocks is very similar to that so liberally made in Maine. As is also the case in Maine, a large number of small quarries have ceased operations entirely for the present, although when business improves they will probably revive.

Minnesota.—Production in Minnesota is about the same for 1895 as for 1894, although the amount is only one-half what was quarried in 1892. All of the operators complain of the dullness of trade, although some are hopeful as to possibilities in 1896. A number of quarries ceased operations entirely.

Missouri.—The output of granite in Missouri is somewhat in advance of 1894, but the figures are decidedly below those of previous years, particularly 1890, when the product was valued at $500,000. In a number of Western States, including Missouri, crushed granite formed an important part of the output. The use of crushed granite in road making seems to be increasing in a very satisfactory manner, a result due to a general disposition to improve roads, aided by the cheapness of stone owing to hard times.

New Hampshire.—A very decided falling off in output marks the granite industry of New Hampshire in 1895. Without exception producers report very poor business and many ceased work entirely. Although many operators express themselves as disheartened, a few predict much improvement for 1896. Complaints of foreign competition are made by a number of producers.

New Jersey.—Very little was accomplished in New Jersey during the past year. The stone is mostly trap rock and is largely used for road making at present, much of the stone being crushed.

New York.—Low prices prevailed throughout the year in New York. Much of the product was crushed stone for road work. Prospects for 1896 are more encouraging.

North Carolina.—Poor demands and low prices characterized the industry for 1895. Much of the product was for paving and curbing. Judging from the abundance of easily quarried granite of good quality in the State, ordinary prosperity in general business will undoubtedly result in making the granite industry quite an important one in North Carolina in the course of a few years.

Pennsylvania.—Many quarries closed during the year. Those that continued in operation report very poor business. Some claims have been made that the extensive use of brick and asphaltum for paving material in Philadelphia has seriously reduced the paving-block output.

Rhode Island.—The special item of interest which attaches to the consideration of granite in Rhode Island is the fact that this State leads in the production of monumental and ornamental stock. The quarries of Westerly are the most important. The output of 1894, valued at $1,211,439, was the largest in the history of the State. The product of 1895 was valued at $968,473, and while this is less than the product of 1894 it is greater than that of any year previous to 1894. Prospects for 1896 are regarded as good.

South Carolina.—Dull business is reported. More than half the output was in the form of paving blocks, prices for which were low.

Vermont.—Hard times and low prices have not been able to prevent a larger output in Vermont. The value of the product in 1894 was $893,956, in 1895, $1,007,718, thus exceeding $1,000,000. With the exception of a slight decline in 1892 the value of the output in Vermont has steadily increased, so that the figure for 1895 is the highest ever reached in the history of the State. It is interesting to note that Vermont is the only granite-producing State which has regularly increased in output, so that for last year the figures reached a maximum.

Virginia.—Business on the whole was very dull in Virginia during 1895. The outlook for 1896 is somewhat better.

Wisconsin.—The same conditions of depression that existed in 1894 are again referred to by producers in Wisconsin to account for a very poor condition of business in 1895. The value of the output in the latter year is about one-half that of 1894.

MARBLE.

VALUE OF MARBLE PRODUCT BY STATES.

The following table shows the value of the marble produced in the United States during the year 1895, by States:

Value of marble product for the year 1895, by States.

State.	Value.	State.	Value.
California	$22,000	New York	$207,828
Georgia	689,229	Pennsylvania	59,787
Idaho	2,250	Tennessee	362,277
Iowa	13,750	Vermont	1,321,598
Maryland	145,000	Total	2,825,719
Massachusetts	2,000		

The value of the output in 1894 was $3,199,585. A falling off of $373,866 is thus evident. Improvement in the industry was noticeable toward the latter part of the year, and many of the producers speak quite hopefully of still more decided improvement in 1896. A number of operators who were entirely inactive in 1895 contemplate a resumption of business in 1896. The chief cause of the decline in 1895 was, naturally, business depression, causing greater economy in the use of ornamental material of every kind. Another reason is one which is independent of hard times—namely, the increasing use of granite for cemetery purposes and for polished interior work in public buildings. Owing to the invention of new machinery for turning, polishing, and carving granite, and the use of improved abrasive material, this stone is coming more and more into general use and thus into competition to a certain extent with the softer and more easily finished marble. Prices for marble products have declined somewhat in a number of localities during the past two years.

The adoption of a number of the leading marbles of the United States in the new Congressional Library Building in Washington furnishes a fine opportunity for the comparative study of these materials as well as of a number of varieties of Italian marble. Probably no other building in the world shows so well the beauties and fine effects obtainable in marble, whether in polished slabs or carved or otherwise finished, as does this magnificent structure.

The following table shows the value, by States, of the marble produced during the years 1890 to 1895, inclusive:

Value of marble, by States, from 1890 to 1895.

State.	1890.	1891.	1892.
California	$87,030	$100,000	$115,000
Georgia	196,250	275,000	280,000
Idaho			
Iowa			
Maryland	139,816	100,000	105,000
Massachusetts			100,000
New York	354,197	390,000	380,000
Pennsylvania		45,000	50,000
Tennessee	419,467	400,000	350,000
Vermont	2,169,560	2,200,000	2,275,000
Scattering	121,850	100,000	50,000
Total	3,488,170	3,610,000	3,705,000

Value of marble, by States, from 1890 to 1895—Continued.

State.	1893.	1894.	1895.
California	$10,000	$13,420	$22,000
Georgia	261,666	724,385	689,229
Idaho	4,500	3,000	2,250
Iowa			13,750
Maryland	130,000	175,000	145,000
Massachusetts			2,000
New York	206,926	501,585	207,828
Pennsylvania	27,000	50,000	59,787
Tennessee	150,000	231,796	362,277
Vermont	1,621,000	1,500,399	1,321,598
Scattering			
Total	2,411,092	3,199,585	2,825,719

THE MARBLE INDUSTRY IN THE VARIOUS STATES.

California.—Marble quarrying in California was very much restricted during 1895, and producers, without exception, have expressed themselves in the most unqualified manner to the effect that there was scarcely any inducement to continue quarrying during the year. Operators are awaiting such revival in business as will justify them in renewing their efforts. Under ordinarily good conditions of trade the State is equal to a production of marble valued at $100,000 per annum, but, as is evident from the table of production, the figure for 1895 is far below this limit.

Idaho.—A small amount of marble was produced in Cassia County during 1895. Larger amounts would doubtless be quarried if business were in a normal condition. Quarries are at present being opened near Albion, Cassia County, and an output may be looked for from these in 1896.

Georgia.—The activity of marble quarrying in Georgia during the past two years is almost phenomenal, when the depressing conditions of trade generally are considered. The product for 1895 was valued at $689,229, which falls but little below the corresponding figure for 1894.

A most commendable spirit of business enterprise has been shown in the development of these quarries since the year 1884. The stone is now well and favorably known throughout the country for interior decoration as well as for outside construction and cemetery work.

Improvement in demands was noticed toward the latter part of the year, and for building, both exterior and interior, the outlook for 1896 is good, much better, in fact, than for ornamental and cemetery products.

Iowa.—Marble production in Iowa is of recent date, but, as the material appears to withstand exposure very well, there is no reason why it should not develop into a permanent industry. The stone is not what would be called highly crystalline, and some of it is not, in the strict sense of the term, true marble; it is really a coralline limestone in various stages of metamorphism, some of it being crystalline. In the form of mantels and other kinds of interior decoration it gives very pleasing effects, some of the coral markings being very delicate and beautiful. As is evident from the table of production, but little has as yet been accomplished in the way of actual output.

Maryland.—The Maryland marble quarries, like those in a number of other States, have produced less stone in 1895 than in the preceding year, but, with the improvement in general trade, activity in quarrying will doubtless increase. The Maryland marble is so thoroughly well known for its desirable qualities that, while production fluctuates a little according to changes in commercial activity, it is as little affected by financial depression as any similar stone in the country.

Massachusetts.—Marble from quarries at Lee, in this State, has long been quarried, but at present but little is being produced.

New York.—In 1894 the value of the marble output was much higher than usual. This was due to greatly increased activity at Tuckahoe. The figure for 1895, namely, $207,828, is somewhat below the customary output, but the restricted production is entirely due to the depression in business, which caused a number of quarries to suspend operations for the year. Some of them resumed production early in 1896, and the quarrymen regard indications for 1896 as much better than for two years past.

Pennsylvania.—Quarries in Montgomery and Chester counties produce an annual output of about $65,000 value. The Montgomery County stone has been known to the trade for a long time, and for building purposes it has a well-established reputation. The Chester County stone is of comparatively recent discovery, but it is rapidly making a reputation for its adaptability to building purposes, for which most of it is used.

Tennessee.—During the past year quite a significant advance has been made in the marble industry of this State. In spite of financial depression the value of the output has increased from $231,796 in 1894 to $362,277 in 1895. The chief use to which Tennessee marble has been put in the past is interior decoration, although at the period when marble-topped furniture was fashionable large quantities were devoted to this use. At present the stone is strongly advocated by the producers as an outside building material; judging from its appearance in a number of buildings in which it has been used it will probably make a reputation in this line. Improvements in quarrying methods are being made, and it will be a matter of surprise if the industry does not show a remarkable advance within the next few years.

Vermont.—About one-half of the marble output of this country comes from Vermont. In 1892 the value of the output was $2,275,000, probably the highest figure which the industry has ever reached in any one year. Since that time there has been a decline, caused entirely by the general dullness of business. The output for 1895 is valued at $1,321,598. Indications for 1896 are for better business than for several years past. A few firms who have almost entirely suspended operations during 1895 expect to resume in 1896.

SLATE.

VALUE OF SLATE PRODUCT, BY STATES.

The following table shows the output of rocfing and milled slate in 1895:

Value of slate product in 1895, by States.

State.	Roofing slate.		Other purposes (value).	Total value.
	Squares.	Value.		
California	1,500	$10,500		$10,500
Georgia	2,500	10,675		10,675
Maine	23,774	118,791	$21,363	140,154
Maryland	13,188	59,157	1,200	60,357
New Jersey	200	700		700
New York	13,624	90,150	1,725	91,875
Pennsylvania	426,687	1,437,697	210,054	1,647,751
Vermont	221,359	531,482	93,849	625,331
Virginia	27,095	92,357	19,000	111,357
Total	729,927	2,351,509	347,191	2,698,700

The table shows a total output of 729,927 squares of roofing slate, valued at $2,351,509. The corresponding totals for 1894 were 738,222 squares, and $2,301,138. It is evident that, although the number of squares produced is somewhat less in 1895, the value is greater, showing an increase in the value per square, namely, from $3.11 in 1894, to $3.23 in 1895.

This gain in value per square is not what would be expected as the result of reading statements made by many of the producers, who claimed that prices had fallen since 1894. Taken as a whole, the slate industry is in better condition than it was a year ago. The following table shows the average annual price per square of roofing slate since 1890:

Average annual price per square of roofing slate for the entire country.

1890	$3.34	1893	$3.55
1891	3.49	1894	3.11
1892	3.58	1895	3.23

The following table shows the value of the production of slate, by States, during the years 1890 to 1895, inclusive:

Value of slate, by States, from 1890 to 1895.

State.	1890.			
	Roofing slate.	Value.	Other purposes than roofing, value.	Total value
	Squares.			
Arkansas	....	....	....	....
California	3, 104	$18, 089	....	$18, 089
Georgia	3, 050	14, 850	$480	15, [illegible]30
Maine	41, 000	201, 500	18, 000	219, 500
Maryland	23, 099	105, 745	4, 263	110, 008
New Jersey	2, 700	9, 675	1, 250	10, 925
New York	16, 767	81, 726	44, 877	126, 603
Pennsylvania	476, 038	1, 641, 003	370, 723	2, 011, 726
Utah	....	....	....	....
Vermont	236, 350	596, 997	245, 016	842, 013
Virginia	30, 457	113, 079	....	113, 079
Other States *a*	3, 060	15, 240	....	15, 240
Total	835, 625	2, 797, 904	684, 609	3, 482, 513

State.	1891.			
	Roofing slate.	Value.	Other purposes than roofing, value.	Total value.
	Squares.			
Arkansas	120	$480	....	$480
California	4, 000	24, 000	....	24, 000
Georgia	3, 000	13, 500	....	13, 500
Maine	50, 000	250, 000	....	250, 000
Maryland	25, 166	123, 425	$2, 000	125, 425
New Jersey	2, 500	10, 000	....	10, 000
New York	17, 000	136, 000	40, 000	176, 000
Pennsylvania	507, 824	1, 741, 836	401, 069	2, 142, 905
Utah	....	....	....	....
Vermont	247, 643	698, 350	257, 267	955, 617
Virginia	36, 059	127, 819	....	127, 819
Other States *a*	....	....	....	....
Total	893, 312	3, 125, 410	700, 336	3, 825, 746

a Includes Arkansas, Michigan, and Utah.

Value of slate, by States, from 1890 to 1895—Continued.

State.	1892.			
	Roofing slate.	Value.	Other purposes than roofing, value.	Total value.
	Squares.			
Arkansas				
California	3,500	$21,000		$21,000
Georgia	2,500	10,625		10,625
Maine	50,000	250,000		250,000
Maryland	24,000	114,000	$2,500	116,500
New Jersey	3,000	12,000		12,000
New York	20,000	160,000	50,000	210,000
Pennsylvania	550,000	1,925,000	408,000	2,333,000
Utah				
Vermont	260,000	754,000	260,000	1,014,000
Virginia	40,000	150,000		150,000
Total	953,000	3,396,625	720,500	4,117,125

State.	1893.			
	Roofing slate.	Value.	Other purposes than roofing, value.	Total value.
	Squares.			
Arkansas				
California				
Georgia	2,500	$11,250		$11,250
Maine	18,184	124,200	$15,000	139,200
Maryland	7,422	37,884		37,884
New Jersey	900	3,653		3,653
New York	69,640	204,776	206	204,982
Pennsylvania	364,051	1,314,451	157,824	1,472,275
Utah	75	450	400	850
Vermont	132,061	407,538	128,194	535,732
Virginia	27,106	104,847	12,500	117,347
Total	621,939	2,209,049	314,124	2,523,173

Value of Slate, by States, from 1890 to 1895—Continued.

State.	1894.			
	Roofing slate.	Value.	Other purposes than roofing, value.	Total value.
	Squares.			
Arkansas				
California	900	$5,850		$5,850
Georgia	5,000	22,500		22,500
Maine	24,690	123,937	$22,901	146,838
Maryland	39,460	150,568	2,500	153,068
New Jersey	375	1,050		1,050
New York	7,955	42,092	2,450	44,542
Pennsylvania	411,550	1,380,430	239,728	1,620,158
Utah				
Vermont	214,337	455,860	202,307	658,167
Virginia	33,955	118,851	19,300	138,151
Total	738,222	2,301,138	489,186	2,790,324

State.	1895.			
	Roofing slate.	Value.	Other purposes than roofing, value.	Total value.
	Squares.			
California	1,500	$10,500		$10,500
Georgia	2,500	10,675		10,675
Maine	23,774	118,791	$21,363	140,154
Maryland	13,188	59,157	1,200	60,357
New Jersey	200	700		700
New York	13,624	90,150	1,725	91,875
Pennsylvania	426,687	1,437,697	210,054	1,647,751
Vermont	221,359	531,482	93,849	625,331
Virginia	27,095	92,357	19,000	111,357
Total	729,927	2,351,509	347,191	2,698,700

THE SLATE INDUSTRY IN THE VARIOUS STATES.

California.—While the production of slate in California has never yet reached large proportions, the product has always commanded a good price. The demand for slate as a roofing material is curtailed by the cheapness and excellence of redwood shingles produced in the State. There is no reason at present to expect that the production of roofing slate will increase markedly within the next few years. The output comes entirely from Eldorado County.

Georgia.—The output of slate in Georgia has been about the same for the past five years, with the exception of 1894, when it reached a total of 5,000 squares. In 1895 the total was 2,500 squares, but indications for steady improvement are better now than they have been, as the producers are better prepared than formerly to fill orders promptly. There seems to be no reason why the production of slate in the South should not prosper, for the material is good and should supply the whole Southern trade, both for roofing purposes and manufactured articles or milled stock. The entire output comes from Polk County.

Maine.—Quarries in Piscataquis County yielded an output valued at $140,154. Of this value, $118,791 represents the value of 23,774 squares of roofing slate, while the remainder is the value of milled stock. The roofing slate commands a price well above the average for the country.

Maryland.—Productive quarries are all in Harford County, near the Pennsylvania State line, and form a part of what is known as the Peach Bottom region. The product has always been favorably regarded for roofing purposes, and the price per square is higher than the average for Pennsylvania slate.

New Jersey.—The slate produced in this State comes from Sussex County, and the quarries form a continuation of the Pennsylvania slate belt. Production on the New Jersey side of the line has never been very considerable.

New York.—The output of 13,624 squares of roofing slate, valued at $90,150, comes from Washington County, near the Vermont line. Most of the product is of a bright cherry-red color, and as it is the only slate in the country of this color it commands a high price. Used with black slate, it forms a very pleasing combination in the roof.

Pennsylvania.—The value of the slate output in Pennsylvania amounts each year to more than half of the total value for the whole country.

The productive counties are Berks, Carbon, Lehigh, Northampton, and York. There is very little difference between the years 1894 and 1895 in total output, but it is interesting to note that the average value per square has increased from $3.35 in 1894 to $3.39 in 1895. This difference is not great, to be sure, but it is sufficient to indicate an improvement, which will probably continue in 1896, as the general prosperity of the country increases in its recovery from the depression of the past few years.

Vermont.—This State is second only to Pennsylvania in the production of slate. The product comes from Rutland County and differs from Pennsylvania slate in color, the latter being entirely black, or nearly so, while Vermont slate is of various shades of green and purple.

Vermont slate is easily and cheaply quarried, and the industry can be successfully prosecuted at lower prices per square than in any other State. There has been but little change (a slight increase) over 1894, but as is true in Pennsylvania also, indications for improvement in 1896 are good. The average price per square in 1894 was $2.12, while in 1895 it was $2.40.

Virginia.—The output comes from Buckingham County. Although there was a slight decrease in output in 1895, it is hardly sufficient to be significant. The production of milled stock is of recent date, but seems to be firmly established as a permanent addition to the industry in the State.

SANDSTONE.

VALUE OF SANDSTONE PRODUCT BY STATES.

The year 1895 shows a slight improvement in the general condition of the industry.

The following table reveals a total of $4,211,314 as the value of the output in 1895; this means a gain of $265,467 over 1894:

Value of sandstone production in 1895, by States.

State.	Value.	State.	Value.
Alabama	$31,930	Montana	$31,069
Arizona	20,000	New Jersey	111,823
Arkansas	13,228	New Mexico	2,700
California	11,933	New York	415,644
Colorado	63,237	North Carolina	3,500
Connecticut	397,853	Ohio	1,449,659
Idaho	6,900	Pennsylvania	500,000
Illinois	6,558	South Dakota	26,100
Indiana	60,000	Texas	97,336
Iowa	5,575	Utah	5,000
Kansas	93,394	Washington	14,777
Kentucky	25,000	West Virginia	40,000
Maryland	16,836	Wisconsin	78,000
Massachusetts	339,487	Wyoming	10,000
Michigan	159,075	Total	4,211,314
Minnesota	74,700		
Missouri	100,000		

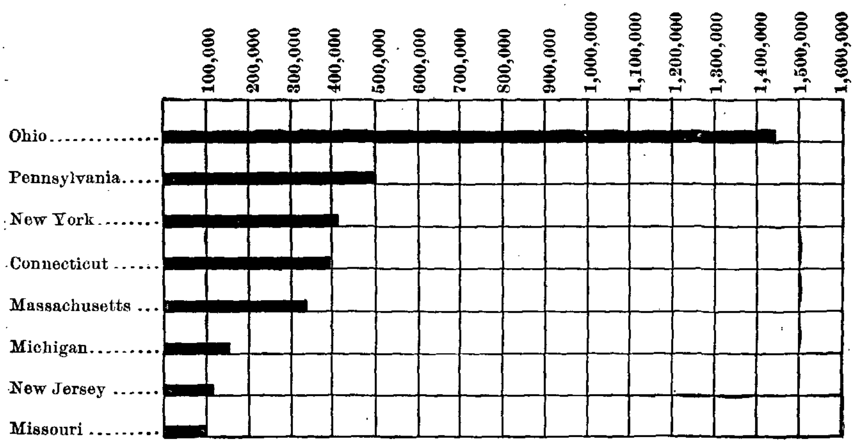

FIG. 3.—Value of sandstone produced in the various States during the year 1895.

The following table shows the output of sandstone, by years, from 1890 to 1895:

Value of sandstone, by States, from 1890 to 1895.

State.	1890.	1891.	1892.
Alabama	$43,965	$30,000	$32,000
Arizona	9,146	1,000	35,000
Arkansas	25,074	20,000	18,000
California	175,598	100,000	50,000
Colorado	1,224,098	750,000	550,000
Connecticut	920,061	750,000	650,000
Florida	(a)		
Georgia	(a)		2,000
Idaho	2,490		3,000
Illinois	17,896	10,000	7,500
Indiana	43,983	90,000	80,000
Iowa	80,251	50,000	25,000
Kansas	149,289	80,000	70,000
Kentucky	117,940	80,000	65,000
Maryland	10,605	10,000	5,000
Massachusetts	649,097	400,000	400,000
Michigan	246,570	275,000	500,000
Minnesota	131,979	290,000	175,000
Missouri	155,557	100,000	125,000
Montana	31,648	35,000	35,000
Nevada	(a)		
New Hampshire	3,750		
New Jersey	597,309	400,000	350,000
New Mexico	186,804	50,000	20,000

a Sandstone valued at $26,199 was produced by Rhode Island, Nevada, Vermont, Florida, and Georgia together, and this sum is included in the total.

Value of sandstone, by States, from 1890 to 1895—Continued.

State.	1890.	1891.	1892.
New York	$702,419	$500,000	$450,000
North Carolina	12,000	15,000	....
Ohio	3,046,656	3,200,000	3,300,000
Oregon	8,424	....	35,000
Pennsylvania	1,609,159	750,000	650,000
Rhode Island	(a)	....	....
South Dakota	93,570	25,000	20,000
Tennessee	2,722	....	....
Texas	14,651	6,000	48,000
Utah	48,306	36,000	40,000
Vermont	(a)	....	....
Virginia	11,500	40,000	....
Washington	75,936	75,000	75,000
West Virginia	140,687	90,000	85,000
Wisconsin	183,958	417,000	400,000
Wyoming	16,760	25,000	15,000
Total	10,816,057	8,700,000	8,315,500

State.	1893.	1894.	1895.
Alabama	$5,400	$18,100	$31,930
Arizona	46,400	....	20,000
Arkansas	3,292	2,365	13,228
California	26,314	10,087	11,933
Colorado	126,077	69,105	63,237
Connecticut	570,346	322,934	397,853
Florida	....	....	....
Georgia	....	11,300	....
Idaho	2,005	10,529	6,900
Illinois	16,859	10,732	6,558
Indiana	20,000	22,120	60,000
Iowa	18,347	11,639	5,575
Kansas	24,761	30,265	93,394
Kentucky	18,000	27,868	25,000
Maryland	360	3,450	16,836
Massachusetts	223,348	160,231	339,487
Michigan	75,547	34,066	159,075
Minnesota	80,296	8,415	74,700
Missouri	75,701	131,687	100,000

a Sandstone valued at $26,199 was produced by Rhode Island, Nevada, Vermont, Florida, and Georgia together, and this sum is included in the total.

Value of sandstone, by States, from 1890 to 1895—Continued.

State.	1893.	1894.	1895.
Montana	$42,300	$16,500	$31,069
Nevada			
New Hampshire			
New Jersey	267,514	217,941	111,823
New Mexico	4,922	300	2,700
New York	415,318	450,992	415,644
North Carolina			3,500
Ohio	2,201,932	1,777,034	1,449,659
Oregon			
Pennsylvania	622,552	349,787	500,000
Rhode Island			
South Dakota	36,165	9,000	26,100
Tennessee			
Texas	77,675	62,350	97,336
Utah	136,462	15,428	5,000
Vermont			
Virginia	3,830	2,258	
Washington	15,000	6,611	14,777
West Virginia	46,135	63,865	40,000
Wisconsin	92,193	94,888	78,000
Wyoming	100	4,000	10,000
Total	5,295,151	3,955,847	4,211,314

THE SANDSTONE INDUSTRY IN THE VARIOUS STATES.

Alabama.—Reports indicate a much more satisfactory condition than that which prevailed in 1894, although, of course, the industry is still struggling under adverse financial conditions. Prospects for 1896 are regarded as good.

Arizona.—Quarries near Flagstaff were in operation during the year, producing an output valued at $20,000. This speaks well for the development of what may be before long an industry of some magnitude.

Arkansas.—Operations of sandstone quarrying have never reached a considerable magnitude in Arkansas, but proportionately much more was done in 1895 than in 1894.

California.—Reports of operations in sandstone quarrying in California are rather discouraging, and an output valued at $11,933 is much smaller than was produced in this State a few years since. Building operations were very much curtailed in the past year.

Colorado.—When the large sandstone outputs of 1890 and 1891 are considered, it is evident that at present the possibilities in this industry are far from being realized. It is encouraging to note, however, that better conditions for 1896 are unhesitatingly predicted by a number of the producers.

Connecticut.—The important and long-known sandstone quarries of Portland and Cromwell, Conn., yield most of the State's output of sandstone. Quite a marked improvement is to be noted for the year 1895, but the industry, as in most States, is far behind what it was in 1890 and 1891. Some of the producers appear to be much encouraged at the outlook for 1896.

Indiana.[1]—Quite a decided improvement in sandstone production is evident for the year 1895. Most of the operators report an encouraging outlook for 1896.

Kansas.—A decided increase in output characterizes this State in 1895. The output of 1894 was valued at $30,265; the product of 1895 reaches the valuation of $93,394. This is due to the increased output of a small number of producers. Prospects for 1896 are good.

Massachusetts.—The year in Massachusetts has been the most productive of sandstone since 1892. The gains are due to the considerably increased output of a few important producers. Small operators complain of the hard times, and quite a number have stopped work until business generally shall improve.

Michigan.—The total value of the sandstone output in 1895 ($159,075) means a heavy gain over 1894. Of this total, $35,107 is the value of grindstones and whetstones. In the production of these articles Michigan is annually increasing in importance, and the cessation of hard times will probably be marked by quite decided gains in this direction. Next to Ohio, Michigan is the most important State in grindstone and whetstone production.

Minnesota.—The sandstone output in Minnesota was quite restricted in 1894, but by the operations of a few new firms the output of 1895 very largely exceeds that of the preceding year. The outlook for 1896 is encouraging.

Missouri.—The output of 1894 was valued at $131,687. Owing to the fact that a number of quarrymen ceased operations during 1895, the total output was reduced to a value of $100,000 in 1895. Complaints of business depression have been made by nearly all of the producers.

Montana.—The output of Montana increased from $16,500 in 1894 to $31,069 in 1895. The latter figure includes the value of stone used for lining converters and furnaces operating in the State. This stone was not on the market, but was quarried by the consumers.

New Jersey.—The sandstone interests of New Jersey have been in the past, notably in the years 1890, 1891, and 1892, of very considerable magnitude, but the business depression of the past few years has been

[1] Attention is called to a valuable article by Prof. T. C. Hopkins on the sandstones of western Indiana on pages 780-787 of this report.

very seriously felt. There seems to be no other reason for the falling off in production, as the stone has an established reputation as a valuable building material. Many of the quarries have ceased operations in the past two or three years. The output of 1895 was valued at $111,823.

New York.—The sandstones of New York have been so long and so favorably known that the financial depression of the past few years has done as little harm in this State as in any other in the country. The output of 1894 was valued at $450,992, and while the value for 1895 ($415,644) is somewhat less, the difference is not great. The general opinion seems to be that 1896 will show a decided gain.

Ohio.—This State is far in the lead in producing sandstone. The output of 1890 was valued at $3,046,656, in 1892 at $3,300,000; since the last-named year the output has been declining, owing, apparently, only to the trying financial conditions which have marked this period. The output of 1895 is valued at $1,449,659. Most of the grindstone output of this country comes from Ohio. The value of the grindstones and whetstones produced is included in the above figure.

Pennsylvania.—The output of Pennsylvania was valued at $500,000 in 1895. This means quite a gain over 1894. The product is the result of the operations of a large number of comparatively small producers. Business was much better after August.

South Dakota.—Owing to the commencement of quarrying operations by a few new firms, the output of this State increased from $9,000 in 1894 to $26,000 in 1895. The sandstone of South Dakota is well worth the attention it has received, and there seems at present to be no doubt but that 1896 will show a considerably increased output, if financial conditions will permit.

Texas.—Owing to increased operations of a few important concerns, the output of sandstone in Texas increased from a valuation of $62,350 in 1894 to $97,336 in 1895. This is the highest figure yet reached for sandstone in the State.

West Virginia.—Production in West Virginia was not up to the average during 1895. There is plenty of good bridge and building stone in the State, but poor demand and low prices have restricted quarrying operations during the past two years.

Wisconsin.—Production fell from $94,888 in 1894 to $78,000 in 1895. The prospects for 1896 are much better.

THE SANDSTONES OF WESTERN INDIANA.

By T. C. Hopkins.

Beds of sandstone of commercial importance occur in both the Upper and Lower Carboniferous strata of western Indiana. In the different deposits the stone varies in texture from very fine-grained to coarse-grained, and even to coarse conglomerate; in color from light-gray, almost white, through various shades of buff, yellow, yellow-brown, red-brown, and red; in thickness from a few inches to more than 100 feet, sometimes regularly stratified in layers from a few inches to several feet in thickness, sometimes in one massive bed. These sandstones occur at more or less widely separated intervals over all the western and southwestern part of the State of Indiana, including nearly one-third of the State.

THE MANSFIELD SANDSTONE.

The most important bed of sandstone in the State from both a commercial and scientific standpoint is the one designated in a recent geological report as the "Mansfield" sandstone, which is supposed to correspond stratigraphically to the Millstone grit of the adjoining States. It lies at the base of the Coal Measures unconformably upon the Lower Carboniferous limestone, or, in the absence of the limestone, on sandstone or shale of Lower Carboniferous age. The unconformity is shown both by the erosion channels and the basal conglomerate, composed of fragments of chert and limestone from the underlying rocks. It is overlain by shale, sandstone, or coal of the Productive Coal Measures, or by glacial drift. It varies in thickness from a few feet to more than 100 feet, and consists largely of a bed of coarse sandstone, but is associated in many places with lenticular and irregular masses of conglomerate varying in thickness from a fraction of an inch to 10 feet or more, and in some places with beds of variable thickness of shale, coal, and fire clay.

The Mansfield sandstone outcrops at intervals over a belt of territory varying in width from a few hundred yards to 10 miles or more, and extending from north of the middle of the State border on the west in a direction east of south to and beyond the Ohio River, a distance of more than 175 miles in Indiana. Over the northern half of this area is a mantle of glacial drift varying in thickness from a few inches to 200 feet or more, and over the southern part of the area is a heavy covering of soil. The sandstone exposures are mainly confined to the water courses, and in some instances are continuous for a mile or more, but more commonly occur in small patches a few yards in extent, between which the stone is concealed by the drift or soil covering.

In many places the occurrence of this stone could be traced on a good topographic map by its bold outcrops, forming perpendicular and overhanging cliffs. These cliffs are caused by (1) the good weathering properties of the sandstone, and (2) the occurrence of a bed of very pyritiferous shale immediately underlying the sandstone, which shale not only disintegrates very rapidly compared with the sandstone, but the acid from the pyrite cuts away the underlying limestone rapidly. The erosive action being greater along the water courses, the small tributaries have cut notches back into the bluffs bordering the larger streams, thus giving the bluff a very winding course. These notches, coves, or gorges extend back a variable distance from the main stream, depending upon the size and age of the tributary. In many places the upper limit of the Mansfield sandstone is a crescent-shaped cliff, with the stream in the middle of the crescent forming a waterfall.

Color.—The many different colors of the sandstone may be conveniently grouped into two general classes: (1) The brownstones; (2) the gray and buff stone, with variegated stone in each class. The coloring matter is mostly iron oxide in various amounts and various degrees of hydration. Part of the blue and dark color may be due to carbonaceous material and iron pyrites. A sandstone may be colored, because the grains composing it are colored, or the cementing substance may be colored; in the latter case the coloring matter may simply form a film over the grain and another colorless or less brightly colored cementing substance may be present and form the bulk of the cement, or the whole mass of the cement may be colored and form the matrix in which the colorless grains are embedded. The last condition prevails in the brownstones or red sandstones of Indiana; the mass of the rock is made up of white or colorless quartz grains embedded in a matrix consisting almost wholly of iron oxide, but containing small quantities of clay and occasional mica flakes.

The red or brown stone deposits contain many different shades of color, due in part to the unequal distribution of the iron oxide, and in part to the different proportions of the hydrous and anhydrous oxides. The prevailing color is a purplish brown, closely resembling that of the average brownstones of Connecticut and Pennsylvania. In general it is of a brighter color than that of the Eastern stone, the lighter shade being due largely to an appreciable amount of light-colored nearly white siliceous grains, supposed to be chert. Interspersed with this red-brown color are patches of lighter yellow-brown and darker walnut-brown. In some localities the stone has a uniform red color, in no sense a brown. In such cases the iron is almost entirely anhydrous, and forms a much smaller percentage of the rock, so that the lighter color of the grains modifies the deeper shade of the iron. This color is a very desirable one, as is shown on the outcrops and in the old buildings. The yellow, buff, and gray sandstones have a lower percentage of iron oxide than the red, and the iron is in the hydrous form. They are more common than the brownstones.

Structure.—In most places the Mansfield sandstone occurs in a massive bed varying from a few feet to more than 100 feet in thickness. In some places the massive seamless stone is accompanied by a few feet of thinly stratified stone, in others by a coarse conglomerate, and in many places by shale and fire clay. In many places it is characterized by false bedding.

Texture.—The stone varies in texture from fine-grained sandstone to very coarse conglomerate. About nine-tenths of the bed is a comparatively uniform medium to coarse-grained sandstone. The remaining one-tenth consists of shale, shaly sandstone, fire clay, coal, and conglomerate. The conglomerate pebbles vary from those no larger than wheat grains to those several inches in diameter. In general, the larger pebbles are composed of chert, and generally, but not always, lie at the base of the sandstone. The hard crystalline quartz pebbles are sometimes closely aggregated in patches and sometimes scattered through the sandstone. The brownstones contain much iron oxide, which in some places has ferruginized the pebbles, often disintegrating them after forming a crust of iron oxide. These are known as iron blisters or iron kidneys, and injure a great deal of otherwise good stone. The iron oxide sometimes segregates along joint planes or in regular masses in the body of the rock. There are certain areas, however, which are almost entirely free from the segregated iron and which will furnish building stone of a superior quality.

The Mansfield stone is in most places soft and friable when first quarried, but hardens on exposure to the air and sunlight. In many places the stone is so soft when first quarried that the citizens are afraid to use it, fearing that it might crush under the buildings. However, no instance of such crushing is recorded.

Chemical composition.—The accompanying table of analyses shows the stone to consist almost entirely of insoluble material and iron oxide. The insoluble material consists almost entirely of quartz grains as shown by microscopic analysis. There are small quantities of mica flakes in places. The iron oxide is most abundant in the brownstones. The microscope shows the presence of small quantities of other minerals in minute grains, such as apatite, rutile, kaolin, feldspar, pyrite, etc

Chemical analyses of Mansfield sandstone.

No.	Locality.	Colors of stones.	Color of insoluble residue.	Insoluble in hydrochloric acid.	Alumina (Al_2O_3)	Iron oxide (Fe_2O_3)	Lime (CaO).	Carbonic acid (CO_2).	Total.
				Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
1	Mansfield	Brown .	White..	92.16	......	6.29	0.05	.004	98.50
2	Portland Mills	...do ...	...do ...	......	2.58	19.39	......	.25	....
3	Judson......	...do ...	...do ...	93.21	.51	4.91	.12	.095	98.85
4	Hillsboro.....	...do ...	...do ...	91.65	.56	6.60	.12	.095	99.03
5	Fountain.....	...do ...	...do ...	91.66	.60	6.44	.05	.04	98.79
6	Bloomfield ...	...do ...	...do ...	85.29	.19	11.82	.06	.05	97.41
7	St. Anthony..	...do ...	...do ...	88.41	.63	8.40	.13	.10	97.67
8	Green Hill....	Red	...do ...	98.73	.28	.36	.03	.024	99.42
9	Williamsport.	Buff....	...do ...	98.57	.05	.65	.02	.016	99.31
10	Fern	...do ...	...do ...	....	.30	1.03	......	......	....
11	Cromwell, Conn.	Brown .	...do ...	70.84	13.15	2.48	3.09	9.73	99.29

Durability.—The Mansfield sandstone, despite its rather coarse grain and friable nature, is an exceedingly durable stone, as is indicated by its topographic features and its appearance in the old buildings and bridges where it has been used. Sufficient laboratory tests have not been made to prove anything in regard to the stone. One or two samples from one locality show a crushing strength about equal to the average sandstone, a porosity above the average, and that the stone does not stand the fire very well. However, the field examination is sufficient to show that the stone, even though porous and friable, is exceedingly durable. The exposures are in most places bold, perpendicular, or overhanging cliffs, with compact, indurated surface, the bowlders having hard surfaces and generally sharp angles, with little or no disintegrated material scattered around them. In many places the stone retains glacial striæ well preserved. In a number of structures where the stone has been exposed fifty years or more, it shows no sign of disintegration and is harder and apparently in a better state of preservation than that in the quarry from which it came. The stone should be quarried early in the season and not exposed to freezing weather until thoroughly dry.

Adaptability to masonry.—Its massive structure, coarse grain, durability, and ease of working render this stone suitable for heavy masonry of all kinds, and unsuitable for work where a smooth finish or delicate carving of anykind is required; hence its fitness for building bridges, foundations, retaining walls, etc.

Occurrence of the stone.—The position of the sandstone area has already been mentioned as extending in a broad strip in a direction east of south through the west-central part of the State. In this area, however, the character of the stone and the extent of the outcrops are by no means uniform. Through the northern half of the area the stone is covered by a bed of glacial drift, varying from zero to 100 feet or more in thickness; and in the southern half there is a heavy bed of disintegrated material. The exposures of the stone are for the most part in the bluffs bordering the water courses, sometimes forming bold cliffs along each side of the stream for several miles, but generally forming only isolated exposures of variable extent, separated by drift or soil covered slopes.

The brownstone has been quarried at Mansfield, Parke County; Hillsboro, Fountain County; near Green Hill, Warren County; Judson and Portland Mills, Parke County, and St. Anthony, Dubois County. The quarries at the last three localities are in operation at the present time, the others being temporarily suspended. Good stone in suitable position for quarrying, but not yet developed, occurs near Bloomfield, Greene County, and on Rocky Fork and on Sugar Mill Creek in Parke County. Smaller outcrops of less importance occur elsewhere in the area.

Buff and gray colored stone is more common and widely scattered than the brownstone. It has been quarried at Williamsport and Attica, and at many places in the vicinity of these towns in Warren and Fountain counties; at Rob Roy, Stone Bluff, Hillsboro, Wallace, and elsewhere in Fountain County; at Guion, Judson, and several different localities along Raccoon and Sugar creeks in Parke County, and at numerous small quarries throughout the area further south.

THE PORTLAND STONE.

Interspersed among the coal beds at a horizon above that of the Mansfield stone are several beds of sandstone which are commercially important at certain localities, but whose areal extent has not been traced out and which are probably more local in their occurrence than the Mansfield stone. One of the most important of these is the so-called Portland stone at Worthy, 4 miles above Hillsdale, on the west side of the Wabash River, in Vermilion County. The quarry is located on the Chicago and Eastern Illinois Railroad, between Terre Haute and Chicago, and the principal markets for the stone are these two cities and intervening points.

The quarry has been opened but a few years and has an extensive trade. It is well equipped with modern machinery, such as channelers, steam drills, and sawmill, and has its own locomotive for shifting cars. The stone is used for buildings, bridges, and similar purposes. As side wall fronts or trimmings, it has been used in two hundred or more buildings in Chicago. The court-house and church at Charleston, Ill., have been built of this stone.

The stone occurs in a massive bed, which in the quarry shows a working face of 51 feet without exposing the bottom of the stone. A core from the diamond drill is said to have been taken out to the depth of 69 feet without reaching the bottom of the stone. However, the present quarry face extends to the bottom of the ravine, and deeper quarrying would require pumping, especially in wet weather. As there is no permanent stream in the ravine, if the stone should prove to be of good quality to a considerable depth, it might prove to be cheaper to pump the water in wet weather than to remove the overlying waste material from a new surface, since the present quarry face has a thickness of 25 feet or more of shale, fire-clay coal, and bowlder clay overlying the quarry stone.

The Portland stone is finer grained and more complex in its composition than the Mansfield stone. It is made up of angular quartz grains associated with feldspar and mica grains in a cement of clay, silica, decaying feldspar, iron oxide, and carbonates of lime and iron. The mica is muscovite in small ragged flakes intimately twisted among the quartz grains, thus serving as a bond of strength.

Chemical analysis of the Portland sandstone.

	Per cent.
Silica	91.18
Calcium carbonate	0.86
Magnesia	1.41
Ferric oxide	1.12
Alumina	2.14
Water and loss	3.29
Total	100.00

The crushing strength of the Portland stone, as given by Professor Kramer, of Cincinnati, is 6,825 pounds per square inch.

THE CANNELTON STONE.

Some of the oldest and largest sandstone quarries in Indiana are those near Cannelton, Perry County. Sandstone is exposed in the Ohio River bluffs in many places in Perry County and has been quarried at and below Cannelton, but the most valuable stone, and that which has been quarried most extensively, occurs on the bluff 2 to 4 miles above (east of) Cannelton, at and below Rock Island, in secs. 12, 13, and 14, T. 7 S., R. 3 W. The Mansfield sandstone and conglomerate occur at the base of the bluff at Rock Island, but is not quarried except in small quantities for riprap. The dimension stone is all taken from beds overlying the Mansfield stone and in most places separated from it by a bed of black shale. It is finer grained than the average Mansfield sandstone, the average diameter of the grains being 0.14 millimeters, the largest being 0.2 millimeters. The chemical analysis shows a higher percentage of insoluble residue than the average sandstone, but the residue is not all quartz, as in much of the Mansfield sandstone, but mica. Both muscovite and biotite occur. The quartz contains zircon, apatite, and rutile crystals.

Analysis of Cannelton sandstone.

	Per cent.
Residue, insoluble in hydrochloric acid	96.18
Ferric oxide (FE_2O_3)	1.56
Alumina (Al_2O_3)	.54
Lime (CaO)	.15
Total	98.43

The color varies from a lemon-yellow to a light or dark gray. In general, however, the color is comparatively uniform at any one quarry opening, but varies from place to place.

The color is in no place an attractive one for fine buildings, owing to the rusty yellow tint of the iron oxide which always occurs. It is better adapted to heavy masonry, where beauty is subordinated to ease of working and durability.

The stone occurs in a massive bed which only rarely shows open bedding planes, but nearly always has an easy cleavage parallel to the bedding, so that it can be readily split into any thickness desired. This greatly facilitates the working of the stone, which is all done by hand. In many of the openings there is not sufficient quarry floor to use a channeler to advantage. The stone occurs on the face of a steep bluff, and is overlain by black shale, which is in turn overlain by other sandstone. The stone is quarried back in the bluff until the thickness of the overlying shale becomes too great to remove and to permit any profit on the stone, which in some places is not far.

The large cotton mill and the Catholic church at Cannelton are constructed of stone from these quarries. There are in Cannelton a dozen or more smaller buildings, storerooms, and dwelling houses which are built of it; also many foundations, retaining walls, etc. It was used in the locks on the canal at Louisville, Ky., and for a similar purpose on the Green River, Kentucky. It has been used in a number of places along the river for riprap, retaining walls, wharves, etc., even as far down as Memphis.

The quarrying of sandstone at this locality will no doubt prove to be an important industry, as the stone occurs in a heavy deposit, is easily worked, and well adapted to heavy masonry.

Sandstone has been quarried in small quantities at Brazil, West Baden, Paoli, Rockport, Coxville, Covington, The Glen, and elsewhere.

LIMESTONE.

PRODUCT IN 1895.

The following table shows the value of the limestone output for 1895:

Value of limestone production in 1895, with the uses to which the stone was applied.

State.	Lime.	Building and road making.	Flux.	Total.
Alabama	$170, 764	$26, 319	$25, 341	$222, 424
Arizona	15, 380	6, 574	2, 205	24, 159
Arkansas	39, 282	8, 094		47, 376
California	244, 580	77, 631		322, 211
Colorado	8, 646	24, 363	83, 346	116, 355

Value of limestone production in 1895, etc.—Continued.

State.	Lime.	Building and road making.	Flux.	Total.
Connecticut	$125,000	$29,333		$154,333
Florida	8,500	2,050		10,550
Georgia	12,000			12,000
Idaho	7,216	613		7,829
Illinois	164,785	1,482,425	$40,452	1,687,662
Indiana	167,451	1,395,286	96,239	1,658,976
Iowa	114,205	324,136	11,160	449,501
Kansas	9,870	306,818		316,688
Kentucky	37,108	113,418	3,604	154,130
Maine	600,000	100,000		700,000
Maryland	150,000	50,000		200,000
Massachusetts	55,000	20,000		75,000
Michigan	70,589	350,000	4,000	424,589
Minnesota	29,895	188,838		218,733
Missouri	210,376	659,787	27,155	897,318
Montana	20,121		75,000	95,121
Nebraska		7,376		7,376
New Jersey	100,000	25,000	25,000	150,000
New Mexico	1,500	1,875		3,375
New York	610,206	406,991	25,985	1,043,182
Ohio	613,575	668,124	287,014	1,568,713
Oregon		970		970
Pennsylvania	1,720,000	796,424	539,489	3,055,913
South Dakota		4,000		4,000
Tennessee	84,297	69,330	3,271	156,898
Texas	30,700	14,194	17,632	62,526
Utah	11,348		11,155	22,503
Vermont	270,000	30,000		300,000
Virginia	186,506	4,866	77,520	268,892
Washington	73,350		2,560	75,910
West Virginia	25,922	5,413	11,557	42,892
Wisconsin	600,000	150,000		750,000
Wyoming	650			650
Total	6,588,822	7,350,248	1,369,685	15,308,755

An inspection of this table shows a total value of $15,308,755 for the entire limestone industry for 1895. The total for 1894 was $16,190,118. There has then been a decrease of $881,363. The value of the lime output for 1894 was $8,610,607 and for 1895 $6,588,822. The falling off in this item is nearly sufficient to account for the total decrease, but this has been offset by an increase of more than half a million in the

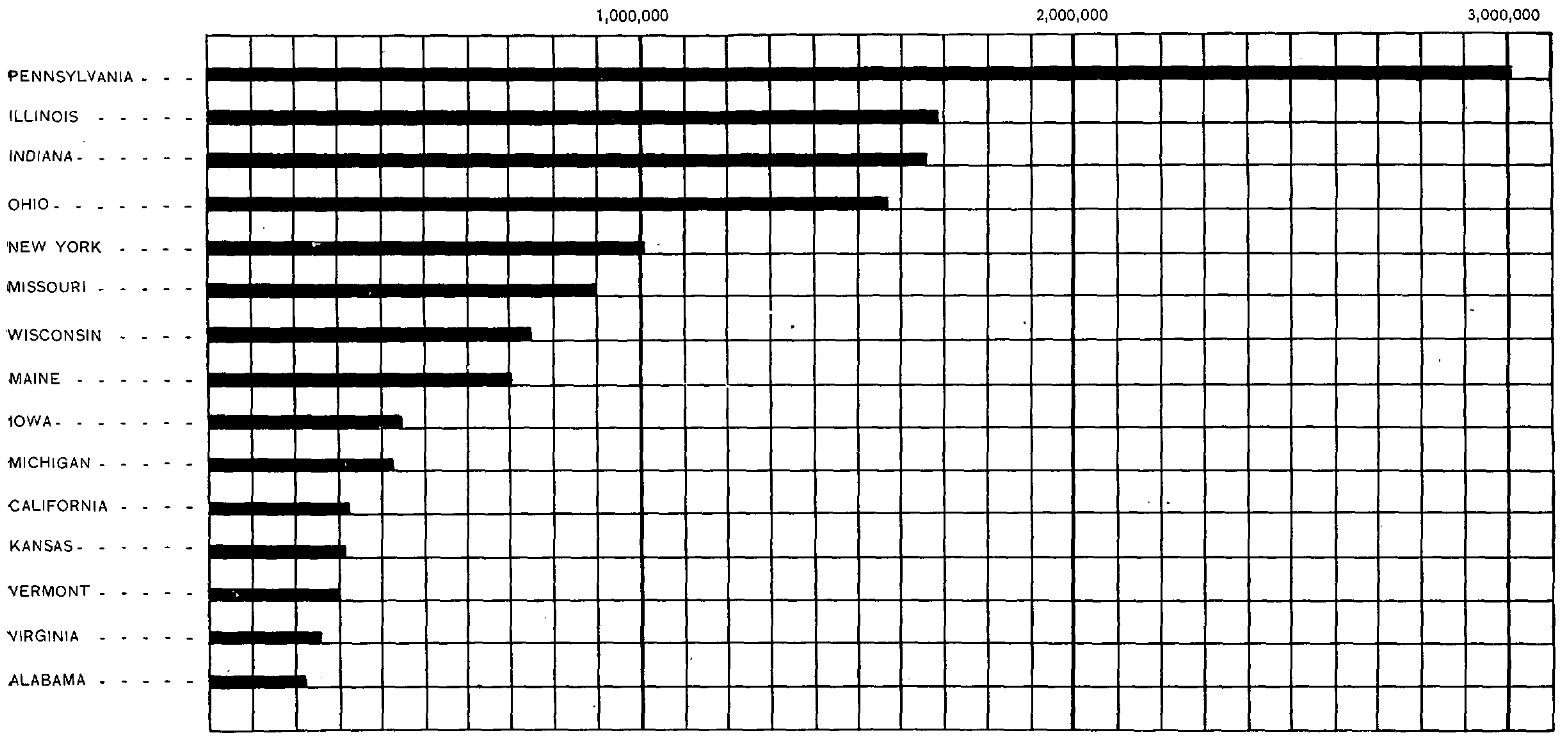

DIAGRAM SHOWING THE VALUE OF LIMESTONE PRODUCED IN THE UNITED STATES DURING THE YEAR 1895.

(In millions of dollars.)

limestone used for fluxing in 1895. Large quantities of limestone for flux were used in the smelting operations of Alabama, Colorado, Montana, Ohio, and Pennsylvania, while neighboring States also supplied stone in increased quantity for this purpose.

The value of lime made is slightly less than the value of stone used for building and roadmaking, while in 1894 it was greater than these two items. Roadmaking is annually making larger demands upon the limestone quarries.

PRODUCT BY STATES FROM 1890 TO 1895.

The following table shows the value of limestone, by States, since 1890:

Value of limestone, by States, from 1890 to 1895.

State.	1890.	1891.	1892.
Alabama	$324,814	$300,000	$325,000
Arizona	(a)	....	....
Arkansas	18,360	20,000	18,000
California	516,780	400,000	400,000
Colorado	138,091	90,000	100,000
Connecticut	131,697	100,000	95,000
Florida	(a)	....	....
Georgia	(a)	....	....
Idaho	28,545	....	5,000
Illinois	2,190,607	2,030,000	3,185,000
Indiana	1,889,336	2,100,000	1,800,000
Iowa	530,863	400,000	705,000
Kansas	478,822	300,000	310,000
Kentucky	303,314	250,000	275,000
Maine	1,523,499	1,200,000	1,600,000
Maryland	164,860	150,000	200,000
Massachusetts	119,978	100,000	200,000
Michigan	85,952	75,000	95,000
Minnesota	613,247	600,000	600,000
Missouri	1,859,960	1,400,000	1,400,000
Montana	24,964	....	6,000
Nebraska	207,019	175,000	180,000
New Jersey	129,662	100,000	180,000
New Mexico	3,862	2,000	5,000
New York	1,708,830	1,200,000	1,200,000
Ohio	1,514,934	1,250,000	2,025,000
Oregon	(a)	....	....
Pennsylvania	2,655,477	2,100,000	1,900,000

a Limestone, valued at $77,935, was produced in Oregon, Georgia, Florida, Arizona, South Dakota, and Wyoming. The value is included in the total.

Value of limestone, by States, from 1890 to 1895—Continued.

State.	1890.	1891.	1892.
Rhode Island	$27,625	$25,000	$30,000
South Carolina	14,520	50,000	50,000
South Dakota	(*a*)		
Tennessee	73,028	70,000	20,000
Texas	217,835	175,000	180,000
Utah	27,568		8,000
Vermont	195,066	175,000	200,000
Virginia	159,023	170,000	185,000
Washington	231,287	25,000	100,000
West Virginia	93,856	85,000	85,000
Wisconsin	813,963	675,000	675,000
Wyoming	(*a*)		
Total	19,095,179	15,792,000	18,342,000

State.	1893.	1894.	1895.
Alabama	$205,000	$210,269	$222,424
Arizona	15,000	19,810	24,159
Arkansas	7,611	38,228	47,376
California	288,626	288,900	322,211
Colorado	60,000	132,170	116,355
Connecticut	155,000	204,414	154,333
Florida	35,000	30,639	10,550
Georgia	34,500	32,000	12,000
Idaho	1,000	5,315	7,829
Illinois	2,305,000	2,555,952	1,687,662
Indiana	1,474,695	1,203,108	1,658,976
Iowa	547,000	616,630	449,501
Kansas	175,173	241,039	316,688
Kentucky	203,000	113,934	154,130
Maine	1,175,000	810,089	700,000
Maryland		350,000	200,000
Massachusetts	156,528	195,982	75,000
Michigan	53,282	336,287	424,589
Minnesota	208,088	291,263	218,733
Missouri	861,563	578,802	897,318
Montana	4,100	92,970	95,121
Nebraska	158,927	8,228	7,376
New Jersey	149,416	193,523	150,000
New Mexico		4,910	3,375

a Limestone, valued at $77,935, was produced in Oregon, Georgia, Florida, Arizona, South Dakota, and Wyoming. The value is included in the total.

Value of limestone, by States, from 1890 to 1895—Continued.

State.	1893.	1894.	1895.
New York	$1,103,529	$1,378,851	$1,043,182
Ohio	1,848,063	1,733,477	1,568,713
Oregon	15,100	....	970
Pennsylvania	1,552,336	2,625,562	3,055,913
Rhode Island	24,800	20,433	....
South Carolina	22,070	25,100	....
South Dakota	100	3,663	4,000
Tennessee	126,089	188,664	156,898
Texas	28,100	41,526	62,526
Utah	17,446	23,696	22,503
Vermont	151,067	408,810	300,000
Virginia	82,685	284,547	268,892
Washington	139,862	59,148	75,910
West Virginia	19,184	43,773	42,892
Wisconsin	543,283	798,406	750,000
Wyoming	....	....	650
Total	13,927,223	16,190,118	15,308,755

THE LIMESTONE INDUSTRY IN THE VARIOUS STATES.

Alabama.—Considering the general condition of trade, the limestone output of the State in 1895 is higher than might be reasonably expected. The output of 1894 amounted in value to $210,269, while that of 1895 reaches the figure $222,424. Of this figure $170,764 represents the value of lime made. In its production of good lime for building and other purposes the State is steadily acquiring a high standing in the South.

Arizona.—It is only within the last few years that limestone production has amounted to anything more than a very small figure. Since 1893, however, there has been a regular annual increase. In 1895 the product was valued at $24,159. More than one-half of this figure is the value of lime made.

Arkansas.—The output of this State in limestone is greater than ever before. The value of the product in 1895 was $24,159; most of this represents the value of lime made.

California.—The value of the product in 1895 was $322,215; this figure includes the value of lime made, namely, $244,580. The remainder was used mainly for rough building and roadmaking. Dull trade is complained of, and a number of the smaller operators ceased quarrying for the year.

Colorado.—Most of the output of limestone in Colorado is used for fluxing and smelting gold and silver ores. The total value of the output was $116,355, of which $83,346 worth was for limestone used as flux. The output is a little behind that of 1894.

Connecticut.—In the burning of limestone to produce lime, Connecticut has done considerable in past years, particularly in 1894, when the value of the lime produced amounted to $204,414. All of the limestone output, with the exception of a very small portion, is burned into lime. In 1895 business seems to have been restricted to actual necessities, and the output is valued at $154,333. The vicinity of Canaan is the most important locality for lime burning.

Illinois.—Next to Pennsylvania, Illinois is the most important in value of output. The extensive quarries at Joliet and Lemont are by far the most productive. The stone is used mostly for building and street work, and it has an enviable reputation for these purposes. A large quantity is annually used in Chicago. The value of the output in 1895 fell quite considerably below that of 1894. The figures for 1894 and 1895 were respectively $2,555,952 and $1,687,662. The only reason apparent for the decline is the usual one—financial depression, which operated to lower the prices and to restrict output. Some of the larger operators report that the outlook for 1896 is much better.

Incidental to the digging of the great Chicago drainage canal, enormous quantities of limestone have been blasted out by violent explosives, so that while the stone is too much shattered to be of value for building, it is nevertheless applicable to roadmaking, and it will all probably be used in time for this purpose. At present the stone removed in excavating the canal is piled in enormous heaps along the edges of the canal.

Indiana.—Much interest attaches to the limestone output of Indiana on account of the beauty of the öolitic stone for use in the finest buildings. The Bedford öolitic stone has a national reputation as an ornamental building stone, and it is also prized for its adaptability to ornamental carving and monumental work. In spite of hard times, the output increased from a valuation of $1,203,108 in 1894 to $1,658,976 in 1895. In 1891 the output was valued at more than $2,000,000. The latter part of 1895 showed much improvement over the earlier part of the year, and for this reason the producers anticipate much better business in 1896.

Slow collections marked the course of business throughout the year. As was the case in many States, small producers in considerable number shut down altogether, but they will probably resume business again when conditions are more favorable. Prices declined somewhat, and this fact, of course, made it necessary to handle much larger quantities of stone to bring up the valuation to its present amount.

Iowa.—The value of the limestone output in Iowa fell off from $616,630 in 1894 to $449,501 in 1895. While this decrease is quite considerable, it is fully accounted for by the strained financial conditions which were apparently keenly felt throughout the State. The resources of Iowa in limestone are undoubtedly large and important, and as developments go on they will be more and more a feature in the annual products from the State. Some of this limestone quite closely approaches the crystalline condition characteristic of marble and, indeed, some of it is used for ornamental work as marble, and with good effect. About one-third of the output is burned into lime, but the prime importance of the stone lies in its adaptability for building and ornamental uses. The industry is widespread and the output comes from a large number of comparatively small producers rather than from a few operating upon a large scale, thus making the production of stone a matter of importance to the masses of the people.

Kansas.—Most of the output in Kansas is devoted to building purposes, and of that a considerable amount goes into bridge work. Quite an increase in output was realized in 1895, so that the entire yield was valued at $316,688.

Kentucky.—Some improvement in the industry is apparent for 1895, namely, from $113,934 in 1894 to $154,130 in 1895, but the total still falls somewhat below the output of former years. Much of the limestone of Kentucky is hydraulic, and this is treated of in this report in the article on cement. Kentucky öolite is well known for its beauty as a building and ornamental stone.

Maine.—The limestone of Maine is almost entirely burned into lime, which enters quite largely into the markets of the more important cities on the Atlantic Coast, particularly New York. The output of 1895 was valued at $700,000, while that of 1894 was $810,089. In 1890 the output reached the figure $1,523,500, and in 1892 $1,600,000, but since the latter year production has decreased, perhaps on account of competition with Canadian lime.

Maryland.—After the publication of the report for 1894 it was found that a number of duplications of figures for output had occurred, making the total much higher than it should have been. The proper total for Maryland in 1894 is $350,000. Operations in 1895 were curtailed by reason of the general depression in business, so that the total for the year is $200,000.

Massachusetts.—Limestone production was at a low ebb during 1895. Production fell off from a valuation of $195,982 in 1894 to $75,000 in 1895. Abandonment of the business by large numbers is the reason for the decline.

Michigan.—Business improved very considerably in 1895. Producers complain, however, of slow collections for the entire year. Most of the product was used for building and roadmaking. Prospects for 1896 are good.

Minnesota.—The output fell off from $291,263 in 1894 to $218,733 in 1895. Most of the product is used for building.

Missouri.—A decided gain was made in the output of the extensive and commercially important quarries of this State. The valuation for 1894 was $578,802; for 1895 it was $897,318. Three-fourths of the product is used for building and road construction, and the remainder is burned into lime.

Montana.—The output of limestone in Montana increased from $92,970 in 1894 to $95,121 in 1895. Most of the product is used as flux in smelting operations, while the remainder is burned into lime.

New Jersey.—The value of the output in 1895 was $150,000. This amount is about the average annual output for the State. The usual complaints of poor business were made by many of the producers.

New York.—The limestone industry of New York State is one of much importance because of the wide range of uses made of the stone and the further fact that the stone is of fine quality for all these uses. The value of the total output in 1895 was $1,043,182. Of this total $610,206 is the value of lime made, while an amount valued at $406,991 was devoted to building and roadmaking. In the intelligent selection and application of stone to roadmaking, few States are in advance of New York. The value of the limestone output in 1894 was $1,378,851. A decrease for 1895 is thus apparent, but it is hardly more than the present condition of finances would naturally produce. Operators speak encouragingly of the prospects for 1896.

Ohio.—The stone industry of Ohio is about equally divided between sandstone and limestone so far as the total value of the output is concerned. The limestone area is a wide one, and the industry is important to the masses of the people, since there is a large number of small concerns which in the aggregate foot up a large output. In addition to these are a few large concerns which annually contribute a considerable addition to the total for the State. The value of the product in 1895 was $1,568,713; the corresponding figure for 1894 was $1,733,477. A comparison of these figures shows a falling off in output, which is readily explained by the dullness of trade generally and the slowness of collections throughout the year. Some improvement is noted for the latter part of the year, and this leads naturally to the conclusion that 1896 will show material gains.

Pennsylvania.—The limestone industry of Pennsylvania is the result mainly of a very large number of small operators, although there are besides these a comparatively small number of producers operating upon a large scale. For the output of all kinds of stone the State stands first; there is, in fact, no kind of stone in commercial use which is not produced within its limits. In the production of slate it stands far in the lead of any other, as has already been stated in the slate report of the present article. While, with the exception of slate, there are no individual localities which stand out prominently for their stone output in the sense that makes Quincy, Mass., or Westerly, R. I., remarkable, it is at the same time true that there are a great many places at which a moderate amount of commercially valuable stone is produced regularly and uninterruptedly year after year. The hard times have, of course, affected all industries in Pennsylvania in much the same way as other States, but in spite of such conditions the value of the limestone output amounts in 1895 to $3,055,913. A little more than half of this is the value of lime, half a million dollars worth of which was used for blast-furnace flux, while the remainder is used for ordinary building and roadmaking. A large quantity of the lime made is used for agricultural purposes. Considerably more attention is being given at present to the improvement of roads than formerly, and this accounts for no small part of the increase in output for the past two years.

Tennessee.—The value of the limestone output for 1895 was $156,898. Somewhat more than half of this figure represents the value of lime made.

Texas.—The value of the limestone product in 1895 was $62,526. The output was greater than that of 1894.

Vermont.—Limestone production in 1895 did not come up to the total for 1894. In the last named year the output was valued at $408,810, while the total for 1895 amounted to $300,000. More than half of this value is that of the lime produced.

Virginia.—The product fell somewhat behind in 1895, being valued at $268,892; the difference, however, as will be seen by referring to the table of production, is not great.

Wisconsin.—The limestone output of this State is an important item. The annual product has been very steady for the past five years, and has ranged from $543,000 to $814,000. More than half the value of the entire product is the value of lime made.

THE LIMESTONE QUARRIES OF EASTERN NEW YORK, WESTERN VERMONT, MASSACHUSETTS, AND CONNECTICUT.

By Heinrich Ries.[1]

There are in the region given above several well-marked limestone belts presenting sufficiently distinctive characters to permit the following classifications:

1. The dolomite area of Westchester and Dutchess counties, N. Y., containing the quarries at Sing Sing, Tuckahoe, Pleasantville, and Patterson.

2. The Cambrian limestone belt, including the quarries at Newburg and Stoneco, N. Y.

3. The Helderberg limestones, of importance at Rondout, Catskill, Hudson, and South Bethlehem.

[1] These notes are furnished with the kind permission of Mr. F. S. Witherbee, president Troy Steel Company, for whom they were collected.—Ries.

4. The Trenton limestones, with quarries at Glens Falls, Hoosick Falls, and Whitehall, N. Y., and Fairhaven, Vt.

5. The Stockbridge limestones, quarried at various points between Canaan, Conn., and North Pownal, Vt.

6. The Vermont marble belt, extending from Dorset to Middlebury.

7. The Black River limestone, quarried at Leicester Junction, Winooski, Swanton, and Highgate Springs, Vt.

In these seven areas there are about 50 quarries, most of which are in operation. This does not include small openings which were operated a short time and then abandoned.

1. THE DOLOMITE AREA OF WESTCHESTER AND DUTCHESS COUNTIES, N. Y.

Tuckahoe, Westchester County, N. Y.—The quarries at Tuckahoe are the most extensive, and are all opened in the same stratum, which extends northeast and southwest and has a thickness of about 40 feet. The three firms are O'Connell & Hillery, Norcross Bros., and the Tuckahoe Marble Company, also known as J. Sinclair & Co. The rock in all is a magnesian limestone of granular character and moderately hard. Its character is quite constant. The bed dips steeply to the west and is bounded by beds of impure micaceous dolomite. O'Connell & Hillery's is the most southern quarry, and is but a short distance east of the Tuckahoe Railroad station. The rock is used chiefly for making lime, but recently the manufacture of marble dust has been commenced. No special methods are used in quarrying, but a wire-rope tram proves an economical means of transporting the rock to the kilns. The rock from this quarry shows the following composition:

Analysis of limestone from O'Connell & Hillery's quarry, Tuckahoe, N. Y.

	Per cent.
$CaCO_3$	70.10
$MgCO_3$	25.40
Insoluble	2.40
Total	97.90

The Tuckahoe Marble Company's quarry is three-fourths of a mile to the north. The quarry is about 400 feet long and 40 feet deep. The output is used for building purposes. Norcross Bros.' quarry is about one-fourth of a mile north of the preceding. The rock is very similar in character, but the quarry is smaller. The marble is sawed and dressed at the works. Two analyses have been made of this stone, No. 1 by Professor Egleston and No. 2 by the writer.

Analyses of limestone from the Norcross Brothers quarry, Tuckahoe, N. Y.

	No. 1.	No. 2.
	Per cent.	*Per cent.*
Insoluble	....	1.33
Lime	30.16	30.68
Magnesia	21.25	20.71
Carbondioxide	47.30	46.66
Ferric oxide	.21	.21
Water	.02	.16
Silica	.24	....
Alumina	.19	....
Loss	.63	....
Total	100	99.75

Sing Sing, Westchester County, N. Y.—There are two quarries at Sing Sing, one belonging to Mr. Henry Marks, the other to the Ossinning Lime Company. Both are on the east slope of the hill overlooking the river at the south end of the town. In Marks's quarry the rock is a granular, fine-grained limestone, dipping steeply to the west, and is apt to vary somewhat in composition. Its chief use for many years has been as a flux for the New Jersey Zinc and Iron Company, of Newark, N. J., whose chemist has kindly supplied the following analysis:

Analyses of limestone from Sing Sing, N. Y.

	Per cent.	Per cent.
Silica	6.77	5.94
Iron and alumina	1.81	2.82
Lime	45.02	29.05
Magnesia	3.61	20.05
Phosphorus	.027	....

The rock is carted down to the river for shipment.

The Ossinning Lime Company's rock is similar to Marks's in the upper portion of the quarry, but in the lower portion it is white and coarsely crystalline, resembling the Pleasantville rock. This portion is used for making an excellent grade of lime. The rock is carried to the kilns at the river on a narrow-gauge tramroad.

Pleasantville, Westchester County, N. Y.—The Pleasantville quarry is also operated by O'Connell & Hillery, successors to the Cornell Lime Company. It is the largest quarry in the county. The limestone is remarkably uniform in its character, and on account of its white color and coarsely crystalline character has been called "Snowflake marble."

Nearly the entire output of the quarry is used for marble dust. The composition of the limestone, as given in the Sixteenth Annual Report of the United States Geological Survey, Part III, page 468, is as follows:

Analysis of Pleasantville (N. Y.) marble.

	Per cent.
Calcium carbonate	54.62
Magnesium carbonate	45.04
Iron carbonate	.16
Alumina	.07
Silica	.10
Total	99.99

Small quarries have been opened up at Scarsdale, Westchester County, and Patterson, Putnam County, but they are no longer in operation.

2. THE CAMBRIAN LIMESTONE BELT.

Newburg, Orange County, N. Y.—There is a small quarry on the southwestern edge of Newburg, Orange County, operated by Miller Brothers. The rock is a blue, finely crystalline limestone with a marked bedding. The limestone is crushed and screened and then used for macadam roads in the vicinity.

Stoneco, Dutchess County, N. Y.—One of the largest quarries in the State is at this locality, which is 2 miles above New Hamburg, on the Hudson River. It is owned and operated by the Hudson River Stone Company. The rock is a hard, fine-grained, siliceous limestone, and the quarry has a working face about 500 feet long and 20 to 40 feet high. Tracks are laid from the dumping chute along the New York Central Railroad track to many points of the quarry face, thus giving a large working capacity. The limestone is crushed to many sizes and used for railroad ballast or road material. The rock powder is sold in large quantities to the asphalt paving companies. The plant is situated between the river and the railroad track and affords excellent facilities for shipment.

3. THE HELDERBERG LIMESTONE QUARRIES.

The Scutella limestone is of importance, and is worked by Benjamin Turner and the Newark Cement Company, at Rondout; by Mr. George Holdredge, at Catskill, and by Mr. F. W. Jones, at Hudson. At South Bethlehem the Tentaculite limestone is of importance, and is there quarried by Mr. P. Callanan.

Rondout, Ulster County, N. Y.—Mr. Turner's quarry has been but recently opened. It is a small opening on the hillside about 200 feet above Rondout Creek, and between Rondout and Eddyville. The stone is sent down a chute to the creek, where it is loaded onto barges. It closely resembles in its character the limestone in the Newark Cement Company's quarry. This latter is a coarsely crystalline, fossiliferous limestone of moderately pure and rather uniform character. The bed is about 40 feet thick and dips rather steeply to the northwest, having a shaly limestone as a hanging wall and a cherty lime rock as a foot wall. The stone has been worked to a depth of nearly 100 feet from the surface and for a distance of about 700 feet north and south along the strike. The track, which comes from the docks about a mile distant, enters the cut through a tunnel and branches, the two arms going to the working face at either end of the quarry. The rock burns to a brown lumpy lime, and, according to Prof. F. L. Nason, 2,000 tons are quarried and sent to Newark, N. J., every year for lime manufacture.[1]

Catskill, Greene County, N. Y.—The Empire Stone Quarry at this point is owned and operated by Mr. George Holdredge. It lies on the ridge a mile west of the town. The rock is similar in every respect to that at Rondout, but the beds dip less steeply to the northwest. There is a capping of less massive rock, which varies in thickness from 2 to 8 feet, being heaviest at the south end of the quarry. Under this, two benches, each about 4 feet high, have been opened up. In former years the rock is said to have been used for flux, but its only use now is for dimension blocks. The nearest shipping points—Catskill Creek and the West Shore Railroad—are both about a mile distant, and if the rock is to be shipped it is carted down the hill to these points. The consumption of the stone is mostly local, however.

Hudson, Columbia County, N. Y.—Becrafts Mountain, near Hudson, is capped with a considerable bed of the Scutella limestone. Several quarries have been opened up in it, all owned and operated by Mr. F. W. Jones. The stone is like that at the preceding localities, and needs no special description. Some dimension blocks have been taken out from time to time, and the quarrying of the rock for marble was attempted, but it is rather soft for this purpose. At present the quarries are operated chiefly to supply flux to the Burden Iron Works at Troy, N. Y. The rock has to be hauled 600 to 1,000 feet to the switch from the New York Central Railroad. The following two analyses, which were kindly furnished by Mr. Jones, may be taken as representative of the Scutella limestone at the various localities in the Hudson Valley. No. 1 is by Professor Egleston, and No. 2 is by the chemist of the Burden Iron Works.

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[1] Twelfth Ann. Rept. N. Y. State Geologist.

Analyses of Scutella limestone, Hudson Valley, New York.

	No. 1.	No. 2.
	Per cent.	*Per cent.*
Lime	51.40	
Calcium carbonate		91.70
Carbon dioxide	41.191	
Magnesium carbonate		3.51
Magnesia	2.233	
Alumina	.635	1.01
Ferric oxide	1.819	.55
Silica	1.842	1.89
Sulphur dioxide	.145	.049
Phosphorus	.149	.022
Water	.271	
Total	99.683	98.731

South Bethlehem, Albany County, N. Y.—The Tentaculite limestone is of importance at this locality as furnishing an excellent road material. Mr. P. Callanan's quarry has a working face 500 feet long and 90 feet high, and the stone is fine-grained, massive, and tough. The quarried material is carried by cars to the crusher, where it is broken, screened, and then shipped. The powdered rock is used for asphalt pavements.[1]

4. THE TRENTON LIMESTONE AREA.

Glens Falls, Warren County, N. Y.—The quarries are well known, and have been in operation for a number of years. They are all situated along the river on the edge of the town, and in common show the following section, beginning at the top:

	Feet.
Thin-bedded, impure black limestone	12–15
Black limestone	2– 3
Fine-grained black crystalline limestone	15
Total	33

The upper bed is used for building material, and is now also used in the manufacture of Portland cement. The lower 15 feet are used for making a good grade of lime. In former years much of it was polished, and made a pretty black marble.

The companies manufacturing lime at Glens Falls are the Glens Falls Lime Company, the Sherman Lime Company, and the Jointa Lime Company. The lime made is rather soft and is said to airslake quickly. It has to be hauled about a mile for shipment. The Portland cement

[1] Prof. F. L. Nason, Thirteenth Ann. Rept. N. Y. State Geologist, p. 280.

is made from a mixture of the upper black limestone and the Champlain clays found overlying it. The composition of the Glens Falls lime, as given on the business card of the associated companies and analyzed by Mr. J. H. Appleton, is as follows:

Analyses of Glens Falls (N. Y.) lime.

	No. 1.	No. 2.
	Per cent.	*Per cent.*
Lime	96.46	97.60
Magnesia	.64	.36
Iron and alumina	1.70	.80
Water and carbon dioxide	1.20	1.24
Total	100	100

Analysis of limestone rock, Glens Falls, N. Y.

	Per cent.
Calcium carbonate	94.98
Iron and alumina	1.26
Silica	2.13
Magnesia	Trace.
Total	98.37

Smiths Basin, Washington County, N. Y.—The Keenan Lime Company has several quarries in the ridge to the east of the railroad. The rock is mostly dark-gray to bluish-black, fine-grained, and moderately hard. Its massive character has been somewhat destroyed by the shearing and folding to which the rock has been subjected. The beds have a general dip to the southeast, and the upper ones in each quarry are more or less shaly and siliceous. The company is now working a quarry at the south end of the ridge and carting the rock to the kilns about an eighth of a mile distant. The quarries in the north end of the ridge have been chiefly used as a source of flux for Troy, but are temporarily inactive. This lime has been analyzed, as follows, by Prof. J. H. Appleton:

Analysis of lime from Smiths Basin, N. Y.

	Per cent.
Moisture and carbon dioxide	2.08
Insoluble	1.06
Iron and alumina	.58
Lime	95.50
Magnesia	Trace.
Total	99.22

Two additional analyses, No. 1 of the limestone and No. 2 of the lime, which were made at the Albany and Rensselaer Iron and Steel Company's laboratory in Troy, showed—

Analyses of limestone and lime from Smith's Basin, New York.

	No. 1.	No. 2.
	Per cent.	*Per cent.*
Lime	54.15	94.07
Magnesia	.39	.79
Carbon dioxide	42.95	3.04
Alumina	.08	.20
Ferric oxide	.02	.07
Silica	.97	1.93
Phosphoric acid	.01	.01
Water	1.47	....
Organic matter	.06	....
Total	100.10	100.11

The limestone is burned in continuous acting kilns.

Fairhaven, Vt.—J. F. Harris's quarry is situated adjoining the Delaware and Hudson Railroad, between Whitehall and Fairhaven. The quarry was at one time operated by the Arana Marble Company. The material they sought to use was a reddish-brown variegated limestone found chiefly in the southwestern end of the quarry and called "onyx." The limestone is not sufficiently massive and homogeneous, however, to permit the extraction of blocks or slabs of moderate size. The chief use now is for flux. The rock in most parts of the quarry is quite low in silica, according to figures furnished by the owner, and its proximity to the track renders shipping easy.

Hoosick Falls, Rensselaer County, N. Y.—Three small quarries have been opened on the hillside to the west of the town. They are owned and operated by Messrs. John Dolin, Con Caffrey, and M. Parsons, to supply a local and intermittent demand. The rock consists of irregular beds of slaty, bluish black limestone, and a lighter-colored, fine-grained limestone. It is very irregularly bedded and its chief application is for road metal and foundations or stone walls.

5. THE STOCKBRIDGE LIMESTONE BELT.

Around Canaan, Conn., this formation is a magnesian limestone and is important as a source of lime, but farther north, in Massachusetts, it extends from West Stockbridge to North Pownal, Vt., with quite uniform character, being quite rich in lime and having usually a low percentage of silica.

Canaan, Conn.—Four firms operate lime quarries, all of which are to the east of the village. They are Chas. Barnes Sons, Pierce & Freeman, the Anchor Lime Company, and Camp & Eddy. The rock is the same character in all of them, being a rather coarse-grained yellowish or bluish white (depending on its depth from the surface) magnesian limestone. Barnes's quarry is half a mile from the railroad, Pierce & Freeman's is connected with a switch from the New England Railroad, and the quarry proper is approached through a cut several hundred feet long, in which there is a tramroad for hauling the stone to the kilns. At the Anchor Lime Company's quarry the rock is raised to the top of the kiln by means of a wire-rope tram. Petroleum is used for burning the limestone. The kiln is continuous in its action, and there is one burner at the base of the kiln. Its operation has been successful thus far.

West Stockbridge, Berkshire County, Mass.—The only firm at this locality is Truesdell & Fuarey, who have two quarries, one at the station and the other about 500 feet west of it. In the first the rock is mostly a gray, moderately fine-grained limestone, with occasional white bands. The quarry is about 100 feet long and 40 feet deep. The stone is chiefly used for lime, but a neighboring blast furnace consumes a small quantity. In the larger quarry the limestone has a similar character, but is somewhat finer grained. Both give a good grade of lime. An analysis of the lime from the smaller quarry gave lime, 91.12 per cent; magnesia, 3.81 per cent.

The Gross Brothers, of Lee, Mass., are opening a marble quarry about 2 miles southeast of Stockbridge, along the railroad, but at the time of the writer's visit, in January, 1896, the weathered rock had not yet been entirely removed.

Lee, Berkshire County, Mass.—The marble quarries half a mile south of the station, and owned and operated by Gross Brothers, have been worked for a number of years. The rock is a soft, rather fine-grained white dolomite, with streaks of gray. The main quarry is a rectangular opening about 40 feet deep. The stone is quarried with gadding machines and its chief use is for floor tiles and headstones, large quantities of the latter having been made for the Government. In addition some lime is made. It is burned in a continuous-acting kiln, and gives a lumpy, slow-slaking lime.

New Lenox, Berkshire County, Mass.—Hutchison Brothers have two quarries about 3 miles west of the depot. The one supplies a coarse-grained, hard, gray limestone, which in certain portions of the quarry may contain micaceous streaks, while the other supplies a soft, white limerock. The rock is hauled to the kilns, which are near the depot.

An analysis of the lime, made by Mr. W. M. Habirshaw, showed—

Analysis of lime from New Lenox, Mass.

	Per cent.
Lime	95.66
Magnesia	.76
Iron and alumina	.17
Silica	1.14
Carbon dioxide	None.
Loss by ignition	3
Total	100.73

Farnham Station, Berkshire County, Mass.—The Farnham Lime Company's quarry is $1\frac{3}{4}$ miles from the depot, on the opposite side of the mountain. The rock is a gray granular limestone. That at the north end of the quarry is much lighter colored and makes a softer lime. The working face is about 40 feet high and 200 feet long. After mining, the limestone is hauled by teams to the kilns at the station. Each team hauls five loads of 6,000 pounds per day. Continuous kilns are used.

Cheshire, Berkshire County, Mass.—Three-quarters of a mile north of the preceding quarry is that of the Cheshire Lime Manufacturing Company. The rock is in every respect like Farnham's. An analysis of the limestone by Davenport & Williams gave:

Analysis of limestone from Cheshire, Mass.

	Per cent.
Silica	0.31
Iron and alumina	.23
Calcium carbonate	98.80
Magnesium carbonate	.37
Organic matter	.35
Total	100.06

Renfrew, Berkshire County.—The Stockbridge limestone, which is well developed at this locality, forms a cliff 90 feet high on the hillside overlooking the town. The Adams Marble Company, which has recently begun operations, has made two small openings at the summit of the cliff. The rock is a rather soft, white, saccharoidal limestone, and after quarrying is lowered to the foot of the ledge, where it is sawed and dressed. The following is the composition, as determined by Prof. E. E. Olcott.

Composition of limestone from Renfrew, Mass.

	Per cent.
Calcium carbonate	99.60
Magnesium carbonate	.49
Iron and alumina	.55
Silica	.63
Total	101.27

The nearest shipping point for this material is the Renfrew station of the Fitchburg Railroad, about three-quarters of a mile distant. The company proposes laying a tramroad down the hill. Messrs. J. Follet & Son's quarry is several hundred feet farther down the slope toward the track. It has been in operation a number of years and has a working face about 50 feet high and 400 feet long. The stone is similar to that mentioned from the preceding quarry, and is generally white, although local bands of carbonaceous matter are not uncommon. The limestone in the upper portion of the quarry is somewhat softer. A tramroad about 500 feet long transports the rocks to the kilns. These are of the old-fashioned type, the rock being too soft to stand the rubbing action of a continuous kiln. The lime is very white. The two following analyses, No. 1 by P. S. Burns and No. 2 by H. P. Eddy, show its composition:

Analyses of lime from Renfrew, Mass.

	No. 1.	No. 2.
	Per cent.	*Per cent.*
Lime	98.13	96.63
Magnesia	.42	.88
Silica	.36	.81
Alumina	.15	.47
Ferric oxide	....	
Carbon dioxide	.60	.12
Water	.20	
Total	99.86	98.91

A third but smaller quarry in this same rock has been recently opened by the Farnham Lime Manufacturing Company along the road halfway between Renfrew and North Adams.

North Adams, Berkshire County, Mass.—Mr. G. Rich is operating a quarry about 1½ miles north of the depot, at a locality known as the Natural Bridge. The stone is similar in composition to that at Renfrew, but contains a larger proportion of carbonaceous matter, 25 to 30 per cent of the rock being a dark gray. There is also a vein of quartz several feet wide down the center of the quarry face. The rock is mostly used for making marble dust.

North Pownal, Bennington County, Vt.—The Stockbridge limestone forms a large outcrop northwest of the station, but is of quite different character from the beds in Berkshire County. Here it is a hard, gray, fine-grained, massive limestone of moderately homogeneous character. It is well exposed in Follet Brothers' quarry, and shows a passage upward into a siliceous limestone, of which there is about 6 feet. This has to be stripped in quarrying. The North Pownal stone makes a harder lime than that quarried at Renfrew, but it is of a grayish shade. A sample of the lime analyzed by R. Schuppaus gave—

Analysis of lime from North Pownal, Vt.

	Per cent.
Lime	98.14
Magnesia	1.40
Silica	.27
Alumina	.11
Ferric oxide	.08
Total	100

The Burden Iron Works, of Troy, have a quarry adjoining Follet's, but it is inactive at present.

6. VERMONT MARBLE BELT.

Most of the quarries in this belt are between Rutland and Middlebury, but a number of openings have been made on Dorset Mountain.

East Dorset, Vt.—Friedley's quarry is a half mile north of the depot and 1,000 feet above the railroad track. The marble works are by the track, and a gravity plane over a mile long brings down the marble. The quarry face is 90 feet in height, and the upper 40 feet of bad rock has to be stripped or the good stone gained by chamber workings. The latter method is usually resorted to, and several large caverns in the hillside indicate the amount of stone that has been removed. The marble is a bluish white, good grade of stone. Most of it is shipped to Philadelphia for building purposes. Several dikes penetrate the marble in the old workings and are known by the workmen as "ore bodies."

The Dorset Marble Company has its works at East Dorset, but the quarries are on Dorset Mountain, near Manchester. The marble is white, with occasional gray mottling. This company has but recently commenced operations.

West Rutland, Rutland County, Vt.—The quarries are a short distance northwest of the railroad station, the largest being those of the

Vermont Marble Company. They have made a number of openings following downward on the dip, and so much of the material between them has been removed that they now practically form one enormous quarry extending along the strike for nearly 700 feet and down on the dip for 280 feet. At this depth the bed begins to turn and the dip decreases. The marble bed has a thickness of 150 feet at the top, but narrows to 75 feet at the bottom. It is divisible, however, into well-marked layers, which, though varying somewhat in thickness in different parts of the quarry, retain their distinctive characters. The following section of the quarry from hanging wall to foot wall was kindly given me by Mr. Howard, the superintendent:

Section in marble quarry at West Rutland, Vt.

	Feet.
Top, blue; Top, white	20
Green stripe	2
Thin statuary	3-6
Striped monument	2-6
Statuary	3-6
Average layer, half green, half white	4
Brocadilla	2.6-3
Crinkly (siliceous; half light, half dark)	2-3
Light, Smith; Mottled, Smith — Light, nearly pure white	4-6
Jackman layer (6 in. green striped, 2 ft. 6 in. white)	3
Sherman (half dark green, half white)	3-6
Italian blue	15-20
Mottled limestone, of no value	

The green color is due to chloritic mica. There is necessarily a large amount of waste material, and Mr. Howard estimates that the refuse from the shops is about 250 tons per week. The chief use of the marble is for monuments and tombstones. The rock is cut out with channeling machines and the blocks are hoisted out of the quarry with large derricks. When the blocks have to be brought from the lower portion of the quarry, they are hoisted successively by several derricks located at different levels. At present the company is following the bed downward on the dip, and also running a level along the strike to the south about 50 feet below the surface. After this has been carried a sufficient distance, they will begin to sink on it. Electricity is used to light the workings. The stone is sawed, cut, and polished in the shops near the quarry. The following analyses of the West Rutland marble were furnished by the Vermont Marble Company.

Analyses of West Rutland (Vt.) marble.

	Blue.	White.	Statuary.
	Per cent.	*Per cent.*	*Per cent.*
Insoluble	.28	.40	.70
Carbon dioxide	43.82	43.66	43.65
Lime	55.27	55.26	55.50
Magnesia	.28	.15	Trace.
Iron and alumina	.30	.20	.15
Total	99.95	99.67	100

It is interesting to note the slight difference that there is between the blue and the white. The following two additional analyses were made by Mr. J. N. Harris:

Additional analyses of West Rutland (Vt.) marble.

	Blue.	White.
	Per cent.	*Per cent.*
Silicate of alumina	.22	.62
Carbon dioxide	44	43.80
Lime	55.15	54.95
Magnesia	.57	.59
Organic matter	.05	....
Total	99.99	99.96

The white and white-striped layers seem to disappear to the north, for at the quarries of the Albertson Company and of the True Blue Marble Company, three-quarters of a mile to the north, only the blue marble is found. These quarries are from 50 to 75 feet deep. The marble is a fine-grained, granular, bluish stone, and is used for monumental and structural purposes. It is sawed at the quarry. Some years ago the True Blue Marble Company attempted the manufacture of lime, but it was abandoned. All the West Rutland quarries are connected by means of a switch with the Delaware and Hudson Railroad.

Proctor, Rutland County, Vt.—The Vermont Marble Company's works are next to the railroad station, and the main quarry is a few hundred feet to the west. The opening is 200 by 125 feet and 140 feet deep. The layers are vertical for about two-thirds of this depth, and then spread out to the northeast and southwest. The best beds seem to dip to the southwest, and the quarrying at the bottom of the pit is trending in that direction. While the different layers are fairly well marked, they are not so persistent in their character as those in the West Rutland quarry. The workable thickness of the bed at the top is 125 feet, but surface indications to the north of the main quarry opening point to a pinching out of the marble bed. No statuary marble or blue marble is found in this quarry. The layers in the main quarry are enumerated as follows, from the southwest to the northeast: xa, xb, xc, etc., to xy, xz, Z, Y, X, etc., to C, B, A, A1, A2, A3, A4, etc.

Most of the blue marble dressed at Proctor comes from the "Mountain Dark" quarry, 2 miles from Proctor, and from the quarry at Pittsford. The latter is known as the "Pittsford Blue." The marble at Proctor is quarried by channeling machines operated by steam power, but the company is now introducing both channeling machines and pumps to be operated by electricity. There is a fall of 125 feet of water in the ravine behind the shops, which, diverted into turbine wheels, supplies abundant power to operate the sawing, polishing, and other dressing machinery, as well as the dynamo which operates the lights, and will also operate the machinery in the quarry. Altogether this is probably one of the best-equipped quarrying plants in the country. The sand for the saws is obtained from a neighboring hill and is brought over on a wire-rope tramway. Most of the marble is converted into monuments and tombstones, but the company has recently undertaken the manufacture of thin marble slabs for electrical switchboards. The preparation of these requires considerable care, as they have to be exact in their dimensions. An analysis of the Proctor marble furnished by the company showed—

Analysis of marble at Proctor, Vt.

	Per cent.
Insoluble	0.35
Carbon dioxide	44.02
Lime	55.00
Magnesia	.25
Iron and alumina	.20
Total	99.82

The two following analyses of Proctor marble are given in the Mineral Resources for 1889:

Additional analyses of marble from Proctor, Vt.

	Light.	Dark.
	Per cent.	*Per cent.*
Calcium carbonate	96.30	98.37
Magnesium carbonate	3.06	.79
Iron carbonate	.053	.034
Insoluble	.63	.63
Organic matter	.004	.08
Manganese oxide		.005
Total	100.047	99.909

Brandon, Rutland County, Vt.—The Brandon Italian Marble Company has a quarry in operation three-quarters of a mile southwest of the station. It is about 50 by 100 feet and 50 feet deep. The marble is mostly white or creamy white, with occasional gray mottlings, and dresses easily. There is one streak 4 feet wide in the center of the quarry which is said to be too hard to work, and has therefore been discarded. The marble is sawed and dressed at the quarry. A number of small quarries have been opened between Middlebury and Rutland, but most of them are inactive.

7. THE BLACK RIVER LIMESTONE BELT.

The quarries in this rock are at Leicester Junction, Winooski, Swanton, and Highgate Springs.

Leicester Junction, Addison County, Vt.—The Brandon Lime and Marble Company has been in operation here for a number of years. The quarry is about 500 feet west of the station. The workable bed, which is about 40 feet thick, dips to the east between two beds of impure limestone, and the material used is a hard, finely crystalline, rather brittle, gray limestone. The bed has been followed southward along the strike, so that now the quarry consists of a cut 25 to 30 feet deep and several hundred feet long. As the width of the cut is not over 30 feet, the capacity of the quarry is limited. The rock is burned in continuous kilns, and gives a lumpy lime. The kilns are arranged with special grates, so that any fine lime is separated. This amounts to about 2 barrels in twenty-four hours. The following analysis of the lime was made by C. T. Lee:

Analysis of lime from Leicester Junction, Vt.

	Per cent.
Lime	98.262
Calcium carbonate	.409
Magnesia	.299
Silica	.383
Ferric oxide	.647
Total	100

The Leicester Marble and Lime Company's quarry is half a mile south of the station. The rock is similar to that in the other quarry, but is more massive, slightly darker, and often contains streaks of calcite. These streaked portions are usually discarded, as they make a gray lime.

Winooski, Chittenden County, Vt.—Two miles north of Winooski is a lime quarry belonging to S. H. Weston. It adjoins the Central Vermont Railroad track. The rock is a uniform, finely crystalline, gray limestone, which is at times siliceous. Most of the stone is burned in the kiln at the quarry, but some is shipped to the steel works at Nashua, N. H.

Swanton, Franklin County, Vt.—The same limestone formation quarried at Winooski is mined $1\frac{1}{2}$ miles from Swanton by J. P. Rich. The quarry is of considerable size, but the character of the rock is extremely uniform. It is massive, hard, and brittle. A switch connects it with the Central Vermont Railroad. The following three analyses show the composition of the lime, No. 1 being by C. Sharpless, No. 2 by F. C. Robinson, and No. 3 by J. R. Chilton:

Analyses of lime made at Swanton, Vt.

	No. 1.	No. 2.	No. 3.
	Per cent.	*Per cent.*	*Per cent.*
Lime	98.47	99.29	98.84
Magnesia	1.12	.46	.12
Ferric oxide	Trace.	.12	....
Silica	Trace.	.10	.02
Carbon dioxide	.45	....	1.02
Alumina and manganese	....	Trace.	....
Total	100.04	99.97	100

Highgate Springs, Franklin County, Vt.—Mr. L. H. Felton's quarry at this locality is in the same limestone, and is so similar to Rich's that no further description of it is required. The quarry is a large shallow opening about 200 by 75 feet. It is connected with the kilns by a narrow-gauge tramroad. An analysis of the stone by Prof. S. P. Sharpless gave:

Analysis of limestone from Highgate Springs, Vt.

	Per cent.
Lime	55.83
Magnesia	Trace.
Iron and alumina	.10
Silica	.40
Carbon dioxide	43.65
Total	99.98

The lime contained 99.80 per cent of calcium oxide. The kilns are connected with the railroad by means of a switch, and they are also located sufficiently close to Lake Champlain to permit shipment by water.

SOAPSTONE.

By Edward W. Parker.

OCCURRENCE.

Soapstone, or talc, is found in nearly every State along the Atlantic slope, the principal deposits being in New York and North Carolina, though it is also quarried in New Hampshire, Vermont, Massachusetts, New Jersey, Pennsylvania, Maryland, Virginia, and Georgia. It has also been reported in some of the Western States, particularly in California, Arizona, South Dakota, and Texas, but no commercial product has been obtained west of the Mississippi River. In some cases, notably at Gouverneur, St. Lawrence County, N. Y., it occurs in a foliated or fibrous form, very valuable as a filler or makeweight in the manufacture of paper. This latter variety, known as fibrous talc or mineral pulp, is considered separately in these reports.

PRODUCTION.

The production of soapstone in the United States in 1895 amounted to 21,495 short tons, valued at $266,495, against 23,144 short tons, worth $401,325, in 1894. These figures do not include fibrous talc, which is treated separately, or the amount of soapstone ground for pigment, which is included in the production of mineral paint.

Comparing the figures for 1894 and 1895, it will be seen that in the latter year there was a decrease of 1,649 short tons. The depressed condition of the trade was not evinced so strongly in the decreased output as it was in the sharp decline in value, that of 1895 being $134,830 less than that of 1894. The product decreased less than 10 per cent, the value more than 32 per cent. For the past three years the statistics of soapstone production have been collected so as to show the amount and value of the product in the condition in which it was first sold. This is shown in the table on the following page.

Production of soapstone in 1893, 1894, and 1895.

Condition in which marketed.	1893.	
	Short tons.	Value.
Rough	5,760	$51,600
Sawed into slabs	104	4,400
Manufactured articles (*a*)	7,070	123,600
Ground (*b*)	8,137	75,467
Total (*c*)	21,071	255,067

Condition in which marketed.	1894.		1895.	
	Short tons.	Value.	Short tons.	Value.
Rough	5,620	$50,780	1,041	$8,886
Sawed into slabs	1,303	19,500	863	12,320
Manufactured articles (*a*)	6,425	244,000	(*d*)10,789	170,791
Ground (*b*)	9,796	87,045	8,802	74,498
Total (*c*)	23,144	401,325	21,495	266,495

a Includes bath and laundry tubs; fire brick for stoves, heaters, etc.; hearthstones, mantels, sinks, griddles, slate pencils, and numerous other articles of everyday use.
b For foundry facings, paper making, lubricators, dressing skins and leather, etc.
c Exclusive of the amount used for pigment, which is included among mineral paints.
d Includes 1 ton of soapstone, reported as 325 gross of slate pencils.

From the above table it will be seen that there was a decrease of more than 4,500 tons in the amount of stone sold in the rough state as quarried, and an increase of more than 4,000 tons in manufactured stuff. Under ordinary circumstances this would be reflected in a comparatively increased value of the product. A further analysis of the table may be made by showing the average price per ton realized for each condition in which the output was marketed during the two years. This is shown in the following table, together with the decrease and percentage of decrease in 1895:

Average prices of soapstone in 1894 and 1895, compared.

Condition in which marketed.	Per short ton.		Decrease in 1895.	Percentage of decrease.
	1894.	1895.		
Rough	$9.04	$8.54	$0.50	5.5
Sawed	14.96	14.28	.68	4.5
Manufactured	37.97	15.83	22.14	58
Ground	8.89	8.46	.43	5
General average	17.34	12.40	4.94	28.5

In the following table is shown the amount and value of soapstone produced in the United States since 1880:

Annual product of soapstone since 1880.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Short tons.			*Short tons.*	
1880	8,441	$66,665	1888	15,000	$250,000
1881	7,000	75,000	1889	12,715	231,708
1882	6,000	90,000	1890	13,670	252,309
1883	8,000	150,000	1891	16,514	243,981
1884	10,000	200,000	1892	23,208	423,449
1885	10,000	200,000	1893	21,070	255,067
1886	12,000	225,000	1894	23,144	401,325
1887	12,000	225,000	1895	21,495	266,495

FIBROUS TALC.

The supply of this variety of soapstone is obtained only at Gouverneur, St. Lawrence County, N. Y. The entire output is ground and used almost exclusively as a filler in the manufacture of the medium grades of paper. The product in 1895 was 39,240 short tons, valued at $370,897. The product was less than 2 per cent short of that of 1894, when 39,906 short tons were obtained. The value declined 15 per cent from $435,060, and was the lowest figure reported since 1889, less even than in 1893, when the output was only 35,861 short tons. The following table shows the amount and value of fibrous talc used for different purposes in 1895:

Disposition of fibrous talc product in 1895.

	Short tons.	Value.
Paper filling	39,021	$369,007
Paint	48	552
Wall plasters	171	1,338
Total	39,240	370,897

The annual production of fibrous talc since 1880 has been as follows:

Annual production of fibrous talc since 1880.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Short tons.			*Short tons.*	
1880	4,210	$54,730	1888	*a* 20,000	$210,000
1881	*a* 7,000	60,000	1889	23,746	244,170
1882	*a* 6,000	75,000	1890	41,354	389,196
1883	*a* 6,000	75,000	1891	53,054	493,068
1884	*a* 10,000	110,000	1892	41,925	472,485
1885	*a* 10,000	110,000	1893	35,861	403,436
1886	*a* 12,000	125,000	1894	39,906	435,060
1887	*a* 15,000	160,000	1895	39,240	370,897

a Estimated.

IMPORTS.

The following table exhibits the imports of talc of all kinds since 1880. From 1880 to 1889 the imports were fairly regular. Since 1889 they have been very irregular. From 19,229 short tons, valued at $30,993 in 1889, they dropped to 1,044 tons, worth $1,560 in 1890, and 81 tons, worth $1,121 in 1891. They increased in 1892 to 531 tons, and again in 1893 to 1,360 tons, decreasing in 1894 to 622 tons. In 1895 they increased to 3,165 short tons, valued at $26,843.

Talc imported into the United States from 1880 to 1895, inclusive.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Short tons.			*Short tons.*	
1880	....	$22,807	1888	24,165	$22,446
1881	....	7,331	1889	19,229	30,993
1882	....	25,641	1890	1,044	1,560
1883	....	14,607	1891	81	1,121
1884	....	41,165	1892	531	5,546
1885	....	24,356	1893	1,360	12,825
1886	....	24,514	1894	622	6,815
1887	(*a*)	49,250	1895	3,165	26,843

a Quantity not reported previous to 1888.

CLAY.

THE STATISTICS OF THE CLAY-WORKING INDUSTRIES OF THE UNITED STATES.

By JEFFERSON MIDDLETON.

INTRODUCTION.

The almost universal abundance of clay suitable for making brick of all kinds, sewer pipe, draintile, terra cotta, etc., makes it possible for nearly every town to have its own brickyard, and this, together with the unsystematic manner in which most of the smaller yards are run, makes the task of a clay census one beset with many obstacles. One of the most difficult portions of this task is to keep the directory of these producers anywhere near up to date. This is owing to the large number of plants, the constant establishing of new yards and the abandonment of old ones. Of late years, however, capital has been attracted to the industry—largely through the efforts of the national and State clay-working associations to raise the standard of the quality of the product by the introduction of improved methods of manufacture—and the result is the establishment of larger plants on a permanent basis.

Another great difficulty is the lack of experience of operators in making returns. This, however, will be overcome in time, and it is gratifying to note that the replies to statistical inquiries were returned much more promptly this year than for 1894, and were much more intelligently rendered. This opportunity is taken to thank the clay workers of the country for their cooperation, without which it would be impossible to make this report.

PRODUCTION.

The results of the second statistical canvass of the clay-working industries of the United States by the United States Geological Survey are shown in the following tables.

The total value of the clay products of the United States, as shown by this canvass, was $65,319,806, as compared with $64,575,385 in 1894, a gain of $744,421, or a little more than 1 per cent. The year 1895 was undoubtedly the worst, from a financial standpoint, experienced for several years by the clay-working industries of the country, and while the figures here presented show a small increase in value of the product, this increase is undoubtedly due to returns from a greater number of the larger producers than in 1894, and can not be taken as an indication of any improvement in trade. The number of works idle in 1895, with stocks on hand, was much greater than in 1894, and almost none were run to their full capacity.

It will be noted that the number of producers reporting also increased very slightly, or from 6,264 in 1894 to 6,284 in 1895. This is an increase of only three-tenths of 1 per cent, while the product increased 1.1 per cent, thus tending to bear out the statement that the increase in value of the product is due rather to more returns from larger producers than to a healthy increase in trade.

Clay products of the United States in 1895.

State.	Number of firms reporting.	Common brick.			Pressed brick, including buff, gray, and other fancy colored and enameled brick.			Vitrified paving brick.		
		Quantity.	Value.	Average price per thousand.	Quantity.	Value.	Average price per thousand.	Quantity.	Value.	Average price per thousand.
		Thousands.			*Thousands.*			*Thousands.*		
Alabama	60	35,822	$190,157	$5.38	318	$3,325	$10.45	2,300	$23,500	$10.21
Arizona	9	960	6,855	7.14	....	....	....	....	....	....
Arkansas	54	27,381	185,009	6.76	566	5,840	10.32	926	9,260	10.00
California	94	144,403	922,712	6.40	3,885	71,286	18.34	....	....	....
Colorado	81	48,762	252,018	5.16	9,828	113,105	11.50	977	10,572	10.82
Connecticut	44	118,550	642,462	5.41	150	4,500	30.00	....	....	....
Delaware	17	7,184	48,915	6.80	400	7,200	18.00	....	....	....
District of Columbia	16	49,002	277,750	5.67	1,126	13,560	12.04	23	190	8.26
Florida	28	19,489	108,775	5.58	70	1,240	17.71	....	....	....
Georgia	76	135,480	655,275	4.83	4,783	46,265	9.69	5	40	8.00
Idaho	14	2,085	17,540	8.41	70	1,050	15.00	....	....	....
Illinois	678	717,079	3,786,747	5.28	29,093	330,318	11.35	82,526	643,997	7.80
Indiana	659	319,751	1,488,370	4.65	17,085	161,336	9.44	22,313	204,000	9.14
Iowa	412	180,664	1,095,074	6.06	11,159	87,130	7.81	31,704	243,928	7.69
Kansas	63	20,756	121,892	5.87	3,730	25,775	6.91	7,902	62,190	7.87
Kentucky	92	86,521	455,927	5.27	1,800	14,240	7.91	3,850	33,150	8.61
Louisiana	44	70,247	378,418	5.39	3,220	25,750	7.99	300	3,000	10.00
Maine	95	72,594	403,217	5.55	1,370	13,520	9.86	....	....	....
Maryland	65	117,016	743,023	6.35	2,555	35,229	13.78	8	80	10.00

Clay products of the United States in 1895—Continued.

State.	Number of firms reporting.	Common brick.			Pressed brick, including buff, gray, and other fancy colored and enameled brick.			Vitrified paving brick.		
		Quantity.	Value.	Average price per thousand.	Quantity.	Value.	Averge price per thousand.	Quantity.	Value.	Average price per thousand.
		Thousands.			*Thousands.*			*Thousands.*		
Massachusetts	112	245,423	$1,443,677	$5.88	8,509	$200,234	$23.53	100	$800	$8.00
Michigan	200	168,574	767,203	4.55	6,530	47,719	7.31	1,300	12,755	9.81
Minnesota	126	127,242	578,329	4.55	5,061	30,635	6.05	2	16	8.00
Mississippi	38	31,135	174,800	5.61	1,290	12,650	9.80			
Missouri	221	234,201	1,251,200	5.34	29,674	275,725	9.29	6,816	54,640	8.01
Montana	18	16,662	112,083	6.70	2,150	15,740	7.32	22	330	15.00
Nebraska	105	28,191	175,480	6.22	2,696	29,659	11.00	475	3,800	8.00
New Hampshire	54	91,415	469,567	5.13	2,300	23,800	10.34			
New Jersey	130	248,831	1,097,063	4.40	18,417	387,737	21.05	2,500	30,000	12.00
New York	280	955,442	4,396,027	4.60	18,437	290,910	15.78	10,896	121,892	11.19
North Carolina	96	60,946	311,088	5.10	577	5,605	9.70	150	1,600	10.66
North Dakota	7	9,000	48,000	5.33						
Ohio	980	381,065	1,887,023	4.95	44,396	518,717	11.68	96,555	787,878	8.16
Oklahoma *a*	21	7,095	39,502	5.56	176	2,510	14.26			
Oregon	68	12,612	70,812	5.61	40	800	20.00	400	3,800	9.50
Pennsylvania	513	612,492	3,570,536	5.82	56,810	1,018,682	17.93	36,268	305,035	8.41
Rhode Island	1	28,000	175,000	6.25	3,000	45,000	15.00	4,000	48,000	12.00
South Carolina	51	56,010	240,785	4.29	310	3,075	9.92			
South Dakota	10	1,195	8,865	7.41	75	1,875	25.00			
Tennessee	90	69,034	355,420	5.14	2,633	25,352	9.62			

Texas	136	138, 465	805, 772	5. 81	16, 143	103, 255	6. 39	1, 492	12, 466	8. 36
Utah	46	13, 533	69, 511	5. 13	2, 496	31, 715	12. 70	150	1, 200	8. 00
Vermont	20	18, 376	97, 212	5. 29	140	2, 220	15. 80			
Virginia	111	96, 407	560, 316	5. 81	11, 176	204, 078	18. 25	3, 000	30, 000	10. 00
Washington	52	14, 865	84, 305	5. 67	585	19, 100	32. 64	2, 301	32, 965	14. 32
West Virginia	46	35, 815	208, 337	5. 82	1, 845	18, 400	9. 97	62, 330	449, 388	7. 21
Wisconsin	146	141, 018	782, 552	5. 54	12, 530	123, 505	9. 85			
Wyoming	5	1, 175	8, 525	7. 25						
United States	6, 284	6, 017, 965	31, 569, 126	5. 25	339, 204	4, 399, 367	12. 97	381, 591	3, 130, 472	8. 20
Per cent of totals			48. 33			6. 74			4. 79	

a Includes Indian Territory and New Mexico.

Clay products of the United States in 1895—Continued.

State.	Fancy or ornamental brick (value).	Fire brick (value).	Drain tile (value).	Sewer pipe (value).	Ornamental terra-cotta work (value).	Terra-cotta lumber (value).	Tile (not drain) (value). *a*	Stoneware (value).	Miscellaneous (value). *b*	Total value.
Alabama	$73,979	$900						$9,480		$301,341
Arizona										6,855
Arkansas		2,000	$2,450				$1,000	38,400		243,959
California	13,654	10,836	8,980	$261,536	$48,300		58,450		$25,400	1,421,154
Colorado	1,960	42,264	320	76,000		$1,000	8,750	350	47,044	553,383
Connecticut	600	64,000	1,000	4,500	44,563			2,800	67,500	831,925
Delaware			2,500							58,615
District of Columbia	3,000		5,168	64,631			2,795		6,210	373,304
Florida			1,000						3,000	114,015
Georgia	27,560	29,950	5,200	54,400	34,850		2,530	6,000	5,285	867,355
Idaho									300	18,890
Illinois	19,500	117,040	1,028,581	389,680	722,500	71,685	231,166	255,540	23,130	7,619,884
Indiana	13,439	12,510	820,602	42,000	52,600	60,000	139,463	11,400	111,800	3,117,520
Iowa	2,300	5,920	290,515	55,131	2,800	400	16,094	25,600	45,400	1,870,292
Kansas	1,000	27,000	4,090			300	500	1,000	2,900	246,647
Kentucky	150	126,539	17,322	25,000			75,000	30,120	61,750	839,198
Louisiana	5,000	50	1,000						2,500	415,718
Maine	4,400	37,501	5,168	270,177	3,121					737,104
Maryland	1,000	232,270	3,079		6,781		12,000		33,525	1,066,987
Massachusetts	91,675	187,710			65,000	63,668	900	1,800	166,126	2,221,590
Michigan	5,850	3,575	200,893	76,000			2,900		12,300	1,129,195
Minnesota	500	2,000	2,775	169,761		49,000	570	246,115	20,434	1,100,135
Mississippi	500	3,300	500					1,500	1,500	194,750
Missouri	1,500	484,415	15,820	212,000		25,300	94,504	8,400	375,714	2,799,218
Montana	380	69,035	137	3,517	30		1,586		1,355	204,193

Nebraska	3,202	....	1,800	....	....	....	600	....	....	214,541
New Hampshire	800	12,400	....	....	....	....	15,000	....	....	521,567
New Jersey	179,828	456,825	14,024	101,316	763,420	285,165	850,014	162,946	570,782	4,899,120
New York	1,025	302,407	56,740	133,000	336,000	....	143,465	44,033	63,997	5,889,496
North Carolina	50	6,140	2,900	25,000	....	....	....	3,600	45,000	400,983
North Dakota	....	....	....	....	....	....	....	....	....	48,000
Ohio	57,767	696,175	884,638	1,746,503	49,678	59,600	797,985	563,355	2,600,063	10,649,382
Oklahoma c	3,295	....	....	....	....	....	....	....	....	45,307
Oregon	45	15,486	4,000	40,500	....	....	100	500	2,500	138,543
Pennsylvania	48,032	2,250,790	13,320	360,475	263,000	120,508	95,529	208,130	553,124	8,807,161
Rhode Island	10,000	3,000	....	....	....	....	16,000	....	....	297,000
South Carolina	1,000	19,750	5,000	4,000	....	....	2,008	500	800	276,918
South Dakota	....	....	....	....	....	....	....	....	....	10,740
Tennessee	356	24,956	6,850	80,300	5,000	....	....	24,300	....	522,534
Texas	1,024	7,060	....	4,450	300	5,000	519	46,600	44,000	1,030,446
Utah	3,410	5,750	1,000	....	....	....	....	....	....	112,586
Vermont	30,132	....	2,980	....	....	....	....	....	....	132,544
Virginia	36,919	1,750	4,980	1,000	....	....	700	3,025	13,000	855,768
Washington	....	12,500	3,175	85,700	24,000	....	2,500	....	1,200	265,445
West Virginia	4,262	4,000	140	196,000	250	....	....	3,000	12,000	895,777
Wisconsin	3,425	1,200	32,314	....	....	....	....	....	1,200	944,196
Wyoming	....	....	....	....	....	....	....	....	....	8,525
United States	652,519	5,279,004	3,450,961	4,482,577	2,422,193	741,626	2,572,628	1,698,494	4,920,839	65,319,806
Per cent of total	1.00	8.08	5.28	6.86	3.71	1.14	3.94	2.60	7.53	100.00

a Including hollow building tile or blocks, roofing tile, floor tile, encaustic and art tile.

b Including ball clay, paper clay, clay ballast (burned), vitrified brick for chemical use, locomotive arch brick, hollow brick, well brick, slab brick, fence posts, fence-post stubs, clay gas retorts and gas-house tiles, boiler and sugar-kettle tiles, kiln and furnace tile, sidewalk tile and blocks, blocks for building caves, foundation blocks, tank blocks, door knobs, wall copings, crestings, stovepipe guards, glass makers' pot clay, glass-melting pots, fire-clay retorts, pottery, wash and bath tubs, kitchen sinks, saggars, conduits for underground wires, flue linings, electrical porcelain specialties, crucibles, scorifiers, muffles, supports, slides, cuspidors, jardinières, vases, earthenware, flower pots, stone pumps, fire kindlers, insulators and insulator supplies, flue pipe, chimney tops, terra-cotta grave and lot markers, curbing, art faience, hitching posts, porcelain washboards, tobacco pipes, clay furnaces, etc.

c Includes Indian Territory and New Mexico.

The following table gives the figures of the clay products of the United States in 1894, and is here reproduced for comparative purposes:

Clay products of the United States in 1894.

State.	Number of firms reporting.	Common and pressed brick.			Vitrified paving brick.			Fancy or ornamental brick (value).
		Quantity.	Value.	Average price per thousand.	Quantity.	Value.	Average price per thousand.	
		Thousands.			*Thousands.*			
Alabama	53	34, 194	$205, 531	$6. 01	150	$1, 500	$10. 00	$1, 000
Arizona	14	2, 092	16, 031	7. 66				
Arkansas	53	24, 604	162, 041	6. 59	705	7, 050	10. 00	80
California	70	94, 561	627, 235	6. 63	110	2, 150	19. 55	14, 350
Colorado	78	33, 998	228, 344	6. 72	2, 188	21, 880	10. 00	2, 680
Connecticut	44	100, 300	549, 650	5. 48	10	250	25. 00	5, 000
Delaware	13	6, 080	43, 528	7. 16				
District of Columbia	23	56, 348	317, 565	5. 64	250	2, 000	8. 00	815
Florida	23	13, 402	82, 387	6. 15				
Georgia	64	110, 218	585, 693	5. 31				14, 048
Idaho	19	3, 184	26, 768	8. 41				
Illinois	697	825, 845	4, 495, 613	5. 44	109, 700	843, 217	7. 69	72, 920
Indiana	663	335, 868	1, 720, 017	5. 12	23, 936	224, 473	9. 38	6, 650
Iowa	437	208, 195	1, 317, 473	6. 33	45, 488	376, 951	8. 29	2, 950
Kansas	67	24, 518	141, 042	5. 75	7, 948	57, 310	7. 21	4, 000
Kentucky	87	84, 498	418, 886	4. 96	6, 256	51, 389	8. 21	50, 700
Louisiana	50	78, 996	442, 862	5. 61	1, 200	9, 400	7. 83	52, 500
Maine	109	72, 302	401, 982	5. 56	1, 650	11, 200	6. 79	200
Maryland	67	141, 055	974, 669	6. 91	50	470	9. 40	1, 100
Massachusetts	114	263, 732	1, 648, 065	6. 25	1, 854	14, 530	7. 84	139, 100
Michigan	196	174, 881	924, 872	5. 29	145	1, 560	10. 76	54, 750

Minnesota	122	98, 957	473, 904	4. 79				1, 340
Mississippi	31	22, 897	134, 930	5. 89	110	770	7. 00	1, 500
Missouri	242	258, 922	1, 541, 553	5. 95	23, 189	190, 220	8. 20	47, 933
Montana	17	10, 316	80, 629	7. 82				
Nebraska	104	58, 289	411, 409	7. 06	5, 700	52, 800	9. 26	29, 375
New Hampshire	56	89, 152	482, 330	5. 41	700	4, 900	7. 00	1, 075
New Jersey	129	317, 260	1, 601, 096	5. 05	400	6, 000	15. 00	257, 300
New Mexico	5	2, 280	17, 125	7. 51				
New York	302	821, 286	3, 945, 022	4. 80	9, 304	136, 697	14. 69	52, 500
North Carolina	78	43, 525	226, 882	5. 21	125	888	7. 10	
North Dakota	8	8, 600	52, 400	6. 09				
Ohio	968	386, 712	2, 136, 691	5. 53	113, 329	928, 948	8. 20	92, 683
Oklahoma *a*	18	6, 404	37, 338	5. 83	100	1, 000	10. 00	
Oregon	69	14, 770	95, 820	6. 49	1, 550	21, 000	13. 55	3, 320
Pennsylvania	508	642, 326	4, 173, 274	6. 50	74, 029	521, 359	7. 04	75, 281
Rhode Island	1	30, 000	240, 000	8. 00	3, 000	33, 600	11. 20	10, 000
South Carolina	47	48, 534	229, 877	4. 74				
South Dakota	8	3, 312	24, 902	7. 52				
Tennessee	76	70, 519	417, 616	5. 92	7, 687	39, 384	5. 12	2, 971
Texas	124	134, 963	895, 359	6. 63	100	1, 000	10. 00	16, 989
Utah	59	21, 606	156, 047	7. 22	1, 575	12, 863	8. 17	
Vermont	17	16, 950	92, 552	5. 46				1, 500
Virginia	104	112, 488	779, 285	6. 93	5, 400	52, 750	9. 77	76, 474
Washington	59	22, 625	153, 259	6. 77	1, 024	17, 600	17. 19	15, 200
West Virginia	36	38, 719	227, 032	5. 86	8, 059	63, 964	7. 94	1, 000
Wisconsin	140	181, 287	1, 099, 102	6. 06				19, 324
Wyoming	4	850	6, 850	8. 06				
United States	6, 264	6, 152, 420	35, 062, 538	5. 70	457, 021	3, 711, 073	8. 12	1, 128, 608
Per cent of total			54. 30			5. 75		1. 75

Clay products of the United States in 1894—Continued.

State.	Fire brick (value).	Drain tile (value).	Sewer pipe (value).	Ornamental terra-cotta work (value).	Terra-cotta lumber (value).	Tile (not drain) *a* (value).	Miscellaneous *b* (value).	Total value.
Alabama	$57,414	$600	....	....	....	....	....	$266,045
Arizona	2,050	....	....	....	....	....	....	18,081
Arkansas	1,860	2,055	$10	....	....	$2,000	$37,000	212,096
California	2,575	15,850	102,950	$23,085	....	....	53,300	841,495
Colorado	113,393	1,540	50,000	....	....	7,500	52,740	478,077
Connecticut	57,500	500	15,000	60,100	....	5,000	24,000	717,000
Delaware	....	2,500	....	....	....	....	....	46,028
District of Columbia	....	2,800	61,100	....	....	....	6,392	390,672
Florida	....	....	....	....	....	....	1,200	83,587
Georgia	17,650	2,000	47,300	11,000	....	....	22,196	699,887
Idaho	....	3,500	....	....	....	....	....	30,268
Illinois	116,904	1,418,572	308,963	430,000	$81,288	44,144	662,739	8,474,360
Indiana	22,720	954,264	1,000	50,000	50,000	101,855	4,590	3,135,569
Iowa	36,525	557,312	58,000	50	500	8,545	21,200	2,379,506
Kansas	2,350	8,048	....	100	....	375	5,350	218,575
Kentucky	87,800	31,400	15,000	....	....	60,000	44,500	759,675
Louisiana	....	12,500	....	....	....	....	....	517,262
Maine	20,000	8,400	390,000	....	....	....	....	831,782
Maryland	164,848	3,050	20	50	....	23,500	177,158	1,344,865
Massachusetts	93,825	....	....	48,000	50,000	46,983	299,431	2,339,934
Michigan	401,880	741,327	99,040	....	....	4,300	26,600	2,254,329
Minnesota	3,950	77,300	218,266	....	34,500	....	111,250	920,510
Mississippi	4,500	1,000	....	....	....	....	....	142,700
Missouri	202,722	172,220	150,000	225	....	24,679	286,026	2,615,578
Montana	56,100	....	7,200	....	....	7,500	3,000	154,429
Nebraska	....	14,000	....	....	....	11,200	1,000	519,784

New Hampshire	15,000						200	503,505
New Jersey	502,430	8,600	137,977	88,000	206,471	701,955	466,726	3,976,555
New Mexico	1,200							18,325
New York	298,578	62,955	10,000	508,000	828	64,704	84,738	5,164,022
North Carolina	1,100	1,810	21,000				35,000	286,680
North Dakota								52,400
Ohio	742,304	1,465,586	3,311,895	19,000		476,118	1,495,273	10,668,498
Oklahoma *c*								38,338
Oregon	630	29,093		1,575	750	7,800	2,000	161,988
Pennsylvania	1,568,545	61,952	347,202	61,000	75,000	67,300	477,135	7,428,048
Rhode Island	3,000					8,000		294,600
South Carolina	3,300	3,500				20		236,697
South Dakota	1,600					500		27,002
Tennessee	30,873	25,900	75,000		15,300		27,300	634,344
Texas	87,360	10,049	2,000				16,096	1,028,853
Utah	4,440	20	2,000				1,530	176,900
Vermont		4,000						98,052
Virginia	4,794	10,705				6,696	6,889	937,593
Washington	24,400	2,750	209,000	86,000		6,750	700	515,659
West Virginia	500	360	350,000	10,000			20,150	673,006
Wisconsin	6,200	85,150				1,300	44,300	1,255,376
Wyoming								6,850
United States	4,762,820	5,803,168	5,989,923	1,396,185	514,637	1,688,724	4,517,709	64,575,385
Per cent of total	7.37	8.99	9.27	2.16	.80	2.61	7.00	100.00

a Including hollow building tile or blocks, roofing tile, floor tile, encaustic and art tile, and enameled brick.

b Including clay ballast (burned), clay pipes, clay retorts, railroad fire-clay tile, stove linings, wall copings, earthenware, cooking utensils, cuspidors, pitchers, vases flowerpots, chemical and cylinder brick, stoneware, stone pumps, well brick and staves, tile posts, furnace and flue linings, terra-cotta chimney pipe tops, terra-cotta grave and lot markers, fence posts, fence-post stubs, electrical porcelain specialties, statuary, relief signs, melting pots, etc.

c Includes Indian Territory.

In 1894 the common and pressed brick were combined, and together there were 6,152,420,000 made, worth $35,062,538. In 1895 these were classified separately, and the result shows that together in that year there were 6,357,169,000 common and pressed brick, worth $35,968,493, or $5.66 per thousand. In 1894 the average value for the United States was $5.70 per thousand. In 1894 these brick made 54.30 per cent of the whole total, and in 1895, 55.07 per cent of the total.

The number of common brick made in the United States in 1895 was 6,017,965,000, valued at $31,569,126, or $5.25 per thousand. The pressed brick numbered in that year 339,204,000, valued at $4,399,367, or $12.97 per thousand. This high average value for pressed brick is due to the fact that enameled bricks are included in several States, notably in Massachusetts, New Jersey, and Pennsylvania. The average value of pressed brick alone throughout the country would be nearer $10 per thousand.

The vitrified paving-brick industry seems to have fallen off considerably without any apparent explanation, or from 457,021,000, worth $3,711,073, or $8.12 per thousand, in 1894 to 381,591,000, worth $3,130,472, or $8.20 per thousand, in 1895. This decline was in almost all of the large producing States, especially in Colorado, Illinois, Iowa, Missouri, Ohio, and Pennsylvania. On the other hand, New York and West Virginia show quite large increases in this product.

The fancy or ornamental brick product also shows a decline, or from $1,128,608 in 1894 to $652,519 in 1895. In 1894 this variety of brick constituted 1.75 per cent of the total value; in 1895 it was but 1 per cent.

The fire-brick product held its own and a little more, being $4,762,820 in 1894 and $5,279,004 in 1895. Its percentage of the total product in 1894 was 7.37, while in 1895 it was 8.08.

The drain-tile product shows quite a remarkable decline, or from $5,803,168, or 8.99 per cent of the total, in 1894 to $3,450,961, or 5.28 per cent, in 1895. This is easily accounted for by the remarkably dry season in the Mississippi Valley, Illinois, Indiana, Ohio, Iowa, Missouri, Wisconsin, and Nebraska, all showing large decreases in this product.

The sewer-pipe product decreased from $5,989,923, or 9.27 per cent of the total, in 1894 to $4,482,577, or 6.86 per cent of the total, in 1895.

Ornamental terra-cotta work increased from $1,396,185, or 2.16 per cent of the total product, in 1894 to $2,422,193, or 3.71 per cent of the total, in 1895. Terra-cotta lumber also increased from $514,637, or 0.8 per cent, in 1894 to $741,626, or 1.14 per cent of the total, in 1895. Tile (not drain) was about the same in 1894 and 1895, or $1,688,724 in 1894 and $1,698,494 in 1895.

Stoneware, which was included in the miscellaneous column in 1894, was given a separate classification in 1895, when $1,698,494, or 2.60 per cent of the total, was produced. The miscellaneous column, notwithstanding the withdrawal of stoneware from it, increased from

$4,517,709 in 1894, or 7 per cent of the total product, to $4,920,839, in 1895, or 7.53 per cent of the total product.

The following table shows the rank of States, total value of products, and percentage of total product produced by each State in 1894 and 1895:

Rank of States in output of clay products in 1894 and 1895.

1894.

Rank.	State.	Number of firms reporting.	Value.	Per cent of total product.
1	Ohio	968	$10,668,498	16.52
2	Illinois	697	8,474,360	13.12
3	Pennsylvania	508	7,428,048	11.50
4	New York	302	5,164,022	8.00
5	New Jersey	129	3,976,555	6.16
6	Indiana	663	3,135,569	4.86
7	Missouri	242	2,615,578	4.05
8	Iowa	437	2,379,506	3.69
9	Massachusetts	114	2,339,934	3.62
10	Michigan	196	2,254,329	3.49
11	Maryland	67	1,344,865	2.08
12	Wisconsin	140	1,255,376	1.94
13	Texas	124	1,028,853	1.59
14	Virginia	104	937,593	1.45
15	Minnesota	122	920,510	1.43
16	California	70	841,495	1.30
17	Maine	109	831,782	1.29
18	Kentucky	87	759,675	1.18
19	Connecticut	44	717,000	1.11
20	Georgia	64	699,887	1.08
21	West Virginia	36	673,006	1.04
22	Tennessee	76	634,344	.98
23	Nebraska	104	519,784	.81
24	Louisiana	50	517,262	.80
25	Washington	59	515,659	.80
26	New Hampshire	56	503,505	.78
27	Colorado	78	478,077	.74
28	District of Columbia	23	390,672	.61
29	Rhode Island	1	294,600	.46
30	North Carolina	78	286,680	.44
31	Alabama	53	266,045	.41
32	South Carolina	47	236,697	.37
33	Kansas	67	218,575	.34
34	Arkansas	53	212,096	.33

Rank of States in output of clay products in 1894 and 1895—Continued.

1894—Continued.

Rank.	State.	Number of firms reporting.	Value.	Per cent of total product.
35	Utah	59	$176,900	.27
36	Oregon	69	161,988	.25
37	Montana	17	154,429	.24
38	Mississippi	31	142,700	.22
39	Vermont	17	98,052	.15
40	Florida	23	83,587	.13
41	North Dakota	8	52,400	.08
42	Delaware	13	46,028	.07
43	Oklahoma *a*	18	38,338	.06
44	Idaho	19	30,268	.05
45	South Dakota	8	27,002	.04
46	New Mexico	5	18,325	.03
47	Arizona	14	18,081	.03
48	Wyoming	4	6,850	.01
	United States	6,264	64,575,385	100.00

a Includes Indian Territory.

1895.

1	Ohio	980	$10,649,382	16.30
2	Pennsylvania	513	8,807,161	13.48
3	Illinois	678	7,619,884	11.67
4	New York	280	5,889,496	9.02
5	New Jersey	130	4,899,120	7.50
6	Indiana	659	3,117,520	4.77
7	Missouri	221	2,799,218	4.29
8	Massachusetts	112	2,221,590	3.40
9	Iowa	412	1,870,292	2.86
10	California	94	1,421,154	2.18
11	Michigan	200	1,129,195	1.73
12	Minnesota	126	1,100,135	1.68
13	Maryland	65	1,066,987	1.63
14	Texas	136	1,030,446	1.58
15	Wisconsin	146	944,196	1.45
16	West Virginia	46	895,777	1.37
17	Georgia	76	867,355	1.33
18	Virginia	111	855,768	1.31
19	Kentucky	92	839,198	1.29
20	Connecticut	44	831,925	1.27
21	Maine	95	737,104	1.13

Rank of States in output of clay products in 1894 and 1895—Continued.

1895—Continued.

Rank.	State.	Number of firms reporting.	Value.	Per cent of total product.
22	Colorado	81	$553,383	.85
23	Tennessee	90	522,534	.80
24	New Hampshire	54	521,567	.80
25	Louisiana	44	415,718	.64
26	North Carolina	96	400,983	.61
27	District of Columbia	16	373,304	.57
28	Alabama	60	301,341	.46
29	Rhode Island	1	297,000	.46
30	South Carolina	51	276,918	.42
31	Washington	52	265,445	.41
32	Kansas	63	246,647	.38
33	Arkansas	54	243,959	.37
34	Nebraska	105	214,541	.33
35	Montana	18	204,193	.31
36	Mississippi	38	194,750	.30
37	Oregon	68	138,543	.21
38	Vermont	20	132,544	.20
39	Florida	28	114,015	.17
40	Utah	46	112,586	.17
41	Delaware	17	58,615	.09
42	North Dakota	7	48,000	.07
43	Oklahoma *a*	21	45,307	.07
44	Idaho	14	18,890	.03
45	South Dakota	10	10,740	.02
46	Wyoming	5	8,525	.01
47	Arizona	9	6,855	.01
	United States	6,284	65,319,806	100.00

a Includes Indian Territory and New Mexico.

As in 1894, every State and Territory, except Nevada, participated in this total. Ohio again leads the other States in value of product, though showing a slight decrease, or from $10,668,498 in 1894 as compared with $10,649,382 in 1895. Illinois, which occupied second place in 1894, has been displaced by Pennsylvania, the former decreasing from $8,474,360 in 1894 to $7,619,884 in 1895, and the latter increasing from $7,428,048 in 1894 to $8,807,161 in 1895. It is rather a coincidence that these two States should have changed rank, each taking almost exactly the figures of the other for the previous year. The other States about held their relative ranks, the most notable changes being those of California, which rose from the sixteenth place in 1894 to tenth place in

1895; Georgia, which rose from twentieth place in 1894 to seventeenth place in 1895, and Nebraska, which fell from twenty-third place in 1894 to thirty-fourth place in 1895.

The most notable feature of these tables is the similarity with the 1894 figures. The number of firms reporting in 1894 was 6,264, while in 1895 6,284 reported. The total value of all the products in 1894 was $64,575,385, and in 1895 it was $65,319,806. The State totals also vary but little. Ohio, which produced $10,668,498 in 1894, produced $10,649,-382 in 1895. In 1894 this was 16.52 per cent of the total product, while in 1895 it was 16.30 per cent. Illinois and Pennsylvania changed relative positions and almost values of products. The first nine States, including the great clay-working region between the Ohio and Missouri rivers, together with Pennsylvania, New York, New Jersey, and Massachusetts, produced 71.52 per cent of the total product in 1894 and 73.29 per cent in 1895. In 1894 Ohio, Illinois, and Pennsylvania produced 41.14 per cent of the total; in 1895 they produced 41.45 per cent of it. In 1894 Ohio, Indiana, Illinois, Iowa, and Missouri produced 42.24 per cent of the total product, while in 1895 these States produced 39.89 per cent of it.

The following table shows the average value per thousand of the several kinds of brick made in the United States in 1895, by States, and is of interest for comparative purposes:

Average price of brick in 1895, by States.

COMMON.

State.	Price per thousand.	State.	Price per thousand.
Idaho	$8.41	Virginia	$5.81
South Dakota	7.41	District of Columbia	5.67
Wyoming	7.25	Washington	5.67
Arizona	7.14	Mississippi	5.61
Delaware	6.80	Oregon	5.61
Arkansas	6.76	Florida	5.58
Montana	6.70	Oklahoma *a*	5.56
California	6.40	Maine	5.55
Maryland	6.35	Wisconsin	5.54
Rhode Island	6.25	Connecticut	5.41
Nebraska	6.22	Louisiana	5.39
Iowa	6.06	Alabama	5.38
Massachusetts	5.88	Missouri	5.34
Kansas	5.87	North Dakota	5.33
Pennsylvania	5.83	Vermont	5.29
West Virginia	5.[illegible]	Illinois	5.28
Texas	5.81	Kentucky	5.27

a Includes Indian Territory and New Mexico.

Average price of brick in 1895, by States—Continued.

COMMON—Continued.

State.	Price per thousand.	State.	Price per thousand.
Colorado	$5.16	New York	$4.60
Tennessee	5.14	Michigan	4.55
New Hampshire	5.13	Minnesota	4.55
Utah	5.13	New Jersey	4.40
North Carolina	5.10	South Carolina	4.29
Ohio	4.95	Average for United States	5.25
Georgia	4.83		
Indiana	4.65		

PRESSED.

State.	Price per thousand.	State.	Price per thousand.
Washington	$32.64	New Hampshire	$10.34
Connecticut	30.00	Arkansas	10.32
South Dakota	25.00	West Virginia	9.97
Massachusetts	23.53	South Carolina	9.92
New Jersey	21.05	Maine	9.86
Oregon	20.00	Wisconsin	9.85
California	18.34	Mississippi	9.80
Virginia	18.25	North Carolina	9.70
Delaware	18.00	Georgia	9.69
Pennsylvania	17.93	Tennessee	9.62
Florida	17.71	Indiana	9.44
Vermont	15.80	Missouri	9.29
New York	15.78	Louisiana	7.99
Idaho	15.00	Kentucky	7.91
Rhode Island	15.00	Iowa	7.81
Oklahoma *a*	14.26	Montana	7.32
Maryland	13.78	Michigan	7.31
Utah	12.70	Kansas	6.91
District of Columbia	12.04	Texas	6.39
Ohio	11.68	Minnesota	6.05
Colorado	11.50	Average for United States	12.97
Illinois	11.35		
Nebraska	11.00		
Alabama	10.45		

a Includes Indian Territory and New Mexico.

Average price of brick in 1895, by States—Continued.

VITRIFIED PAVING.

State.	Price per thousand.	State.	Price per thousand.
Montana	$15.00	Texas	$8.36
Washington	14.32	District of Columbia	8.26
New Jersey	12.00	Ohio	8.16
Rhode Island	12.00	Missouri	8.01
New York	11.19	Georgia	8.00
Colorado	10.82	Massachusetts	8.00
North Carolina	10.66	Minnesota	8.00
Alabama	10.21	Nebraska	8.00
Arkansas	10.00	Utah	8.00
Louisiana	10.00	Kansas	7.87
Maryland	10.00	Illinois	7.80
Virginia	10.00	Iowa	7.69
Michigan	9.81	West Virginia	7.21
Oregon	9.50	Average for United States	8.20
Indiana	9.14		
Kentucky	8.61		
Pennsylvania	8.41		

The price of common brick, as will be seen from the above table, in 1895 ranged from $8.41 per thousand in Idaho to $4.29 per thousand in South Carolina. These two States were the extremes of prices in 1894 also, being $8.31 and $4.74, respectively. It should be borne in mind, however, that in 1894 these averages included both pressed and common brick.

Pressed brick ranged in price from $32.64 per thousand in Washington to $6.05 in Minnesota. The high average price for this kind of brick in Pennsylvania, New Jersey, and Massachusetts is due to the inclusion of enameled brick. The average price for the whole country in 1895 of pressed brick was $12.97 per thousand, which is undoubtedly high, and is explained elsewhere by the statement that enameled brick is included.

Vitrified paving brick ranged in value from $15 per thousand in Montana to $7.21 per thousand in West Virginia. The average for the whole country was $8.20 per thousand. In 1894 the average for the whole country was $8.12 per thousand.

The following table shows the average value of the clay products per plant by States and for the whole country, and is a fair index as to where the largest plants are located:

Average value of clay products per plant in 1895, by States.

State. *a*	Average value per plant.	State. *a*	Average value per plant.
New Jersey	$37,686	Wisconsin	$6,467
New York	21,034	Tennessee	5,806
Massachusetts	19,836	Michigan	5,646
West Virginia	19,473	South Carolina	5,430
Connecticut	18,907	Mississippi	5,125
Pennsylvania	17,168	Washington	5,105
Maryland	16,415	Alabama	5,022
California	15,119	Indiana	4,731
Missouri	12,666	Iowa	4,540
Georgia	11,413	Arkansas	4,518
Montana	11,344	North Carolina	4,177
Illinois	11,239	Florida	4,072
Ohio	10,867	Kansas	3,915
New Hampshire	9,659	Delaware	3,448
Louisiana	9,448	Utah	2,448
Kentucky	9,122	District of Columbia	2,332
Minnesota	8,731	Oklahoma *b*	2,157
Maine	7,759	Nebraska	2,043
Virginia	7,710	Oregon	2,037
Texas	7,577	Wyoming	1,705
North Dakota	6,857	Idaho	1,349
Colorado	6,832	South Dakota	1,074
Vermont	6,628	United States	10,394

a Rhode Island is not included since it has only one operator reporting.
b Includes New Mexico and Indian Territory.

IMPORTS.

In the following tables will be found a statement of the clay and manufactured goods imported into the United States in recent years:

Classified imports of clay during the calendar years ending December 31 from 1885 to 1895.

Kind.	1885.		1886.		1887.	
	Long tons.	Value.	Long tons.	Value.	Long tons.	Value.
China clay or kaolin	10,626	$83,722	16,590	$123,093	23,486	$141,360
All others:						
Unwrought	9,736	76,899	13,740	113,875	17,645	139,405
Wrought	3,554	29,839	1,654	20,730	2,187	22,287
Total	23,916	190,460	31,984	257,698	43,318	303,052

Kind.	1888.		1889.		1890.	
	Long tons.	Value.	Long tons.	Value.	Long tons.	Value.
China clay or kaolin	18,150	$102,050	19,843	$113,538	29,923	$270,141
All others:						
Unwrought	20,604	152,694	19,237	145,983	21,049	155,486
Wrought	6,832	53,245	8,142	64,971	2,978	29,143
Total	45,586	307,989	47,222	324,492	53,950	454,770

Kind.	1891.		1892.		1893.	
	Long tons.	Value.	Long tons.	Value.	Long tons.	Value.
China clay or kaolin	39,901	$294,458	49,468	$375,175	49,713	$374,460
All others:						
Unwrought	16,094	118,689	20,132	155,047	14,949	113,029
Wrought	6,297	56,482	4,551	64,818	6,090	67,280
Common blue	....	....	5,172	59,971	4,304	51,889
Total	62,292	469,629	79,323	655,011	75,056	606,658

Kind.	1894.		1895.	
	Long tons.	Value.	Long tons.	Value.
China clay or kaolin	62,715	$465,501	75,447	$513,714
All others:				
Unwrought	13,146	98,776	18,419	125,417
Wrought	4,768	60,786	5,160	60,775
Common blue	2,528	28,886	3,869	40,578
Total	83,157	653,949	102,895	740,484

Earthenware, china, brick, and tile imported and entered for consumption in the United States, 1867 to 1895, inclusive.

Year ending—	Brown earthen and common stone-ware.	China and porcelain not decorated.	China and decorated porcelain.	Other earthen, stone, or crockery ware, glazed, etc.	Brick, fire brick, and tile.	Total.
June 30—						
1867	$48,618	$418,493	$439,824	$4,280,924	....	$5,187,859
1868	47,208	309,960	403,555	3,244,958	....	4,005,712
1869	34,260	400,894	555,425	3,468,970	....	4,459,549
1870	47,457	420,442	530,805	3,461,524	....	4,460,228
1871	96,695	391,374	571,032	3,573,254	....	4,632,355
1872	127,346	470,749	814,134	3,896,664	....	5,308,893
1873	115,253	479,617	867,206	4,289,868	....	5,751,944
1874	70,544	397,730	676,656	3,686,794	....	4,831,724
1875	68,501	436,883	654,965	3,280,867	....	4,441,216
1876	36,744	409,539	718,156	2,948,517	....	4,112,956
1877	30,403	326,956	668,514	2,746,186	....	3,772,059
1878	18,714	289,133	657,485	3,031,393	....	3,996,725
1879	19,868	296,591	813,850	2,914,567	....	4,044,876
1880	31,504	234,371	1,188,847	3,945,666	....	5,500,388
1881	27,586	321,259	1,621,112	4,413,369	....	6,383,326
1882	36,023	316,811	2,075,708	4,438,237	....	6,866,779
1883	43,864	368,943	2,587,545	5,685,709	....	8,686,061
1884	50,172	982,499	2,664,231	(*a*)	$666,595	4,363,497
1885	44,701	823,334	2,834,718	....	963,422	4,666,175
December 31—						
1886	37,820	865,446	3,350,145	....	951,293	5,204,704
1887	43,079	967,694	3,888,509	....	1,008,360	5,907,642
1888	55,558	1,054,854	4,207,598	....	886,314	6,204,324
1889	48,824	1,148,026	4,580,321	....	788,391	6,565,562
1890	56,730	974,627	3,562,851	....	563,568	5,157,776
1891	99,983	1,921,643	6,288,088	....	353,736	8,663,450
1892	63,003	2,022,814	6,555,172	....	380,520	9,021,509
1893	57,017	1,732,481	6,248,255	....	338,143	8,375,896
1894	47,114	1,550,950	5,392,648	....	189,631	7,180,343
1895	61,424	2,117,425	8,055,473	....	156,271	10,390,593

a Not separately classified after 1882.

FLINT AND FELDSPAR.

Mr. William Golding, of Trenton, N. J., has kindly furnished the following information in regard to flint and feldspar:

FLINT.

INTRODUCTION.

As a rule the use of flint (quartz) and feldspar is limited to the pottery and tile trades. The principal exceptions to this rule are: (1) The use of impure flint in an admixture with fire clay, either in the shape of bricks or in a plastic condition, as a refractory lining for furnaces; (2) its use in glass manufacture, where large quantities of impure flint sand are employed; (3) its use in the manufacture of sandpaper, where purity is not so essential as hardness and sharpness; and (4) its use in the manufacture of soap either as an adulterant or for the purpose of increasing its scouring qualities.

In the case of feldspar its only use, besides in pottery, is a small one in the manufacture of the finer varieties of glass.

The pottery trade requires that flint shall be almost entirely free from the red oxide of iron with which it is so generally coated, as well as from other impurities of mica, soapstone, etc. The trade requires further that it shall be furnished at a small cost for transportation from the mine to the mill, which means practically from the mines to either of the two pottery centers—Trenton, N. J., and East Liverpool, Ohio. There are excellent deposits of flint in the vicinity of Bath and Portland, Me., Bedford, N. Y., and Lynchburg, Va., which are particularly free from iron oxide, but they are at present barred from these markets by the cost of transportation.

SOURCES OF SUPPLY.

The principal sources of supply of flint for Trenton are the quarries in the vicinities of Conowingo, Md., Chambersburg, Pa., and Kaolin, Pa. The sources of supply for the East Liverpool trade are Utica, Ill., and McVeytown, Pa. These are both rock sand deposits. The sand is very thoroughly washed and scoured at these mines. While this gives a fair quality of sand flint, it is not equal to the best product of quartz rock.

PRODUCTION.

The following table shows the production of flint in the United States in 1895. Owing to the inability to secure direct returns from all producers, it has been necessary to make estimates in some cases. The figures here given, however, closely approximate the actual production:

Production of flint in 1895.

State.	Quantity.
	Long tons.
Connecticut	4,400
Illinois	4,500
Maryland	10,100
New York	800
Pennsylvania	17,000
Total	36,800

The lower duties on imported crockery ware and the competition of fine grades of sand flint have considerably lowered the prices for crude rock flint, so that its value at Trenton, N. J., is $3.20 per ton of 2,240 pounds. There being no suitable rock flint at present available for the Western market, almost the entire supply of flint to that market is the highest grades of glass sand, which have the same value at East Liverpool, Ohio, namely, $3.20 per ton.

FELDSPAR.

SOURCES OF SUPPLY.

It has for some years been a difficult matter to find supplies of feldspar of sufficient purity and at a moderate cost. The trade requires that it shall be practically free from iron oxide, mica, tourmaline, and quartz, and that when subjected to the heat of the pottery biscuit kiln it shall fuse into a white opaque glass. The chief difficulty is the fine admixture of quartz, so that it can not be practically broken to such sizes as to assort the pure spar.

There are no feldspar quarries operated in the West, so that the entire supply for both the eastern and western pottery centers comes from the East. The principal sources of supply are from mines in the vicinities of Bath, Me.; Bedford, N. Y.; Brandywine Summit, Pa.; Branchville, Conn., and Glastonbury, Conn. The best mines so far discovered are those of Georgetown, Me., which has been continuously operated for twenty years, and Topsham, Me., which has been operated almost as long, both yielding a pure quality of feldspar. The feldspar of Connecticut is of fine quality, but it is much more difficult to obtain in large quantities free from the fine quartz mixture. The Brandywine Summit district comprises a number of small quarries, all within a radius of 12 miles from the Summit. The product is not so good as the Maine and the Connecticut spars, and requires a much closer assorting. The bulk of the feldspar from this section goes to the Western market. We give below, as nearly as we can ascertain, the mine shipments:

PRODUCTION.

The following table shows the production of feldspar in the United States in 1895. As in the case of flint it is partly estimated:

Production of feldspar in the United States in 1895.

State.	Quantity.
	Long tons.
Pennsylvania	14,000
Connecticut	4,700
Maine	4,000
New York	700
Total	23,400

Notwithstanding the scarcity of a good quality of feldspar the prices have been forced down to $5 to $5.50 per long ton f. o. b. Trenton, N. J., and $6.50 to $7 per long ton f. o. b. East Liverpool, Ohio. The cost for milling these rock products is about $4 per ton.

The following table shows the amount and value of the potters' materials produced in the United States from 1887 to 1895:

Amount and value of potters' materials from 1887 to 1895.

	1887.		1888.		1889. *a*	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Tons.		*Tons.*		*Tons.*	
Kaolin and china clay	22,000	$231,000	18,000	$189,000	294,344	$635,578
Ball clay	6,000	36,000	5,250	31,500		
Fire clay	15,000	45,000	13,500	40,500		
Crude flint	32,000	185,000	30,000	175,000	11,113	49,137
Crude feldspar	10,200	56,100	8,700	50,000	6,970	39,370

a From 1889 all clays burned in kilns are considered.

Amount and value of potters' materials from 1887 to 1895—Continued.

	1890.		1891.		1892.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Tons.		*Tons.*		*Tons.*	
Kaolin and china clay, Ball clay, Fire clay	350,000	$756,000	400,000	$900,000	420,000	$1,000,000
Crude flint	13,000	57,400	15,000	60,000	20,000	80,000
Crude feldspar	8,000	45,200	10,000	50,000	15,000	75,000

	1893.		1894.		1895.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Tons.		*Tons.*		*Tons.*	
Kaolin and china clay, Ball clay, Fire clay	400,000	$900,000	360,000	$800,000	360,000	$800,000
Crude flint	29,671	63,792	38,000	145,920	36,800	117,760
Crude feldspar	18,391	68,037	17,200	98,900	23,400	133,400

THE POTTERY INDUSTRY OF THE UNITED STATES.

By Heinrich Ries.

INTRODUCTION.

Pottery was made in this country by the settlers in Virginia and by the Dutch in New York as early as 1640, and it is interesting to follow the development of the ceramic art in this country since that time, especially up to the year 1876.[1] While some very creditable and, for that period, good work was done, nevertheless the American pottery industry received its first great impetus through the Centennial Exposition held in 1876. Since then the progress has been rapid and the manufacture of pottery has increased in quantity and improved in quality. This fact could not help but impress itself on those who saw the ceramic exhibit at the World's Columbian Exposition, where a most creditable collection of potters' wares was displayed.

American potters have, however, had to fight against the unreasonable prejudice on the part of the American public that foreign wares are superior in quality to the domestic. The result has been that many of our native products are placed upon the market bearing no trade-mark and are sold by retail dealers as imported wares. This prejudice may arise partly from the lack of knowledge of our ceramic products, and is, perhaps, partly the fault of retail dealers, some of whom have foreign interests. There certainly can be nothing more beautiful and artistic than the Rookwood pottery of Cincinnati, the Belleek ware of Trenton, N. J., or the Royal Blue porcelain of Wheeling, W. Va., while the white wares made will bear close examination.

In the following pages it is not proposed to consider the technology of the question more than is absolutely necessary, but rather to give an outline of the pottery resources or raw materials developed in the United States and the uses to which they are put.

RAW MATERIALS.

These include kaolin, or china clay, ball clay, feldspar, and quartz, and to these should be added the materials used for the glazes and coloring, such as metallic oxides and boracic acid. The number and quantity of

[1] See Barber's Pottery and Porcelain of the United States.

each used depend on the grade and character of the wares, the lower grades, such as red earthenware, requiring simply ordinary plastic clay, while the product of the better quality needs all four, namely, kaolin, ball clay, feldspar, and quartz for the body of the ware.

KAOLIN.

The use of this material has a twofold object, namely, to give whiteness to the ware as well as refractoriness. It is used as a constituent of the bodies of "C. C." ware, white granite, and porcelain. For a long period the American potters were dependent on English kaolin, but within recent years important deposits have been opened in this country. The kaolin may occur in masses or pockets, resulting from the decay of the feldspar of a granite or pegmatite vein, or it may form beds of sedimentary origin, although American potters usually designate such occurrences as ball clays, and they will be mentioned under that head. The residual occurrences present the purer material, but the kaolin from either class of deposit has to be washed before it can be put on the market in order to remove all possible impurities.

The usual method of cleansing followed is to wash the mined material into a trough several hundred feet in length. This trough has riffles and bends, so that the water passes along it with decreasing velocity. The larger grains of sand settle at the upper end of the trough while the finer grains of sand, and also the flakes of mica, are deposited at the lower end. The water with the kaolin then passes through a screen to the settling vats. After settling the slip-like mixture of kaolin and water (the clear water in the tank being first drawn off) is pumped into the presses, where the water is expelled. The kaolin is then removed and dried for shipment.

Pennsylvania and Delaware were the earliest sources of kaolin in this country, and the mines of the National Kaolin Company and of the Brandywine Summit Feldspar and Kaolin Company, both at Brandywine Summit, Delaware County, Pa., have been in operation for many years.[1] The kaolin is a residual deposit resulting from the decay of feldspar. It has to be washed before shipment.

Similar deposits occur in Delaware, one at Mermaid, mined by the Peach Kaolin Company, and a second at Hockessin, operated by Mr. William Burgess. Recently a new firm, Walker Bros., has also commenced mining at this locality.

The Pennsylvania and Delaware washed kaolins have a yellowish tint, but are said to burn white.

Much kaolin is now obtained from a deposit 4 miles west of Dillsboro, N. C., at the Harris mines. At this locality it occurs as a residual from a large granite or pegmatite vein. The kaolin is of remarkable whiteness, but occasionally contains small patches of garnet and quartz. These impurities are removed in washing. The mining is carried on

[1] Second Geol. Survey, Pennsylvania Ann. Rept. for 1885, p. 605.

by sinking a number of temporary pits in the kaolin and filling them after the clay has been mined out.[1]

Another residual kaolin is found at Blandford, Mass., and owes its existence to the decay of a pegmatite vein cutting the schist.[2]

Kaolin is also mined at Glen Allen, Mo., by Mr. J. H. Maudle.

The indianaite of Lawrence County, Indiana, is one of the purest kaolins found in the United States, but little or none of it has been used by potters.

Analyses of washed kaolins from American localities.

	Blandford, Mass.	Brandywine Summit, Pa.	Near Dillsboro, N. C.
	Per cent.	*Per cent.*	*Per cent.*
SiO_2	52.03	46.278	{a 2.28 b 41.62
Al_2O_3	31.76	36.25	40.66
Fe_2O_3	Trace.	1.644	.14
CaO	Trace.	.192	....
MgO	.54	.321	Trace.
Alkalies	Trace.	2.536	.46
H_2O	15.55	13.535	14.84
Total	99.84	100.748	100.00

a Free. *b* Combined.

For other analyses see table of clay analyses, Sixteenth Annual Report, United States Geological Survey, Part IV, Nonmetallic Products, p. 554, et seq.

The value of kaolin for the manufacture of white wares is largely dependent on the color to which it burns, for the smallest amount of iron will exercise an influence either in the production of specks or of a yellow tint. The character of the clay must therefore be tested by burning; a coating of glaze may bring out a slight discoloration which the biscuit ware alone will not always show. The relative shrinkage in burning of different kaolins is also an important item.

Considerable English china clay is used by American potters, not because it is better than the native material, but because it is cheaper. English china clay can be bought in Trenton for from $9 to $12 per ton, while the American costs $11 to $12. The high freight rates are one cause of the greater price of the American material.

BALL CLAYS.

These are plastic clays containing a small percentage of impurities, and are used to give plasticity to the potter's mixture and permit the molding of it.

[1] J. A. Holmes, The kaolin of North Carolina: Trans. Am. Inst. Min. Eng., Atlanta meeting, 1895.
[2] Technological Quarterly, 1890.

Ball clays are rarely as pure as kaolins, and generally are more or less colored, as a result of their sedimentary origin.

The color in the natural condition is not an indication of the purity, as many contain sufficient organic matter to tinge them deeply. Pyrite is sometimes present in ball clays, and must be removed. Ball clays are generally marketed as mined, with the exception of those from Florida and New Jersey, which have to be washed.

The purest ball clays found in this country are those mined in Florida (described elsewhere in this report) at Edgar and near Leesburg. The New Jersey ball clays are probably second in point of purity; they are mined at Woodbridge, Perth Amboy, and South Amboy. Others are obtained from Mayfield, Ky., and Regina, Mo.

The following analyses indicate the composition of three ball clays which are much used by American potters:

Analyses of American ball clays.

	Edgar, Fla.	South Amboy, N. J.	Mayfield, Ky.
SiO_2	45.39	*b* 43.83 *a* 1.06	56.40
Al_2O_3	39.13	37.629	30.00
Fe_2O_3	.45	.97	....
CaO	.51	.41	.40
MgO	.29	.19	Trace.
Na_2O	.83	1.124	2.01
K_2O		.317	3.26
H_2O	14.01	14.47	*a* 7.93
Total	100.61	100.00	100.00

a Free. *b* Combined.

The shrinkage of ball clays in burning varies somewhat, and is an important item. The linear shrinkage at the melting point of orthoclase of a number of American ball clays is given by Dr. Langenbeck,[1] as follows:

Shrinkage of ball clays.

	Per cent.
Florida	15
Jefferson County, Mo	15
New Jersey	14
Calloway County, Ky	10

FELDSPAR.

The commercial name for this material is "spar." It is used as a component of the body of white earthenware, semiporcelain or porcelain, and serves the purpose of a flux, binding the mass together. It is

[1] The Chemistry of Pottery.

also one of the elements of porcelain glaze. In calling the feldspar a flux it is not meant that the kaolin with which it is mixed is made to fuse, for this is not the case, but the spar melts, filling all the pores between the grains of clay, binding them firmly together.

Feldspar occurs in veins, often of large size, and sometimes mixed with quartz, less often mica. The spar occasionally has to be separated by hand picking.

The usual method of preparation is to crush the material in a chaser mill with heavy stone rollers. It is discharged automatically into a carrier, which dumps it on a screen. The portion that does not pass through goes back to the mill, but that which does is put into a cylinder with rolled flints and the whole revolved for five hours, or until it is sufficiently fine.

The important sources of spar in this country are Brandywine Summit, Pa.; Rockyhill, Conn., and Bedford, N. Y. Some is obtained from Maine and Delaware. Spar and flint are usually ground by firms located at the centers of the pottery industry, there being several at both Trenton and East Liverpool.

A firm in East Liverpool has recently begun preparations for obtaining it from Virginia and North Carolina.

The following are analyses of commercial feldspar mined in the United States:

Analyses of commercial feldspar.

	Bedford, N. Y., C. Langenbeck, analyst.	Brandywine Summit, Pa., C. G. Pond, analyst.	Fayette County, Tex., C. Langenbeck, analyst.
	Per cent.	*Per cent.*	*Per cent.*
SiO_2	65.85	65.607	68.88
Al_2O_3	19.32	16.916	16.77
Fe_2O_3	.24	....	.83
CaO	.56	.164	.99
MgO	.08	.978	.17
Na_2O	....	2.114	....
K_2O	14.10	12.915	6.77
Loss	....	.496	....
H_2O	....	....	5.79
SO_3	....	....	.42
Total	100.15	99.190	100.62

QUARTZ.

This is commercially known as "flint." It is added to the clay to counteract excessive shrinkage. It is desirable that it should be as free from impurities as possible.

Quartz for potters' use is mined in Maine, at Darlington, Md.; in

Lasalle County, Ill., and by the Potters' Flint Company at Riverton, Ala. The flint from the last locality is much used by Western potters. Its mode of occurrence is similar to that of feldspar. A large quantity of quartz rock is associated with the kaolin near Dillsboro, N. C., but it is not used.

The following are analyses of American flint, given by Dr. Langenbeck:[1]

Analyses of potters' flint.

	Lasalle Co., Ill.	Sand from Cumberland River in Tennessee.	Similar material from Calloway Co., Ky.
	Per cent.	*Per cent.*	*Per cent.*
SiO_2	99.555	85.80	90.49
Al_2O_3	.155	9.75	5.45
Fe_2O_3	.069	.46	.39
CaO	.026	.20	.23
MgO	.013	.23	.30
Alkalies	.112	.98	1.74
Moisture	.070		
H_2O		3.07	1.64
Total	100.000	100.49	100.24

SAGGAR CLAYS.

All white ware, and the better grades of colored ware, have to be burned in receptacles called "saggars" (abbreviation of safeguard) in order to protect it from the smoke and gases of the kiln fire, which would tend to discolor it. These saggars are cylindrical or oval in shape, and are set one upon the other in the kiln, the bottom of one acting as a cover for the one below it. The requisites of a saggar clay are that it must stand as much or slightly more heat than the ware in it; it must shrink little when burned, and withstand changes of temperature. Saggars are generally made from a plastic refractory clay with as great an admixture of grog (ground up old pottery) as possible. An excess of the latter is deleterious. The color-burning properties of a saggar are of little importance. Many firms make their own saggars, but there are also parties whose sole product is saggars for supplying local manufacturers.

Saggar clays are mined in New Jersey, Ohio, and Indiana.

STONEWARE CLAYS.

These are plastic clays, which can be turned or molded into the desired shapes. They must also be refractory enough to keep their shape in burning at the temperature required to melt the glaze. At

[1] The Chemistry of Pottery, Easton, 1895.

the same time the clay should undergo a partial vitrification. In an oxidizing atmosphere the clay should burn to a yellow or red color with soft firing, or to a gray or blue with hard firing.

Stoneware clays are extensively mined in Ohio, New Jersey, Pennsylvania, Indiana, Missouri, and to some extent in California. As a rule they are not washed before using.

YELLOW WARE AND ROCKINGHAM WARE CLAYS.

These are also plastic clays, containing enough iron to give them a fair color, but great refractoriness is not essential, as the heat used in glazing the ware is low; neither is the body vitrified. Clays for this purpose are carefully washed before using. As in the case of yellow ware, the color of the body shows through the usually transparent glaze.

They are also mined in New Jersey and Ohio. The color of the Rockingham ware lies in the glaze, and not in the body.

EARTHENWARE CLAYS.

Clays for making common red earthenware are found in every State, for almost any good, red-burning brick clay answers for this purpose.

SLIP CLAYS.

These are such as are used in glazing stoneware. The requirements of such a clay are that it must fuse at a lower temperature than the ware which it is to coat, and also fuse to a glaze of uniform color. Neither should it melt at too low a temperature. Attempts have been made to lower the fusibility of such clays by the addition of borax or other fluxes, but with only partial success. The tendency is to make the glaze watery or to destroy its uniformity of color. The best slip clay thus far found is that obtained in the Hudson Valley at Albany, N. Y. This fuses to a uniform brown glaze, and is used by potters all over the United States. Its composition is as follows:

Composition of slip clay from Albany, N. Y.

	Per cent.
SiO_2	58.54
Al_2O_3	15.41
Fe_2O_3	3.19
CaO	6.30
MgO	3.40
Alkalies	4.45
CO_2	6.85
SO_3	1.10
H_2O	1.23
Total	100.48

Other slip clays are found at Rowley, Mich., and Brimfield, Ohio, but none of these are equal to the Albany slip. Sometimes a mixture of two or more slip clays is used with good results.

METHODS OF MOLDING.

Pottery is manufactured in four different ways--turning, "jollying" in molds or jigging, casting, and pressing.

TURNING.

The clay after coming from the presses is wedged—that is, a lump of desired size is cut in two by a wire, the two halves united by a blow, this piece cut again, and so on, subjecting the clay to kneading and eliminating air bubbles. The turning is done on a rapidly revolving disk, the lump of clay being brought down on the disk, with some force, thereby sticking to it. The potter then presses his fingers against the revolving mass and works it into any desired shape. Crocks, jugs, and similar articles are turned.

JOLLYING OR JIGGING.

Jollying or jigging is a more rapid method, but the clay is tempered to a much softer consistency. The "jolly" is a wheel fitted with a hollow head to receive the plaster mold, whose interior is of the same shape as the exterior of the object to be molded. A lump of clay is placed in the revolving mold and the potter gradually forces it up around the sides of the mold with his fingers. A metallic arm is then brought down into the mold and shapes the interior of the object. Cups, crocks, jugs, pitchers, and similar articles are molded in this way. Articles with tapering necks are generally jollied in two parts, which are subsequently cemented together with slip. Handles are generally stamped out separately and subsequently fastened on to the article. One manufacturer in Trenton, N. J., however, by the use of a specially devised mold makes his pitchers and fastens on the handles in one operation.

A modification of jollying, used for making plates and saucers, consists in having a plaster mold whose surface is the shape of the interior of the saucer. The potter's assistant takes a piece of clay of the desired size and pounds it out into a flat cake, which is laid on the mold. The latter is then revolved and the potter, by pressing on the clay, makes it conform to the surface of the mold. He then shapes the other side or bottom of the plate by pressing a wooden tool against it as it revolves.

Ewers and oval articles are usually made in sectional molds, consisting of two or three pieces, whose inner surface conforms to the outer surface of the object to be molded. A slab of clay is laid in each section and carefully pressed in. The mold is then put together and the seams carefully smoothed with a wet sponge. After drying for a few hours the parts of the mold are lifted off. Clocks, lamps, picture frames, and many ornaments are molded in this manner.

CASTING.

Casting consists in pouring the slip into a porous mold, which absorbs the water and leaves a deposit of clay on the surface. When the deposit is sufficiently thick the mold is inverted and the remaining slip poured out. After a few hours the mold can be removed. This method is used extensively in making thin porcelain ornaments, the Belleek ware being formed in this way.

All wares in the construction of which plaster molds are used are allowed to stand for a few hours, during which the mold absorbs the water and the article shrinks slightly. It can then be easily removed. The wares require more or less pressing, trimming, or smoothing on the edges.

Doorknobs, many pieces of electrical work, and articles like flat, rectangular dishes are stamped in steel dies. The wares are then fired.

METHODS OF DECORATIONS.[1]

These seem to deserve special mention, as in many cases they form an important and distinct branch of the pottery industry.

Decoration may be imparted to a ware in three ways: (1) By the production of a raised design; (2) by covering the ware with a solid color; (3) by the decoration of the surface with various designs, applied to the ware in one way or another. Common red earthenware seldom receives any decoration, although this has been decorated more within the last year or two. Stoneware, yellow ware, and Rockingham ware often have the surface ornamented with a raised design, which is imparted to the article in molding it. Stoneware is often decorated under the glaze with crude designs made by tracing the figure with a dull point and some coloring matter, which remains in the depressions of the design. Yellow ware is frequently ornamented with bands of various colors.

In majolica the coloring materials are mixed directly with the glaze.

It is the decoration of white earthenware and china, however, that calls forth the ingenuity and skill of the potter. White wares may be decorated either over the glaze or under it. In the former the decoration is applied after the glaze has been put on and fired; in the latter the decoration is put on the biscuit ware, then fired, then the glaze applied and the ware fired again.

The advantage of underglaze decoration is that it is more durable, the decoration being protected by the glaze, and oftentimes the effect produced is prettier than when the colors are applied upon the glaze.

[1] Mr. Joseph Willetts, of Trenton, N. J., has kindly furnished much information on this subject.

The number of colors which can be used in underglaze decoration is limited, as they have to withstand the effects of the heat required to fuse the glaze. The colors which can thus be used are blue, brown, green, yellow. It is on this account that hard fired porcelains have their delicately tinted decorations applied over the glaze. Pink, for instance, has to be applied in this way, and so does gold.

An imitation of underglaze work is sometimes made by applying the decoration on the glaze and then firing until the glaze softens and the colors sink into it.

Underglaze work was the prevalent method of decoration in this country from 1845 to 1850. It then was abandoned for a time, and in the last ten years the method has been steadily regaining favor.

All designs and colors were formerly applied by means of a brush, but the prevalent method now is by printing. The design is engraved or etched on a copper plate and the reversed print is then made on specially prepared fine paper. This is applied to the piece of pottery to be decorated, either on the glaze or on the biscuit ware. The paper is carefully rubbed so that every portion of it shall come in contact with the surface of the ware, and it is then allowed to stand for a while, when the paper is removed, leaving the design on the ware. This is then gone over with colors and the design filled in. The decoration is then called a "filled print." The amount of "printed" ware turned out annually is very great.

Raised gold work, often seen on wares, is made by painting the design with a yellow paste overglaze, firing in the decorating kiln, and then covering with gold and firing again.

Underglaze colors are fired at a sufficient temperature to drive off the oil. The overglaze colors are usually fixed in a muffle kiln in which the temperature reaches between 900° and 1,000° F.

A rather ingenious method for making border decorations on plates and cups was recently witnessed. It consisted in having a design, such as a flower or cluster of leaves, stamped on a flat surface of fine-grained sponge. The plate, for instance, is then placed on a wheel, and while slowly revolving it is given a number of successive touches with the inked surface of the sponge. In this way a continuous design is stamped on the ware. The method is quick and cheap and well adapted to the cheaper grades of white ware, for which it is used.

The Rookwood pottery is decorated underglaze, and consists of clouded grounds of underglaze colors applied with a brush, the colors being applied in a slip to the green ware. After burning the glaze is applied.

TRADE-MARKS.

It is the general custom of all potters to stamp all grades of white ware or art pottery with a trade-mark characteristic of the grade or of the design. These marks are either impressed in the green ware or printed in different colors on the biscuit or over the glaze.

Earthenwares, stonewares, and Rockingham wares seldom have any mark.

A number of the marks used by different American potters in their wares are given in the accompanying plates.

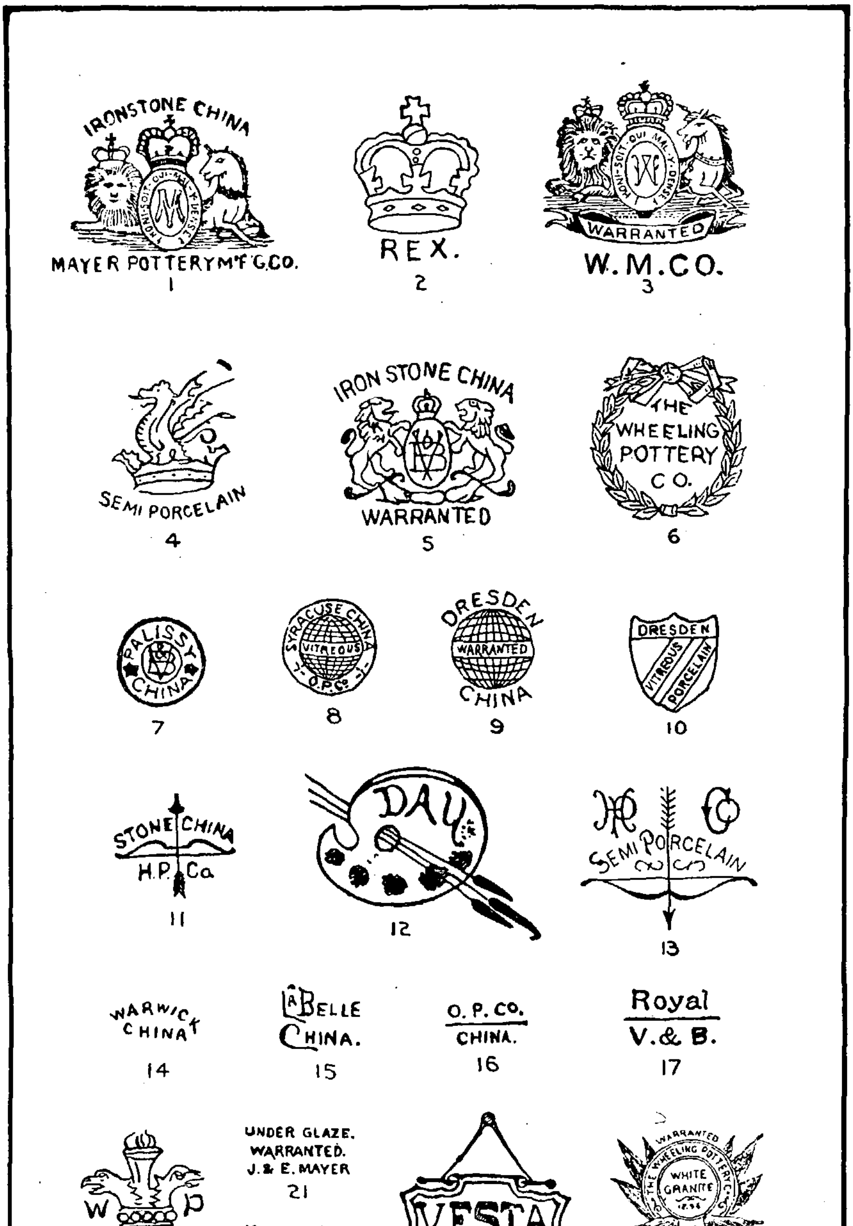
TRADE-MARKS OF AMERICAN POTTERS.

Pl. XI.

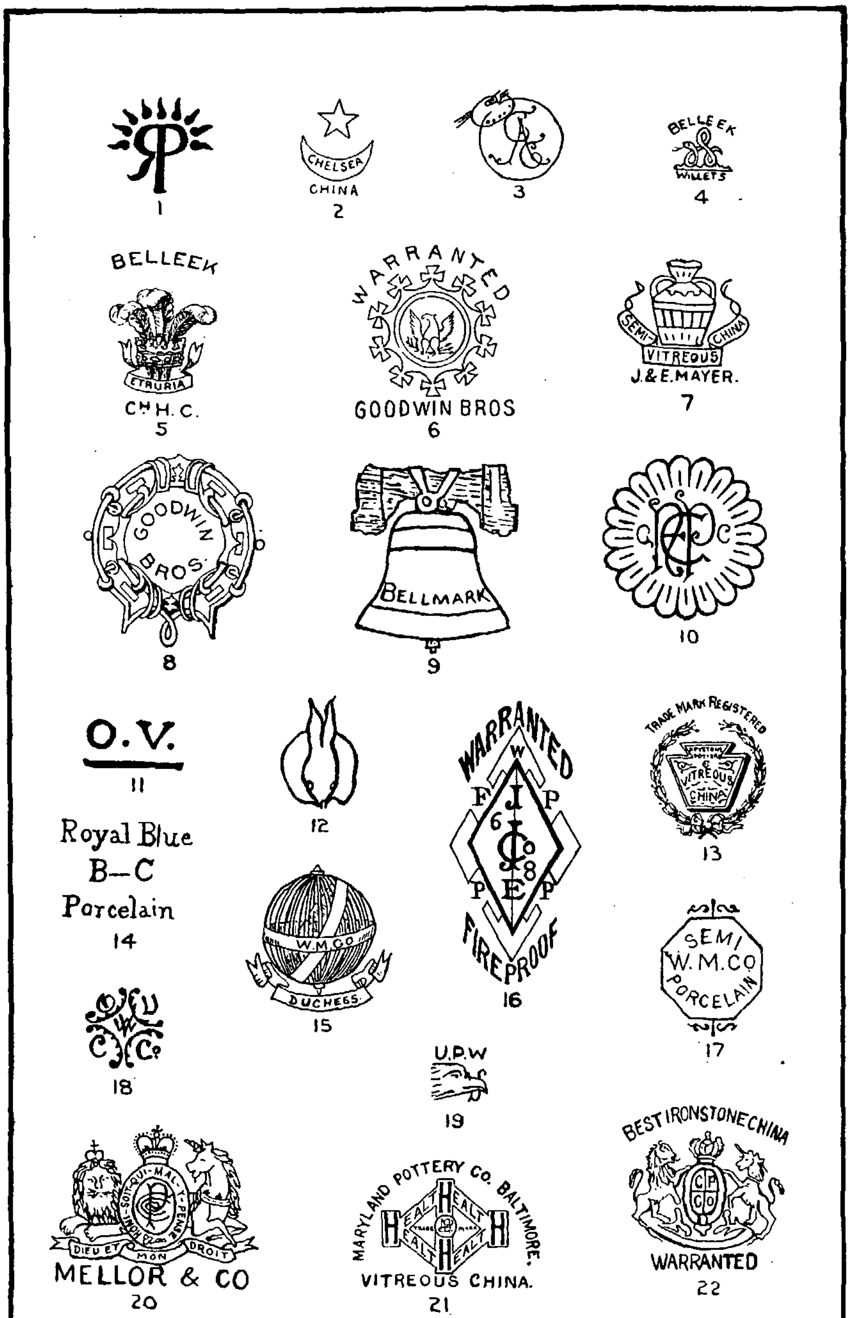
1. Ironstone china, Mayer Pottery Co., Beaver Falls, Pa.
2. Crown china, Crown Pottery Co., Evansville, Ind.
3. Ironstone china, Willets Manufacturing Co., Trenton, N. J.
4. Semiporcelain, Wheeling Pottery Co., Wheeling, W. Va.
5. Ironstone china, Vodrey & Bro., East Liverpool, Ohio.
6. Wheeling Pottery Co., Wheeling, W. Va.
7. Palissy china, Vodrey & Bro., East Liverpool, Ohio.
8. Vitreous china, Onondaga Pottery Co., Syracuse, N. Y.
9. Ironstone china, Potters' Cooperative Co., East Liverpool, Ohio.
10. Vitreous china, Potters' Cooperative Co., East Liverpool, Ohio.
11. Ironstone china, Harker Pottery Co., East Liverpool, Ohio.
12. Dinner ware, Steubenville Pottery Co., Steubenville, Ohio.
13. Semiporcelain, Harker Pottery Co., East Liverpool, Ohio.
14. Warwick China Co., Wheeling, W. Va.
15. Wheeling Pottery Co., Wheeling, W. Va.
16. White granite, Onondaga Pottery Co., Syracuse, N. Y.
17. Vodrey & Bro., East Liverpool, Ohio.
18. Wheeling Pottery Co., Wheeling, W. Va.
19. Hotel china, Potters' Cooperative Co., East Liverpool, Ohio.
20. Steubenville Pottery, Steubenville, Ohio.
21. Underglaze mark, Mayer Pottery Co., Beaver Falls, Pa.
22. Ironstone china, Wheeling Pottery Co., Wheeling, W. Va.

Pl. XII.

1. Rookwood Pottery, Cincinnati, Ohio. One flame was added to the "R" in 1887, and an additional one is added each year.
2. Chelsea Pottery, New Cumberland, W. Va.
3. Belleek ware, Ceramic Art Co., Trenton, N. J.
4. Belleek ware, Willets Manufacturing Co., Trenton, N. J.
5. Belleek ware, Etruria Pottery Co., Trenton, N. J.
6. Pearl gray ware, Goodwin Pottery Co., East Liverpool, Ohio.
7. Semivitreous china, Mayer Pottery Co., Beaver Falls, Pa.
8. C. C. ware, Goodwin Pottery Co., East Liverpool, Ohio.
9. Sanitary ware, Bellmark Pottery Co., Trenton, N. J.
10. New England Pottery Co., Boston, Mass.
11. Underglaze mark, Ohio Valley China Co., Wheeling, W. Va.
12. Chelsea Art Works, Boston, Mass.
13. Sanitary ware, Keystone Pottery Co., Trenton, N. J.
14. International Pottery Co., Trenton, N. J.
15. Underglaze mark, white granite ware, Willets Manufacturing Co., Trenton, N. J.
16. J. E. Jeffords & Co., Philadelphia, Pa.
17. Semiporcelain, Willets Manufacturing Co., Trenton, N. J.
18. Porcelain, Ohio Valley China Co., Wheeling, W. Va.
19. Union Porcelain Works, Brooklyn, N. Y.
20. White granite ware, Cook Pottery Co., Trenton, N. J.
21. Sanitary ware, Maryland Pottery Co., Baltimore, Md.
22. Ironstone china, Crown Pottery Co., Evansville, Ind.



TRADE-MARKS OF AMERICAN POTTERS.



TRADE-MARKS OF AMERICAN POTTERS.

PRODUCTS.[1]

The pottery wares made in the United States include common red earthenware, stoneware, Rockingham ware, yellow ware, C. C. ware, white granite or ironstone china, porcelain, majolica, parian ware, Belleek china, and art pottery.

EARTHENWARE.

This is the product of a natural clay burned hard, but not vitrified. Any good brick or tile clay will answer for the purpose. The grade of clay needed being, therefore, easy to obtain, there are numerous small earthenware potteries in nearly every State, whose usual product includes flowerpots and saucers. Some of the larger firms produce elaborate designs in flowerpots or vases and pedestals. These are often called terra cotta.[2]

The production by some Ohio manufacturers of very artistic glazed earthenware jardinières is worthy of mention.

STONEWARE.

This is also made of natural clay, but differs from earthenware in having an impervious or vitreous body. It is glazed either with slip or salt. The burning of the ware and melting of the glaze are done in one operation. Stoneware has three chief uses, namely, for domestic utensils, ornamental articles, and chemical ware. The products of the first two classes, which are manufactured in the United States, include meat jars, butter jars, preserve jars, bean pots, jelly pots, churns, milk pans, filters, jugs, umbrella stands, vases, beer mugs, cuspidors, flowerpots, hanging baskets, milk and mustard pitchers, pie plates, snuff jars, drinking fountains, French pots, stew pans, teapots, custards, shirred egg dishes, match safes, coquilles, bakers, nappies, plates, and jardinières.

The color of stoneware is brown, blue, or gray, depending on the intensity of the firing. White-lined wares are not uncommon.

The surface of stoneware is glazed either with salt, or slip clay obtained mostly from Albany, N. Y. The latter gives a brown color to the ware, while the former makes a transparent coating. Sometimes slip is used to glaze the inside and salt the outside.

Very little decoration is used on stoneware, but, if attempted, it consists of raised designs or patterns etched with a dull point. Blue is a common decorative color.

Many stoneware jardinieres are made which are decorated with colored glazes and floral patterns. The colors include blue, olive green, brown, yellow, etc.

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[1] Art tiles are not included under this heading.

[2] Terra cotta proper, however, should be restricted to ornamental burned clay ware for structural purposes.

The manufacture of stoneware cooking utensils which can be set directly on the fire is a somewhat recent introduction, as compared with the other grades made. In such ware the body is not vitrified, although burned very hard.

Stoneware is produced at many localities in this country, the clays often being obtained in the vicinity of the factory, although much stoneware clay is mined in New Jersey. Ohio is the largest producer of stoneware in the United States, with many factories at Zanesville and Akron. Other works are located at Poughkeepsie and Rochester, N. Y.; Beaver Falls and Philadelphia, Pa.; Stephens Pottery, Ga.; Red Wing, Minn., as well as at various points in Indiana, Massachusetts, Texas, Colorado, Tennessee, Maryland, Iowa, and California.

The manufacture of chemical stoneware, which it is hoped will some day become an important branch of the stoneware industry in this country, is at present carried on only in Philadelphia, Pa.; Akron, Ohio, and Oakland, Cal. The wares include acid receivers up to 85 gallons capacity, coolers or precipitating jugs up to 500 gallons capacity, strainers, acid jugs, pipe, stopcocks, sleeves, round pans, connecting pipes, crystallizing pans, etc.

YELLOW AND ROCKINGHAM WARE.

These two grades are, like stoneware, made of natural clay (although mixtures of several clays may be used), but differ from stoneware in having a porous body. The ware is first burned in the biscuit kiln to a hard product which cannot be scratched by a knife. This is covered with a lead glaze and subjected to a second firing. Rockingham ware has a brown glaze, colored by manganese, while in yellow ware the glaze is transparent and the color of the body shows through it.

The variety of articles made is fewer than in stoneware, and they are mostly domestic utensils. They include teapots, kettles, bakers, lipped bowls, jars, bedpans, cake pans, puff cups, jugs, mugs, nappies, pie plates, slop pails, cuspidors, soap dishes, pipkins, footwarmers, tureens, cow creamers, pudding molds, and stew pans. The localities of production are very nearly the same as in the case of stoneware, Ohio being the largest producer.

C. C. WARE AND WHITE GRANITE WARE.

C. C. ware and white granite or ironstone china are made from different grades of a similar mixture, composed of kaolin, ball-clay, flint, and feldspar. Queensware is a general term used for the lower grades of white ware and also stoneware.

C. C. or cream-colored ware is the lowest of these grades, having a white, porous body and a transparent glaze. The yellowish tint, due to slight amounts of iron in the clays used, has given rise to the name.

In granite ware the same materials enter into the body, but the best grades obtainable are used in order to produce as white a product as possible. Any tendency to a yellow tint in the ware is counteracted by the addition of cobalt. This gives a faint green color, which is far less noticeable. The body of white granite is not vitrified.

C. C. ware, having more ball clay in its body, is easier to mold, and can therefore be made cheaper. White granite ware may contain as much as 60 per cent of kaolin. The proper preparation of the materials entering into the body of these two kinds of ware is very important. The raw materials, after being weighed out in proper proportions, are generally mixed in a "blunger" with water to an even slip. This slip is passed through a sieve covered with silk bolting cloth or wire cloth with 100 or even 120 meshes per inch, to remove any impurities that may have crept in and also to insure an even-grained texture to it. Loss may result at this point from the loss of fluxes if they have not been perfectly ground, or if the slip is too thick pieces of clay may not pass through. The cobalt is generally added as a solution to the slip. The slip is then forced into the filter presses, where the water is expelled. It is then wedged and molded.

The biscuit ware, or that resulting from the first burning, is porous, and can not be scratched with a knife. Biscuit ware that is too dense will not retain the dip of glazes evenly and perfectly on its surface.

The glaze used consists of a frit of borax, boracic acid, feldspar, and whiting, with the addition of white lead. These materials are applied to the biscuit in the form of a slip. An increase of the lead and boracic acid renders the glaze more fusible and brilliant, but less white and softer.

C. C. ware and white granite are both extensively manufactured in the United States. About the same line of articles is made in both grades, and includes all forms of table dishes and cooking utensils, toilet wares and many common ornaments. The granite ware is usually stamped with the characteristic figure of the lion and the unicorn, while underneath is the name or initials of the firm.

The clays used in the manufacture of these wares are obtained largely from this country, ball clay coming from Kentucky, Missouri, New Jersey, and Florida; while kaolin is procured in North Carolina, Pennsylvania, Delaware, Missouri, and Massachusetts. Flint is obtained from Maine, Connecticut, Illinois, and Alabama; and feldspar from Maine, Connecticut, New York, Pennsylvania, and Maryland.

Considerable quantities of ball clay and kaolin are imported from England, largely because they can be obtained cheaper.

Trenton, N. J., is the center of the C. C. and white granite ware industry in this country, with East Liverpool a close second, but much is also made at Wheeling, W. Va.; Beaver Falls, Pa.; Evansville, Ind., and Baltimore, Md.

Very little decoration is applied to C. C. ware, but the white granite is often profusely ornamented. This decoration varies from a plain band, sometimes with gilt edges, to an elaborate filled print design, with gold illumination or stippling. The prints are both underglaze and overglaze. A larger proportion of underglaze work is done at Trenton than at East Liverpool.

DELFT WARE.

Much pottery having a white granite or semiporcelain body and with blue decoration, in imitation of Delft ware, is made in this country at Trenton, N. J., and Baltimore, Md. The articles, which are usually decorated under the glaze, include ornaments of various shapes, fern dishes, jardinières, and clocks. Much of this ware is an excellent imitation, and large quantities of it are being sold, the retail dealers frequently disposing of it as imported ware, there being commonly no trade-mark on it.

SANITARY WARE.

This usually has a body of similar composition to that of white granite ware, but it is sometimes of a vitreous or nonabsorbent nature. This branch of the pottery industry has assumed vast proportions in the last few years, especially at Trenton, N. J., where the largest number of sanitary-ware factories are situated. Others are located at Baltimore, Md.; Wheeling, W. Va., and Kokomo, Ind.

The products include closet-bowls, urinals, kitchen sinks, washtubs, wash basins, and bath tubs. Of these the first two and the last are the most important products. The closets and wash basins are usually decorated, and often very elaborately, the ornamentation of the former being frequently accentuated by the production of a relief design, whose prominent parts are touched up with gold. The decoration generally consists of filled-in prints applied either under or over the glaze. It is evident that the manufacture of such large and heavy articles requires the greatest care at every stage in the process. According as the body is porous or vitreous, we have sanitary earthenware or vitreous sanitary ware. On account of its nonabsorbent properties. the latter is much to be preferred.

Wash basins and closet-bowls are formed in molds. The closets are molded in several pieces, which are joined together before burning. Larger articles, such as washtubs, sinks, and bath tubs, are built up in sectional plaster molds. The glaze is applied to the interior of these by means of a brush. The drying of these larger articles must proceed very slowly, a bath tub requiring several weeks to dry, and two to three weeks to burn. This is done in a muffle kiln.

PORCELAIN OR CHINA.

This has the same ingredients as granite ware, but in different proportions, so that the body of the ware is vitreous, and the ware is translucent when held to the light. The term porcelain is usually restricted to thin china. The glaze of china generally has the same constituents as the body, but the fusible elements are present in greater proportions. Some manufacturers increase its fusibility by lead, though the glaze of true porcelain should contain none.

The amount of porcelain made in this country is of course smaller than the C. C. ware or white granite ware, and the articles are generally table and toilet wares and ornaments. Table wares are made at Trenton, N. J.; East Liverpool, Ohio; Wheeling, W. Va., and Brooklyn, N. Y.

BELLEEK WARE.

Belleek ware, or eggshell china, is a high grade of porcelain of unusual thinness and delicacy. It was originally manufactured at Belleek, Ireland, but its production there has died out and the introduction in this country has been attended with the greatest success.

There are several works at Trenton, N. J., making Belleek ware. Most of the articles are for ornamentation and have beauty and artistic merit. The cream enamel surface of some bears a resemblance to Royal Worcester porcelain. Others are finished with a transparent glaze showing the white body color, while the decorations are overglaze. A violet design is a common one. Some underglaze Delft decoration is also done on the Belleek ware.

Belleek wares are generally made by casting.

ELECTRICAL SUPPLIES.

This branch of the porcelain manufacture bids fair to grow with the progress of electrical industry. The supplies consist of insulators, cut-outs, fuse boxes, push buttons, etc. They are generally formed by steel dies. Electrical supplies have a vitreous body and are generally glazed. They are manufactured at Trenton, N. J.; East Liverpool, Ohio, and Brooklyn, N. Y.

MAJOLICA.

This is an earthenware decorated in many colors. These colors are in the glaze which is applied in the form of a slip, either by dipping or with a brush. The ware is fired at a low heat, thereby permitting the use of softer tints. Structurally, majolica is very imperfect. In former years considerable majolica was made in this country, and much of it was of an interesting character, but the quality and price have gone down until now it is one of the cheapest wares made. On account of its cheapness, but rather bright and attractive appearance, it is frequently used by merchants to give away with samples of new brands of wares.

True majolica is manufactured at Trenton, N. J., and unlike most wares made in this country is made entirely of foreign clays. Majolica marbles are made at Akron, Ohio.

What may be designated as a hard-fired majolica is manufactured in Philadelphia.

Majolica has been made in former years in Baltimore, Md., and New York, N. Y., but the factories producing it have turned their attention to other lines of ware of a more marketable nature.

PARIAN WARE.

This product is white, unglazed porcelain, with a dense body and closely resembles Parian marble, whence the name of Parian ware. This class of goods is used somewhat for the manufacture of ornaments and small busts. Trenton is at present the only producer.

THE POTTERY INDUSTRY, BY STATES.

CALIFORNIA.

This State has the most active potteries along the Pacific Coast. The recent exhibit at the Cotton States and International Exposition, held in Atlanta, Ga., in 1895, demonstrated the ability of the California potters to produce some excellent white wares for toilet, table, and ornamental uses, as well as colored glaze jardinières. There are a number of small works, but the important producers in the State are as follows: Acton Brick and Pottery Company, Acton; Mount Diablo Pottery and Paving Brick Company, Antioch; California Pottery and Terra Cotta Works, San Francisco; A. Steiger & Sons' Brick and Pottery Works, San Francisco; The Oakland Art Pottery and Terra Cotta Company, Oakland; A. Clark & Son, San Francisco; Gladding, McBean & Co., San Francisco. The last firm produces stoneware (domestic and chemical), earthenware flowerpots and vases.

COLORADO.

Stoneware is made at Denver by the Queen City Pottery Company and the Denver Porcelain and Stoneware Company. Their clays are obtained in large part from Golden. Other concerns in the State are the Pueblo Pottery Company, of Pueblo, and the San Juan Broom and Pottery Company, of Durango. The industry was not very active in 1895.

ILLINOIS.

Very little pottery clay is mined in Illinois, but considerable quartz for china manufacture is obtained from Lasalle County. C. C. ware, white granite, and semiporcelain ware are made by the Peoria Pottery Company at Peoria. The products are plain white or decorated overglaze. This is probably the most western factory making white ware.

INDIANA.[1]

CLAYS.

The kaolin or indianite of this State is well known. The most important deposits are near Lawrence, 4 miles south of the Baltimore and

[1] See Twentieth Ann. Rept. Geol. Survey, Indiana.

Ohio Southwestern Railway. The kaolin bed varies from 4 to 11 feet in thickness. It is nonplastic, white, and either massive or concretionary. The following analysis was made by Dr. J. N. Hurty:

Analysis of kaolin from Lawrence, Ind.

	Per cent.
SiO_2	44.75
Al_2O_3	38.69
Fe_2O_3	.95
CaO	.37
MgO	.30
K_2O	.12
Na_2O	.23
H_2O	15.17
Total	100.58

The material has in the past been chiefly used by paper manufacturers.

Most of the pottery clays mined within the State are a grade of fire clay, and are used for making stoneware or saggars. The stoneware clays are especially abundant within the coal area of Indiana. Prominent among these is a bed at Annapolis, Parke County, which is 22 feet thick. It contains more or less impurities, but when washed and mixed with one-eighth fire clay makes an excellent grade of stoneware. The bed at Huntingburg is one of the best pottery clays in southern Indiana. It is 5 feet 10 inches thick and has been worked for a number of years. The firms now mining at this locality are Bockting Bros., Benighof, Uhl & Co., and V. Waltz. The analysis of this clay is:

Analysis of stoneware clay from Huntingburg, Ind.

	Per cent.
SiO_2	69.23
TiO_2	1.50
Al_2O_3	18.97
Fe_2O_3	1.57
FeO	.12
CaO	.36
K_2O	2.27
Na_2O	.33
H_2O	5.46
Total	99.81

At Cannelton, Perry County, there is said to be an excellent bed of stoneware clay several feet thick under the "Upper Coal." Other localities are Shoals, Martin County; Brazil, and Clay City, Clay County; and Troy, Perry County.

PRODUCTS.

Red earthenware and stoneware are common products. Stoneware is made at Annapolis by Atchison and Lee; Bloomingdale, Dr. J. L. Myers; Rockville, J. H. Baker & Son; Brazil, Torbett and Baker; Clay City, Beryl Griffith; Worthington, G. Baker; Shoals, Indiana Clay and Specialty Works; Huntingburg, V. Waltz; Cannelton, A. D. Clark and the Cannelton Stoneware Company; Evansville, Indiana Pottery Company; Spencer, Woods Bros. White granite or ironstone china is made by the Crown Pottery Company at Evansville. These two grades are generally made in plain white, and consist of dinner and toilet wares and druggists' sundries. A similar line of wares is made with decorations.

These wares are also made at Kokomo, by the Great Western Pottery Company. Their decorations are entirely underglaze. Their specialty is sanitary earthenware. Queensware is produced by Otto Bish at Frankfort.

IOWA.[1]

Iowa does not support a very extensive pottery industry, and potteries are rather rare. The three formations which have supplied more or less pottery clay are the Coal Measures, Cretaceous, and the Maquoketa shales, all of them sedimentary deposits. Most of the pottery is made from the Coal Measure clays.

In the central part of the State the pottery industry assumes some dimensions, as at Fort Dodge, Boone, Des Moines, Cedar Falls, and Ottumwa. At all of these places the fire clays of the Coal Measures are used, the clay coming from some neighboring coal mine or surface pits. The ware is chiefly crocks, jugs, flowerpots, and similar articles. Black, yellow, and gray stoneware are made. Many clay toys are manufactured in the region of Fairport. There are also rather extensive works at Sioux City and Redoak. These two use Cretaceous clays. No fine ware is made in Iowa.

MARYLAND.

CLAYS.

Maryland has comparatively few developed deposits of pottery clays. Colored clay used in the manufacture of red earthenware and stoneware is not uncommon, and a large amount of it has been obtained within the city limits of Baltimore where street openings or excavations for foundations have been made. Flint is mined at Darlington.

PRODUCTS.

The center of the pottery industry in Maryland is at Baltimore, and the output includes all grades from common red earthenware to white ware. The firms are:

D. F. Haynes & Son: Dinner and toilet wares in various styles of

[1] Mr. H. F. Bain, assistant State geologist, has kindly furnished the writer with much information.

decoration. The firm makes a specialty of clocks and lamps, being very successful with underglaze Delft decoration. Edwin Bennett Pottery Company: Though making a full line of plain white granite wares, their output also includes plain print underglaze decoration in several colors, and semiporcelain with colored and gold decorations. Their specialty is colored glaze jardinières, cuspidors, and teapots. A recent introduction consists of clay painted wares. Every white-ware manufacturer uses a mixture of clays from the different States producing these plastic materials.

The Maryland Pottery Company is the only one in the State making vitreous sanitary ware, and was one of the earliest in the country to introduce it. In former years their raw materials used were exclusively native, but now some foreign clay is used. The decoration of their wares is entirely overglaze. The other firms in Baltimore are L. Leopold & Co., C. C. ware; W. L. Paterson, Rockingham, yellow, and stoneware, and flowerpots, the clays used being obtained mostly from within the city limits; M. Perine & Son, Rockingham ware, white-lined ware, and flowerpots; James Whipfield, flowerpots.

MASSACHUSETTS.

CLAYS.

Hardly any pottery clays except those used for common red earthenware are known to exist within the State. These are obtained in the vicinity of Cambridge. A deposit of kaolin, which has been a profitable source of material, has been mined for several years at Blandford, but all the other clays used are brought from other States. Kaolin is also said to occur near Ashleyfalls, Berkshire County, but it has never been used for pottery purposes.

PRODUCTS.

Most of the pottery establishments are in the eastern part of the State. Common flowerpots and brown earthenware are made by Bullard and Scott at Cambridgeport, from clays obtained at Cambridge. Similar wares are produced from the same clays by A. H. Hews & Co., North Cambridge, Mass. They also make a specialty of cuspidors and jardinières, the latter being finished in imitation of underglaze colors. Glazed earthenware jardinières and flowerpots are manufactured at West Brookfield and by the Washacum Pottery Company at Sterling.

The New England Pottery Company of East Boston is the only producer of C. C. ware in the State. At one time they also manufactured wares with colored glazes, but their specialty now is porous jars for filtering and electrical purposes.

The Chelsea Pottery Company of Boston has produced some vases which are claimed to be after the long lost art of the "Chinese Dragon's Blood," and their crackleware plates have much artistic merit.

MINNESOTA.

Earthenware and stoneware, which are the only pottery products of the State, are made entirely from local clays.

The stoneware factories at Red Wing are quite extensive. The following are the Minnesota pottery producers: Red Wing Pottery Works, Red Wing; Red Wing Stoneware Company, Red Wing; Union Stoneware Company, Red Wing; Mr. Stoeckert, New Ulm.

MISSOURI.

The Coal Measure clays and residual clays derived from the weathering of Carboniferous shales are much used by pottery makers. Ball clay is mined at Regina, and kaolin at Glen Allen by Mr. J. H. Maudle. China clays are said to occur in Franklin, Crawford, Jefferson, and Cape Girardeau counties; kaolin occurs in Bollinger, Howell, Wright, and Reynolds counties; feldspar in St. Genevieve County, and flint in Franklin, Jefferson, and Cape Girardeau counties.[1] So far as is known few of these deposits are mined.

PRODUCTS.

Mr. H. A. Wheeler informs the writer that there are no white-ware factories in the State, but that many stoneware potteries are in operation, especially in the region about St. Louis and Kansas City. The following manufacturers of flowerpots and stoneware are located in the latter region:[2] Clinton Pottery Company, Clinton; North & Reeves, Clinton; Calhoun Pottery, Calhoun; G. A. Jegglin, Calhoun; Darby & Sons, Calhoun; Underwood & Sons, Calhoun; Kansas City Pottery Company, Kansas City; Martin & Sons, Deerfield.

NEW JERSEY.

CLAYS.

The grades of clay mined within the State are yellow ware, stoneware, C. C. ware, white granite ware, and ball clays. The localities at which the clays are obtained and the men engaged in mining are:

Woodbridge: Edgar Plastic Kaolin Company, with mines 4 miles west of South Amboy. The clay obtained is a ball clay, which is washed and sold for use in the manufacture of sanitary ware, white earthenware, and electrical supplies. The clay from the company's mines on the north side of the Raritan River and south of Metuchen is used for saggars.

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[1] Min. Ind., Vol. II, p. 198. [2] Bull. Geol. Survey, Missouri, No. 4.

The analysis of the South Amboy clay is:

Analysis of saggar clay from Woodbridge, N. J.

	Per cent.
SiO_2	43.83
Al_2O_3	37.629
Sand	1.06
K_2O	.317
Na_2O	1.124
CaO	.41
MgO	.19
Fe_2O_3	.97
H_2O	14.47
Total	100.00

J. H. Leisen's clay bank is at High Hill, near Woodbridge, and contains stoneware clay, saggar clay, and clay used for sanitary ware. The following section from Mr. Leisen's bank shows how the different beds have particular qualities and, accordingly, different uses:

Section of clay bank at Woodbridge, N. J.

	Feet.
Loam	8–20
Blue sand	2– 6
Blue retort clay	2– 6
Stoneware clay	2– 3
Drainpipe and No. 2 brick clay	3– 5
No. 1 fine clay	2– 6
No. 1 blue fine clay	2– 4
Black fine clay	1½
Black saggar clay	1½
Lignite	....
Fine yellow loam	13
Brick clay	18
Fine sand and spar	8

W. Drummond's bank furnishes saggar clay. P. L. Ryan's bank, at the same locality, contains saggar, stoneware, earthenware, Rockingham ware, and flower-pot clays. In W. H. Cutler's bank there are mined ball, stoneware, Rockingham ware, and ball clays. The latter are used in the manufacture of white ware. In J. P. Prall's bank are clays for Rockingham and stoneware and saggars. The clay in Mrs. S. A. Dixon's bank is used for ornamental tile.

An analysis of this latter gave:

Analysis of clay for ornamental tiles, Woodbridge, N. J.

[J. G. Pohle, analyst.]

	Per cent.
SiO_2	61.60
Al_2O_3	28.38
TiO_2	3.60
CaO	.46
MgO	.36
Fe_2O_3	.52
H_2O	5.08
Total	100.00

Other miners of pottery or saggar clays at Woodbridge are L. C. Potter, B. Dunnigan, A. Martin, G. W. Ruddy, A. C. Campbell, and D. A. Flood. J. R. Such, at South Amboy, mines ball clay, which is washed and used in the manufacture of semigranite, ironstone china, and sanitary ware.

PRODUCTS.

Trenton.—Nearly all of the pottery manufactured in New Jersey comes from Trenton, which is one of the two great centers of the pottery industry in the country, East Liverpool, Ohio, being the other. The condition of the industry at Trenton can be best seen, perhaps, from the following brief statement of the information collected from the various potters:

Anchor Pottery Company: C. C. ware and white granite table and toilet ware, either plain or decorated.

Bellmark Pottery Company: Sanitary earthenwares and vitreous wares, including closets, basins, washtubs, sinks, and bath tubs. Some decoration used. Mortars and pestles are also made.

Brian-Coxon Pottery Company: This company is engaged solely in making bath tubs and washtubs. These have an earthenware body and glazed lining. No decoration is used.

Ceramic Art Company: One of the firms making the Belleek ware in various styles, often decorated with a violet design.

Coalport Pottery Works: This firm also makes a specialty of sanitary earthenwares, including closets and wash basins, both for houses and railroads. Decorations are sometimes used and are both underglaze and overglaze.

Cook Pottery Company (Etruria Works): While a large line of C. C. tablewares are made by this firm, their specialties are fancy Belleek goods of various shapes, and also jardinières, pedestals, and ferneries decorated mostly in delft designs of the usual color. The body of the ware is porcelain.

Dale and Davis: C. C. ware.

Eagle Pottery: Engaged in making the usual line of C. C. and white granite wares, although the firm has specialized somewhat in ornamental pottery.

Egyptian Pottery: Sanitary earthenware.

Glasgow Pottery: Also producers of white granite and C. C. ware as well as semiporcelain. These grades are generally made in various characteristic patterns. The decoration is both underglaze and overglaze. A specialty is hotel china.

Greenwood Pottery: Vitrified china, decorated in various styles of underglaze and overglaze prints, the former being a specialty. Several new designs have been introduced in the past year.

International Pottery Company: White and decorated granite ware of high quality and porcelain tablewares. The products are printed, painted, gilded, or enameled. A specialty is their royal blue decorated porcelain, with blue flowers or border illuminated with gold. Much of this is decorated underglaze.

Keystone Pottery Company: Entire production is sanitary earthenware and vitreous ware, including wash basins and closet-bowls. The decoration is both underglaze and overglaze, and the pattern is usually a wreath design illuminated with gold.

John Maddock's Sons: Plain and decorated white granite table and toilet ware.

Thos. Maddock & Sons: C. C. and white granite, table, and toilet wares.

Mayer Pottery Company: Plain and decorated white granite ware, but making large quantities of majolica at present. The shapes are plates, pitchers, and mugs, decorated with glazes of various colors.

Monument Pottery Company: Vitreous sanitary ware.

Trenton Fire Clay and Porcelain Company: During the past year this company has begun the manufacture of glaze-lined bathtubs, washtubs, and sinks. No decoration is used. They also manufacture saggars.

Trenton Potteries Company: Several of the potteries are consolidated under this name. Their product is white granite and sanitary earthenware.

Willetts Manufacturing Company: The output comprises C. C. ware, ironstone china, and semiporcelain, table, and toilet wares. They are decorated chiefly with underglaze prints, the usual colors being brown, dove, and olive, with gold edging or stippling. A large number of designs in Belleek ware, both glazed and enameled, with plain gold or colored decorations, are a specialty. Considerable underglaze delft decoration is done by them on Belleek ware. Vitreous and earthen sanitary wares, both plain and decorated, are made. Recently this company has begun the manufacture of parian ware busts.

Elizabeth.—The only firm at this locality is L. Beerbower & Co. Their output consists of C. C., semigranite, and white granite ware, both plain and decorated. They have a specialty of colored glazed jardinières.

Haddonfield.—Chas. Wingender & Bros.: Fancy and artistic jars, coolers, and beer mugs.

NEW YORK.

CLAYS.

New York is destitute of any extensive deposits of pottery clays. The Albany slip clay, which is mined at Albany, N. Y., is of great importance, and is shipped to potteries all over the country. Its value lies in the easy fusibility and the uniform brown color to which it glazes.

Stoneware clays are found on Staten Island, near Kreischerville, and at Elm Point, Glen Cove, and Little Neck, near Northport, all on the north shore of Long Island. Only those from Northport are actually used in stoneware manufacture.

Kaolin does not occur in marketable quantity within the State. Spar is mined in considerable amounts by P. H. Kinkel, at Bedford, N. Y.

PRODUCTS.

Common red earthenware flowerpots are made from local clays near Greenport, L. I., and from Albany clay at Albany and at Fort Edward.

Stoneware is produced at A. Caire's factory, at Poughkeepsie, and also at Rochester. The product is glazed with Albany slip, and includes kitchen utensils mostly. For the body of the ware New Jersey clays are used. Stoneware, some of it of Flemish designs, is made at Utica by the Central New York Pottery Works.

C. C. ware and white granite as well as a semiporcelain is made by the Onondaga Pottery at Syracuse, and the first two grades are also made by the East Morrisania China Works.

The Union Porcelain Works, of Brooklyn, E. D., have been in operation for many years, making semiporcelain and porcelain wares, chiefly for table use. The decorations are overglaze, or an overglaze application of the design, with firing to produce underglaze effect. Considerable quantities of hotel china are made. Electrical goods constitute a second line of wares, and some large porcelain insulators for trolley wires recently made by the company are of special note.

OHIO.

CLAYS.

Ohio stands second to no other State as regards her clay-working industries. No white clay is found in the State, but the fire clays of the Coal Measures form an abundant source of supply for the manufacture of earthenware, stoneware, Rockingham, and yellow wares. The clays for white ware are obtained mostly from Delaware, Kentucky, North Carolina, Pennsylvania, Florida, Missouri, New Jersey, Maryland, South Carolina, and England.

PRODUCTS.

These include earthenware, stoneware, yellow ware, Rockingham ware, C. C. ware, white granite, and porcelain.

Earthenware flowerpots are made at a number of localities by small firms, but there are three large factories engaged in this branch of production, namely, S. A. Weller, and the J. B. Owens Pottery Company, at Zanesville, and the Roseville Pottery Company, at Roseville. These firms have also been very successful in the making of internally glazed cuspidors.

Stoneware is made in large quantities near Zanesville and Akron. The products include the usual line of articles. Ohio is the largest producer of stoneware in the Union, as the following list of manufacturers indicates: Atwater, Gerhardt and Goodman; Canton, Canton Stoneware Company, Champion Stoneware Company; Crooksville, Burley and Winters, Crooksville Stoneware Company, Star Stoneware Company, Diamond Stoneware Company; Deavertown, Conway, Watt and Allen; Limaville, Kuntz & Sons; Massillon, Massillon Stoneware Company; Mogadore, Myers and Hall, T. S. Monroe & Sons, Shattuck and Hill; Roseville, Midland Pottery Company, L. S. Kildow; Salineville, Standard Pottery Company; South Zanesville, South Zanesville Stoneware Company, South Zanesville Clay Manufacturing Company; White Cottage, Wilson and Williams, Reed Bros., and Settles Estate; Zanesville, Bagley and Roberts, Zanesville Stoneware Company, Muskingum Stoneware Company.

Yellow and Rockingham wares are made in shapes similar to those of stoneware, but the variety of articles is smaller. The clays used are mostly local, and the colors of the product yellow and brown. One firm, the Globe Pottery Company, has recently begun the use of colored glazes. The producers of yellow and Rockingham wares in Ohio are fewer in number than the stoneware manufacturers. They are: Akron, Whitmore, Robinson & Co.; Cincinnati, J. Fisher & Sons; East Liverpool, J. W. Croxall & Sons, Globe Pottery Company, D. E. McNicol Pottery Company, McDevitt and Moore, and the C. C. Thompson Company; East Palestine, East Palestine Pottery Company; Wellsville, J. Patterson & Sons.

Starting with Rockingham and yellow ware manufacture at East Liverpool, the potters gradually drifted into the manufacture of white wares, so that now C. C. ware, white granite ware, and porcelain are important factors in the pottery industry at this locality. Probably less vitreous china is made at East Liverpool than at Trenton. Neither is much sanitary ware made. The firms and their specialties are as follows:

Burford Bros. Pottery Company: White granite ware, usually decorated; and if so, this is done over the glaze.

East End Pottery Company: Granite ware and "Columbia china," decorated both under glaze and over glaze (chiefly the former) in different styles and colors.

Goodwin Pottery Company: Overglaze decorated C. C. wares for dinner and toilet sets.

Harker Pottery Company: White granite table and toilet wares. Decoration mostly in overglaze prints, but some underglaze work is also done.

Potters' Cooperative Company: White granite and china. Decorations used, but all overglaze.

Sebring Pottery Company: White granite and china. The manufacture of the latter has just begun.

R. Thomas & Sons Company: Doorknob tops and porcelain insulators for electrical purposes.

C. C. Thompson Pottery Company: C. C. ware, with decorations, mostly underglaze.

Union Cooperative Pottery Company: White granite ware, decorated either overglaze or underglaze.

Vodrey & Bro.: C. C. ware and white granite ware. Dinner, tea, and toilet wares, both plain and decorated, the latter mostly overglaze, although some underglaze work is done.

Other C. C. ware producers at East Liverpool are the D. E. McNicol Pottery Company and Cartwright Bros., while white granite ware is made by William Brunt, Son & Co. and Wallace & Chetwynd. China is made by Knowles, Taylor & Knowles.

At Akron; the Akron China Company: White granite ware, plain or decorated overglaze. The American Marble and Toy Manufacturing Company: Marbles of majolica and white earthenware and electric insulators.

At Steubenville, Steubenville Pottery Company: White granite ware (manufactured since 1881) and semiporcelain, called "Canton china," added since then. The forms are dinner and toilet sets, children's dishes, and jardinières. The decorations are filled-in prints, illuminated with gold; also gold stippling, bands, and traced work.

At Wellsville, the Wellsville Pioneer Pottery Company, producers of white granite table and toilet wares, and jardinières, with both underglaze and overglaze decoration. J. H. Baum: White granite. White granite is also produced at East Palestine by the East Palestine Pottery Company.

Toronto: The Toronto Pottery Company.

Tiltonville: Western Sanitary Ware Company.

Findlay: Bell Bros.

Tiffin: Brewer Pottery Company.

Cincinnati: Brockman Pottery Company, George Scott's Sons.

Art pottery.—The product of the Rookwood Art Pottery, of Cincinnati, has been already mentioned. It compares favorably with anything of a similar nature made in this country and abroad, and represents the successful result of years of patient and persevering work. The body of the ware is made from native clays.

PENNSYLVANIA.

CLAYS.

Red earthenware clays and stoneware clays are to be found at a number of localities, but the important clay material mined in the State is the kaolin at Brandywine Summit, Delaware County. This is mined by two firms—the National Kaolin and Feldspar Company, and the Brandywine Summit Kaolin Company. The kaolin results from the decay of a granite or feldspar vein. Before shipment to market it is washed to separate the quartz and mica. [1]

PRODUCTS.

Beaver Falls is an important locality of pottery productions, but several works are located at Philadelphia and other localities.

At Beaver Falls semivitreous china is made by the Mayer Pottery Company, the products including dinner, tea, and toilet wares, decorated by hand or by printing, either underglaze or overglaze. The underglaze work is in plain prints or illuminated with gold. A specialty is colored glaze jardinières, teapots, cracker jars, etc. Some of the colored glazes used have been very successful, especially an olive green.

Stoneware is produced at New Brighton by the Pittsburg Clay Manufacturing Company, Sherwood Bros., and the Enterprise Pottery Company, and at Fallston by the Fallston Pottery Company.

At Philadelphia sanitary earthenware is produced by J. E. Jeffords & Co. They originally manufactured yellow, Rockingham, white-lined, and buff stonewares, but in recent years they have added a variety of articles in colored glazes with a stoneware body. These consist especially of teapots and jardinières.

Chemical stoneware and porcelain are also produced in Philadelphia by R. C. Remmey, some of the vessels having a capacity of 500 gallons. In addition to these, Mr. Remmey also produces stoneware mugs, pitchers, cuspidors, money banks, and porcelain-lined bath tubs.

WEST VIRGINIA.

CLAYS.

So far as is known, no clays for pottery of a higher grade than red earthenware, or perhaps stoneware, are obtained from West Virginia.

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[1] See Second Geol. Survey Pennsylvania, Report of Progress, 1885.

All the manufacturers of white ware obtain their clays in varying quantities from Pennsylvania, Delaware, New Jersey, Florida, Kentucky, North Carolina, and England.

PRODUCTS.

Most of the pottery works are at Wheeling.

White granite, C. C. ware, and semiporcelain are made by the Wheeling Pottery Company in a variety of styles, one shape, "La Belle china," being a specialty. The decorations are mostly overglaze, but some underglaze work is done, notably in blue and gold table sets. They also make jardinières and umbrella jars of similarly decorated wares, which are very artistic in character. Some sanitary earthenware is also produced.

The Warwick China Company makes only semiporcelain dinner, tea, and toilet ware, the decorations of which are mostly overglaze solid colors, or scroll and spray patterns.

Those who visited the ceramic exhibit at the World's Fair may remember the unique wares exhibited by the Ohio Valley China Company. Their porcelain vases with royal blue glaze and gold decoration with gilt intertwined handles are objects of great beauty. The decoration is all overglaze. The company also makes a line of plain and decorated porcelain table wares.

White granite and semiporcelain dinner and toilet wares are made at New Cumberland by the Chelsea China Company in both underglaze and overglaze decorations.

SOUTHERN STATES.

CLAYS.

Little work has been done on the pottery clays of the Southern States, and their extent and value are comparatively unknown, but experiments are going on in several localities at present which will no doubt prove the existence of very desirable materials.

The plastic china clay of Florida (described in another portion of this report) and the kaolin of Dillsboro, N. C., are well known. Some flint is also mined in Alabama.

Ball clay is mined in large quantities 4 miles south of Mayfield, Ky. The bed is about 40 feet thick, but only the upper 30 feet are mined. It is used in the manufacture of white ware and art tile, and is shipped to Beaver Falls, Wheeling, Zanesville, Steubenville, East Liverpool, and points in Indiana and Illinois.

The following analysis represent the average composition of the complete section:

Average composition of clay from Mayfield, Ky.

[R. Peter, analyst.]

	Per cent.
SiO_2	56.40
Al_2O_3	30.00
CaO	.40
MgO	Trace.
K_2O	3.26
Na_2O	2.01
Moisture	7.93
Total	100.00

PRODUCTS.

All the manufacturers obtain their clay in the vicinity of the works.

Common earthenware and stoneware are produced by Stevens Bros. & Co., at Stephens Pottery, Ga., and the Landrum Pottery Company, at Columbia, S. C., is making glazed red earthenware. At Mohawk, Tenn., the Columbian Pottery Company turns out stoneware jars and jugs which are salt glazed outside and slip glazed inside.

Similar grades of ware are made by the Stonington Brick and Pottery Company, Stonington, Miss., and at New Orleans, La., by the American Pottery Works, Magnolia Pottery Works, and Charles Macket.

The Athens Pottery Company, of Athens, Tex., is also a producer of stoneware, which is made from clay obtained 1 mile from Athens. The glazes used on the ware are salt glaze outside and Albany slip inside.

NOTES ON THE FLORIDA CLAYS.

Florida has two classes of clay materials, kaolin and brick clays.

KAOLIN.

This material occurs at several points in the north central portion of Florida, and the different areas probably represent portions of a formerly continuous bed. It is undoubtedly of sedimentary origin, and the occurrence of such an extensive deposit so free in most instances from impurities is indeed remarkable. The usual consistency of the mass is a mixture of kaolin and white quartz pebbles, the latter forming 65 to 75 per cent of the whole, so that for every ton of washed kaolin about 4 tons of raw material have to be mined. The quartz pebbles vary in size from the dimensions of a pin head to a diameter of three-quarters of an inch, and they are frequently flat. The largest ones seem to occur chiefly at the northern end of the area over which the kaolin is found. If these deposits were near to pottery centers, or if freight rates were lower, these quartz pebbles would no doubt form a good grade of flint for potters' use.

The location of the kaolin deposits is as follows: There is a large bed at Edgar, Putnam County. This point is on the narrow-gauge road between Palatka and Ocala, and about 50 miles southwest of Jacksonville. The region is comparatively flat and thinly wooded. At this place the Edgar Plastic Kaolin Company has an extensive pit nearly 40 feet deep, and exposing about 30 feet of kaolin. The section in their mine is approximately as follows:

Section of the kaolin deposit at Edgar, Fla.

	Feet.
Top soil	8
Impure upper kaolin	8-10
White kaolin	25
Green clay	....

The thickness of the green clay is not known exactly, but it is probably inconsiderable. At other localities this green clay rests on limestone.

An analysis of the washed kaolin from Edgar, Fla., is as follows:

Analysis of washed kaolin from Edgar, Fla.

[C. Langenbeck, analyst.]

	Per cent.
SiO_2	45.39
Al_2O_3	39.19
Fe_2O_3	.45
CaO	.51
MgO	.29
Alkalies	.83
H_2O	14.01
Total	100.67

Another but more extensive area of this kaolin occurs along the Palatlakaha River, south of Leesburg, Lake County. Leesburg is 30 miles southeast of Ocala and near Lake Harris. The Palatlakaha

River flows into Lake Harris from the south. Some kaolin was found in a well driven in the town of Leesburg, and there is also an outcrop of the material on Main street on the edge of the town. The material here is very impure and heavily stained in places with iron. Its only use is for road-metal.

The large kaolin tract begins about a mile south of Lake Harris and extends along both sides of the river nearly to Villa City. Throughout this belt there is an overburden of about 3 feet of loose sand, and underneath this is the kaolin, which varies in depth from 10 to 30 feet. The upper portions of the material are sometimes slightly stained with iron, but as a rule the material is very white. It may be said in general that the material is finer at the lower end of the belt. It is frequently well exposed in the bluffs along the river, which stand out with glistening whiteness in the sunlight. The only point at which this bed is being worked is the bank on the property of Dr. J. F. Richmond, on the Palatlakaha River, 4 miles south of Leesburg. The kaolin deposit at this point is 25 to 30 feet thick, and is overlain by 3 feet of sand. The clay is not quite so pure in the upper portion of the bank. A "horse" of yellowish sand occurs in the middle of the bank on the north side of the excavation, but this portion is not mined. At the bottom of the kaolin a thin bed of greenish clay is encountered, and this in turn rests on limestone.

What is probably a continuation of the Palatlakaha bed occurs at Bayside, east of Villa City. The material is finer grained than the other, but contains more mica.

An analysis of the washed kaolin from along the Palatlakaha River showed:

Analysis of washed kaolin from the Palatlakaha River.

	Per cent.
SiO_2	46.11
Al_2O_3	39.55
Fe_2O_3	.35
MgO	.13
H_2O	13.78
SO_3	.07
Total	99.99

Still another area, and an undeveloped one, occurs at Bartow Junction, Polk County, about 45 miles a little north of east from Tampa and on the South Florida and Western Railroad. Very little exploiting has been done, so that not much is known concerning the extent of the bed, but about three-fourths of a mile from the station, at the south end of a lobe of Sloop Lake, a test pit was sunk to a depth of about 12 feet. The section showed 5 feet of sandy clay, and under this 18 inches to 2 feet of sandy kaolin stained with iron oxide, followed by white kaolin. This is on the property of Mr. A. E. Parslow, of Tampa. According to Mr. Potter, of Bartow Junction, another boring was made about 300 feet farther south and showed a similar section.

In the railroad cut of the Bartow branch of the Savannah, Florida and Western Railroad, and about 1,000 feet from the station, the same material is exposed. The section shows 4 to 5 feet of loose sand and under this 6 to 8 feet of kaolin streaked with iron oxide stains. The material would no doubt become whiter with the depth.

Washing the kaolin.—As will be noticed from the above description, the kaolin is being mined at only two localities, namely, on Dr. Richmond's property south of Leesburg, and at Edgar.

The methods used for mining and washing are similar, but have certain important differences.

At Dr. Richmond's deposit the clay is mined by pick and shovel and loaded on a small car, which is hoisted to the top of an incline, where the clay is dumped into a vat. A powerful stream of water is turned onto the clay, and it is washed into a long sluice. At the beginning of this trough there are three wooden wheels with iron scoops. These revolve as the material is being washed down the trough, and the scoops catch up a large amount of the coarse sand as it rushes down. As each scoop reaches an inverted position, due to the revolution of the wheel, the sand is dropped into a neighboring box. The sluice or trough along which the water with suspended kaolin, sand, and mica passes is 350 feet long, and consists of connected sections arranged side by side. The current is considerably slower at the lower end of the trough, and most of the sand and mica have been dropped. The water with the suspended kaolin then passes through an 80-mesh screen, to remove any remaining mica flakes or pieces of foreign matter, to the settling tanks, where the kaolin settles. The supernatant liquid is drawn off, and the slip-like mass of kaolin and some water is pumped into the presses, where the water is forced out. The pressed kaolin is then put on the drying racks, and subsequently shipped. Dr. Richmond ships his kaolin from Okahumpka, on the Florida Southern Railroad, about 2 miles distant.

The works of the Edgar Plastic Kaolin Company are much larger and among the best equipped in the country. The deposit is worked on a different plan from Dr. Richmond's. The bottom of the pit is filled with water, in which there floats a large platform with the pump and scraper. A scraper loosens the clay and sand, and it is sucked up through a large pipe and discharged into the upper end of a long trough, of greater length and width than at Dr. Richmond's. The water with suspended kaolin, after leaving this trough, passes through a revolving screen (which eliminates sticks and other impurities) to the settling tanks. It is pumped from these to the presses, and after removal of the water is carried on an endless belt to the drying racks. The air-dried kaolin is broken into small pieces and shipped in sacks of 200 pounds each.

The Florida kaolins contain very few impurities, and owing to their being plastic after washing they are called ball clay by potters. These kaolins are now shipped to many American potteries and are used in the manufacture of C. C. ware, white granite, and porcelain.

The shrinkage of this kaolin at the fusion temperature of orthoclase is given by Dr. Langenbeck as 15 per cent.[1]

BRICK CLAYS.

There are a number of small brick works in Florida, but most of them are run intermittently to supply the local trade. The following notes were collected by the writer in Florida recently:

Jacksonville: The Jacksonville Brick Company is 2 miles southwest of the town. The clay bank is about 1,000 feet from the yard, and about 15 feet of clay are exposed. The deposit is basin shaped, and is very sandy in its upper portion and very tough in the lower portion. An indistinct horizontal lamination is present in the clay, and the sandy streaks are often highly colored by iron. The pit is about 150 feet long and 50 feet wide. The clay is hauled to the yard in a wire-rope tram. Molding is done in an end-cut stiff-mud machine, and the endless belt on which they are carried to different parts of the drying shed is 900 feet long. Burning is done in a Dennis down-draft kiln.

Ocklocknee: The Tallahassee Pressed Brick Company has its works on the Ocklocknee River 9 miles west of Tallahassee. The clay is dug in the woods on the opposite side of the river. It is a bluish and red clay, rather tough in spots, often apparently containing a considerable percentage of iron oxide. This clay has been deposited by the annual floods of the Ocklocknee River. The bricks are molded in an auger side-cut machine and dried on a steam-heated slat floor. They are burned in a Morrison kiln. The clay does not seem to be able to stand a very high degree of heat.

Mr. W. B. Durr's yard, on the west side of the river, has the same kind of clay as that used at the preceding yard, and it is molded without other preparation than a preliminary pugging in a Cleveland machine.

Bartow: There is a small brick plant at this locality, which is of interest chiefly on account of the curious material used. The yard is operated by Mr. C. H. Irving, and the clay is obtained from a neighboring bank. In the upper portion is a low grade of light-colored pebble phosphate containing a considerable quantity of argillaceous matter. This passes downward into an impure clay, which still contains some small phosphate pebbles, while underneath the clay there is in places a bed of fuller's earth 5 to 6 feet thick. The bricks are

[1] The Chemistry of Pottery, Easton, 1895.

made from the clay under the phosphatic material. It is tempered in ring pits and molded in soft-mud machines, both operated by horse power. The bricks are dried in the sun and burned in scove kilns. The product is very porous, but has a fair ring. The white phosphatic pebbles can be easily seen on breaking the brick open. Like most other Florida brick clays, the material at Bartow will not stand very much heat.

Leesburg: The Keystone Brick Works are 4 miles west of here. Two different beds of clay are worked by the company. In the first bank the layers beginning at the top are black clay, dark-gray clay, mixed white clay, and mixed yellow clay. These have been used together without other admixture, and make a satisfactory brick. The second clay bank contains red sand, stiff gray clay, and stiff white clay. A yellow sandy clay with abundant pyrite nodules overlies the red sand. The mixed clays from the second bank have also been used together, but the brick is not considered as good, and shrinks more in burning. The bricks are now made of a mixture of five cars of clay from the first bank and two cars from the second.

FULLER'S EARTH.

The term "fuller's earth" has been used to include a variety of clay-like substances which have strong absorbent properties. Prof. E. S. Dana[1] defines fuller's earth as including many kinds of "unctuous clays, gray to dark green in color, and being in part kaolin and in part the mineral smectite." It is placed by him with several clay-like minerals (all of them hydrous silicates), namely, smectite and malthacite, of not very definite chemical composition, but all having a high percentage of combined water.

Smectite proper is defined as a "mountain green, oil green, or gray-green clay, from Cilly in Lower Styria."

Malthacite is defined as occurring in thin laminæ or scales, and sometimes massive, with the color white or yellowish. The original occurrence is the result of disintegration in a basalt at Steindörfel, in Lausitz. Beraum, in Bohemia, is another locality.

Judging from the analyses given below, the composition of fuller's earth varies considerably, although this may be due in part to impurities, and indicates that all fuller's earth does not contain a high percentage of combined water, as most books state, nor a large amount of magnesia, as claimed by some.[2] The high percentage of combined water seems to be true of most of the foreign occurrences.

Fuller's earth is generally fine-grained, but nonplastic (thereby differing from true clay), and when thrown into water and broken up forms a somewhat flocculent mass. Even when simply air-dried it adheres strongly to the tongue and thereby shows it absorbent powers.

[1] System of Mineralogy, 1893, p. 695. [2] Muspratt: Chemische Tecknologie, Vol. VI, p. 1311.

FOREIGN OCCURRENCES.

Fuller's earth occurs in Saxony as the result of decomposition of diabase and gabbro.

In England it forms a bed 150 feet thick in the Lower Oolite of the Jurassic.[1] The deposit is argillaceous and extends from Dorsetshire to Bath and Cheltenham.

AMERICAN OCCURRENCES.

The development of fuller's earth in the United States is of comparatively recent date, and has occurred in Florida, Georgia, Virginia, and South Dakota. Fuller's earth was discovered at Quincy, in the northwestern part of Florida, about one and one-half years ago, and its development caused so much excitement that persons all over the State have been searching for the material, with the result of finding much of it, but of variable quality. In the northwestern part of the State, in Gadsden County, fuller's earth has been found around Quincy, Mount Pleasant, Norway, and River Junction. The usual section involved in this region is—

Calico clay (a mottled sandy clay).
False fuller's earth.
Fuller's earth.
Bluish sand, sometimes partly consolidated.

The calico clay is generally of considerable thickness, and the fuller's earth which underlies it has become exposed by erosion, so that around Quincy it is to be looked for in the depressions, or often at the foot of slopes around the edge of the swamps.

Farther west, around Mount Pleasant, Norway, and River Junction, the beds of fuller's earth usually crop out on the sides of the valleys and ravines 30 to 40 feet above the streams. The reason for this may be that in the latter region the bed rises or the valleys are cut down nearer to sea level. Just which is the case is not known, as no levels were obtainable.

The fuller's earth is well exposed at Quincy, where it is being mined by two companies. It occurs there as a fine-grained, nonplastic material, usually thinly laminated, and when dry is hard but brittle. It turns white on drying. In the pit of the Cheesebrough Manufacturing Company the section observed in April, 1896, was—

Soil	18 inches.
Red clay	3 feet.
Blue clay	3 do.
Fuller's earth	5½ do.
Sandy blue earth	3 do.
Fuller's earth (second bed)	

[1] Geikie: Text-Book of Geology, p. 905.

The second bed has been penetrated but recently. Its thickness is not known, but the quality is said to be as good as the upper bed. The main or upper stratum dips slightly to the south, and the amount of overburden varies somewhat, being 8 feet at one time, but usually not more than 3 feet. In some of the test pits that were sunk on the Cheesebrough property a stratum of material was struck which resembled the fuller's earth very closely in appearance, but possessed a very soapy feel and abundant conchoidal fracture. In the general section given above this is designated as "false fuller's earth."

A general feature of all these fuller's earth deposits is that they usually thin out toward the swamps.

Flint and chalky nodules occur in the Cheesebrough pit, and a few sharks' teeth have also been found. There also are found irregular lumps of aragonite or calcite made up of numerous small rounded, milky crystals, or transparent scaly ones. These crystals have formed between the layers of the fuller's earth, and also in the vertical cracks, so that the lumps often have numerous parallel laminæ of the earth projecting from them.

In the Owl Cigar Company's pit, which lies on the opposite side of the town, the fuller's earth is of similar character and varies in thickness from 3 to 4 feet. The overburden is about 3 feet.

Between Mount Pleasant and River Junction fuller's earth outcrops at a number of points, especially south of the line of the Florida Central and Peninsular Railroad. The material is of similar appearance to that at Quincy, but there is usually more overburden. The known thickness of the earth is from 2 to 6 feet. Openings have been made in the properties of Howell, Morgan, Shepherd, and Sadler. Most of the outcrops are along branches of Mosquito Creek.

Fuller's earth is also mined 8 miles north of Quincy, on Mr. Howard's property. The material outcrops at the base of the hill along the highway, and the section exposed is rather unique, on account of the sharp boundary which exists between the overlying red clay and the fuller's earth. The material is also very much drier and consequently more brittle than the material in the Quincy mines. The fuller's earth is said to be 6 feet deep in the main pit, and is underlain by sand rock, but suddenly thins out about 200 feet north of the mine, as can be well seen in the embankment along the road. From here for a distance of 2 miles southward along Willacoochee Creek the earth is said to occur in pockets. Mr. Howard's material is shipped from Faceville.

Another deposit of fuller's earth is found on Lester's property, to the northeast of Howard's, the test pits being in the valley 1 mile northeast of Lester's house.

As the deposits of fuller's earth found in Decatur County, Ga., are so close to those of northwestern Florida it may be well to mention them here.

Several openings have been made on the land of Mr. R. A. Connell south of Whigham, Ga. A rectangular pit 26 feet deep was sunk in the woods 1 mile south of Mr. Connell's house. The lower 6½ feet of the section exposed was fuller's earth, there being therefore an overburden of 19½ feet.

An auger boring made in the bed of the creek a few hundred feet distant showed 10 feet overburden and 1 foot of fuller's earth. Some chert was found in the test pit. Other test pits were sunk on Sears Creek and Wolffs Creek on the same property, and both showed several feet of fuller's earth with 5 to 8 feet of overburden.

Fuller's earth has also been found in the vicinity of Ocala, on Spencer's place, but it is cherty and of poor quality. A bed about 15 feet thick is exposed near the bottom of a sinkhole at Bellevue, about 12 miles from Ocala. It is rather siliceous, and has about 40 feet overburden. If of good quality it could be worked profitably, however.

Considerable fuller's earth occurs in the neighborhood of Port Tampa, and on the Manatee River.

A bed of fuller's earth of good quality and resembling the English material very closely is mined at Fairburn, S. Dak. Some of it was tested with cotton-seed oil and showed excellent decolorizing properties. It is more siliceous than the Florida fuller's earth and possesses a nodular character.

MINING AND PREPARATION.

The Florida earth is usually mined with picks and shovels. A good method is to use mattocks, which shave the material off in thin pieces. This saves subsequent labor in breaking up the fuller's earth after it has been spread upon the drying floor.

After mining, the usual method is to spread the material in a thin layer over a drying floor constructed of planks. It is thus dried in the sun, and in drying it bleaches to a white color. The material is then gathered into sacks for shipment. By this air drying about 50 per cent of moisture is removed. The Owl Cigar Company dry a large portion of their output in cylinder dryers heated by a strong fire. The material passes through these in about four minutes. It is first ground, however. About 6,900 tons were produced in 1895.

USES.

Fuller's earth was originally used for cleansing cloth of grease, and also by furriers for cleansing furs. In the latter case the fur was covered with a considerable quantity of the earth and rubbed or trodden. It has also been used as an absorbent by druggists. At the present day its chief use is for clarifying oils.

In clarifying lard oil the fuller's earth ground to 120 mesh is added to the hot oil and stirred for a short period; the oil is then passed through a filter press, the earth and coloring impurities being left behind. The degree of fineness of the fuller's earth is of great importance, and it is necessary to heat it well before use.

In clarifying lubricating and similar oils the fuller's earth is now being used as a substitute for boneblack. In this case it does not seem necessary to grind the material so fine, and the size to which it is ground varies with the grade of oil to be treated.

Analyses of fuller's earth.

	Smectite from Cilly.*a*	Fuller's earth from Reigate.*b*	*Malthite* from Steindörfel.*c*	Fuller's earth from England.*d*	Fuller's earth from England.*e*	Fuller's earth from Gadsden County, Fla.*f*	Fuller's earth from Decatur County, Ga.*f*	Fuller's earth from Fairborn, S. Dak.*g*	Fuller's earth from southeast of River Junction, Fla.*h*	Fuller's earth from between Mt. Pleasant and Norway, Fla.*i*	Fuller's earth from near Norway, Fla.*j*
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
SiO_2	51.21	53.00	50.17	44.00	44.00	62.83	67.46	58.72	50.70	58.30	54.60
Al_2O_3	12.25	10.00	10.66	11.00	23.06	10.35	10.08	16.90	21.07	10.63	10.99
Fe_2O_3	2.07	9.75	3.15	10.00	2.00	2.45	2.49	4.00	6.88	6.72	6.61
CaO	2.13	.50	.25	5.00	4.08	2.43	3.14	4.06	4.40	1.71	6.00
MgO	4.89	1.25	......	2.00	2.00	3.12	4.09	2.56	.30	3.15	3.00
H_2O	27.89	24.00	35.83	......	24.95	7.72	5.61	8.10	9.60	9.05	10.30
Na_2O	......	......	......	5.00	......	.20	......	} 2.11	......	......	......
K_2O	......	......	......	......	......	.74	......				
Moisture	......	......	......	......	......	6.41	6.28	2.30	7.90	9.55	7.45
Total	100.44	98.50	100.06	77.00	100.09	96.25	99.15	98.45	100.95	99.11	98.95

a Pogg. Ann., Vol. LXXVII, p. 591, 1849.
b Klaproth, Beitr., Vol. IV, p. 338, 1807.
c Dana, System of Min., p. 695, 1893.
d Geikie, 1893, p. 133.
e Penny Encyclopedia, Vol. XI. Dr. Thompson, analyst.
f P. Fireman, analyst.
g E. J. Riederer, analyst.
h Standard Oil Company's property. E. J. Riederer, analyst.
i Howell property. E. J. Riederer, analyst.
j Morgan property. E. J. Riederer, analyst.

CEMENT.

PORTLAND CEMENT.

By Spencer B. Newberry.

PRODUCTION IN 1895.

The production of Portland cement in the United States during the year 1895 reached a total of 990,324 barrels, as compared with 798,757 barrels in 1894, an increase of 191,567 barrels, or 24 per cent. The increase is to be found almost wholly in the output of the larger factories in New York, New Jersey, Pennsylvania, and Ohio, several of which showed nearly double the production reported for 1894. From one small factory in Indiana and one in Utah no returns could be obtained, and it is therefore supposed that they were not in operation during the year 1895. One factory in Colorado was destroyed by fire near the end of 1894, and has not been rebuilt. The only new factory started during 1895 was one at Phillipsburg, N. J. There were therefore 22 factories producing Portland cement in 1895, as compared with 24 in the previous year.

The increase in production, which has gone on uninterruptedly ever since the industry was first established in this country, will evidently be maintained during the present year. Two of the leading factories near Coplay, Pa., have again doubled their capacity during the past winter, and are now producing over 1,000 barrels per day each. A number of new works are projected, and there is little doubt that the year 1896 will show an increase in production at least proportional to that of 1895.

IMPORTS AND EXPORTS.

The imports of cement for the year 1895 were 2,997,395 barrels, a decided increase over 1894. From this it appears that the increased production of the American factories has by no means kept pace with the growing demand for Portland cement in this country.

The following table shows the relative proportion of Portland cement made in this country and imported during the past five years:

Comparison of the domestic production of Portland cement with the imports.

	1891.	1892.	1893.	1894.	1895.
	Barrels.	*Barrels.*	*Barrels.*	*Barrels.*	*Barrels.*
Production in the United States	454,813	547,440	590,652	798,757	990,324
Imports	2,988,313	2,440,654	2,674,149	2,638,107	2,997,395
Total	3,443,126	2,988,094	3,264,801	3,436,864	3,987,719
Exports	....	21,536	14,276	9,725	83,682
Total consumption	3,443,126	2,966,558	3,250,525	3,427,139	3,904,037
Percentage of total consumption produced in the United States	13.2	18.4	18.2	23.3	22.8

It will be seen from this table that the increase in the amounts of Portland cement manufactured in this country and imported have been as follows: Increased production, 191,567 barrels; increased importation, 359,288 barrels. From this it appears that the increased production of the American factories has fallen far short of supplying the increased demand. New uses for Portland cement are being found every day, and the rapid adoption of concrete construction causes a steadily increasing demand. Portland cement is also coming rapidly into use for building purposes in place of the cheaper natural-rock cements, the production of which in 1895 shows only a very slight increase over the previous year. To meet the increased importation of Portland cement, if the increase in demand should be maintained, as appears decidedly probable, it would be necessary to establish a factory every year, capable of producing 1,000 barrels per day. With the general extension of knowledge of correct methods of testing, American Portland cements are rapidly gaining recognition as fully equal to imported, and the prejudice which once existed against the domestic product has almost entirely disappeared. The writer believes that careful study of the tests of American and foreign cements, as shown by the records of city and Government engineers in various parts of the country, will show that there is no cement made in any foreign country which will show as high tests, at long or short periods, as the product of any one of the three or four leading American factories. During the year 1895 the capacity of all the American works was taxed to the utmost, and it is safe to say that had the supply of the domestic product been equal to the demand, the increased importation would not have taken place.

The following table gives a classified statement of the imports of cement, by countries, during 1895:

Imports of cement into the United States in 1895, by countries.

Country.	Barrels.
United Kingdom	806,884
Belgium	708,875
France	22,837
Germany	1,299,919
Other Europe	141,909
British North America	10,416
Other countries	6,555
Total	2,997,395

As compared with the previous year, the imports from the United Kingdom show a decided decrease, while those from Germany show a considerable gain. This corresponds with the general gain in reputation of the German cements throughout the country, as compared with the English.

The general condition of the cement trade in this country is at present very favorable to the American manufacturer. The freight rate on foreign cement to interior points has for some years been exceedingly low, owing to a combination of ocean and lake or rail charges. This combination no longer exists, and the freight on cement from Europe to Chicago has advanced during the past two years from 52 cents to 77 cents per barrel. With this freight rate it is impossible for the cheaper grades of foreign cement to compete with the domestic product. Many large dealers have practically ceased to import Belgian and English cements, and are selling American Portland in their place.

Owing to increasing home demand and a combination of the leading manufacturers, the price of cement in Germany has also advanced. The capacity of the largest German factories is fully taxed to meet the increased demand. Importers of the leading brands find some difficulty in getting their orders filled, and show no eagerness in bidding on large contracts. There appears to be a scarcity of good Portland cement in the United States, and, as a result, prices have generally been well maintained.

That the demand for Portland cement in this country will continue to increase for many years to come can hardly be doubted. This is to be expected, not only from the continued growth and development of our cities, railways, and public works, but also from the multitude of new uses of this most valuable material which are constantly being devised. Germany manufactured during the past year 13,000,000 barrels of Portland cement, and exported 2,360,000 barrels. More than 10,000,000 barrels were therefore consumed in Germany, or more than two and one-half times the quantity consumed in the United States. In this country, however, nearly 8,000,000 barrels of hydraulic (natural-rock) cement were also consumed, while the use of this class of cements in Germany has practically ceased. It thus appears that the total consumption of hydraulic materials in this country was practically equal to that in Germany. Good Portland cement is sold in Germany at $1.25 to $1.50 per barrel. When the industry in this country reaches sufficient magnitude to allow Portland cement to be sold at $1.50 per barrel, there can be little doubt that practically all the natural-rock cement now used will be replaced by Portland. From present indications, however, it will be many years before this result is even approached.

PRODUCTION IN 1894 AND 1895.

The following table shows the product of Portland cement, by States, during 1894 and 1895:

Product of Portland cement in the United States, 1894 and 1895.

State.	1894.			1895.		
	Number of works.	Product.	Value, not including barrels.	Number of works.	Product.	Value, not including barrels.
		Barrels.			*Barrels.*	
California	1	19,300	$43,425	1	16,283	$32,566
Colorado	1	15,000	37,500			
Dakota	1	43,500	80,475	1	6,497	12,994
Illinois	1	300	540	1	750	1,325
Indiana	1	4,000	7,200			
New York	4	117,275	205,231	4	159,320	278,810
New Jersey	1	72,223	119,168	2	155,000	232,500
Ohio	4	80,653	144,425	4	136,698	239,221
Pennsylvania	7	437,106	718,009	7	504,276	756,414
Texas	1	8,000	24,000	1	10,000	30,000
Utah	2	1,400	3,500	1	1,500	3,000
Total	24	798,757	1,383,473	22	990,324	1,586,830

It will be seen from the above table that practically all the Portland cement produced in this country is made in Pennsylvania, New Jersey, New York, and Ohio, and the remarkable increase in production in these States has been accompanied by a falling off at most other points. The returns for the present year will undoubtedly show a decidedly further increase in New Jersey, Pennsylvania, and Ohio, as the factories in these States are being rapidly extended.

THE PORTLAND CEMENT INDUSTRY IN THE VARIOUS STATES.

Arkansas.—New Portland cement works are now in process of erection to work the white chalk cliffs, a few miles north of Texarkana, Ark. This chalk formation lies directly on the banks of Little River and within the three counties of Howard, Sevier, and Little River. The White Cliffs Portland Cement and Chalk Company own the entire chalk formation and a domain of 3,000 acres of well-wooded land. A brickyard and sawmill are turning out material for the new works, which have been projected on a large scale, including a town site.

Colorado.—The factory of the Denver Cement Company, at Denver, was destroyed by fire in November, 1894, and has not been rebuilt.

Dakota.—The works at Yankton were not in operation during the greater part of the year.

Illinois.—The works at Deer Park Glen, referred to in former reports, have not yet been started.

The factory of the Anglo-American Company, near Chicago, has been worked only experimentally up to the present time. It is proposed now to use the limestone from Bedford, Ind., as a material, and to begin the manufacture on a considerable scale.

Michigan.—A company is being organized at Elyria, Ohio, to manufacture Portland cement from a large deposit of marl near Coldwater, Mich.

New Jersey.—The Vulcanite Cement Company, located near the Alpha works at Phillipsburg, began operations in August. The material is a black slaty rock containing carbonate of lime and clay in nearly the proportions for a correct cement mixture. The rotary process of burning is employed, as at the Alpha works.

New York.—The works at Glens Falls, started in 1894, were in operation most of last year. This is a very complete cement plant, built closely after the model of the best German works. A hard, crystalline limestone and clay are the materials employed. The "tube mill" is used for grinding the raw materials together. This is a rotating, horizontal iron cylinder, partly filled with round flint pebbles. It was first brought out in Denmark, and has been widely adopted in Europe for grinding finished cement to extraordinary fineness. At the Glens Falls factory the Shöfer continuous kiln is used for the burning.

New works have been built by Rochester parties at Wayland, near the Millen factory. These will be in operation early in 1896.

The factory at Cassadaga Lake is still working on an experimental scale only.

Ohio.—A new enterprise is under way near Sandusky. This is the manufacture of white Portland cement for artistic and ornamental uses. A deposit of marl at Ransomes, near Sandusky, has been proved to contain only traces of iron or manganese. This, with a clay of peculiar composition, brought from a considerable distance, furnishes a snow-white product, fully equal to ordinary Portland cement in strength and hardening qualities. The Art Portland Cement Company is erecting a factory for the manufacture of this material. It is expected that the white cement will find extensive use for ornamental artificial stone work. It will also probably find application as mortar for stone buildings, as it does not stain the stone, as most ordinary Portland cement does. Certain brands of cement called stainless, like the Lafarge, are imported from Europe for this purpose and command a high price. The only other white cement, so far as the writer can ascertain, is manufactured at Thale, Switzerland. The Art Portland Cement Company expect to have their factory in operation in September, 1896.

Parties at Dayton have leased a large tract of marl land near Harper, adjoining the property of the Buckeye Portland Cement Company, and expect to proceed at once with the erection of a large plant. The marl deposit near Harper lies in the valley of Rush Creek and extends to its source in Rush Lake. This is probably the largest single deposit of marl as yet found in this country, and covers an area probably not less than a thousand acres in extent. The depth of the deposit at some points reaches 30 feet. The marl is grayish in color and contains a considerable proportion of fragments of shells. At the request of the writer an average sample of this marl was analyzed by Mr. W. B. Newberry, with the following results:

Analysis of marl from near Harper, Ohio.

	Per cent.
Carbonate of lime	82.66
Carbonate of magnesia	1.92
Sulphate of lime	.45
Iron oxide and alumina	1.15
Insoluble (clay)	7.28
Organic matter, etc., by difference	6.54
Total	100.00

The above analysis shows the material to be very suitable for the manufacture of cement. It will, however, be necessary to find some method of thoroughly grinding up the coarse shells in the marl in order to produce the fine mixture absolutely necessary for success.

PROCESSES.

As stated in former reports, the three types of kilns used for burning Portland cement in this country are the intermittent or dome kiln, the continuous kiln (Dietzsch or Shöfer), and the rotary kiln.

During the past year the Shöfer continuous kiln has been introduced at one of the largest factories at Coplay, Pa., at which common dome kilns were previously used. The Shöfer kilns lately erected at these works are stated to be capable of producing over 1,000 barrels per day.

The rapid growth of the rotary process of burning may be seen from the following table:

Amount of Portland cement made in kilns of various kinds.

	1893.	1894.	1895.
	Barrels.	*Barrels.*	*Barrels.*
Rotary furnace	149,000	242,176	400,821
Vertical kilns (continuous and intermittent)	441,653	556,581	589,503
Total	590,653	798,757	990,324
Per cent of total product burned in rotary furnace	25.2	30.3	40.5

It appears from the above table that the relative increase in the products of the rotary furnace and the vertical kilns, from 1894 to 1895, were as follows:

Comparison of increased product from cement furnaces in 1895.

	Barrels.
Rotary furnace	158,645
Vertical kilns	32,922
Total	191,567

From these figures we see that the use of the rotary furnace is extending much more rapidly than that of the common or continuous kilns. This is due, as explained in previous reports, to the great economy of labor which the rotary process allows, and also to the growing recognition of rotary-burned cement as equal in quality to the product of the older process. It must be remembered, however, that the rotary furnace has not as yet been successfully used with any other fuel than crude or fuel oil. In case of rise in the price of petroleum the economy of this method of burning may quickly disappear.

SAND CEMENT.

It has been known for many years that a given quantity of Portland cement may be made to go much further by grinding with it, to great fineness, a certain amount of sand. The sand cement so produced is found to carry about as much coarse sand as the undiluted cement would have carried, and a considerable economy is thus obtained. Sand cement was introduced in Europe several years ago by F. L.

Smidth & Co., of Copenhagen, and is finding extensive use. Factories are now producing this material on a large scale in Germany, Russia, France, Denmark, and other countries. The manufacture of this material has been greatly facilitated by the use of the tube mill, which is capable of grinding the sand and cement to the great fineness necessary for good results.

The manufacture of sand cement has been begun in this country within the past year by the Standard Silica Cement Company, of Glens Falls, N. Y. The industry is fully described, with illustrations of the plant, in a paper published in the Engineering News, April 16, 1896, page 252.

It is claimed by the manufacturers that the sand cement supplied by them gives only 5 per cent residue on a sieve of 180 meshes to the linear inch. It is stated that about 6,000 barrels of this sand cement were used in the concrete foundations of St. John's Cathedral, at New York. The paper referred to above contains the following table of comparative tests of sand cement, 1 to 1, and Portland cement, each with three parts ordinary sand:

Comparative test of sand cement with Portland.

	Per square inch.		
	7 days.	14 days.	28 days.
	Pounds.	*Pounds.*	*Pounds.*
Sand-cement (1 to 1) with 3 parts sand......	156	188	200
Portland cement with 3 parts sand..........	137	170	179

An extensive series of tests on this subject has also been published by Wallin.[1] Wallin concludes that the highest economy is obtained by grinding about three parts of sand with one part cement.

The good results given by sand cement are easily explained. It is wholly a question of the filling up of the voids in the sand. These voids in ordinary building sand amount to about one-third of the total volume; therefore if more than three volumes of sand be mixed with one volume of cement the voids will not be wholly filled. By grinding a part of the sand to great fineness, however, the proportion of voids may be greatly reduced, and a mixture of one of cement to six of sand may thus be made as effective as a one-to-three mixture with ordinary sand. It is evident that many very careful tests will be required to determine the precise proportions of cement and sand which will give a sand cement of the best efficiency. There can be little doubt, however, that the introduction of this new product will tend to increase the consumption of Portland cement, since it will make it possible to use Portland for common purposes at no greater cost than cheap hydraulic cement, and at the same time to obtain greatly superior results.

[1] Thonindustrie-Zeitung, 1896, p. 18.

AMERICAN ROCK CEMENT.

By URIAH CUMMINGS.

PRODUCT IN 1895.

The reports for the season of 1895 show a healthy growth in the manufacture of rock cement, and with the exception of the year 1892 the output is the largest in the history of the industry in this country.

The increase in production over that of 1894 was confined to Illinois, Kansas, Minnesota, and New York. In the other districts there was a slight falling off in the volume of trade.

PRICE.

There has been an advance in the prices, as will be seen by the following table:

Prices of American rock cement in bulk at mills.

Year.	Per barrel.	Year.	Per barrel.
	Cents.		*Cents.*
1890	51.37	1893	43.87
1891	47.26	1894	48.07
1892	48.61	1895	50.32

When it is considered that the Portland cements have, during the past year, declined in price over 13 cents per barrel, and that there is no perceptible recovery from the general business depression, the advance in the price of rock cements during the past season is very gratifying.

NEW DEVELOPMENTS.

Plans are issued for the erection of a large plant at Kings Rock, on the left bank of the Susquehanna River, near Larrys Creek, Pa. It is probable that these works will be in full operation before the close of the present season and will embody several new features in calcination and grinding which will undoubtedly tend to reduce the cost of production.

The cement-rock formation at this place contains many features of unusual interest. It lies almost horizontally in well-defined strata, and rises from the water's edge to a height of 70 feet. Its thickness below the water line is unknown, but the formation above that line contains over 100,000,000 barrels of the raw material. A series of exhaustive tests, extending over a period of two years, from samples taken from all parts of the deposit, vertically and for nearly a mile along the river, yield tensile-strain results far above the records of existing American rock cements. This cement exhibits no signs of shrinkage, expansion, checking, or disintegration. It bears submersion immediately after being made up into balls, patties, or briquettes. It neither heats nor falls down, and its induration is in perfect keeping with the laws governing the action of first-quality hydraulic cements.

Analyses made from the various layers show a remarkable uniformity in the proportions of its constituent parts, which are such as to insure the production of a cement of a high order.

Analysis of cement from Kings Rock, Pa.

	Per cent.
Silica	28.14
Alumina	9.10
Ferrous oxide	3.20
Lime	53.34
Magnesia	1.00
Potash and soda	2.80
Water and loss	2.42
Total	100.00

A careful study of this analysis reveals the surprising fact that it contains less than 1 per cent of inert matter. The color of the rock is a dark blue, the fracture conchoidal, and the texture is exceedingly fine and uniform, showing the clay and carbonate of lime to be intimately commingled in the rock.

During the summer of 1831 excavations were made for a canal on the left bank of the Susquehanna River to connect Muncy and Lock Haven, Pa. At Kings Rock the excavations disclosed this enormous body of rock, which was ascertained by Mr. Robert Farries, chief engineer of the canal, to be hydraulic cement rock. Col. George Crane, contractor of the canal construction, erected a small cement plant, and the cement was used in the building of the locks, bridges, culverts, dams, and viaducts of the canal system. The manufacture was practically discontinued on the completion of the canal, but the condition of the work done over sixty years ago is still good. A large body of masonry in the Susquehanna River at Williamsport, Pa., constructed with this cement, was the only work of the kind at that point which withstood the memorable flood of 1889.

PRODUCT.

The following table gives the amount and value of rock cements produced in the United States during 1894 and 1895. The values are based on the price per barrel in bulk at the various factories. The cost of package is always added to the price of the cement by the manufacturer. Approximately 60 per cent of the product is sold in paper or cloth sacks, and 40 per cent is sold in wood packages.

Product of rock cement in 1894 and 1895.

State.	1894.			1895.		
	Number of works.	Barrels.	Value.	Number of works.	Barrels.	Value.
Georgia	1	9,266	$7,094	1	8,050	$6,038
Illinois	2	446,267	133,880	2	491,012	171,854
Indiana and Kentucky (Louisville district)	13	2,000,000	800,000	14	1,703,000	681,400
Kansas	1	50,000	25,000	2	140,000	56,000
Maryland and West Virginia	6	279,000	136,000	4	242,000	116,700
Minnesota	1	63,290	31,645	2	73,772	33,621
New Mexico	1	Idle.		1	5,000	6,000
New York:						
Ulster County	17	2,659,601	1,595,760	15	3,230,000	1,938,031
Erie County	4	578,800	289,400	4	556,754	269,089
Onondaga County	8	187,929	78,303	6	138,100	69,050
Schoharie County	1	20,000	11,000	1	14,873	8,924
Ohio	3	55,023	33,598	3	38,060	22,836
Pennsylvania	5	605,812	269,701	5	600,895	300,447
Texas	1	12,000	18,000	1	10,000	17,000
Virginia	2	14,500	8,700	2	13,050	7,830
Wisconsin	2	582,000	197,400	1	476,511	190,604
Total	68	7,563,488	3,635,731	64	7,741,077	3,895,424

The following table is given in conformity to the expressed wishes of several manufacturers:

Product of hydraulic rock cement in the United States, 1880 to 1895, inclusive.

Year.	Number of barrels.	Year.	Number of barrels.
1880	2,030,000	1889	6,531,876
1881	2,440,000	1890	7,082,204
1882	3,165,000	1891	7,451,535
1883	4,190,000	1892	8,211,181
1884	4,000,000	1893	7,411,815
1885	4,100,000	1894	7,563,488
1886	4,186,152	1895	7,741,077
1887	6,692,744	Total	89,050,367
1888	6,253,295		

This table exhibits a record unparalleled in the history of cement. From the foundation of the industry in this country in 1818, the production has exceeded 150,000,000 barrels. It has been used with unqualified success in the construction of nearly all of the greatest engineering and architectural works in the country. It may confidently be predicted that in future years the intrinsic worth of our rock cements will be more and more appreciated, by reason of their well-proven excellence and enduring qualities, as shown by the records of their use during the past seventy-six years.

IMPORTS.

The following table shows the imports of cement into the United States during the fiscal years ending June 30, 1893, 1894, and 1895, by ports of entry:

Imports of cement, by ports, during the fiscal years ending June 30, 1893 to 1895.

Ports.	1893.		1894.		1895.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Atlantic coast.	*Pounds.*		*Pounds.*		*Pounds.*	
Aroostook, Me	8	$2	163,000	$853	977,225	$4,980
Baltimore, Md	108,479,638	359,144	77,968,821	249,039	113,334,906	353,033
Bath, Me			8,400	54		
Boston and Charlestown, Mass	61,346,305	208,783	62,072,160	198,653	68,952,320	216,392
Charleston, S. C	2,482,400	8,709	6,224,911	21,956	6,350,350	15,295
Georgetown, D. C	4,000	10	165,345	655		
New Bedford, Mass					20,000	44
Newport News, Va			11,904,000	35,920	29,436,949	92,244
New York, N. Y	504,135,906	1,690,622	384,406,068	1,251,090	429,254,171	1,419,216

Imports of cement, by ports, etc.—Continued.

Ports.	1893.		1894.		1895.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Passamaquoddy, Me	600	$4			16,400	$57
Philadelphia, Pa	129,883,778	412,140	111,829,516	$348,662	106,658,722	336,788
Portland and Falmouth, Me			1,699,608	5,246		
Richmond, Va			200,000	613		
Savannah, Ga	6,350,902	19,031	9,881,156	27,008	16,651,072	48,075
Wilmington, N. C	222,224	800				
Total	812,905,761	2,699,245	666,522,985	2,139,749	771,652,115	2,486,124
Gulf coast.						
Galveston, Tex	27,563,767	93,322	19,207,393	58,681	23,703,800	62,879
New Orleans, La	112,445,409	377,288	83,794,052	273,570	100,811,527	313,200
Pensacola, Fla	806,840	3,261	1,315,559	4,005	1,480,000	4,591
Saluria, Tex					3,800	11
Tampa, Fla	936,000	3,225				
Total	141,752,016	477,096	104,317,004	336,256	125,999,127	380,681
Pacific coast.						
Los Angeles, Cal	11,027,183	36,068	6,658,448	21,637	8,878,392	30,683
Oregon City, Oreg			399,980	1,277	817,000	2,555
Puget Sound, Wash	24,141,906	82,079	21,706,002	66,665	6,156,340	12,892
San Diego, Cal	22,744,180	79,300	14,761,600	48,802	18,450,800	61,275
San Francisco, Cal	82,643,856	279,478	135,889,312	433,364	89,630,282	304,168
Willamette, Oreg	14,652,325	49,706	47,560,684	155,222	27,102,654	91,814
Total	155,209,450	526,631	226,976,026	726,967	151,035,468	503,387
Lake.						
Buffalo Creek, N. Y	115	40			4,000	46
Cape Vincent, N. Y	50,900	164	76,450	245	43,750	193
Champlain, N. Y	98,900	387			487,500	2,600
Chicago, Ill	1,374,262	4,811	998,026	3,289	6,415,582	20,311
Cuyahoga, Ohio	40,000	136	194,000	808	1,529,500	5,370
Detroit, Mich	11,000	61	313,300	1,420	1,018,750	4,515
Huron, Mich			2,700	20		
Miami, Ohio			412,500	1,750	96,250	437
Oswegatchie, N. Y	815,285	2,476	3,605	27	333,005	1,457
Oswego, N. Y	2,220	12	74,000	400	232,050	1,044
Total	2,392,682	8,087	2,074,581	7,959	10,160,387	35,973
Interior.						
Vermont	5,600	26	5,600	26		
Cincinnati, Ohio	99,207	393				
Indianapolis, Ind			80,000	255		
Kansas City, Mo	80,000	257	80,000	260		
Louisville, Ky	266,138	1,008	200,000	618		
Memphis, Tenn					200,000	639
St. Louis, Mo	12,223,701	47,701	14,877,677	52,997	824,496	3,133
Total	12,654,646	49,385	15,243,277	54,156	1,024,496	3,772
Grand total	1,124,914,555	3,760,444	1,015,133,873	3,265,087	1,059,871,593	3,409,937

PRECIOUS STONES.

By GEORGE F. KUNZ.

INTRODUCTION.

Among the more interesting occurrences and changes in precious stones for the year 1895 may be mentioned (1) the finding of a 6-carat diamond at a new locality, Saukville, Ozaukee County, Wis.; (2) the diligent search made for monazite in North Carolina and Georgia, resulting in the finding of a number of interesting gems; (3) continued finding of rubies near Franklin, Macon County, N. C.; (4) the discovery of true blue sapphires near Utica, Fergus County, Mont.; (5) the discovery of some remarkable gem tourmaline of extraordinary size and wonderful perfection at the historic Paris Hill locality, Oxford County, Me.; (6) the finding of a large quantity of fine chrysoprase in Tulare County, Cal.; (7) the discovery of an enormous crystal of tourmaline on New York Island; (8) the interesting exhibition of Southern gems at the Cotton States and International Exposition, at Atlanta, Ga., and the presentation of this collection to the Lea collection at the United States National Museum; and (9) the opening of the Golden Gate Park Museum, at San Francisco, with an interesting collection of gems. Among foreign occurrences may be noted (1) the increased yield of the South African diamond fields and the absorption of the entire yield by the gem markets of the world; (2) the occurrence of rubies of good color and in some abundance in various fields in Siam; these are very rarely equal to the Burmese, yet they are fine stones, and although generally much lower in price, a single stone sold for more than $1,000; (3) the great profusion and beauty of the opal and the large demand for these stones, which were produced in greater quantity, finer quality, and at a somewhat lower cost than ever before from the fields at Fermoy, Queensland, and in the new locality at White Cliff, in New South Wales.

The literature of gems has been enriched by the Barrington Brown, and Judd contributions to the literature of corundum; Dr. Max Bauer's great work on precious stones, and the interesting results in regard to precious stones and their behavior with that new and mysterious agency known as the "X" ray; a phosphorescent hydrocarbon, or rather a hydrocarbon "Tiffanyite," that causes certain diamonds to phosphoresce and to retain sun or artificial light, allowing it to be slowly given out for a period of time after exposure; and finally, the changes in the diamond-cutting industry, importations, and diamond business in the United States during the year 1895, caused by new conditions.

The increased search for monazite, in addition to the gold and mica mining, has stimulated a search for gems in North Carolina and Georgia to a greater extent than ever before, resulting in the finding of more varieties and a large increase in product. The monazite industry and mining is fully and admirably described in Bulletin No. 9, North Carolina Geological Survey, Monazite and Monazite Deposits in North Carolina, by Mr. Henry B. C. Nitze. There is no reason why this State and Georgia, with their wealth of semi-precious stones, should not develop an industry employing as many people as that in the Ural Mountains, where over 1,000 men make a living by searching for and cutting gems.

DIAMONDS.

Prof. William H. Hobbs reports the finding of a diamond near Saukville, Ozaukee County, Wis. The facts as reported by Mr. Kummel, a former student in the mineralogical department of the Wisconsin State University, and now in the Wisconsin State chemist's office, are as follows: The diamond was alleged to have been found by a Mr. Schafer in a potato field at Saukville. This locality is on the Wisconsin Central Railroad, about 6 miles from Milwaukee and 1½ miles from Lake Michigan. It was brought to the State chemist's office in March, 1896. It is white and weighs a little over six carats. It is interesting to note that this locality is not on the Green Bay lobe of the ice sheet, as were the other Wisconsin stones, but on the terminal moraine of the Lake Michigan lobe.

The occasional occurrence of diamonds in California, ever since their discovery over forty years ago, is very remarkable. For 1895 the following are noted: A small diamond was found on the banks of Alpine Creek, Tulare County, by Mr. L. W. Hawkins. Mr. Dwight Whiting reports the finding of five small diamonds near Oroville, on Feather River, Butte County, and as many more about 4 miles from the head of the creek, suggesting a peridotite origin. More may be looked for in this region.

In reviewing the general condition and prospects of the South African diamond industry, the features of greatest commercial interest are those connected with the valuable annual report and balance sheet prepared by its general manager, Dr. Gardner F. Williams, of the great De Beers Consolidated Company, submitted at the last meeting. During the twelve months prior to June, 1895, diamonds have been taken out which have realized £3,105,957, and the total expenditure amounted to £1,704,812, thus leaving the immense profit of £1,401,145. The stock of blue ground on the floors has been increased by 1,974,127 loads.

The cost of hauling has been greatly reduced; the cost of the blue ground is estimated at 3s. 6d. instead of 5s. 1.7d. per load. The accounts end with June 30, so that the rise of prices during the last six months does not make itself felt. The total quantity of "blue" hauled from the De Beers mine was 1,625,096 loads, 600,000 loads being from the levels between 700 feet and 800 feet and 1,025,000 loads coming from a still lower depth. During the year no greater depth has been sunk in the "blue," so that the quantity of that material in sight is estimated at 3,300,000 loads above the 1,000-foot level. The main shaft, however, has been sunk to the 1,200-foot level. The water pumped from the mine has averaged nearly 6,000 gallons per hour. The total output of the "blue" from the Kimberley mine was 900,621 loads, where the workings on the whole are deeper and there is in sight "blue" to the extent of 2,740,000 loads. No work has been done at either Bultfontein or Du Toits Pan, both these mines having been shut down—first, to limit the supply; and secondly, because the "blue" can be more readily and cheaply worked at the other two mines.

The Kimberley mine has yielded 900,621 loads, mostly from levels between 845 and 1,085 feet, but the 1,205-foot level has yielded 9,962 loads. The output for 1896 has been sold for £5,400,000, or an increase in revenue of £500,000 as compared with 1894-95.

Considerable work has been done at the Harvey shaft on the 1,000-foot level. During the six months between January 1 and June 30 there were washed at the Premier mine 1,641,267 loads of yellow and 303,739 loads of calcareous waste, and 92,797 loads of floating reef were removed. With reference to operating the mines, it has been found impossible to reduce the time of working from twelve to eight hours and yet reduce the cost per load.

The summary of results for June, 1895, to December, 1895, is: Revenue, £1,679,000, including the diamonds unsold on December 31; expenditure, £589,000; gross profit, £1,090,000; leaving a net profit of £962,000 after providing for sinking fund and interest, with a slight increase of the blue ground on floors.

An important step has been taken by the De Beers Company in setting up new and powerful machinery for breaking up the "hard" or refractory blue ground; a crushing plant was erected at a cost of £110,000. Most of the blue ground disintegrates on exposure for a few weeks to the sun and air, and is then easily washed and assorted; but some of it is very hard and does not decompose. Of this material which can not be dealt with by the ordinary machinery there has been gradual accumulation for some years past, which now amounts to many hundreds of thousands of loads. The new machinery can break up this hard blue and the diamonds in it can now be recovered. Another advantage which has been secured is that, through the introduction of a new pumping plant, the water taken from the Vaal River, 16 miles distant, is now brought to the mines at a cost of £100 to £200 per month, instead of £1,800 per month, as formerly.

In reviewing the history of the De Beers Company, Mr. B. I.

Barnato, in a recent statement to a meeting of stockholders, has given some remarkable figures for the past few years. The company has paid back its whole original capital since 1888; and during the last year it paid its stockholders 36 per cent. The total dividends from the South African diamond companies in the past ten years amount to £12,000,000. The nominal capital of the De Beers Company is about £4,000,000, with a reserve of £3,500,000; its present assets are some £18,000,000. In the past twenty years Africa has produced £70,000,000 worth of diamonds, and the world has absorbed them all. It thus appears that the African mines have now yielded diamonds to the total value of $350,000,000 uncut, while after cutting these are fully worth $700,000,000. The trade is carried probably by about 8,000 jewelers, who have in stock not far from $350,000,000 worth of diamonds, the total value of all the diamonds known being at least $1,000,000,000; in other words, the African mines have produced twice as many diamonds as were known in the world before. There are fully 30,000 people employed in cutting and setting diamonds, and in addition to these fully 10,000 men are employed in the African mines. The entire yield of the De Beers mine to the end of 1897 has been sold.

The New Jägersfontein mine has declared an interim dividend of 5 per cent, and the output is being maintained both in weight and quality. During December, 1895, this company produced diamonds valued at £27,250, and increased their stock of "blue" by 44,000 loads, which, valued at 1s. 6d., gives £3,300. Deducting £15,750 for expenses gives £14,800 as the net month's profit.

These mines are now famous for the extraordinary size of some of the diamonds they have produced. Two years ago the great Excelsior, of 971 carats, was found here, and at the close of 1895 another great stone was discovered by a Kaffir workman and given to one of the overseers. This is a diamond of 640 carats, only about two-thirds the size of the Excelsior, but still one of the very largest in the world, and said to be of better shape than the Excelsior and of spotless beauty and perfect color. It was proposed to name it the Reitz diamond, in honor of the retiring president of the Orange Free State, who has taken much interest in the mineral resources of the region.

The Vaal River Diamond Company has not a very favorable report for its twenty months, the total debit balance amounting to nearly £10,000. In the New Gordon, pumping has greatly reduced the water, and, if continued, they will soon be able to get at blue, which is known to be profitable.

A Dutch syndicate is now working the Kaffirfontein mine, the former owners having sold out their interest. The shaft is down 400 feet, and work is being pushed forward, the mine having yielded 3,750 carats of diamonds in November, 1895. At Klerksdorp the colored diamonds keep turning up in the batteries, and a green one was found recently in a new spot by a Kaffir.

Colored diamonds have never been found in any considerable numbers in South Africa, though amber and green stones have been obtained occasionally from the same ground yielding the ordinary white and yellow gems. The largest green diamond ever found at Kimberley weighed 7 carats. In 1894 an amber-colored diamond of very fine form was found at Kimberley at the river diggings. It weighed 11 carats and was sold for £350.

Recent discoveries in the northern part of the Orange Free State are naturally causing much interest, and great activity is noticeable in these districts, where no stone is being left unturned to develop the hidden treasures. In the Winburg district, where Mr. J. B. Robinson has taken in hand Winter's discovery, known as the Kall Vallei mine, now established as the Robinson Diamond Mining Company, machinery, buildings, and surface works are being erected on a scale said to be unprecedented in the country. The mine is situated within an area of 600 acres. There are about 50 whites and 500 natives employed. Water is plentiful, and the stones found are remarkable for pureness and quality. Another discovery within a thousand yards of this mine (for the half interest of which Mr. Winter received £150,000 cash) has also excited great interest. At 75 to 80 feet down, blue has been struck of remarkable quality, pulverizing more easily in the open air than any diamantiferous soil in South Africa, and some splendid stones have been found. Digging is being extensively prosecuted, and it is reported that the diggers have discovered a third "crater" closely adjacent. If this latest account proves to be genuine, the triangle thus formed will compose the largest diamond mine in the world.

Passing to other aspects of the diamond resources of Africa, it may be noted that not only is the great group of mines controlled by the De Beers company increasing its yield, but indications point to a wide extension of the diamond-bearing area. In Bechuanaland reports are continually coming in of the discovery of the precious gems. The formation is said to be exactly similar to that of the Colesberg Kopje, and one of the diamonds recently found weighs 40 carats. Prospecting is going on in all the adjacent parts of South Africa, and work is being done at many points where favorable indications are thought to exist. Two old pioneers have lately succeeded, after several years of search through the Transvaal and Swaziland, in locating the source of the garnets and rubies (so-called) found on the Lebombo flats, which they regarded as indications of a diamond field, because products from the decomposition of peridotite. They have found the spot at Mahasha, at the exact meeting place of the Portuguese, Transvaal, and Swaziland boundaries. Here diamantiferous ground is reported, and the indications are thought to be highly promising, though it may be found that the locality lies within Portuguese territory.

Among various items of interest connected with the diamond region of Africa, the following may be noted: A correspondent of the Leeds Mercury states that exploration in what appears to have been a prehistoric diamond mine, recently discovered near Winburg, in the Orange Free State, has disclosed some curious and interesting facts. The shaft is almost perpendicular, and at the bottom, 100 feet from the surface, workings or tunnels branch off for several hundred feet, much after the fashion of an English coal mine. The ground in the workings is diamantiferous, and many small gems have been found in the recovered débris. Appearances indicate that the mine was secretly worked and that the miners were armed, for old-fashioned spears and battle-axes have been found side by side with primitive tools and skeletons of men who seem to have been above the average stature of any race of the present day. Stones bearing inscriptions in curious characters have also been found. It is yet a matter of conjecture as to what race worked these old mines. The natives of the country have not even a legend or tradition regarding them. They may be connected with a search for gold by the Arabians, who are said to have explored this region over one thousand years ago, and to whom the wonderful African gold work may owe its origin.

The Cape of Good Hope government is contemplating the bestowal of a pension upon Mr. Lennard Jacobs, who found the first diamond in the colony. Mr. Jacobs is a Koranna, who settled in Peniel, now known as Barkly, in 1866. A German missionary, Kallenberg, told him to look out for diamonds, explaining to him their value and appearance. Mr. Jacobs's children soon after found several glittering stones, one of which proved to be a real diamond; the others were quartz crystals. His wife, not knowing that any particular value attached to it, exchanged the stone for calico. Mr. Jacobs set out on the trail of the lucky trader, and, finding him, forced him to return the gem. It was afterward forwarded to Port Elizabeth, where Sir Philip Wodehouse, the governor, purchased it for £500. He named it the "Star of South Africa," and it still remains in his family. Mr. Jacobs, after a lapse of two years, received a horse, a wagon, and some sheep as payment. The man is now an octogenarian and still in hearty health.

The diamond fields at Bingara, in New South Wales, have been visited and examined by Mr. A. G. Stonier, on behalf of the Geological Survey of that province, with a view to ascertain whether they resemble the South African deposits at Kimberley. The result is interesting as proving marked differences, though in somewhat similar conditions. The diamonds are found in an alluvial deposit which is thought to be of Tertiary age, and are derived, as Mr. Stonier suggests, from an intrusive mass of peridotite (as in Africa), but now altered to serpentine, and especially from a jaspery rock produced by the metamorphic action of the peridotite in breaking through Carboniferous rocks of the vicinity. The diamonds themselves are claimed to be of a quality superior to that of the African, but are extremely hard and do not polish so readily. This may be imaginary. The jasper may be derived from a sandy shale which has been jasperized by the heat action of the peridotite with which it came in contact.

A movement is on foot in Cape Colony to place an export duty on diamonds; and, as before, it has been strongly opposed by the mine owners. It has lately been adopted, however, by the opposition party in the colony as a definite part of their platform, and recent changes would suggest that this policy may very probably prevail. The proposed tax of 10 per cent on exported diamonds would furnish a considerable revenue to the colony, which is now claimed to be bearing a pretty heavy burden of taxation, and the amount would come wholly from nonresidents. The De Beers Company would reimburse itself by adding the tax to the price of rough stones, and thus the difference would fall entirely on purchasers and stockholders in foreign lands. In this way the immense diamond treasures of the Cape Colony would be made to serve the general interests of that country. This policy is urged by its promoters under the plea that nearly all of the shareholders of the De Beers are residents of Europe and do not contribute to the mines in any other way.

The year 1895 has, in many ways, been the most remarkable ever known in the history of the diamond trade in the United States. Important changes have occurred in the importation of diamonds, and another serious attempt has been made to establish diamond cutting as a permanent industry in this country. The late Henry D. Morse, of Boston, first taught pupils to cut diamonds here, and after much effort and with great ingenuity and skill he succeeded in teaching the art to young American women as well as men, and established diamond cutting in Boston about 1860. It has never become important or extensive, however, on this side of the Atlantic. The art has been so long established and so thoroughly systematized in Holland that it is more economically carried on there; and, moreover, all the rough diamonds from Africa, India, and Brazil are taken to Europe, principally to London, and hence large supplies can not be readily obtained here. Furthermore, American banks do not make advances on uncut diamonds, as do the English and Dutch banks, which make loans on the rough stones, knowing that the cutting enhances the value of the material on which advances are made.

In the latter part of 1894, however, a movement was begun looking toward the establishment of diamond cutting in this country. In August and September of that year foreign cutters began to visit the United States with a view to the possibility of beginning a business here. Very soon a Dutch firm, with large capital, arrived with more cutters and announced the intention of establishing in New York. In November a number of firms were incorporated in the same city, and from this time an influx of diamond cutters began and large prospects were entertained. Establishments were opened in New York, Brooklyn, Cincinnati, and elsewhere. In December, 1894, the report of United States Consul Downes, at Amsterdam, announced a serious falling off in the cutting industry at that place, which had been the most important center of that art, and the emigration of many diamond cutters to the United States, where work was being commenced in view of the high tariff on cut stones as compared with uncut. By the spring of 1895 the new industry was in a thriving condition in New York, and the immigration of cutters began to attract attention in connection with the contract-labor law. Question and opposition were aroused, and strong efforts made to procure the exclusion of the diamond workers under that statute.

About the same time (April, 1895) a question arose which produced much discussion and agitation. A semicolon in paragraph 467 of the tariff law led to a claim that diamonds cut, but not set, were really on the free list; and such was the decision of the appraisers at the New York Custom-House. The question was carried to the United States circuit court, and the decision of the appraisers was reversed. An appeal was taken, and a further decision was obtained in behalf of the Treasury Department from the circuit court of appeals March 9, 1896. This question is now to be brought before the Supreme Court early in 1896. Partly, however, in consequence of this litigation, and partly from other causes, among which smuggling was largely suspected, the diamond-cutting enterprise speedily began to decline, and has gone down as rapidly as it arose. By September, 1895, many establishments were either closing down for lack of business or were involved in strikes of the workmen against lower rates of pay. A return movement now set in among the cutters, and by November hundreds of them had returned to Holland. The English cutters, and those who could speak English readily, remained to some extent, but the others left for their European homes. At the present time the industry is greatly depressed. Some large stones are cut in this country, but the smaller ones are principally finished abroad.

Fourteen diamond-cutting establishments in New York and vicinity report a total of about 490 employees. Of these, three have stated only their entire number of work people, without specifying the particular branches in which they were engaged. The remaining eleven firms employ 313 persons, whose occupations are classified as follows: Cleavers, 6; polishers, 230; cutters, 32; setters, 45. An approximate estimate of the total number of diamond workers would be 500, of whom there would be about 10 cleavers, 370 polishers, 50 cutters, and 70 setters. Several of the establishments report having employed a larger number before than at present; and four others have closed altogether. Three of these latter employed about 36 workmen in all; as to the fourth, the number is not known.

With regard to importation, the last year has witnessed an extraordinary falling off. In 1894 the declared value of diamonds brought into the United States, as indicated by the revenue derived through the custom-house, was: Rough and uncut, $839,836; precious stones, $6,710,472; while in 1895 it was: Uncut, $1,051,203. and precious stones, $6,623,669, although a greater trade was apparently done

Carbon, carbonado, or bort, has greatly increased in value during the past year and a half. This is the amorphous variety generally called black carbon, but in reality often brown, though frequently stained black, with graphite or some other cheap material, to increase its weight. As the hardest substance known, it has been greatly in request for diamond drills, and the vast amount of prospecting carried on in the South African gold fields and in the new gold regions of Colorado and elsewhere has increased the demand beyond the supply. The only source has been Bahia, Brazil, and it has been exported thence to the amount of 50,000 carats per year. But such has been the demand that the price has trebled in the past eighteen months. From $10.50 a carat in 1894, it rose to $12, and then to $18; in 1895 it advanced to $25, and in the latter part of the year to $28; and it has now reached $36, with no definite promise of filling orders even at that price.

The scarcity and increased cost has led to a search for substitutes, among which are the varieties of carbon known as round bort, from Brazil. This is a rounded semicrystalline and sometimes semitransparent form of carbon, somewhat intermediate between bort or carbonado and diamond. For the Brazilian bort, when in crystals with rounded edges, it is claimed that 2 carats, selling at $5 or $10 per carat, are equivalent in doing work to 1 carat of carbonado, worth perhaps $30. Much depends, however, on the care and use of the tools in which the diamonds are secured. It was formerly the custom to put a very great pressure on the carbon tools, so that frequently even carbonado has been crushed. Bort, or in other words diamond too impure for cutting, has not the same resistance, and consequently is more liable to break, but by using less pressure in feeding the tools, it has been found possible to saw through a block of sandstone 8 feet long and 3 feet in depth in one hour's time with selected bort, and a granite block 72 inches in depth in a day of eight hours. African bort is occasionally very hard, and well-selected crystals sell for from $3 to $10 per carat. The octahedral crystals usually cleave too readily, but even these are used by some of the marble workers.

During this year the largest piece of carbonado or bort known, or, indeed, the largest mass of diamond substance of any kind, was found in Bahia. This was a mass of carbon weighing 3,073 carats; it was underestimated at the quoted rate of 52s. per carat, which would have given it a value of £8,000. It was taken to Paris, and a strong effort has been made on the part of the Brazilian Government to obtain it for the national museum at Rio Janeiro.

It is now some years since a prize of $10,000 was offered by the French Academy for the discovery of a substance to take the place of black diamond carbon in the diamond drill. Mine exploration has been immensely facilitated by this wonderful aid, which has been known for only half a century. Such a substitute is now said to have been found by Dr. Moissan, who has recently experimented in producing artificial diamonds by means of a high-tension electric current. He employs a combination of boric acid and carbonized sugar, which result in a new material asserted to be superior to the diamond in hardness, and even to cut it without difficulty, and which can be made in any size or shape. The combination of boron with carbon occurs when the mixture of boric acid and carbonized sugar is heated in an electric furnace to a temperature of about 3,000° C. The result is a black mass, similar in appearance to graphite. Such a stone would be of considerable importance, where heretofore the expensive and much softer black diamond has been used.

Prof. Henri Moisson, during his recent visit to this country, informed the writer that he had produced in all about 0.1 of a gram of diamonds, equivalent to 100 milligrams, or a little less than one-half of a carat. These consist of several hundred crystals, some of which are transparent octahedrons marked with trihedral depressions, and some round, like a drop of water; the rest are transparent, containing carbon in the form of a black powder, which Professor Moisson has termed "diamant crapaud," because they are spotted like a frog. The largest do not exceed 0.7 of a millimeter in diameter. The cost of the experiments, apart from the professor's time, has amounted to nearly 10,000 francs, equivalent to $4,000 a carat for the rough powder, 2,000 times the value of natural diamond powder. Although of great scientific interest, the results of these experiments do not endanger diamond mining as a profession.

The luminous properties of gems have been referred to from the earliest times. The phosphorescence of the diamond was treated at some length by Robert Boyle in 1666, and by Du Fay in 1751. Only certain diamonds emit light or phosphorescence on exposure for a time to the rays of the sun, or of electric, calcium, or other intense light. The various colors of the diamond are evidently due to the presence of hydrocarbons, similar to those which are artificially made in such endless variety and of all known colors, and which often fluoresce and phosphoresce. After an examination by the writer of a great number of diamonds, it appears that only certain ones fluoresce on exposure to the ultraviolet rays of an electric or other strong light, and from the observations made it is very evident that this fluorescence and phosphorescence is a property of only those diamonds that contain a certain bluish-white substance, and it is this substance that fluoresces and phosphoresces and not the diamond. This is undoubtedly a hydrocarbon, for, as stated above, this property of fluorescence and phosphorescence is marked in many hydrocarbons, notably anthracene. I therefore think it would not be inappropriate to give this substance a definite name, and I propose that of *Tiffanyite*. It is only the bluish-white diamonds, containing this hydrocarbon, that possess the property of storing up sunlight, electric light, or other strong artificial light, and emitting it for a continued period in the dark.[1]

[1] George F. Kunz, on Phosphorescent diamonds: Trans. New York Acad. Sci., May 20, 1895, p. 260.

RUBY.

In addition to what appeared in the last volume of Mineral Resources, it may be stated that rubies have been found "in place" near Franklin, Macon County, N. C., associated with garnets and chlorite in decomposed gneiss, and in gravel beds associated with cyanite, garnet, staurolite, small quantities of gold, and arsenide of platinum (sperrylite).

By far the most complete and accurate account of the Burmese ruby mines that has yet been given to the world has recently appeared in the elaborate paper of Mr. C. Barrington Brown and Prof. John W. Judd.[1] The ruby district proper, apart from a few small outliers, occupies a country variously estimated at from 45 to 66 square miles in area, and consists of a range of gneiss hills with extensive beds of crystalline limestone, some 96 miles northeast of Mandalay. These mountains extend from a few miles east of the Irrawaddy River, northeastward to the limits of the British territory, beyond which they pass into the Shan States of Siam, and have not been examined, but probably extend quite far. In the Burmah territory the heights rise in going eastward, and reach 7,700 feet near Mogok. From the main range spurs run off toward the northwest and southeast; and in the valleys between and extending from these are many streams draining respectively toward the Irrawaddy and the Mobaychoung. The rubies, and also the red spinels and the rubellites, which have rendered this region celebrated, are chiefly found in the valleys of these streams, where they have been washed out of the disintegrated rocks of the hills around. It soon appeared that the two former came from the crystalline limestone belts, while the rubellite does not occur in the limestone, but in certain acid members of the gneissic series, known as aplites. The rocks of the region include a little granite, a large body of gneisses and mica-schists, and the belts of crystalline limestone interbedded and interlaminated with the gneisses. A supposed Tertiary sandstone appears at some points; and large areas are covered in the broader valleys with river alluvium, and in the smaller valleys and mountain slopes with what the authors called "hill-wash." The gems are obtained either from these two latter deposits or from the limestone rock. The methods of mining are four, and are fully described in the report. First, in the river alluvium pits are sunk below the level of the valley to the gem-bearing layer. These pits, called "twinlones" by the natives, were formerly made round and of all sizes; they are now made larger and square. They are carefully and ingeniously timbered, but when a pit

[1] The rubies of Burmah and associated minerals; their mode of occurrence, origin, and metamorphoses; a contribution to the history of Corundum: Philos. Trans. Royal Soc. of London, vol. 187, A, pp. 151–228. In this paper the authors, after a brief introduction, proceed to describe first, the geographical distribution of the ruby-bearing rocks of Burmah; second, the physical features of the district; and third, its geological structure. This is treated of for each of the rocks composing it, and then follows, fourth, the methods of mining; fifth, the petrology; and sixth, the mineralogy, closing with a general summary of results.

is worked out the timbers are removed and used for another "twinlone." The gem-bearing earth and gravel is taken out in baskets and then washed and picked over. Second, in the hill-wash, cuts and drifts are made, known as "hmyaudwins" (water mines). Into these, water is led through bamboo conduits, and made to play against the sides and undermine them, causing the walls to cave in; and the same water is used farther on to wash and disintegrate the clay. This is a curious approach, on a small scale, to our system of hydraulic mining for gold. Third, in the limestone rocks there are many caverns, gorges, and pockets of erosion, more or less filled with a hard, red clay, which appears to be a result of decay of the limestone, and contains many fine rubies. The natives climb into and through these rugged caves and passages, using no ladders, but provided with lamps, baskets, and a few simple tools; occasionally they use (Burman) gunpowder; and much fine gem material is obtained from these "loodwin" mines, as they are called. Fourth, regular quarry mining in the limestone rock has been carried on but little, and is now hardly employed at all, owing to British restrictions upon native use of powder. The blasts, moreover, and the use of hammers in breaking up the rock, cause injury to the ruby crystals by fracture; and the authors suggest that quarry mining can not be advantageously employed until some process is adopted for cutting out blocks without concussion, and dissolving or decomposing them by chemical means.

The mode of occurrence in Burmah is found to be most closely similar to that in Orange County, N. Y., and Sussex County, N. J., where corundum appears in crystalline limestone interstratified with gneisses in the same way, and with an almost identical body of associated minerals.

This portion of the report has great scientific interest, and presents some novel and rather startling conclusions. Whether these are fully accepted or not, it is certainly a very able piece of work, and marks an important stage in our knowledge of the occurrence of this most valuable of the gem minerals. The authors announce that, contrary to all the ordinary geological views, they can find no evidence that the limestones are altered organic sediments, but that rather they and their contained minerals are products of extensive alteration from originally igneous rocks. In seeking to trace the origin of the corundum, they argue strongly for the following course of events:

Much of the gneissic rock consists of basic rocks made up of pyroxene with lime feldspars (anorthite and labradorite, etc.). These last, under the action of even small amounts of hydrochloric acid under pressure, are altered readily into scapolites—a well-known process, for which Lacroix proposed the name of "Werneritization." These latter are again unstable minerals, readily breaking up under the influence of carbonic and other acids and yielding lime carbonate and hydrated aluminum compounds, such as bauxite, gibbsite, and the like. Then, reviewing some twenty processes whereby anhydrous alumina has been artificially obtained in several cases from such compounds as the last, they advocate some such origin for the rubies and spinels as found in the Burmah limestone. All the steps in this series of changes are compared with well-established facts from various localities, tending to suggest, illustrate, or confirm the remarkable views here presented.

A very interesting section follows on the alterations, both physical and chemical, which the corundum has itself undergone. Here handsome recognition is given to the two eminent American mineralogists who have so largely and ably contributed to this subject, the late Profs. F. A. Genth and J. Lawrence Smith. One very singular point is brought out in this discussion, i. e., the age of these alterations, the facts appearing to indicate that some of the changes took place before the inclusion of the crystals in the limestone, and others afterwards. Another very interesting conclusion, which is further discussed by Professor Judd in a separate paper,[1] is that pure corundum, like quartz, has really no cleavage, but only a conchoidal fracture, and that all the apparent cleavages which it displays are due to alteration or pressure. The rhombohedral cleavages are gliding planes, such as are produced by pressure in calcite, etc., and the basal and prismatic cleavages are caused by incipient hydration and formation of diaspore, etc., along the planes of structure. These then become planes of weakened adhesion and so of parting; and the same may occur as a secondary result on the rhombohedral gliding planes. The films of diaspore thus present give rise to the beautiful phenomena of asterism, while a further advance in the process will result in the partial or entire alteration of the crystal into various minerals, whose origin was first shown by the late Dr. Genth and has since become familiar to mineralogists.

With regard to the ruby mines of Siam, there seems to be no very definite information as to the extension into that country of the gem-bearing district of Upper Burmah, as suggested by Messrs. Brown and Judd in their report on the latter country. The rubies and sapphires of Siam are obtained from a region some 800 miles to the southeast in the Moung Klung district, which lies between the provinces of Krat and Chantabun, on the western side of the latter. The gems are said to come from the Chantabun mines, because they are brought to the little port of that name, on the Gulf of Siam. A few years ago it was only a fishing village, but the mines have given it some business activity, and it has now a population of 5,000 inhabitants.

The gem district lies about 50 miles inland, and consists really of two areas on the flanks of a high wooded range, the Patat Hills, running northwest and southeast, or about parallel to the coast. On the seaboard slope the gems are principally rubies, with a few sapphires; on the inland slope is the Pailin district, where sapphires predominate. The hills are about midway between Chantabun and Battanbang, and the mines are a little east of a line joining the two towns. The Pailin

[1] On the structure planes of corundum: Mineralogical Mag., Vol. XI, No. 50.

district is at present the most important. It occupies an area about 6 miles long and 2 miles wide, in which are several little mining villages. The region has lately been visited and described by a correspondent of the London Times, who started from Battanbang. For some distance southward from that place the country is low, barren, and desolate, parched in the dry season and half drowned in the rainy, with scarcely any villages or roads. On entering the hilly country, however, all is changed, with thriving villages, good roads cut through the forests, and bridges over the streams. In the mining portion the whole country is filled with the holes or pits ("twinlones" of Burmah) which have been sunk in the red soil to the gem-bearing layer. Formerly they were only a few feet deep, but these have been exhausted and they are now sunk to another and lower layer 15 or 25 feet from the surface and consisting of a stratum of reddish gravel a foot and a half in thickness. The Burmese gem diggers, who have come into Siam in considerable numbers of late years, still work over the material thrown out from the old pits, in the belief that the stones grow. The methods are those of the Burmese "twinlone" mining; the pit may be either round or square, is usually some 5 feet across, and the soil is raised in bamboo baskets balanced at the end of a lever like a well sweep; when the gem layer is reached, the material is washed at the nearest stream and carefully examined in bamboo sieves. Only about one-third of the pits sunk pay for the labor; but when they strike a rich spot they pay largely. The digging and working of one pit usually occupies two or three men for a month; usually a partnership is formed between two or three Burmese who hire Laos workmen to sink the shaft at the rate of about 1s. 10d. per foot. There is already formed and in operation a Siam exploring company, which has obtained the right of working some of the Chantabun mines, and was at recent accounts proposing to lease the privilege to the highest bidder. Among several applicants, the company was disposed to favor the previous lessee, one Moung Khime, as most likely to conduct operations successfully in the face of native jealousies and various obstacles that impede the enterprise in that country. The latest advices, however, state that a new lessee, Moung Sia, has obtained control and was about to begin work; but that there was much controversy and dissatisfaction, and a general unsettled state of affairs in the district.

In comparing these mines, from which many fine gems are said to be obtained, with those of Burmah, it is not difficult to recognize some marked resemblance to the alluvium and "hill-wash" deposits so fully described by Messrs. Brown and Judd. The "twinlone" working is almost identical; but the other methods of exploitation used in Burmah do not seem, from present accounts, to have been yet employed in Siam. The lack of definite geological information regarding the Patat Hills, however, prevents any detailed comparison as to the source of the gems.

Mr. G. H. F. Ulrich, of the Dunedin University in New Zealand, mentions the occurrence of ruby crystals in small prisms from 2 to 6 mm. in length and from 1 to 2 mm. in thickness. The color is sometimes a fine rose red, approaching carmine, but is generally of a deep purple red and rather dull. The prisms are closely striated horizontally, the planes of the rhombohedra having alternate basal replacement, as in rubies of some other localities. These were observed in large bowlders found in the gold drift of a claim at Back Creek, near Rimu, Westland, New Zealand. Transparent finely colored grains of ruby were also observed in moderate abundance embedded in a green mineral which proved to be margarite.

SAPPHIRE.

Further discoveries of sapphires have been made in Montana, and the outlook is promising. It is over a year since sapphires were first found in Fergus County, near the upper waters of the Judith River, on the eastern slope of the Little Belt Mountains. The town of Utica, Fergus County, is about 15 miles to the northwest. A large tract of country has been explored and claims staked out. The gems occur in a deposit of what is reported as a decomposed limestone, and are separated by water, the pulverized material being sluiced in the same manner as for gold, the heavy crystals gathering at the bottom of the sluices. This mode of occurrence bears an interesting resemblance to that of the Burman and Siamese corundum, elsewhere described in this report. The Fergus County sapphires present a variety of forms, from a simple rhombohedron of 1 to 8 mm. in diameter to low flat rhombohedrons 2 mm. thick and 12 or 14 mm. in diameter. In color they vary greatly; many are pale blue, some peacock blue, and there are some fine cornflower sapphires; some show dichroism, lighter blue in one direction and deeper in the other; and a few are amethystine. Several thousand carats of all grades were obtained from a preliminary washing of 100 loads of material; of these there were 200 carats that cut into 60 carats of fine gems worth from $5 to $25 a carat.

For information on these points acknowledgments are due to Mr. T. E. Crutcher, of Helena, and Messrs. M. Dimon and S. S. Hobson, of Lewiston, Mont.

Mr. W. E. Knuth, of Helena, writes of other Montana localities. He refers to the blue and purple sapphires of Fergus County, as perhaps the best thus far obtained, and to the stones already described in former reports, from the Missouri River, Canyon Ferry to the Bear Tooth, on Emerald bar, French bar, Eldorado bar, and others. He then mentions other points, as Yogo Gulch, Fergus County, for blue sapphires; Rock Creek, Granite County, 30 miles from Phillipsburg, very good blue, with other tints, and some pale rubies; and on Cottonwood Creek, some 18 miles from Deer Lodge, all colors—red, pink, yellow, and occasionally blue.

ANDALUSITE.

Andalusite, in unaltered crystals with black crosses, is reported from Vallencita, San Juan Mountains, Colo., by Prof. Horace B. Patton, Golden, Colo.

CYANITE.

Mr. H. S. Durden, curator of the State mining bureau, San Francisco, Cal., writes that Mr. W. H. Storms, M. E., field assistant of the bureau, has discovered cyanite in large quantity in the Carga Muchacha district, San Diego County, but the crystals are small and of no value.

TOURMALINE.

During the year 1895 a remarkable discovery of rich green tourmaline was made at the historic Mount Mica, Paris, Oxford County, Me. In a single pocket was found material that was cut into wonderful gems weighing respectively 57, 34, 17, 12, and 5 carats. The largest of these was presented to the Isaac Lea collection in the United States National Museum. The one weighing 34 carats is now in the Tiffany-Morgan collection in the American Museum of Natural History, New York. For size and great depth of rich green color these gems are quite equal to any tourmaline found at any known locality.

In the Flint and Spar Company's mines, Haddam Neck, opposite Haddam, Middlesex County, Conn., a large number of green, pink, and multicolored tourmaline crystals, from 1 to 9 inches long, together valued at over $500, were found in mining for feldspar and quartz for pottery uses. This locality promises to produce most interesting material.

TURQUOISE.

Mr. John F. Blandy, of Prescott, Ariz., writes that half a peck of turquoise, valued at $2,000, was found with a mummy in a tomb near that city, the value evidently being largely for its archæological interest.

Turquoise in limited quantity has been found in the Cripple Creek camp, Colorado, as stated by Mr. Don Maguire, of Ogden, Utah. Turquoise is also reported from near Castle Rock Spring, Platte County, Colo., by Mr. J. M. Leader, of Los Angeles, Cal.

Prosopite, a bluish-green mineral, at first believed to be turquoise, was found by Mr. Josiah Beck, of Provo, Utah, near that place. Dr. W. F. Hillebrand, of the United States Geological Survey, by chemical analysis, identified the mineral as prosopite mixed with quartz, almost turquoise-like in appearance, the blue color being due to the presence of a small quantity of copper.

GARNET.

Almandite garnet in large loose crystals, much decomposed, has been found on the surface near Thomaston, Upson County, Ga., by Prof. W. S. Yeates.

Almandite fragments, one-half pound in weight, have been noticed in the gold washings at Alamo Canyon, Cal., by Mr. Dwight Whiting, of Los Angeles.

The almandite garnets found 9 miles east of Franklin, North Carolina, possess wonderful transparency, and when cut into gems are of exceptional beauty and brilliancy, many of them showing something like fire. Gems up to 5 carats each in weight have been found here.

Mr. C. M. Cotton, of Gallup, N. Mex., writes: "There have been no garnets (pyrope) or peridots brought in by the Indians during the past year, for the reason that there is no market for them."

Mr. M. Braverman, of Visalia, reports upon three varieties of garnet in that vicinity, as follows: Essonite, on Three Rivers, Tulare County; value of those found, about $50. Pyrope, on Rattlesnake Creek, also at Mineral King, Tulare County; value obtained (for specimens only), $100. Topazolite, at the chrysoprase locality, 12 miles northeast of Visalia; value of those found, $150.

Andradite specimens, associated with copper ores, have been brought from a locality in the Wasatch Mountains, some 65 miles south of Salt Lake City; and a brown garnet that has been mistaken for corundum occurs near Clifton, Utah. A yellowish-green garnet is found at the Carissa mine, in the Tintic district, Utah. These are reported by Mr. Maynard Bixby in the Mineral Collector for June, 1896. He also refers to a reddish-brown garnet at Copper Gulch, near Frisco, Utah, and also near Park City.

Mr. George F. Becker[1] says: "The fact is little known that garnets are also found in gold-quartz veins, and that the garnets, both in the veins and in the schists, at some little distance from quartz, sometimes carry gold in notable quantities. The only district in which such occurrences have been discovered, so far as I know, is northern Georgia, where they have long been familiar to miners, although until lately only one brief allusion to them seems to have been published."

QUARTZ (ROCK CRYSTAL).

Prof. Edward Orton, State geologist, Columbus, Ohio, writes: "A few specimens of quartz are collected from time to time in the drift and are brought to the lapidary, but the only value is in the labor bestowed upon them."

Rock crystal is reported by Mr. M. Braverman, of Visalia, Cal., as occurring at Three Rivers, Yokohol, and Drum Valley, all in Tulare County. The value obtained is probably $50.

A bowlder of sagenite (rutile in quartz) is reported from Jefferson County, Mont., by Mr. Don Maguire, of Ogden, Utah.

Inclusions of fluid with movable bubbles in quartz have been found in beautiful specimens on the land of Mr. John Chapman, South Fork Run, Burke County, N. C., by Mr. E. H. Harn.

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[1] Cosmopolitan Mag., October, 1895.

Smoky quartz in fine specimens is reported at the tourmaline locality in the San Jacinto Mountains, Riverside County, Cal., by Mr. Dwight Whiting.

Rose quartz occurs at Theresa, Jefferson County, N. Y., and 50 tons were mined in 1895, according to Mr. C. D. Nimms, of Philadelphia, N. Y.

Rose quartz is also noted by Mr. E. H. Saltiel, of Denver, occurring at a mica mine in Park County, Colo., at the head waters of Currant Creek; Mr. M. Braverman, of Visalia, Cal., reports that about $150 worth have been obtained on the Yokohol River, in Tulare County, near that place; and Prof. W. H. Smith, also of Visalia, states that it is found of beautiful pink color at many points in the neighborhood.

AMETHYST.

Prof. F. W. Clarke, of the United States National Museum, reports rich purple amethyst from Anderson County, N. C., in large crystals and groupings, in many respects rivaling those from any other American locality. Some of these crystals would cut into good stones. With them were found large coarse beryls.

A single great crystal of amethyst, 9 inches long and 5 wide, and weighing 12 pounds, was found at Granite Creek, Montana, over a year ago, according to the Montana Mining and Market Reporter, but nothing was said of its color or quality.

Mr. E. H. Saltiel, of Denver, reports amethyst likewise at the Last Chance mine, Creede, Mineral County, Colo., and in various parts of Park County, but gives no particulars.

New Zealand is now coming into notice as a promising field for mineralogical discovery, and many interesting things are brought to light by the indefatigable German agate hunters from Oberstein, who are searching that country, Queensland, and New South Wales as diligently as they have Brazil and Uruguay. Among minerals recently found are some rolled masses of sagenite (rutilated quartz) of many pounds in weight. The penetrating crystals of rutile, red, brown, and yellow, are several inches long and vary from hair-like fineness to 2 mm. in diameter. Sometimes they are very sparsely distributed, and at other times in such profusion as to give the appearance of a matted mass of hair. One piece weighing 30 pounds was entirely of this character. Another of 15 pounds contained a dozen or more rutile crystals from 1 mm. to 2 mm. thick and 9 inches long.

Among other quartz minerals, magnificent crystals of amethyst have been found; one of these is entirely of gem quality, and weighs 550 pennyweights (27½ ounces troy); also in the same vicinity many fine specimens of smoky quartz.

CHRYSOPRASE.

This mineral occurs at several localities on the Pacific Coast, and may prove a valuable addition to American semi-precious stones. Small amounts have been found at several points in the East, but not sufficient to be important. A fine vein has lately become known at Riddles, Douglas County, Oreg., and now two or three promising localities are found in Tulare County, Cal., near Visalia. The first discovery here dates from 1878, when Mr. George W. Smith, a surveyor, found pieces of it and brought them to the notice of experts. Mr. M. Braverman, of Visalia, tested the material, which at first had been thought to be colored by copper, and finding nickel oxide present, identified it as chrysoprase. This opinion was confirmed by the State mining bureau, and from that time specimens have been sent to various museums and collections in this country and abroad. Of late it has been attracting attention for jewelry, and two other localities have been discovered.

The principal point of occurrence is about 12 miles northeast of Visalia, where the chrysoprase forms small veins of 2 or 3 inches in thickness in a jaspery rock. It is much flawed and good pieces for cutting are scarce, but the color is excellent and some handsome articles of small size have been made from it.

Another locality is on Stokes Mountain, and a third on the Tule River, all in Tulare County. It is estimated that about $550 worth has been taken out during the year, about half of which has been used for cutting and half for cabinet specimens. The locating of the principal vein is due to Mr. C. P. Wilcomb, curator of the Golden Gate Park Museum, at San Francisco. Mr. Braverman has been working and exploring for it actively, and information has also been given by Prof. W. H. Smith, of Visalia.

Of allied varieties, the following may be further noted: Plasma, prase, chalcedony, and chrysoprase are reported in good specimens from near Joseph, Socorro County, N. Mex., by Mr. F. G. Hillman, of New Bedford, Mass., and prase at Stone Corral, Millard County, Utah, by Mr. Don Maguire.

Chalcedony, blue (saphirine), occurs in fine specimens in Santa Barbara County, Cal., according to Mr. Dwight Whiting.

Agate and plain chalcedony, coated with drusy quartz, have been found near Thomaston, Upson County, Ga., by Prof. W. S. Yeates.

PLASMA.

Among archæologists the name plasma has always been applied with some uncertainty, generally to any green substance that is hard and resembles quartz. From a careful study of many hundreds of antique green gems, I am inclined to believe that among them there are a number that are true jade ("nephrite"), which from its appearance and hardness was called plasma from the unfamiliarity of the glyptological archæologists with jade. This as yet has not been definitely identified as being a material that antique gems were engraved on, although Prof. F. W. Rudler mentions as such a reputed seal of Egyptian origin.

MOSS AGATE.

The locality at Hartville, Wyo., referred to in previous reports, is further reported upon lately by Mr. H. A. Crain, of that place. The vein is from 8 to 10 inches wide, and pieces of 2 or 3 feet across can be obtained. Mr. Crain thinks that the indications are that yet larger slabs can be procured as the vein is worked farther down.

Mr. P. McGill, of Cheyenne, Wyo., writes that there are moss-agate quarries about 75 miles northwest of that city, where the material is abundant and of good quality. Another extensive locality is 47 miles northwest of Cheyenne. He reports also onyx of good quality as existing in large amount in the same region.

A ledge of moss agate 1 inch in thickness is reported by Mr. Dwight Whiting in San Bernardino County, Cal.

Moss opal is also announced as occurring in Tulare County, Cal., near Visalia, on the same land with the chrysoprase elsewhere referred to.

OPAL.

The igneous rocks of Idaho seem to promise well in reference to opals. Mr. R. Bell, of Salmon City, Idaho, gives interesting particulars of the occurrence of opal in that vicinity. Some years ago an old miner found a trachyte bowlder about two tons in weight which attracted his attention from the rich gleams of color which it gave in the sunshine. He broke off specimens, but they were pronounced by parties to whom he showed them to be volcanic glass and of little value. For some years he and his sons broke off handsome pieces and gave them away from time to time to travelers and collectors, until Mr. Bell happened to find a piece in the miner's cabin and at once recognized it as fine opal. He was taken to the spot where the bowlder lay, on the hillside a couple of miles from the cabin, and though a good deal of it had been broken and hammered off, he obtained from the rest of it 200 carats of gem material. Some of this has been cut and sold at $6 a carat. Mr. Bell found other bowlders of like character, though not so richly veined with opal, lying in a line for several miles, and finally traced them to the parent ledge, which he describes as a contact between two slightly different gray trachytes. One of these presents a thickness of from 30 to 50 feet, and is full of chalcedonic geodes, white striped agate, hyalite, white opal, etc.

The original bowlder, which must have come from this ledge, contained material of the finest quality, some of it transparent, some milky, but both with brilliant fire showing rich and various colors, as beautiful as the opals of Queretaro and Guerrero, Mexico. The old miner declares that the pieces that he at first broke off were finer than any that Mr. Bell has obtained. With the true opal occur many varieties—brown, black, honey yellow, etc., and in some cases hydrophane, which, when wet, is as beautiful as the opal.

Other localities that are noted from Idaho are the following: Panther Creek, Lemhi County, where noble opal in fine specimens is reported by Mr. Don Maguire, of Ogden, Utah; Squaw Creek, the Bengal Tiger Opal mine, where an opal weighing more than 500 carats was taken out at a depth of only 3 feet from the surface. In DeLamar County the prospects are reported as very good, but nothing was done during the year.

The opal excitement has brought a host of tramps and adventurers to Idaho, who have sold quantities of quartz and inferior opal material on the trains passing through the country under the name of Idaho opals, to the detriment of the real industry.

In Washington State, hyaline opal, white and reddish, is reported from Walla Walla, by Mr. W. O. Donnell; and in Douglas County, a rich golden semiopal of great beauty is found, also red, olive green, and striking mingling of all three colors.

From Grass Valley, Oreg., Mr. George Perault reports semiopal, and Mr. S. F. Mackie, of Salt Lake City, opalized wood from a locality in Utah.

Mr. G. Rawls, of Phœnix, Ariz., has found an opal-like material of a turquoise blue color, in a vein 1 to 3 feet wide and 600 feet long.

In California, at the chrysoprase locality near Visalia, Tulare County, a beautiful yellow opal, resembling amber, is described by Mr. Braverman.

Opal and chalcedony in obsidian, and oligoclase in spherulites, have been noted at Ute Creek, Hinsdale County, Colo., by Prof. Horace B. Patton.

Hyalite on granite, but of poor quality, is reported at Stone Mountain, Ga., by Prof. W. S. Yeates.

The Australian opal fields are yielding largely and the material is very fine. A new region has been opened at Norseman, West Australia, where much beautiful opal is found in a conglomerate rock, the colors being white, blue, and light green, richly veined, occasionally dark blue to black. When struck, they are said to be highly sonorous, yielding a bell-like ring. They are found just below the surface over an area thus far examined of about 100 acres.

The great recently developed locality at Fermoy, Queensland, 550 miles from Rockhampton, has been visited and described by Mr. P. G. Grant, mining commissioner. After leaving the railroad at Fermoy station, the country soon changes from fertile grassy downs to a barren sandy region, covered with sparse shrub and more or less sprinkled with ironstone. The diggings are shallow excavations, few of the shafts going as far down as 20 feet, and much of the opal being found quite near the surface. The matrix is a layer of hard ferruginous sandstone, found at varying depths a little below the general level of the ground; it is not continuous over any great area, being sometimes in very small patches, and again traceable for considerable distances.

Beneath it is a stratum of hard clay; whether any more opal-bearing "bands" exist below this is not yet known. No wagemen are employed thus far; all the working is by individuals on their own account and apparently with good success. The great difficulty is that no water can be had within several miles, but otherwise the working is very easy, no washing, carting, or timbering being needful; food is easily procured and the opals have a ready market, so that profitable employment is found there by a large number of men. Over $100,000 worth of Australian opals was sold in 1896.

LABRADORITE.

Mr. W. C. Lynch, of Toronto, Ohio, reports finding a bowlder of labradorite resting on the "third terrace" near that place. The country rock in the whole vicinity is Carboniferous, and this is evidently an iceborne erratic from the Canadian highlands. Mr. Lynch first noticed it from the play of colors exhibited by the stone in the sunshine.

Labradorite is also announced as occurring in large quantities on Mount Shavano, Chaffee County, Colo., by Mr. E. H. Saltiel.

LAPIS LAZULI.

The casket of lapis lazuli that Nasrulla Khan presented to Queen Victoria from the Ameer of Afghanistan is a marvel of art. It is 18 inches long by 15 inches high, cut from a single block of lapis lazuli, and is incrusted with large diamonds, rubies, and emeralds. From the four top corners spring stars containing 612 brilliants. The value of the whole is $85,000. The great block of lapis lazuli of 180 pounds in the Montez collection in Higinbotham Hall, at the Field Columbian Museum, was found in Bolivia, and consists of material fine enough for an object of this kind.

RHODOCROSITE.

Rhodocrosite of a fine red color, in loose grains from one-half of an inch to 2 inches across, is announced from Vallecita (basin of Needle Mountain), in the San Juan Mountains of Colorado, by Prof. Horace B. Patton, of Golden, Colo. The same mineral is also reported in crystals from Dalton gold mines, near Marysvale, Utah, by Mr. Maynard Bixby; but those thus far seen, though good, are not equal to the best from the Colorado locality.

REALGAR.

Mr. Maynard Bixby mentions, in the Mineral Collector for June, 1896, the occurrence of realgar at the Golden Gate mine, Utah, in beautiful crystals and associated with orpiment. This occurrence is of especial interest, as the association of these two minerals together is highly prized in China and Japan, and ornaments are frequently cut from them in such a manner that the realgar and orpiment serve to give an interesting cameo effect to the carved objects made of this mixture; and this effect is so highly prized that it is beautifully imitated in glass, examples of which can be found in many oriental collections.

AMBER.

From the dawn of history the world's principal supply of amber has come from the southern shore of the Baltic, and chiefly from the eastern portion, the Samland Peninsula, between the Frische Haff and the Kurische Haff, a low region of barren sands, which has been vividly described as "a strange, weird land of blowing sand, shifting sand dunes, and poverty-stricken amber hunters."

It was first gathered along the shore, where it was washed up by the sea after storms, and some is still obtained in this manner by men who wade into the water and gather the pieces from among the seaweed, etc., by means of hooks, or sometimes dredge for it in boats. The amber, as is well known, is the fossil resin of a coniferous tree, *Pinites succinifer*, which grew extensively over the now partly submerged lowland of northern Germany and the Baltic in the earlier Tertiary. These ancient forests are now represented by lignite, among which the resin occurs and from which it is washed out from off-shore outcrops. More recently the same beds have been worked by mining where they underlie the shore, and of late the main supply has been thus obtained from two mines, the Palmnicken and the Anna, at Palmnicken and Kraxtepelle, respectively. The principal points of trade and export are Königsberg, Memel, and Dantzig. The amber production amounted in 1893 to 405,000 pounds, valued at $500,000. There are some indications of a failure in the yield of amber from this region, if not immediate, at least prospective. Herr von Muden, the Prussian amber expert, is reported as saying that the supply is nearly exhausted. Much of the material now obtained is of inferior quality. In 1894 only one-seventh of the amber brought to that port was fine enough for working into ornaments; the rest had to be melted up for varnish and was worth only 3d. a pound for that purpose. On the other hand, it is stated that the reserve supply of amber is so great that if at any time new mines were to enter as competitors the market could be kept depressed for years to prevent the new fields from entering into competition. Messrs. Stantin and Becker, of Königsberg, Prussia, annually handle 132,000 pounds of amber, employing 1,500 people—1,350 men, at 2 marks a day, and 150 girls, at 1 mark a day. This firm has for many years employed Professor Klebs to gather interesting amber specimens. As a result, they have a remarkable museum entirely of amber and amber articles, which is of special ethnological interest, since they furnish amber to India, Persia, Egypt, Tripoli, Senegambia, Korea, and South America. They also exhibit some Chinese amulets and a tower-ring-shaped piece of amber drilled at one end, a finger piece intended for the Soudan, and many quaint ethnological forms. This, with the remarkable geological collection, showing almost every known occurrence and geological condition of amber, in the Provincial Museum at Dantzig, arranged by Dr. Conwentz, and the private collection of Dr. O. Helm, of the same city, affords the student of this interesting fossil gum facilities of study that have never existed before.

In case of a failure of the Baltic amber supply, the question of its occurrence elsewhere assumes increased interest. Similar material is known to occur at various places and in various geological formations, from the Cretaceous to the Quaternary. Amber is found on the east coast of England, in Sicily, and on the shores of the Adriatic, but nowhere in any large amount. In this country some has been obtained both in the Cretaceous and Tertiary deposits, but thus far only occasionally. It occurs on the Magothy River, in Maryland.

Many fossil and semifossil resinous bodies exist which resemble true amber, but are not equal to it in hardness or in brilliancy. Some of these are important articles of commerce in connection with the manufacture of varnish. Of these the principal ones are the copal of Africa and the Farther Indies and the "kauri gum" of New Zealand, both of which are of late geological age, apparently Quaternary passing into the Recent period, as they are semifossilized resins of trees still living, though frequently not now in the same immediate region.

The kauri gum is the product of a large coniferous tree, *Dammara sautralis*, of Farther India and New Zealand, well known as a most valuable timber tree, under the name of kauri pine. Thirty years ago the Maoris were the only people employed in procuring the gum, which was found on or near the surface of the ground, in the Auckland district. Now there are perhaps 4,000 whites and 1,000 Maoris engaged in this industry in that province, where alone the gum occurs, and from which it is largely exported to Europe and America for making varnish.

The copal resin, like amber, is rich in included insects, and the Chinese in a very clever manner insert brilliant colored beetles in copal and kauri gum by heating and sell the product extensively as being natural inclusions under the pretense that the beetle is of the same age as the gum in which they have put it.

MISCELLANEOUS DISCOVERIES.

Some remarkable discoveries of minerals have been made during the past year on Manhattan Island, New York City, by Mr. William Niven. Among these is a giant crystal of black tourmaline, which is pronounced by experienced mineralogists to be perhaps the largest anywhere known. It was purchased for $250 by the American Museum of Natural History, New York, and is on display in their collection. The crystal lies on a piece of the gray quartz matrix, attached but fully displayed, showing about 9 inches of the prism and one complete projecting termination; the diameter is 4 inches. The bright black tourmaline is divided across at one point by a narrow seam of quartz. Much other tourmaline was found in the same vein of gray quartz; but the crystals, though brilliant, were generally small. Many large garnets were also obtained at the same excavation; one of these, also in the museum, weighs nearly 10 pounds. Mr. Niven has an imperfect crystal which would have had a diameter of 23 inches had it developed to completion. These are dark-brown almandites, much modified and twinned.

In the same neighborhood Mr. Niven has also obtained more and larger crystals of the rare species, monazite and xenotine, which he first discovered on Manhattan Island a few years ago. Some hundreds of these crystals have now been found, most of them quite small, but all interesting, and the larger ones valuable.

The district in which the minerals occur lies in the upper west side of the island, along the recently excavated Harlem speedway. They are found in granite veins traversing the gneiss and schist of the island.

GEM COLLECTIONS.

The question may perhaps be asked, Is the appreciation of gems to-day simply a monetary one, or are they valued for their true beauty and interest? To this I will simply reply by giving certain facts, and referring to some of the leading public collections in the United States, as indicative of the growing appreciation of such objects in their artistic and scientific relations.

One of the newest, though not yet a very large collection of this kind, is that in the Golden Gate Park Museum at San Francisco, founded through the enterprise of Mr. M. H. De Young, as an outgrowth of the Midwinter Fair of California held in the winter of 1893–94. In this museum is exhibited a collection of over 200 varieties and localities of precious stones, and also an interesting collection of East Indian and other jewelry. Lately it is announced that Mr. Z. M. Davis, who has spent many years in gathering precious stones in all parts of the world, has presented to this museum his admirable collection of opals, embracing nearly 800 specimens. The same gentleman has given to the San Francisco Academy of Sciences a large and beautiful series of Japanese works in rock crystal, some of them elaborately carved. The gem of the collection is a crystal ball 7 inches in diameter.

A similar outgrowth of the Columbian Exposition is the Field Columbian Museum at Chicago, which is already one of the most important institutions of the kind in this country.

The Metropolitan Museum of Art, in New York, contains three collections of especial value from the historical and artistic standpoint. These are : (1) The Cesnola collection of Cypriote gems and jewelry; (2) that of the late Rev. C. W. King, the highest authority and most important writer on antique gems, whose unique collection of these was acquired by the museum a few years ago; (3) the collection of the Rev. W. Hayes Ward, the oriental scholar, which comprises about 1,000 Babylonian cylinders and kindred objects of ancient Eastern jewelry.

Comparable with these may be named also the entire collection of antique and oriental engraved gems of Dr. Maxwell Sommerville, now belonging to the University of Pennsylvania.

Of more especial mineralogical and æsthetic interest are: (1) The Tiffany-Morgan collection at the American Museum of Natural History, New York; (2) the Garland cabinet of gem minerals at Harvard University, Cambridge, Mass.; (3) the collection belonging to the New York State cabinet, at Albany, N. Y.; (4) the Higinbotham Hall collection at the Field Columbian Museum, Chicago, Ill.; (5) the Golden Gate Park Museum collection at San Francisco, already referred to; (6) the collection of the State mining bureau at San Francisco; (7) that of the United States National Museum, founded by Prof. F. W. Clarke, which now has incorporated with it the gem collection of that indefatigable and original writer, the late Dr. Isaac Lea, and has been still further enriched by the entire Tiffany-Lea collection of pearls and Southern gems from the Atlanta Exposition, and many fine gems from other sources.

THE GEM EXHIBITS AT ATLANTA.

Mention may be made here of several exhibits connected with precious stones at the Cotton States and International Exposition, held at Atlanta, Ga., in the autumn of 1895. An extensive display of the minerals of Georgia was made by Prof. W. S. Yeates. Among those of interest in connection with gems were amethysts from localities in seven counties (Forsyth, Habersham, Newton, Rabun, Troup, Towns, and White); some of those from Rabun County, of light claret color, flawless and brilliant, were cut and mounted. Troup County sent delicately colored rose quartz, beryl, aquamarine, and tourmaline; the latter was also displayed from Dekalb County. Corundum, of course, as one of the most important minerals of the State, was exhibited from various localities in Cherokee, Cobb, Habersham, Paulding, Rabun, and Towns counties. While most of it is valuable chiefly as an abrasive, some transparent corundum occurs in all these counties; Rabun is thus far the richest. Other valuable species include the celebrated rutiles of Graves Mountain, monazite from Hall County, opalite from the Rabun corundum mines, etc.

In the mines department an interesting group of collections was also displayed, illustrating the associations and mode of occurrence of several important gems. The first of these was a series of rocks and minerals associated with opal, from Washington, Oregon, Idaho, Hungary, New Zealand, Queensland, Honduras, and Mexico. Those of Hungary and Mexico were personally collected by the writer.

Another comprised the various earths, rocks, and minerals in or with which occur the pyrope garnets of Bohemia. These had also been gathered by the exhibitor at the principal locality, Dlaschkowitz, and were supplemented by a published paper on their occurrence, by the same author, and by microscopic rock sections.

A third series consisted of the rocks, minerals, gravels, and earths from the diamond fields of South Africa, Brazil, and India, and the occasional diamond regions of California, North Carolina, and possibly Kentucky.

A fourth exhibit was of amber from Eastern Prussia, New Jersey, and a few other points, together with the geological deposits and fossils found in connection with it. These exhibits were made by Mr. George F. Kunz, of New York, at the request of the chief of the department of mining.

The Tiffany-Lea collection of gems occupied a hexagonal case in the center of the mining building. It contained a large number of the most remarkable precious stones, both cut and uncut, found in the Southern United States. Among them is a crystal of emerald weighing 8 ounces, found at Stony Point, N. C., and a collection of over 400 pearls, showing all of the various colors; intergrowths and groupings, from one to a dozen pearls; various imitative forms, such as wings, dogs' heads, and others, constituting what are known as hinge pearls, also pearls of various colors and inclusions in shells of various colored pearls in pearl shells, and the encysting of the crawfish, etc. This collection was presented to the United States National Museum by a relative of the late Dr. Isaac Lea, and was incorporated in the Isaac Lea collection of gems.

THE BEHAVIOR OF GEMS WITH ROENTGEN RAYS.

Prof. Dr. C. Doelter, of the University of Graz, Styria, Austria, has laid before the mineralogical and geological section of the university some very interesting conclusions on the action of the Roentgen rays on minerals and precious stones. The experiments were carried on in the laboratory of Professor Rollet.

White diamond, spinel, sapphire, zircon, topaz, yellow chrysoberyl, and colorless rock crystal are readily distinguished by these rays from glass; ruby from spinel, tourmaline, and garnet; sapphire from iolite, blue quartz, indicolite, aquamarine, and others. The new rays were also found of value in observing inclusions and in detecting doublets. His experiments were made on 65 minerals, and the results show that the specific gravity of a mineral does not determine its power to allow the X rays to pass through, although minerals with a density over 5 are nearly all opaque to them; yet rock salt, sulphur, niter, and realgar do not allow the rays to go through, while cryolite, corundum, and diamond allow them to pass freely.

Among the precious stones, etc., diamond, amber, corundum (sapphire), and meerschaum allow the rays to pass, whereas epidote, pyrite, rutile, and almandine do not.

Dr. Doelter[1] has arranged the minerals into eight groups, as follows:

1. Diamond.	5. Rock salt.
2. Corundum.	6. Calcite.
3. Talc.	7. Cerusite.
4. Quartz.	8. Realgar.

The diamond allows 10 times more light to pass than corundum and 200 times more than realgar.

Professor Robb, of the Jarvis Laboratory, Trinity College, Hartford, Conn., has conducted a variety of experiments as to the behavior of different gems under the action of the so-called X rays. It soon appeared that the new rays afford a means of distinguishing true diamonds from the best imitations, the former being perfectly transparent, while glass and paste are opaque. Two rings of similar size and character were tested, the one having a diamond and the other a paste; in the former case the "cathodegraph" showed only the setting, the diamond being represented by a white space, while in the latter the paste appeared as a dark object.

A similar series of experiments on various gems was conducted by Prof. J. B. Cochrane, of the Royal Military College, at Kingston, Canada. A full account of these, with illustrations, appeared in the Jeweler's Circular, New York, for April 22, 1896. The same facts were developed as to the complete transparency of diamond as compared with either quartz or paste, although paste is not so opaque as ordinary glass; and a similar though less conspicuous contrast exists between almost all true gems and their imitations, even in the case of an opaque stone like the turquoise. It is suggested that this will prove an extremely valuable test in the case of cut, and especially of mounted gems.

GEM LITERATURE.

During the past year a German work has appeared on precious stones which will be regarded as a standard treatise for a long time to come—the Edelsteinkunde of Prof. Dr. Max Bauer, of the University of Marburg, the editor of the Jahrbuch für Mineralogie. This work has been issued at Leipsic in ten parts, and is to be supplemented by an eleventh. Each part contains a beautiful colored plate of gems, shown both in the matrix or in crystals, and cut, in all some 80 colored figures. The colors are remarkably well shown, from the diamond to opal, labradorite, beryl, emerald, topaz, and amber. These plates are the finest representations that have yet appeared of the species described, and reflect great credit upon Dr. Bauer for the careful selection of the subjects, and upon Mr. Ohman, the color artist who executed them. Part I of the series

[1] Separat Abdruck aus Mittheilungen des Naturwissenschaftliches Vereins. f. Steiermark, Jahrg. 1895; March 26, 1896.

and a portion of Part II are occupied with the physical properties and crystallography; then follow the methods of cutting, the modes of valuation, and other practical relations. Much space is given to occurrence and exploitation, with numerous maps of mining regions and figures of machinery and appliances, together with geological charts, views of diamond mining, and figures of remarkable diamonds. The work is very comprehensive and the whole well arranged. The chapter on color and optical phenomena is of special value; that on the heating and burning of diamonds is a full résumé of the literature of that subject, and the phosphorescence of diamonds is also treated of. The chapter on the occurrence of gems is very complete, and the mining and geological maps and the views of mines and mining appliances are admirable. The chapter which treats of cutting is illustrated with a number of plates of the different forms into which precious stones are cut, and a special section is given to the method of engraving gems, while the chapter on weights and values is well up to date, and the various methods of determining gems are thoroughly and clearly presented.

Dr. Bauer, with the resources at his command, has written a volume which will long be a scientific classic in German literature. Since Kluge's book on gems in 1860 no important work on this subject has appeared in Germany, with the exception of Dr. Paul Groth's Edelsteinkunde, which was welcomed by all in 1887; but so much advance has been made since that time that this new and admirable treatise is of great value and interest.

PRODUCTION IN THE UNITED STATES.

Production of gems in the United States in 1895.

Gem.	Value.
Diamond	$250
Sapphire	9,057
Ruby	2,000
Topaz	1,000
Beryl (aquamarine, etc.)	369
Phenacite	1,050
Emerald	25
Tourmaline	3,160
Opal	300
Peridot	300
Smoky quartz	4,000
Quartz, rock crystal	8,160
Silicified wood	4,000
Chrysoprase	550
Prase	100
Andalusite	1,000

Production of gems in the United States in 1895—Continued.

Gem.	Value.
Garnet (pyrope, almandite, and essonite)	$2,350
Anthracite	2,000
Pyrite	1,000
Rutile	100
Epidote	75
Oligoclase	150
Moonstone	25
Prehnite	200
Catlinite (pipestone)	3,000
Arrow points	1,000
Thomsonite	500
Diopside	200
Agate	2,000
Chlorastrolite	500
Turquoise	50,000
Moss agate	1,500
Amethyst	200
Fossil coral	1,000
Rose quartz	1,000
Gold quartz	10,000
Rutilated quartz	500
Dumortierite in quartz	....
Utahlite (compact variscite)	1,000
Total	113,621

Production of precious stones in United States from 1880 to 1895.

Year.	Value.	Year.	Value.
1880	$100,000	1888	$139,850
1881	110,000	1889	188,807
1882	150,000	1890	118,833
1883	207,050	1891	235,300
1884	222,975	1892	312,050
1885	209,900	1893	264,041
1886	119,056	1894	132,250
1887	163,600	1895	113,621

IMPORTS.

The diamonds used in this country are all imported, for, as already mentioned, they are but rarely found in the United States. The following table gives the imports of rough diamonds for a series of twenty-three years:

Imports of rough or uncut diamonds since 1873.

Year ending June 30—	Value.	Year ending June 30—	Value.
1873	$176,426	1885	$371,679
1874	144,629	1886	302,822
1875	211,920	1887	262,357
1876	186,404	1888	322,356
1877	78,033	1889	250,187
1878	63,270	1890	513,611
1879	104,158	1891	804,626
1880	129,207	1892	1,032,869
1881	233,596	1893	802,075
1882	449,513	1894	839,806
1883	443,996	1895	111,033
1884	367,816		

Diamonds and other precious stones imported and entered for consumption in the United States, 1867 to 1895, inclusive.

Year ending—	Diamonds.			Diamonds and other stones not set.	Set in gold or other metal.	Total.
	Glaziers'.	Dust.	Rough or uncut.			
June 30, 1867	$906			$1,317,420	$291	$1,318,617
1868	484			1,060,544	1,465	1,062,493
1869	445	$140		1,997,282	23	1,997,890
1870	9,372	71		1,768,324	1,504	1,779,271
1871	976	17		2,349,482	256	2,350,731
1872	2,386	89,707		2,939,155	2,400	3,033,648
1873		40,424	$176,426	2,917,216	326	3,134,392
1874		68,621	144,629	2,158,172	114	2,371,536
1875		32,518	211,920	3,234,319		3,478,757
1876		20,678	186,404	2,409,516	45	2,616,643
1877		45,264	78,033	2,110,215	1,734	2,235,246
1878		36,409	63,270	2,970,469	1,025	3,071,173
1879		18,889	104,158	3,841,335	538	3,964,920
1880		49,360	129,207	6,690,912	765	6,870,244
1881		51,409	233,596	8,320,315	1,307	8,606,627
1882		92,853	449,513	8,377,200	3,205	8,922,571

Diamonds and other precious stones imported and entered for consumption in the United States, 1867 to 1895, inclusive—Continued.

Year ending—	Diamonds.			Diamonds and other stones not set.	Set in gold or other metal.	Total.
	Glaziers'.	Dust.	Rough or uncut.			
June 30, 1883..	....	$82,628	$443,996	$7,598,176	a$2,081	$8,126,881
1884..	$22,208	37,121	367,816	8,712,315	....	9,139,460
1885..	11,526	30,426	371,679	5,628,916	....	6,042,547
Dec. 31, 1886..	8,949	32,316	302,822	7,915,660	....	8,259,747
1887..	9,027	33,498	262,357	10,526,998	....	10,831,880
1888..	10,025	29,127	244,876	10,223,630	....	10,557,658
1889..	8,156	68,746	196,294	11,704,808	....	11,978,004
1890..	147,227	179,154	349,915	b 12,429,395	....	13,105,691
1891..	565,623	125,688	408,198	11,657,079	....	12,757,079
1892..	532,246	144,487	516,153	13,328,965	....	14,521,851
1893..	357,939	74,255	444,137	9,321,174	....	10,197,505
1894..	82,081	53,691	c 1,423,275	5,868,067	....	7,427,215
1895..	107,463	135,558	c 3,329,545	2,987,487	....	6,560,053

a Not specified since 1883.
b Includes stones set and not specially provided for since 1890.
c Includes precious stones other than diamonds.

ABRASIVE MATERIALS.

By EDWARD W. PARKER.

BUHRSTONES.

PRODUCTION.

While the value of the product of buhrstone in 1895 was larger than that of 1893 or 1894, it can not be taken as indicating any tendency toward a permanent improvement in the industry, which has been on the decline for the past fifteen years. In 1880 the value of buhrstones made from domestic material in the United States was placed at $200,000. In 1895 it was $22,542, but 11½ per cent of that of 1880, while in 1894 it was but little more than half this. There will always be a small demand for these domestic stones, and as long as it will pay to make them at all there will continue to be a limited production. Paint mills, cement mills, and mills for the grinding of the coarser cereals, bone, and phosphate rock find their requirements well filled by these stones, which can be obtained at moderate cost. For fine flouring mills the roller process has supplanted domestic buhrstones, and to some extent French buhr also, which, while superior to domestic stone and procurable at comparatively slight expense, does not compete with the more modern roller process.

Although classed as buhrstone, the domestic material is entirely distinct from any of the buhrs which are imported from France, Belgium, and Germany. The French buhr is considered the best. Both it and the Belgian buhr consist of small particles of silica mixed with calcareous material, and are hard and porous. The German buhr is said to be of basaltic lava. The domestic stone is a quartz conglomerate. All of the foreign stone is quarried in small pieces, which are shipped in the rough state at cheap freight rates to this country, where they are dressed to conformable shapes, fitted together, and bound into solid wheels. The domestic stone is found in large bowlders, which are worked down to millstones of the required size, the chief advantag for these being in the fact that they are in one piece. It occurs in several localities along the eastern slope of the Alleghany Mountains, notably in Ulster County, N. Y., where it is called Esopus stone; in Lancaster County, Pa., where it goes by the name of Cocalico stone, and in Montgomery County, Va., it is quarried as Brush Mountain stone. It has also been quarried in Moore County, N. C., under the name of North Carolina grit, but no product has been reported from that locality for several years. The product in 1895 was from New York, Pennsylvania, and Virginia.

In the following table is exhibited the value of the millstones produced in the United States since 1880:

Value of buhrstones produced in the United States from 1880 to 1895.

Year.	Value.	Year.	Value.
1880	$200,000	1888	$81,000
1881	150,000	1889	35,155
1882	200,000	1890	23,720
1883	150,000	1891	16,587
1884	150,000	1892	23,417
1885	100,000	1893	16,639
1886	140,000	1894	13,887
1887	100,000	1895	22,542

IMPORTS.

Value of buhrstones and millstones imported into the United States from 1868 to 1895.

Year ended—	Rough.	Made into millstones.	Total.
June 30, 1868	$74,224	....	$74,224
1869	57,942	$2,419	60,361
1870	58,601	2,297	60,898
1871	35,406	3,698	39,104
1872	69,062	5,967	75,029
1873	60,463	8,115	68,578
1874	36,540	43,170	79,710
1875	48,068	66,991	115,059
1876	37,759	46,328	84,087
1877	60,857	23,068	83,925
1878	87,679	1,928	89,607
1879	101,484	5,088	106,572
1880	120,441	4,631	125,072
1881	100,417	3,495	103,912
1882	103,287	747	104,034
1883	73,413	272	73,685
1884	45,837	263	46,100
1885	35,022	455	35,477

Value of buhrstones and millstones imported into the United States, etc.—Continued.

Year ended—	Rough.	Made into mill-stones.	Total.
Dec. 31, 1886	$29,273	$662	$29,935
1887	23,816	191	24,007
1888	36,523	705	37,228
1889	40,432	452	40,884
1890	32,892	1,103	33,995
1891	23,997	42	24,039
1892	33,657	529	34,186
1893	29,532	729	30,261
1894			*a*18,087
1895			*a*20,316

a Not separately classified after 1893.

GRINDSTONES.

Grindstones of domestic manufacture are obtained from the sandstone deposits which extend along the shores of Lake Erie for some distance east and west of Cleveland, Ohio, and as far inland as Marietta, and on Lake Huron above Detroit, Mich. In Mineral Resources for 1886 the methods of manufacture and use are given in detail, together with a tabular statement of the several varieties, foreign or domestic, that occur, with their special uses. Five varieties are produced in the United States—four in Ohio and one in Michigan. The four in Ohio are: (1) Berea, fine sharp grit, used specially for sharpening edge tools; (2) Amherst, soft loose grit, for edge tools and saws; (3) Independence, coarse sharp grit, for grinding springs and files and for dry grinding of castings; (4) Massillon, also coarse sharp grit, for large edge tools, springs, files, and dry castings. The Huron (Michigan) stone has a fine sharp grit, and is used for sharpening edge tools when a very fine edge is required.

The production of grindstones has been seriously affected by the trade depression of the past few years. In 1891 the value of the output was $476,113. In 1892 it dropped to $272,244, but reacted in 1893 to $338,787. In 1894 it fell to $223,214, and reached the lowest point of $205,768 in 1895, less than 45 per cent of the value of the product in 1891. The large decrease in value is brought about by a combination of smaller output and reduced prices.

In the following table is shown the value of grindstones produced in the United States since 1880:

Value of grindstones produced in the United States, 1880 to 1895.

Year.	Value.	Year.	Value.
1880	$500,000	1888	$281,800
1881	500,000	1889	439,587
1882	700,000	1890	450,000
1883	600,000	1891	476,113
1884	570,000	1892	272,244
1885	500,000	1893	338,787
1886	250,000	1894	223,214
1887	224,400	1895	205,768

Grindstones imported and entered for consumption in the United States, 1868 to 1895, inclusive.

Year ended—	Finished.		Unfinished or rough.		Total value.
	Quantity.	Value.	Quantity.	Value.	
	Long tons.		*Long tons.*		
June 30, 1868		$25,640		$35,215	$60,855
1869		15,878		99,715	115,593
1870		29,161		96,444	125,605
1871	385	43,781	3,957.15	60,935	104,716
1872	1,202	13,453	10,774.80	100,494	113,947
1873	1,437	17,033	8,376.84	94,900	111,933
1874	1,443	18,485	7,721.44	87,525	106,010
1875	1,373	17,642	7,656.17	90,172	107,814
1876	1,681	20,262	6,079.34	69,927	90,189
1877	1,245	18,546	4,979.75	58,575	77,121
1878	1,463	21,688	3,669.41	46,441	68,129
1879	1,603	24,904	4,584.16	52,343	77,247
1880	1,573	24,375	4,578.59	51,899	76,274
1881	2,064	30,288	5,044.71	56,840	87,128
1882	1,705	30,286	5,945.61	66,939	97,225
1883	1,755	28,055	6,945.63	77,797	105,852
1884					a 86,286
1885					50,579
Dec. 31, 1886					39,149
1887					50,312
1888					51,755
1889					57,720
1890					45,115
1891					21,028
1892					61,052
1893					59,569
1894					52,688
1895					54,276

a Since 1884 classed as finished or unfinished.

OILSTONES AND WHETSTONES.

PRODUCTION.

The value of the finished product in 1895 amounted to $155,881, the highest figure ever attained.

The statement of the production of oilstones and whetstones included also that of scythestones and kitchen and shoemakers' rubstones. The rough material from which they are made is obtained from various localities in the United States. The higher grades of oilstones are made from two grades of novaculite quarried in the vicinity of Hot Springs, Ark., and known, respectively, as "Arkansas" and "Washita" stone. Fine-grained sandstone, called "Hindostan" or "Orange" stone, from Orange County, Ind.; Lake Superior stone, quarried in Cuyahoga County, Ohio, and a similar material known as Labrador stone, from Cortland County, N. Y., and chocolate stone from Lisbon, N. H., are used for whetstones. Scythestones and rubstones are made from Indian Pond Lamoille stone, quarried in Grafton County, N. H., and Orleans County, Vt., from Berea grit (which also furnishes grindstones) and from some of the Indiana sandstone.

The production of oilstones, etc., in the United States has for several years been practically controlled by one concern, the Pike Manufacturing Company of Pike Station, N. H. This company owns quarries at French Lick, Georgia, Orangeville and Paoli, Ind.; Haverhill, Piermont, Orford, and Lisbon, N. H.; Truxton, N. Y.; Westmore and Brownington, Vt., and besides having its own quarries and 1,000 acres of quarry land in Garland County, Ark., this company has contracted with all the individual quarrymen for their entire output for a number of years. Under these circumstances the first uniform selling value that can be placed upon the product is for the finished articles, which for the past five years has been as follows:

Value of oilstones, whetstones, etc., produced in the United States since 1891.

Year.	Value.
1891	$150,000
1892	146,730
1893	135,173
1894	136,873
1895	155,881

From 1880 to 1890, inclusive, the product and value of the rough stone has been published in these reports, exception being made in the case of the output for 1890, when the value for the unfinished product was given for the novaculite of Arkansas, and in all other cases the value of the finished stones is quoted. The annual production from 1880 to 1890 was as follows:

Product of oilstones and whetstones from 1880 to 1890.

Year.	Pounds.	Value.
1880	420,000	$8,000
1881	500,000	8,580
1882	600,000	10,000
1883	600,000	10,000
1884	800,000	12,000
1885	1,000,000	15,000
1886	1,160,000	15,000
1887	1,200,000	16,000
1888	1,500,000	18,000
1889	5,982,000	32,980
1890	....	69,909

The reports of production by the Pike Manufacturing Company have been furnished this office annually since 1892, with permission to publish. They may be taken as indicative of the condition of the industry, and are shown in the following table. These figures are not claimed to be exact, but are estimated, though sufficiently approximate for all practical purposes.

Production of oilstones, etc., by the Pike Manufacturing Company in 1892, 1893, 1894, and 1895.

Kind.	1892.		1893.	
	Output.	Value.	Output.	Value.
Washita stone .... pounds..	400,000	$60,000	300,000	$45,000
Arkansas stone .... do....	20,000	12,000	12,000	12,000
Labrador stone .... do....	500	50	200	20
Hindostan stone .... do....	300,000	15,000	250,000	13,000
Sandstone .... do....	100,000	2,000	100,000	2,000
Chocolate stone .... do....	20,000	2,000	20,000	2,000
Scythestones .... gross..	16,000	50,000	13,000	40,000
Total value	....	141,050	....	114,020

Production of oilstones, etc., by the Pike Manufacturing Company, etc.—Continued.

Kind.	1894.		1895.	
	Output.	Value.	Output.	Value.
Washita stone.........pounds..	300,000	$45,000	250,000	$40,000
Arkansas stone............do....	15,000	15,000	15,000	20,000
Labrador stone............do....	100	10	....	....
Hindostan stone..........do....	300,000	15,000	300,000	12,000
Sandstone ....do....	100,000	2,200	100,000	2,000
Chocolate stone ....do....	25,000	2,500	10,000	1,000
Scythestones ....gross..	15,000	45,000	15,000	47,750
Total value...............	....	124,710	....	122,750

IMPORTS.

The following table shows the total value of all kinds of hones and whetstones imported since 1880:

Imports of hones and whetstones since 1880.

Year ended—	Value.	Year ended—	Value.
June 30, 1880.............	$14,185	Dec. 31, 1888.............	$30,676
1881.............	16,631	1889.............	27,400
1882.............	27,882	1890.............	37,454
1883.............	30,178	1891.............	35,344
1884.............	26,513	1892.............	33,420
1885.............	21,434	1893.............	25,301
Dec. 31, 1886.............	21,141	1894.............	26,671
1887.............	24,093	1895.............	32,439

CORUNDUM AND EMERY.

PRODUCTION.

In 1895 the total amount of corundum and emery mined in the United States was 2,102 short tons, valued at $106,256, against 1,495 short tons, worth $95,936, in 1894. The amount of the product was larger than in any previous year except 1889 and 1891, and the value, while greater by $10,000 than in 1894, was less than in 1892 or 1893. There was an increased production both of corundum and emery, the output of the latter, from Westchester County, N. Y., showing the greater increase. In 1889 the production of Westchester County emery did not exceed 30 tons. In 1894, five years later, the shipments amounted to more than 500 tons, and in 1895 to little less than 1,000 tons.

The producers of both emery and corundum are averse to giving publicity to their business, and in order to maintain the confidential nature of the statistics, the production of the two minerals is stated together in the following table:

Annual product of corundum and emery since 1881.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Short tons.			*Short tons.*	
1881	500	$80,000	1889	2,245	$105,567
1882	500	80,000	1890	1,970	89,395
1883	550	100,000	1891	2,247	90,230
1884	600	108,000	1892	1,771	181,300
1885	600	108,000	1893	1,713	142,325
1886	645	116,190	1894	1,495	95,936
1887	600	108,000	1895	2,102	106,256
1888	589	91,620			

IMPORTS.

The corundum used in the United States is exclusively of domestic production. Emery is imported from Turkey and the island of Naxos, one of the Cyclades group in the Grecian Archipelago.

The following table shows the imports of emery from 1867 to 1895:

Emery imported into the United States from 1867 to 1895, inclusive.

Year ended—	Grains.		Ore or rock.		Pulverized or ground.		Other manufactures.	Total value.
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.		
	Pounds.		*Long tons.*		*Pounds.*			
June 30, 1867	....	....	428	$14,373	924,431	$38,131	....	$52,504
1868	....	....	85	4,531	834,286	33,549	....	38,080
1869	....	....	964	35,205	924,161	42,711	....	77,916
1870	....	....	742	25,335	644,080	29,531	....	54,866
1871	....	....	615	15,870	613,624	28,941	....	44,811
1872	....	....	1,641	41,321	804,977	36,103	....	77,424
1873	610,117	$29,706	755	26,065	343,828	15,041	$107	70,919
1874	331,580	16,216	1,281	43,886	69,890	2,167	97	62,366
1875	487,725	23,345	961	31,972	85,853	2,990	20	58,327
1876	385,246	18,999	1,395	40,027	77,382	2,533	94	61,653
1877	343,697	16,615	852	21,964	96,351	3,603	....	42,182
1878	334,291	16,359	1,475	38,454	65,068	1,754	34	56,601
1879	496,633	24,456	2,478	58,065	133,556	4,985	....	87,506
1880	411,340	20,066	3,400	76,481	223,855	9,202	145	105,894

Emery imported into the United States from 1867 to 1895, inclusive—Continued.

Year ended—	Grains.		Ore or rock.		Pulverized or ground.		Other manufactures.	Total value.
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.		
	Pounds.		*Long tons.*		*Pounds.*			
June 30, 1881	454,790	$22,101	2,884	$67,781	177,174	$7,497	$53	$97,432
1882	520,214	25,314	2,765	69,432	117,008	3,708	241	98,695
1883	474,105	22,767	2,447	59,282	93,010	3,172	269	85,490
1884	143,267	5,802	4,145	121,719	513,161	21,181	188	148,890
1885	228,329	9,886	2,445	55,368	194,314	8,789	757	74,800
Dec. 31, 1886	161,297	6,910	3,782	88,925	365,947	24,952	851	121,638
1887	367,239	14,290	2,078	45,033	*a* 144,380	6,706	2,090	68,209
1888	430,397	16,216	5,175	93,287			8,743	118,246
1889	503,347	18,937	5,234	88,727			111,302	218,966
1890	534,968	20,382	3,867	97,939			5,046	123,367
1891	90,658	3,729	2,530	67,573				71,302
1892	566,448	22,586	5,280	95,625			2,412	120,623
1893	516,953	20,073	5,066	103,875			3,819	127,767
1894	597,713	18,645	2,804	51,487			1,841	71,973
1895	678,761	25,066	6,893	80,386			27,586	133,038

a To June 30, only; since, classed with grains.

CORUNDUM DEPOSITS OF THE SOUTHERN APPALACHIAN REGION.

By J. A. HOLMES.

The production of corundum in the United States has been practically limited to the southern Appalachian region, by far the larger part of the product having come from a few mines in Macon, Jackson, and Transylvania counties, in North Carolina, and Rabun County, Ga. The rocks with which the larger part of this corundum has been found associated may be designated in a general way as basic magnesian rocks, including under this term the peridotites (dunite, hartzburgite, amphibole-pierite, forellenstein), pyroxenites (enstatite rocks, Websterite), and amphibolites (smaragdite (?), edenite (?)), the former of these groups being by far the most abundant.

These rocks occur in a series of narrow and elongated lenticular masses, in that extensive series of crystalline gneisses and schists to be found all the way from New England into Alabama, though partially covered by later deposits in New Jersey and Pennsylvania, New York, western Massachusetts, and Connecticut. It may be said, also, that with these peridotite rocks in Massachusetts and New York occur the important emery deposits in Westchester County, N. Y., and at Chester, Mass. These peridotite rocks have been traced at intervals from New York southward through Pennsylvania, Maryland, and Virginia into Alabama, but thus far the known workable deposits of corundum are found in the southwestern portion of North Carolina and in the northeastern portion of Georgia.

Preliminary reports have been recently published by the Geological Surveys of Georgia[1] and North Carolina[2] describing in some detail the corundum deposits in each of these States. In the latter of these reports a carefully prepared geologic map is given, which shows the distribution of the corundum and basic magnesian rocks with which it is associated in western North Carolina and northeastern Georgia. The larger part of this region is occupied by the broad belt of gneisses and crystalline schists of supposed Archæan age, which lie between the Blue Ridge and Great Smoky Mountains.

Along the line of the Great Smoky Mountains, extending southward from the vicinity of Johnson City, is a belt of shales and limestones, conglomerates, and sandstones, resting unconformably on the underlying gneisses. This belt is quite narrow at its northern end, but widens to more than 20 miles along a section of the Little Tennessee River. To these rocks, the exact age of which is still unknown, the term Ocoee has been applied. Another exceedingly narrow belt of similar rocks extends from South Carolina in a northeasterly course, near the crest of the Blue Ridge to Watauga County, where it spreads out in a somewhat irregular way (due probably to the faulting of the rocks), and has an aggregate width of some 15 miles; whereas farther southward, in Transylvania County, its width is probably in places less than 1 mile.

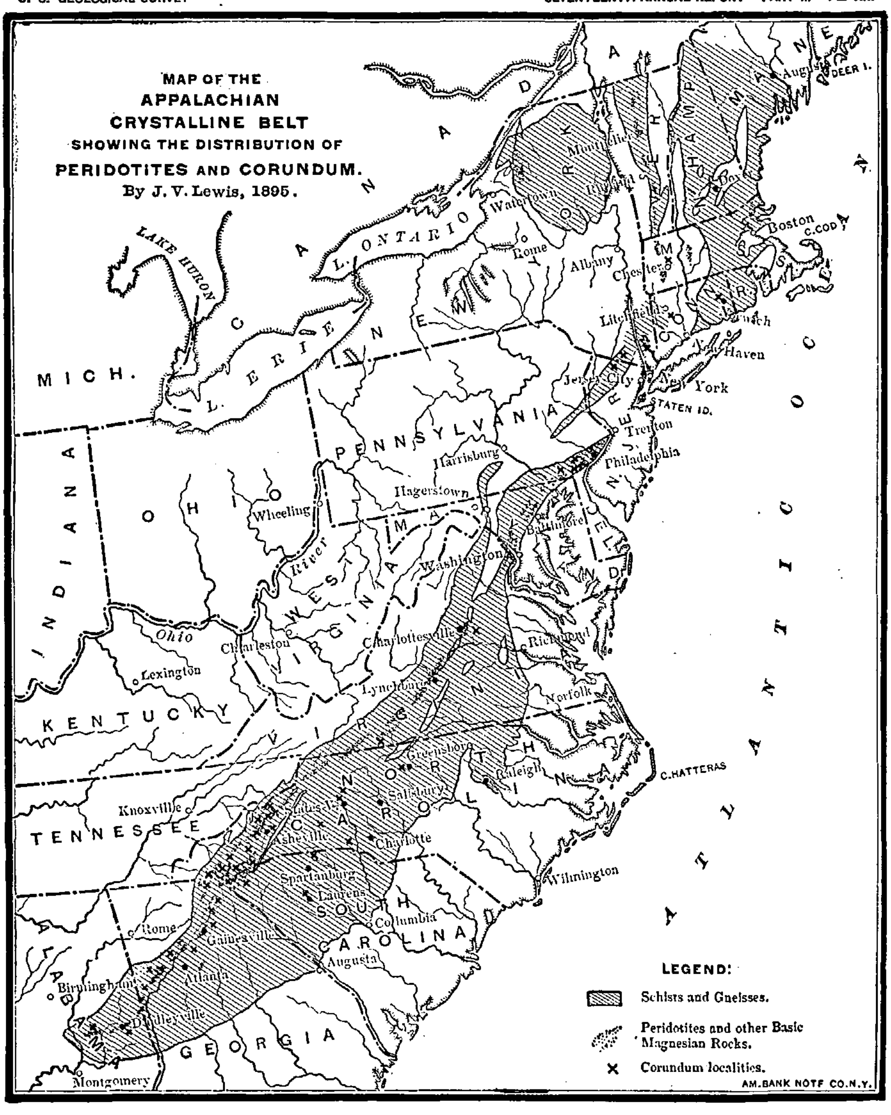
Between these two somewhat parallel Ocoee belts is the extensive area of gneisses and crystalline schists in which occur the numerous lenticular masses or dikes of the peridotite and associated basic magnesian rocks. From Yancey County, N. C., southwest into Rabun, Towns, and Union counties, Ga., these have been found to be corundum bearing, and this portion of the area may be designated as the corundum belt of the southern Appalachian region. The masses of peridotite rock are usually only a few hundred feet across, and have a length of from a few hundred yards to a mile or more, this greater length being usually in the same direction as the strike of the rocks of the region (N. 30 to 40 E.). At Webster, Corundum Hill, and Buck Creek, North Carolina, and Laurel Creek, Georgia, and some other places, the form varies from this type, being less elongated. The strikes and dips of these rocks in most cases conform to those of the gneisses and schists, though in other cases they appear to break across those of these inclosing rocks. The origin of the peridotites is still a matter of some doubt, but the evidence generally appears to point to their being eruptives.[3]

In some portions of the area, as in Haywood, Buncombe, and Madison counties, the lenticular peridotite masses follow each other along a few well-defined lines, as though they represented the somewhat

[1] Corundum in Georgia, Bull. 2, Geol. Survey of Ga., 1894, by Francis P. King.

[2] Corundum and the Basic Magnesian Rocks of Western North Carolina, Bull. 11, Geol. Survey of North Carolina, 1896, by J. V. Lewis.

[3] See Origin of the Peridotites of the Southern Appalachians, by J. Volney Lewis, Elisha Mitchell Society Journal, Part II, 1895, pp. 24–37.



MAP SHOWING CORUNDUM DEPOSITS OF THE SOUTHERN APPALACHIAN REGION.

disconnected portions of extensive dikes. In Transylvania, Jackson, Macon, and Clay counties, N. C., and Rabun and Towns counties, Ga., they are exceedingly numerous and have been found at hundreds of localities across an area nearly 40 miles wide. At many of these places they have been found to carry more or less corundum. They are also exceedingly numerous near the crest of the Blue Ridge Mountains in the western part of Transylvania and the eastern part of Jackson counties, in the neighborhood of Big Hogback Mountain, where the Sapphire Corundum mines are located, and in a belt extending northeast and southwest from this point. In another belt which extends northeast and southwest of Corundum Hill, in Macon County, at which point are also important corundum deposits, and in a short belt extending from the noted Buck Creek corundum deposits in Clay County in a southeasterly direction across into Georgia.

OCCURRENCE AND DISTRIBUTION OF CORUNDUM.

As a rock constituent corundum has been associated with other minerals under a number of different conditions, but as a commercial product it has been found usually in the gravel beds of streams, or, when in place, in veins or dikes of feldspar; or associated with chlorites and vermiculites in the peridotites and serpentines of the eastern States.

By far the larger part of the corundum mined in the southern Appalachian region has been found associated with the peridotites in the bands of chlorites and vermiculites developed either between the masses of peridotites and the adjacent gneisses, or along the joint planes even toward the interior of the peridotite masses. These chlorite and vermiculite bands, which vary in thickness from a few inches to more than a dozen feet, in places have the corundum distributed throughout their mass with some degree of uniformity, though in other places the corundum will be concentrated more or less in certain portions of the bands, the remainder of the material being nearly or quite barren. Such has been the condition of things exhibited at Corundum Hill.

A considerable amount of corundum has been found in amphibolite rock, either in the dike-like masses of this rock found at Buck Creek, in Clay County, where the corundum crystals are scattered through the rock associated with minute grains of picotite, or, as in another case, as at the Acme mine, near Statesville, in Iredell County, along the joint planes and borders of the amphibolite rocks, where the corundum occurs along with the amphibolite developed to a thickness of from a few inches to several feet. The corundum also occurs in this latter locality in the feldspar veins or dikes which occur in these hornblende rocks.

A limited amount of corundum has also been found in bands of chlorite schist, which in some portions of this area may be traced in a generally northeast to southwesterly direction for a distance of several miles, and having a width sometimes as much as several hundred feet, though usually much narrower.

In still other cases corundum has been found in considerable quantity in gneiss rock without their being any direct association, as far as is known, with the peridotite. Thus in a number of North and South Carolina localities the corundum seems to occur in the gneiss, in crystals or nodules surrounded by a sheath of muscovite. One case of this sort may be mentioned on the west slopes of Chunky Gal Mountain in Clay County, and another at Laurens, S. C.

A very considerable amount of corundum, especially that found in foreign countries, as in India, Ceylon, China, Armenia, Siberia, Bactria, as well as some of that found in North Carolina, has been mined from gravel deposits. The only locality in the southern Appalachian region where the placer mining for corundum has been carried to any considerable extent for the past few years is that on Cowee Creek, 8 or 10 miles north of Franklin, in Macon County, where the main object appears to have been the discovery of gem corundum. Here the gravel deposits along Cowee Creek occur in a valley from 100 to 400 yards in width, and are being worked by a company for a distance of 2 to 3 miles by improved hydraulic methods. The gravel along the banks of the stream is from 4 to 10 feet in thickness made up of débris from the adjacent hills, and there is usually from 2 to 4 feet of quartz below overlaid by from 4 to 8 feet of finer sands, loam, and clay. In several other localities, in Jackson, Macon, and Clay counties, however, the placer mining for corundum has been carried on to a small extent.

As stated above, corundum in commercial quantities appears to be limited to that portion of western North Carolina south of the French Broad River (especially Jackson, Transylvania, Macon, and Clay counties), and to Rabun, Towns, and Union counties, Ga. The peridotite rocks extend into northeastern Alabama, but no workable bed of corundum has as yet been discovered in that region. These rocks extend across the State of Georgia, and corundum has been found in a dozen or more counties (Lumpkin, Habersham, Hall, Cobb, Paulding, Douglas, Carroll, Heard, Troup, and Walton—in addition to the three mentioned above), but in a majority of cases only in limited quantities. The mine of the Hampden-Emery Company, in Rabun County, Ga. (Laurel Creek or Pine Mountain mine), has yielded a considerable quantity of commercial corundum. In South Carolina, corundum has been found in Laurens, Anderson, and Oconee counties, in the first two of these the deposits apparently lying outside of the peridotite belts.

In the States to the northeast, corundum has been found and mined to a limited extent in Pennsylvania; and it has been found in a few places in Virginia, New York (Orange and Westchester counties), and Massachusetts (Chester)—the two latter occurrences being in the form of emery—and in Maine and Canada.

In North Carolina, corundum has been found at nearly 300 localities, in 20 or more counties, in a majority of cases within the peridotite belt; but in a number of cases, as in Iredell, Alexander, Gaston, Burke, and Cleveland counties, the discoveries have been entirely outside of this belt and within the great gneissic area. At only one of these latter, however, has corundum been mined on any considerable scale, namely, at the Acme Corundum mine, near Statesville, Iredell County.

Many of these corundum localities have been described elsewhere.[1] The limits of the present paper permit only a few of the important localities being mentioned here.

CORUNDUM MINES AND MINING.

The Corundum Hill mine, perhaps the most widely known and the most extensively worked corundum property in the country, has been fully described elsewhere.[2] The corundum-carrying rock here is mainly that variety of peridotite described as dunite. This occurs in the form of a rather blunt lens-shaped mass of about 10 acres in extent, which has at least two fairly sharp arms projecting out into the gneiss on its northwest side. Along the lines of contact between the dunite and the gneiss are belts of chlorite and vermiculite, usually varying from 1 to 12 or 15 feet in width, which carry the larger part of the corundum. The mass of dunite is also broken by a system of joints, and along these joint plains are often similar, though less extensive, belts of corundum-bearing vermiculite and chlorite. Numerous corundum crystals are also found in portions of the gneiss immediately contiguous to the chlorite and vermiculite zones.

The method of mining corundum adopted here is comparatively simple and crude. Near the surface open cuts are run along the line of these vermiculite and chlorite zones, which material is usually removed with a pick and shovel, and it is then carried to the dump in wheelbarrows and hand cars. When the mining operations have extended to such a depth that it is difficult to keep the side walls from sliding in on the working areas, timbering is resorted to, and drifts are cut into these corundum-bearing zones and the material removed in a similar manner. In mining the corundum-bearing gneiss, similar methods are adopted, but the rock material being exceedingly hard, has to be blasted and the fragments subsequently crushed. Mining operations were begun here in 1871 by Col. C. W. Jenks, who mined largely for gem corundum. Mining operations for abrasive corundum were begun by Dr. H. S. Lucas in 1878, and have continued since that time, the annual output of the mines ranging from 300 to 400 tons.

As this was the only mine in active operation during 1895, it may be well here also to describe briefly the methods of cleaning adopted. A

[1] Bull. Geol. Survey North Carolina No. 11, by J. V. Lewis, 1896.

[2] Ibid., pp. 36, 55, 69, 85, 92; Mineral Resources U. S. 1883-84, pp. 714-720; Bull. U. S. Geol. Survey No. 42, 1887, pp. 45, 63, etc.

line of sluice troughs $1\frac{1}{2}$ miles long extends from the dump at the mine to the mill, where the final washing, separating, and drying of the corundum takes place. This trough has a considerable fall, and at several places there are vertical drops of from 5 to 10 feet. The vermiculite and chlorite carrying the corundum is taken from the dump of the mine, placed in the upper end of the sluice trough, whence it is carried by a swift current of water down the line to the mill, the swift current tending to separate the vermiculite and chlorite from the heavier corundum, and the several vertical drops in the line tending to break the lumps and facilitate this separation, so that by the time the material has reached the mill the separation of the corundum from its softer and lighter matrix is well advanced.

As this material reaches the mill it is thrown upon a screen with 14 meshes to the inch, and what does not pass between this screen is crushed between rollers, and then along with the finer material which passes through this screen originally it is placed in a gravity box and stirred vigorously with currents of water. The corundum and that part of the matrix which still adheres to it is then passed through a machine called a "muller" or "chaser," a process which has been described as follows: "In this machine two heavy wooden rollers move around the circumference of a shallow tub. The partially cleaned corundum is thrown into this tub, and is stirred constantly by iron teeth that move in front of the rollers. Being thus alternately stirred up by the teeth and pressed down by the rollers, a scouring motion is continually kept up between the grains, and the impurities are gradually cut away. In this action the impurities are reduced to the form of a fine powder, and are carried away by a small current of water which continually flows through the tub. This process is continued from three to five hours, according to the difficulty of cleaning and the degree of purity required."[1]

When the cleansed corundum is removed from the mullers it is dried as follows:[2] "When the material is removed from the mullers it is allowed to lie over night in a heap on an inclined floor. This material, still wet, is carried up in an elevator and dropped vertically through a distance of about 20 feet down the stack of a furnace. At the bottom of this it strikes an inclined plane and slides down this for a few feet through the flames of a wood fire. By this time it is thoroughly dry and is passed into a chamber beneath, whence it is removed with shovels and subjected to a final sifting. All material not fine enough to pass through a screen with 14 meshes to an inch is again passed through the rolls, and the entire cleaning process is repeated."

The corundum-bearing gneiss, which is also found here to a limited extent, is brought to the dump in large blocks which are in some cases heated to a high temperature by means of a log fire and reduced suddenly to cold by having water poured upon them. This causes

[1] Bull. Geol. Survey North Carolina No. 11, 1896, p. 85. [2] Ibid, p. 86.

the blocks to crumble into small fragments, which are then passed through the crushers and rolls until the material is sufficiently fine to be passed through the screen with 14 meshes to the inch. It is then passed through a tub into a screw-like conveyor, revolves upon an axis and the particles of rock thus grinding upon one another, the softer gneissic matrix is cut away and the corundum grains are left in part intact. The larger part of this finer material resulting from the grinding of the gneissic matrix is washed away by the currents of water, the remainder and the heavier corundum settling to the bottom is then passed through the mullers for more complete separation.

Unquestionably the larger portion of the surface material at the Corundum Hill mines has already been removed, but by running deeper drifts and sinking deeper shafts and in other ways following the more improved mining methods doubtless there are still to be obtained from this mine considerable quantities of corundum. Near Corundum Hill, on the slopes of one of the prominent spurs of the Cowee Mountains, between Ellijay and Walnut creeks, in Jackson County, many promising corundum localities are found, a few of which have been mined on a small scale; and this region promises to be, in the near future, perhaps the most important corundum-producing area in the whole Appalachian belt. Corundum mines are now being opened up in this region by Mr. C. C. Foster, of Boston, and the American Corundum Company, on Ellijay Creek, about 7 miles southeast of Franklin, and another corundum mine is now being opened up at Cartoogajay or Skeen Creek, about 6 miles southwest of Franklin, by Dr. H. S. Lucas.

Sapphire or Hogback mines, in Jackson County, which were operated on a considerable scale during the years 1892 and 1893, were closed during the financial depression of the latter year and have not since been worked on any considerable scale, only development work being carried on at intervals. The methods of mining and washing the corundum here were somewhat similar to those described above as being practiced at Corundum Hill. The corundum of this region is associated with peridotite and enstatite rocks, the latter generally predominating. In this neighborhood there were operated by the Sapphire Valley Mining Company some seven or more mines, all in the neighborhood of Big Hogback Mountain and near the Jackson-Transylvania county line. Specimens of corundum have been found in a number of localities in this vicinity, and there are many outcrops of the enstatite and peridotite rocks, indicating that there exist in this neighborhood very considerable quantities of corundum; and if the corundum market improves we may expect to hear of mining here on a considerable scale in the near future.

The Buck Creek mines, in Clay County, were first prospected by Major Bryson about 1875, but for six months only; two years later they were worked by Mr. Frank Menninger, and ten years later by Mr. Ernst for about nine months, and four years later by Mr. Gregory Hart for a period of one and one-half years. There is here a large mass of peridotite, which, like the masses found elsewhere, is more or less jointed, and along the joint planes are found vermiculite and chlorite, which in places carry corundum. There are also considerable quantities of amphibolite rock in this peridotite region which contain numerous crystals of corundum, and a limited quantity of this rock has been hauled to Corundum Hill, where it was crushed and the corundum separated. But the principal mining operations have consisted in the sinking of a shaft and some drifts into corundum-bearing veins of coarse feldspar and hornblende along the eastern margin of the peridotite outcrop and within a few feet of the border of the gneiss. No active mining work is now in progress in this region, or has been for several years.

At Shooting Creek, also in Clay County, near Elf post-office, is the Behr corundum mine, which was opened in 1880 by Dr. H. S. Lucas, and was subsequently operated by Herman Behr & Co. as late as 1890, but no work has been done there since that time. The corundum is found here associated with peridotite and occurs in seams or bands of scale vermiculite, known as "sand veins"; and it also occurs in the vicinity of this mine in veins of feldspar and green chlorite, and in still other places in veins of feldspar associated with zoisite, and in masses of margarite. Much of the so-called mining of this region has been simply prospecting, and there still remain several deposits of corundum in these different forms which have as yet been barely touched.

The Carter mine, in the eastern end of Madison County, near Democrat post-office, was worked at intervals for several years prior to 1886 by Messrs. William Carter, H. S. Lucas, M. E. Carter, Rice & Coleman, and Messrs. Tarr, Hamilton & Co.; but it has not been worked since that time. The corundum here is of white, pink, and blue colors, intergrown with greenish black spinel in a matrix of feldspar, this material occurring in a vein of chlorite and vermiculite within and near the extreme northern end of the lenticular mass of peridotite several miles in length. In the region intervening between this mine and those of Jackson and Macon counties, while numerous lenticular masses of peridotite have been found, yet no important deposits of corundum have so far been discovered, though specimens of corundum have been picked up at a number of localities in this region.

The Acme mine is the only important corundum deposit in North Carolina which has been worked east of the Blue Ridge and entirely without the limits of the peridotite belts. It is located about three-fourths of a mile west of Statesville, in Iredell County, in which the ordinary country rock is a gray gneiss. Corundum has been found in the form of loose surface specimens in a number of localities in Iredell County, and at the Acme mine they were first found in an alluvial deposit, clays and sands, the corundum masses being loose or attached to masses of cyanite. Beneath these clays and gravels a corundum-bearing vein of feldspar 2 to $2\frac{1}{2}$ feet in thickness was found in a massive hornblende rock, the vein being separated from the hornblende rock through which it passed by bands of vermiculite. Corundum was found at the location of this mine in 1875 by Dr. J. A. D. Stevenson. Mining operations were begun here in 1893 and were continued for some months, when the work was suspended owing to the great expense of removing the overlying 12 to 15 feet of clay and the large amount of water which continually poured into the works. Since that time some prospecting work has been done with a view of tracing the vein into adjoining areas where the thickness of the overburden and the amount of water would both be less, but no decidedly favorable results have as yet been reached.

The Pine Mountain or Laurel Creek mine, in Rabun County, Ga., which was worked from 1880 to the spring of 1893, is the only corundum mine which has been worked on any considerable scale in Georgia. This mine is located in a mass of peridotite (dunite), oblong and somewhat irregular in shape and somewhat larger than that at Corundum Hill. It lies directly southwest of the Sapphire and of the Jackson County peridotite belts. The formation here is similar in many respects to that at Corundum Hill. It has already been described in some detail by Dr. T. M. Chatard in The Mineral Resources of the United States, 1883–84, and in Bulletin 2 of the Geological Survey of Georgia, 1894. As at Corundum Hill, the corundum is found here largely in a band of alteration products (steatite, chlorite, talc) lying between the gneiss and dunite, and the mining methods pursued are quite similar to those which have been followed at Corundum Hill. Part of the corundum, however, occurs in more solid veins of feldspar, and this material has to be blasted and subsequently crushed before being passed through the cleaning and assorting machinery.

THE MANUFACTURE AND USE OF CORUNDUM.

By Charles N. Jenks.

All corundum does not make a good abrasive, and corundums from different localities differ greatly in their cutting qualities. Here arises the first and most important question for every would-be producer, viz, What constitutes a good corundum? A few weeks of careful investigation in the abrasive trade several years ago convinced me that I knew nothing whatever about the subject of abrasive materials beyond the locating of veins and the mining of corundum, and that I was not alone in my ignorance. It also showed that in contrast with the production of any other raw material the responsibility of the producer did not cease with the furnishing of this product to the refiner, but making the primary work successful financially requires education as to what constitutes a good article of corundum, and then education of the manufacturers of the grain corundum, who must in turn fully understand the subject, in order to place the product upon the market.

The qualities necessary to make a grain corundum of the greatest possible efficiency when manufactured into wheels are: (1) It must be practically pure (at least 95 per cent), and all impurities containing water or iron must be as far as possible eliminated; (2) it must possess great hardness, and at the same time contain the peculiar property of disintegration that many corundums lack and comparatively few possess in the most desirable degree; (3) it must be of such a structure that it will crush or disintegrate under pressure into shotty fragments, rather than into pieces flat, flaky, long, or cubical.

When all these points of efficiency and the quantity of the material have been proved to the satisfaction of the manufacturer of grain emery or corundum, who must refine the product and introduce it to the wheel maker, the additional fact becomes apparent that the consumer of wheels does not discriminate and will not pay enough more for a corundum wheel than for an emery wheel to justify the average wheel maker in paying much more for grain corundum than he does for grain emery. The best grain emery can be delivered to the wheel maker at $3\frac{1}{2}$ to $3\frac{3}{4}$ cents per pound, inside price, and 4 cents outside, either Turkish, Naxos, or Chester.

The present price of an all-corundum wheel is only about 15 per cent in excess of an emery wheel similar in all other respects. There is no inducement to the average wheel maker to pay 7 or 8 cents per pound for grain corundum (all sizes), even if it can be demonstrated to his entire satisfaction that it possesses twice the efficiency of emery, so long as the consumer will only pay for the manufactured wheels 15 per cent advance over emery-wheel prices.

There are large customers in the wheel trade who thoroughly appreciate the value of "all-corundum" wheels for specific purposes, such as saw gummers, wheels for grinding chilled iron, and for other uses. The trade and reputation of these customers depend to a certain extent upon their ability to furnish corundum wheels for these purposes. They also produce, by a judicious mixture of corundum with emery, a wheel adapted to certain other classes of work and having far greater efficiency than clear emery. All these things, combined with safety in the operation of wheels and thorough workmanship, enable corundum to hold its position in the trade, although the users do not attribute the superiority of their wheels to the corundum contained therein.

In many if not all the abrasives upon the market, the fine sizes (No. 60 and smaller) are the least efficient. This is due to the fact that the impurities subdivide minutely and hence run rapidly to sizes finer than No. 60. This has given corundum a bad reputation in many classes of work. It is, nevertheless, entirely feasible and economical to produce sizes 60 to FFF of at least 90 per cent purity. As the impurities in emery also run to fine sizes, both emery and corundum are often almost worthless as abrasives. There is room for improvement in the methods at present employed in the cleaning of both these products.

Sources and cost of emery.—Emery is an intimate mixture of corundum with oxide of iron, either magnetite or hematite. It owes its cutting qualities almost entirely to the presence of corundum, and it is more or less efficient as the quantity of corundum increases or diminishes. If, other impurities being at a minimum, good emery were divested of its iron, it would be a good corundum. In the case of an otherwise pure corundum product, the presence of 10 per cent of iron is sufficient to greatly reduce its efficiency and economy. In the case of emery the mixture of iron is so intimate as to make its separation for abrasive purposes impossible, while with corundum the iron is readily extracted by the magnetic separator.

Foreign trade emery is found in nearly all parts of Asia Minor, and in the Grecian Islands, there being 17 deposits in Naxos alone. It is known in the trade as "Turkish" and "Naxos." The Abbott mines in Turkey are thought by many to produce the best emery stone. Others prefer the best Naxos to any of the other foreign emeries. My own experience is in favor of the Turkish; but whatever comparative result might be disclosed by sufficiently exhaustive experiments, it is a fact that emery from different foreign localities varies greatly in efficiency.

Five distinguished experts upon corundum and emery, who are actively engaged in the trade, have stated to me that in their opinion there is no emery proper in the United States. I agree with the late Prof. J. Lawrence Smith, who said, "I consider the Chester mineral as true an emery as that of Naxos." It contains an intimate mixture of iron, although on an average less than the foreign emeries, but it can not be separated by magnetic apparatus. It possesses a greater efficiency than the best foreign emery, although less than one-half the efficiency of pure corundum.

Other localities in the United States which are mentioned in Government reports and by other authorities as yielding emery are Peekskill, N. Y., Tallapoosa, Ga., and one or more points in North Carolina.

The present tariff on emery, since August 27, 1894, is as follows: Emery grains, and emery ground, pulverized, refined, or manufactured, 0.8 cent per pound; emery wheels and files, 20 per cent ad valorem; emery ore, free of duty.

Prior to this the tariff was 1 cent per pound on emery grains; emery ore free.

One authority (Stevens) says: "Good clean lump stone can be contracted for here (Smyrna) on board ship at $19.50 to $20.70 per ton of 2,240 pounds. The same quality, but in smaller pieces, at $3.65 per ton less." This is an average price of less than 1 cent per pound. Another authority (Heap) gives average price at Smyrna at $19.50 per ton of 2,240 pounds.

From other reliable sources in the trade it is learned that the average cost of lump stone at either New York or Boston is less than 1 cent per pound. Emery stone is shipped from the Turkish and Grecian mines in sailing vessels as ballast at merely nominal figures, or with no charge; or when by steamer to New York or Boston, at the rate of $1.22 to $2.44 per long ton. Our annual importation of emery stone is about 5,000 tons. The total annual production of corundum from all sources during the years 1893 to 1895, inclusive, was less than 400 tons.

The manufacture of grain emery.—Eight or nine mills manufacture the bulk of the grain emery which is produced in the United States. The Levant Company, with headquarters in New York City, operate in the trade for four of these mills, namely, the Walpole, Jackson, Diamond, and New York.

The processes of manufacture of grain emery are quite expensive, and from the lump to the finished product in kegs it costs fully 1¼ to 1½ cents per pound. This added to the cost of raw material (stone), 1 cent per pound, makes the total cost to the manufacturer 2¼ to 2½ cents. The expense of marketing varies, but is necessarily considerable, yet the competition is so great that the best article on the market can be obtained at 3½ to 4 cents, freight paid, which leaves a margin not exceeding 1 cent per pound, and probably less in some cases.

The wheel trade.—There are to-day about 25 concerns, great and small, in the United States, engaged in making abrasive wheels. No large company has really been forced out of existence during the past three years by competition, but the small ones have suffered. In 1892 a price 75 per cent off the standard list (which all emery-wheel concerns quote) was as low as could be secured for good emery wheels. In 1895 discounts varied from 60 and 10 to 80 and 10, freight paid, so fierce has been the competition. Several of the 25 wheel makers are quoting 80 per cent off. I think only two or three of the entire number in the United States have maintained their old prices, and this is due to the general superiority of their wheels and to their great deserved reputation.

The present or past miners of corundum can not be blamed for the quality of the material they have placed upon the market. In most cases ignorance of corundum mining, of what constitutes a good and reliable product, and the market conditions have conspired to curtail the production of a pure article and to discredit its efficiency in every attempt. There is no way of determining, even approximately, the efficiency of a corundum product or its actual market value but the competitive wheel tests against the standard now on the market, conducted under conditions of absolute accuracy and impartiality as nearly as these conditions can be secured by human watchfulness. This should be the first step in all corundum-mining operations.

The writer has no faith in a chemical analysis as determining even approximately the efficiency of an alleged corundum. Its great value is of course admitted for determining the existence of corundum in any considerable quantity as an ingredient in a doubtful product.

The fact that a corundum sample assays a large percentage of alumina is, however, no proof either of its purity or of its abrasive efficiency. Many of the common associate minerals and much of the impurity contained in various products upon the market contain a large proportion of alumina by assay. Margarite or emerylite contain at times 50 per cent. The chlorites show from 5 to 35 per cent. Neither of these substances possesses any useful abrasive properties when they are present in the wheel. On the contrary, they may be expected, if present in any quantity, to greatly impair its efficiency.

The future of corundum production.—The three different trades, mining, cleaning, and wheel making, should be associated under one head. This would be a saving (1) on freight, (2) of the entire profit now charged for cleaning and grading, and (3) on the fine sizes. Instead of shipping from the mines a 50 per cent product and paying freight on worthless impurities to the extent of one-half the entire transportation weight, corundum can be refined and graded on the ground at a small additional cost—much less than that which is necessarily incurred in trade centers. The middle man—the manufacturer of grain corundum—would be eliminated entirely. Thus far there appears a saving of at least one-fourth of a cent per pound on freight; three-fourths of a cent in decreased cost of refining as at present conducted, and refiner's profit, 1 cent more; a total saving of 2 cents per pound over existing conditions. The wheel-making end of the business located in the trade centers could then operate with the sizes most in demand without a necessity of shipment of sizes not needed. The advantage of close touch between these departments, mining and wheel making, would greatly exceed those afforded by the present method of doing business.

INFUSORIAL EARTH.

OCCURRENCE.

Deposits of infusorial earth, or tripoli, occur in several of the Atlantic States, and it has been mined in Connecticut, New Hampshire, New Jersey, Maryland, and Virginia. It also occurs and has been mined in Napa County, Cal., and near Virginia City, Nev. At the latter place mining is not prosecuted regularly, enough being obtained in one year to supply the owners with sufficient crude material to last for from three to five years. The principal use for the material is in the manufacture of polishing powders, etc., though it has been used to a considerable extent as an absorbent in the manufacture of dynamite from nitroglycerine, and as a protective packing around steam boilers. Its use as an absorbent has been supplanted by sawdust, and the increased use of asbestos in boiler packing has militated against the use of infusorial earth. Other occurrences than those mentioned above have been noted, particularly in some of the Western States, but they have not been worked.

PRODUCTION.

The production of infusorial earth is very irregular. In 1880 the value of the product was $45,660. In 1883 it had dropped to $5,000, and remained at approximately that figure for four years. In 1887 it increased to $15,000, but fell again to $7,500 in the following year. It increased to $23,372 in 1889, and again to $50,240 in 1890. The next year it decreased to $21,988; nearly doubled that in 1892, and again decreased in 1893 to $22,582. The value of the product in 1894 was but little more than half of that of 1893, being $11,718. The decrease was due chiefly to the suspension of mining at Popes Creek and Dunkirk, Md., formerly the principal producing localities. The mines in Napa County, Cal., were also idle, and the production was limited to New Hampshire, Connecticut, New Jersey, and Nevada. The total output was 2,584 short tons, valued at $11,718, the smallest in point of value since 1888. In 1895 the product increased again to 4,954 short tons, with a total value of $20,514. The Napa County (Cal.) mines were still idle, as were those of Virginia City, Nev., and of Popes Creek, Md., and Drakesville, N. J. On the other hand, the mines of Dunkirk, Md., were reopened, and produced nearly 3,000 tons of earth. The balance was contributed by Connecticut and New Hampshire.

The following table exhibits the annual output since 1880:

Production of infusorial earth from 1880 to 1895.

Year.	Short tons.	Value.	Year.	Short tons.	Value.
1880	1,833	$45,660	1888	1,500	$7,500
1881	1,000	10,000	1889	3,466	23,372
1882	1,000	8,000	1890	2,532	50,240
1883	1,000	5,000	1891	....	21,988
1884	1,000	5,000	1892	....	43,655
1885	1,000	5,000	1893	....	22,582
1886	1,200	6,000	1894	2,584	11,718
1887	3,000	15,000	1895	4,954	20,514

GARNET.

OCCURRENCE.

Garnet is mined or quarried in New York State in and near the valley of the upper Hudson River, in Warren County, on the borders of the Adirondack region. It all appears to be of the common variety, almandite, and occurs in a formation of crystalline limestone, which constitutes the bed rock of the valley in the vicinity of North Creek and Minerva, and in gneissic rocks which adjoin or are intercalated with the crystalline limestone. It is found in segregated masses of sizes varying from that of a pigeon's egg to a diameter of 20 feet. It is commercially classified as massive garnet, shell garnet, and pocket garnet, the former being impure from the admixture of other minerals. The shell garnet is almost entirely pure, and the most valuable for industrial purposes. The pocket garnet is that which occurs in small segregations or incipient crystals in the gneiss. Garnet is also found in Delaware County, Pa., where it is quarried under the name of "Rose" garnet to the extent of about 1,000 tons annually. It occurs there in small crystals thickly disseminated through a quartzose gneiss. There is also a deposit of garnet at Chester, Pa., which is worked to some extent. Large deposits of the mineral have been found in North Carolina, but its quality is not considered as satisfactory as that from the Adirondack region. Other deposits are said to occur in Georgia and Alaska, but no definite information can be obtained concerning them. Connecticut is also mentioned as a source of garnet.

USE.

This garnet is used almost exclusively in the manufacture of sandpaper, or "garnet paper," as it is called, which is employed extensively for abrasive purposes in the manufacture of boots and shoes. It is also employed to some extent in the wood-manufacturing industry. For metals garnet is not as good as emery, although some satisfactory results have been obtained from its use on brass. It has been experimentally mixed with emery in the manufacture of emery wheels, but without very satisfactory results.

In commercial use garnet is found to be harder, sharper, and more lasting than quartz, and is preferred to it for certain kinds of work, although it costs about eight times as much as quartz. The Adirondack garnet is said to be worth about $40 a ton at the railroad, although the average value of the mineral throughout the country is stated to be about $35. The superiority of garnet to quartz is probably due to the fact of its ready cleavage, which enables it to present as it breaks away new and sharp-cutting edges, whereas quartz, which has no cleavage, becomes dulled by friction. The only garnet now mined in the Adirondack region is the pocket garnet, which is used to make the better grade of garnet paper. Some of the massive garnet has been used to make sandpaper for woodworking, and also mixed with corundum to make wheels.

PRODUCTION.

The statistics of garnet production (except the gem variety) were collected by this office for the first time in 1894, when an output of

2,401 short tons, valued at $90,660, was reported. The product in 1895 increased to 3,325 short tons, but the value increased much less in proportion, amounting to $95,050.

QUARTZ CRYSTAL.

Quartz crystal used for wood finishing is mined in Connecticut. The quartz is reduced to an impalpable powder, mixed with oil, and applied to the smooth surface of the wood. The oil passing into the wood carries the fine grains of quartz with it, and these fill up the pores of the wood, which then, when dry, is capable of taking a high polish. No statistics of the production of this material were collected until 1894, when the output amounted to 6,024 short tons, having a value of $18,054. In 1895 the product increased to 9,000 short tons, worth $27,000.

TRIPOLI.

The material mined in Newton County, Mo., under the name of tripoli amounted in value in 1895 to $25,000, against $35,000 the preceding year. The decrease may be readily attributed to the general trade depression. While this product is included under the head of abrasives, a large portion of it is consumed in the manufacture of filters and as an absorbent. The character of the material has been described in previous reports of this series. A somewhat similar deposit occurs in Georgia, from which 146 short tons, valued at $1,464, were obtained in 1895 and used in the manufacture of filters.

PHOSPHATE ROCK.

PRODUCTION.

The phosphate industry continues in the depressed condition noted in the last report, although the product increased slightly to a total of 1,038,551 long tons, the price remaining about stationary, the value of the total product being $3,606,094. The Florida product shows a slight increase, against a slight decline in South Carolina. Tennessee produced 38,515 tons in 1895—just double the product of 1894.

The record of production and values in late years is given in the following tables:

Product of phosphate rock from 1891 to 1895.

State.	1891.		1892.		1893.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Florida:	*Long tons.*		*Long tons.*		*Long tons.*	
Hard rock			a 155, 908	$859, 276	215, 685	$1, 117, 732
Soft rock	57, 982	....	6, 710	32, 418	13, 675	64, 626
Land pebble			21, 905	111, 271	86, 624	359, 127
River pebble	54, 500	....	b 102, 820	415, 453	122, 820	437, 571
Total	112, 482	$703, 013	287, 343	1, 418, 418	438, 804	1, 979, 056
South Carolina:						
Land rock	344, 978	2, 187, 150	243, 653	1, 236, 447	308, 435	1, 408, 785
River rock	130, 528	760, 978	150, 575	641, 262	194, 129	748, 229
Total	475, 506	2, 948, 138	394, 228	1, 877, 709	502, 564	2, 157, 014
Grand total	587, 988	3, 651, 151	681, 571	3, 296, 227	941, 368	4, 136, 070

State.	1894.		1895.	
	Quantity.	Value.	Quantity.	Value.
Florida:	*Long tons.*		*Long tons.*	
Hard rock	326, 461	$979, 383	307, 098	$1, 302, 096
Soft rock	....	....	6, 916	32, 000
Land pebble	98, 885	296, 655	181, 011	593, 716
River pebble	102, 307	390, 775	73, 036	185, 090
Total	527, 653	1, 666, 813	568, 061	2, 112, 902
South Carolina:				
Land rock	307, 305	1, 252, 768	270, 560	898, 787
River rock	142, 803	492, 808	161, 415	512, 245
Total	450, 108	1, 745, 576	431, 975	1, 411, 032
Tennessee	19, 188	67, 158	38, 515	82, 160
Grand total	996, 949	3, 479, 547	1, 038, 551	3, 606, 094

a Includes 52,708 tons of land rock carried over in stock from 1891.

b Includes 12,120 tons of river pebble carried over in stock from 1891.

Detailed statement of total foreign and coastwise shipments and local consumption of South Carolina rock since July 1, 1874.

[Long tons.]

Periods.	Shipments and consumption.	Beaufort.	Charleston.	Total.	Total for each year.
June 1, 1874, to May 31, 1875.	Foreign ports	44, 617	25, 929	70, 546	122, 790
	Domestic ports	7, 000	25, 560	32, 560	
	Consumed	....	19, 684	19, 684	
June 1, 1875, to May 31, 1876.	Foreign ports	50, 384	25, 431	75, 815	132, 896
	Domestic ports	9, 400	28, 831	38, 231	
	Consumed	....	18, 850	18, 850	
June 1, 1876, to May 31, 1877.	Foreign ports	73, 923	28, 844	102, 767	163, 220
	Domestic ports	6, 285	40, 768	47, 053	
	Consumed	....	13, 400	13, 400	
June 1, 1877, to May 31, 1878.	Foreign ports	100, 619	21, 123	121, 742	208, 323
	Domestic ports	8, 217	60, 729	68, 946	
	Consumed	....	17, 635	17, 635	
June 1, 1878, to May 31, 1879.	Foreign ports	97, 799	21, 767	119, 566	199, 365
	Domestic ports	8, 618	52, 281	60, 899	
	Consumed	....	18, 900	18, 900	
June 1, 1879, to May 31, 1880.	Foreign ports	47, 157	14, 218	61, 375	190, 763
	Domestic ports	13, 346	94, 002	107, 348	
	Consumed	....	22, 040	22, 040	
June 1, 1880, to May 31, 1881.	Foreign ports	62, 200	8, 568	70, 768	266, 734
	Domestic ports	65, 895	91, 929	157, 824	
	Consumed	....	38, 142	38, 142	
June 1, 1881, to May 31, 1882.	Foreign ports	89, 581	22, 905	112, 486	332, 077
	Domestic ports	65, 340	111, 314	176, 654	
	Consumed	....	42, 937	42, 937	
June 1, 1882, to May 31, 1883.	Foreign ports	94, 789	28, 251	123, 040	378, 380
	Domestic ports	62, 175	150, 545	212, 720	
	Consumed	....	42, 620	42, 620	
June 1, 1883, to May 31, 1884.	Foreign ports	132, 114	20, 539	152, 653	431, 779
	Domestic ports	41, 040	181, 363	222, 403	
	Consumed	5, 800	50, 923	56, 723	
June 1, 1884, to May 31, 1885.	Foreign ports	111, 075	11, 495	122, 570	395, 403
	Domestic ports	44, 130	161, 700	205, 833	
	Consumed	12, 000	55, 000	67, 000	
June 1, 1885, to Dec. 31, 1885.	Foreign ports	105, 761	8, 581	114, 342	277, 789
	Domestic ports	16, 321	112, 126	128, 447	
	Consumed	5, 000	30, 000	35, 000	
Jan. 1, 1886, to Dec. 31, 1886.	Foreign ports	153, 443	5, 926	159, 369	430, 549
	Domestic ports	14, 622	187, 558	202, 180	
	Consumed	9, 000	60, 000	69, 000	
Jan. 1, 1887, to Dec. 31, 1887.	Foreign ports	189, 995	9, 740	199, 735	480, 558
	Domestic ports	15, 905	181, 918	197, 823	
	Consumed	13, 000	70, 000	83, 000	
Jan. 1, 1888, to Dec. 31, 1888.	Foreign ports	124, 474	3, 611	128, 085	448, 567
	Domestic ports	20, 404	212, 078	232, 482	
	Consumed	13, 000	75, 000	88, 000	
Jan. 1, 1889, to Dec. 31, 1889.	Foreign ports	137, 102	5, 900	143, 002	541, 645
	Domestic ports	60, 000	248, 643	308, 643	
	Consumed	15, 000	75, 000	90, 000	
Jan. 1, 1890, to Dec. 31, 1890.	Foreign ports	72, 241	55, 000	127, 241	463, 998
	Domestic ports	15, 000	213, 757	228, 757	
	Consumed	13, 000	85, 000	98, 000	

Detailed statement of total foreign and coastwise shipments and local consumption of South Carolina rock since July 1, 1874—Continued.

[Long tons.]

Periods.	Shipments and consumption.	Beaufort.	Charleston.	Total.	Total for each year.
Jan. 1, 1891, to Dec. 31, 1891.	Foreign ports	94,528	4,655	99,183	475,506
	Domestic ports	22,000	252,083	274,083	
	Consumed	14,000	88,250	102,250	
Jan. 1, 1892, to Dec. 31, 1892.	Foreign ports	105,150	5,052	110,202	394,228
	Domestic ports	30,425	148,600	179,025	
	Consumed	15,000	90,000	105,000	
Jan. 1, 1893, to Dec. 31, 1893.	Foreign ports	156,257	175	156,432	502,564
	Domestic ports	22,872	160,942	183,814	
	Consumed	15,000	147,318	162,318	
Jan. 1, 1894, to Dec. 31, 1894.	Foreign ports	114,155	12,417	126,572	450,108
	Domestic ports	21,000	154,853	175,853	
	Consumed	12,683	135,000	147,683	
Jan. 1, 1895, to Dec. 31, 1895.	Foreign ports	114,430	10,090	124,520	431,975
	Domestic ports	9,500	155,855	165,355	
	Consumed	12,100	130,000	142,100	

Phosphate rock (washed product) mined by the land and river mining companies of South Carolina since 1867.

Year ending—	Land companies.	River companies.	Total.
	Long tons.	*Long tons.*	*Long tons.*
May —, 1867	6		6
1868	12,262		12,262
1869	31,958		31,958
1870	63,252	1,989	65,241
1871	56,533	17,655	74,188
1872	36,258	22,502	58,760
1873	33,426	45,777	79,203
1874	51,624	57,716	109,340
1875	54,821	67,969	122,790
1876	50,566	81,912	132,478
1877	36,431	126,569	163,000
1878	112,622	97,700	210,322
1879	100,779	98,586	199,365
1880	125,601	65,162	190,763
1881	142,193	124,541	266,734
1882	191,305	140,772	332,077
1883	219,202	159,178	378,380
1884	250,297	181,482	431,779
1885	225,913	169,490	395,403
Dec. 31, 1885 (from June 1)	149,400	128,389	277,789
1886 (calendar year)	253,484	177,065	430,549

Phosphate rock (washed product) mined by the land and river mining companies of South Carolina since 1867—Continued.

Year ending—	Land companies.	River companies.	Total.
	Long tons.	*Long tons.*	*Long tons.*
Dec. 31, 1887	261,658	218,900	480,558
1888	290,689	157,878	448,567
1889	329,543	212,102	541,645
1890	353,757	110,241	463,998
1891	344,978	130,528	475,506
1892	243,652	150,575	394,228
1893	308,425	194,129	502,564
1894	307,305	142,803	450,108
1895	270,560	161,415	431,975

IMPORTS.

The following table shows the imports of fertilizers of all kinds into the United States from 1868 to 1895:

Fertilizers imported and entered for consumption in the United States, 1868 to 1895.

Year ending—	Guano.		Crude phosphates and other substances used for fertilizing purposes.		Total value.
	Quantity.	Value.	Quantity.	Value.	
	Long tons.		*Long tons.*		
June 30, 1868	99,668	$1,336,701	....	$88,864	$1,425,625
1869	13,480	217,004	....	61,529	278,533
1870	47,747	1,414,872	....	90,817	1,505,689
1871	94,344	3,313,914	....	105,703	3,379,617
1872	15,279	423,322	....	83,342	506,664
1873	6,755	167,711	....	218,110	385,821
1874	10,767	261,085	....	243,467	504,552
1875	23,925	539,808	....	212,118	751,926
1876	19,384	710,135	....	164,849	874,984
1877	25,580	873,459	....	195,875	1,069,334
1878	23,122	849,607	....	285,089	1,134,696
1879	17,704	634,546	....	223,283	857,829
1880	8,619	108,733	....	317,068	425,801
1881	23,452	399,552	....	918,835	1,318,387
1882	46,699	854,463	133,956	1,437,442	2,291,905
1883	25,187	537,080	96,586	798,116	1,335,196
1884	28,090	588,033	35,119	406,233	994,266
1885	20,934	393,039	40,068	611,284	1,004,323

Fertilizers imported and entered for consumption in the United States, etc.—Continued.

Year ending—	Guano.		Crude phosphates and other substances used for fertilizing purposes.		Total value.
	Quantity.	Value.	Quantity.	Value.	
	Long tons.		*Long tons.*		
Dec. 31, 1886 ...	13, 520	$306, 584	82, 608	$1, 179, 724	$1, 486, 308
1887 ...	10, 195	252, 265	53, 100	644, 301	896, 566
1888 ...	7, 381	125, 112	36, 405	329, 013	454, 125
1889 ...	15, 991	313, 956	35, 661	403, 205	717, 161
1890 ...	4, 642	59, 580	31, 191	252, 787	312, 367
1891 ...	11, 937	199, 044	29, 743	214, 671	413, 715
1892 ...	3, 073	46, 014	92, 476	666, 061	712, 075
1893 ...	5, 856	97, 889	106, 549	718, 871	816, 760
1894 ...	5, 757	105, 991	126, 820	904, 247	1, 010, 238
1895 ...	4, 270	51, 642	80, 088	450, 379	502, 021

PENNSYLVANIA.

An interesting report has been received of the finding of phosphate rock in Juniata County, Pa. A number of analyses have been made by Prof. M. C. Ihlseng, of State College, Pa., the phosphoric acid running from very low percentages up to about 30 per cent. The best specimens examined by the United States Geological Survey showed 20 per cent phosphoric acid. It is probable that much more prospecting will be done in this region in the hope of finding commercially valuable material. The discovery of phosphate rock in Juniata County is thus referred to by Professor Ihlseng:

A PHOSPHATE PROSPECT IN PENNSYLVANIA.

By M. C. Ihlseng.

At various points within 12 miles of Reeds Gap, Juniata County, phosphate rock has been found along a so-called black belt at the foot and on the flank of the low ridge formed by the Oriskany sandstone resting on the Lower Helderberg limestone. This belt is of reputed fertility and its soil is strewn with nodules which have recently been discovered to contain as much as 30 per cent of phosphoric acid equivalent, in commercial language, to 66 per cent of bone phosphate. During the past few months explorations have been entered upon, and, though inextensive, have revealed considerable concentration of mineral manure which may prove to be valuable for extraction and shipment to moderate distances.

Amidst a heterogeneous mass of marls and sands—débris from the contiguous formations at the crucial horizon between the Devonian and Upper Silurian—two, and sometimes three, layers of material are embedded. They vary in thickness, each containing a different type of rock. The seams are obscurely bedded, but appear to be conformable with the stratification of the inclosing rocks. Though there is a great diversity of pebbles, all containing more than 12 per cent phosphoric acid, they may be classified into three types: (1) A white, vesicular rock, soft, tasteless, and dry; (2) red nodules resembling the concretions found within limestone; (3) blue limestone fragments, odoriferous on fracture and dense in texture. In addition to these it may be said that the entire mass of detritus between the Oriskany sandstone and the Onondaga limestone has been phosphatized to an extent varying from 3 to 12 per cent of acid, the whole giving ample evidence of being a residual ablation product. Doubtless the earthy phosphate was derived from the Marcellus shales immediately overlying these beds. The copious deposit of wavellite and amblygonite in the crevices and joints of the underlying flint and the vertical films of the same suggest an intermediate chemical reaction, preceding the time of deposition, between the primary calcic phosphate and the alum derived from the decomposition of the pyritiferous slates.

The white rock analyzes from 30 to 54 per cent of bone phosphate and weighs 153 pounds per cubic foot. It contains also from 5 to 7 per cent of iron and alumina and 30 to 50 per cent of insoluble matter. The red nodules, though gathered from widely divergent sources, show remarkably close chemical composition, analyzing: Insoluble matter, 30 per cent; iron and alumina, 18 per cent; phosphoric acid, 21 per cent. They are of close-grained texture, oval and flattened in shape, have a specific gravity of 2.6, and emit a fetid odor on breaking. The goose-egg pebbles are slightly heavier, have a polished exterior, and contain many oolitic grains of a concretionary nature. The blue rock averages: Bone phosphate, 40 per cent; iron and alumina, 18 per cent; and insoluble matter, 33 per cent. The absence of carbonic acid, magnesia, and fluorine is conspicuous in all the specimens.

The yield of the seams in commercial rock, assuming a workable depth of continuous stratum for 100 feet, will reach 15 tons per foot of length of outcrop. Inasmuch as the formations comprise the synclinal basin of the Tuscarora valley, dipping at an angle of 40°, it is evident that in quarrying the deposit much of the adjoining land is more or less permanently injured for subsequent farming purposes. One acre of land will be rendered valueless for each 150 feet of outcrop which is exploited if the same is quarried to a depth of 60 feet. The output from this tract will be sufficient for 12 square miles of cereal crop.

Though the fertilizing power of this rock is not equal to that of the southern product, nevertheless the conditions are favorable for a cheap extraction; and as both the field and the deposits are very accessible, it would seem that if explorations prove the present isolated pockets to form portions of a continuous deposit, their nearness to consumers would give them a decided advantage over the southern product. If, moreover, other portions of the 1,100 miles of Oriskany outcrop in this State should be ascertained to contain similar pockets of phosphate, there is hope for the establishment of another important industry on this unique contact.

Notwithstanding the finding of phosphatic nodules and "calcareous pebbles" along this belt in many places, the writer believes that the prospect is favorable only in certain portions of the western end of the Oriskany outcrop in this State.

SULPHUR AND PYRITES.

By Edward W. Parker.

SULPHUR.

OCCURRENCE.

Deposits of native sulphur are known to exist in a number of localities in the United States, but all that have proven or promise to be of commercial importance are west of the Mississippi River. East of that stream the deposits are unimportant. Sulphur is reported in small quantities on the Potomac River, about 25 miles above Washington, D. C.; at Cayuga, N. Y., and at Put in Bay, Ohio. It has not been mined commercially at any of these places. West of the Mississippi it exists in large quantities at several localities, principally in California, Nevada, Utah, Louisiana, and Texas. It has been reported in Kansas. Operations were formerly carried on in California and Nevada, but no product has been reported from either State for a number of years. Utah has been the only regular producer, and in three years, 1888 to 1890, owing to litigation among the owners, no product was reported from that Territory. The now well-known deposits of Louisiana are at last giving promise of yielding large supplies of sulphur, and recent investigations of extensive deposits in El Paso County, Tex., lead to the belief that another important source of supply will be developed at an early day. More extended notice of these two interesting regions will be found further on.

PRODUCTION.

In 1895 the total amount of sulphur won from mines in the United States was 1,800 short tons, having a value at the mines of $42,000. This includes 800 tons mined by the Frasch liquifying process from the deposits near Sulphur City, Calcasieu Parish, La. This product was not marketed. The other 1,000 tons were from Black Rock, Beaver County, Utah, the property from which most of the sulphur product of the United States has been obtained. Owing to litigation among the owners, the Beaver County mines were idle during 1888, 1889, and 1890. As a result no sulphur was mined in the first and last of these three years, and but 450 tons were mined in 1889 at Winnemucca, Nev. Since that year no product has been reported from that State.

The following table shows the product of sulphur in the United States since 1880:

Sulphur product of the United States since 1880.

Year.	Quanity.	Value.	Year.	Quantity.	Value.
	Short tons.			*Short tons.*	
1880	600	$21,000	1888		
1881	600	21,000	1889	450	$7,850
1882	600	21,000	1890		
1883	1,000	27,000	1891	1,200	39,600
1884	500	12,000	1892	2,688	80,640
1885	715	17,875	1893	1,200	42,000
1886	2,500	75,000	1894	500	20,000
1887	3,000	100,000	1895	1,800	42,000

REVIEW OF THE INDUSTRY.

Compared to the consumption of sulphur in the United States and the quantity obtained from foreign sources (chiefly from Sicily), the domestic production falls into insignificance. Even when the output of pyrite, mined for its sulphur contents, is considered, the home product remains of comparatively small importance. If we take, for instance, the imports of the last five years: Exclusive of pyrites these have averaged about $2,000,000 in value, though there has been a steady decline from $2,683,971 in 1891 to $1,613,754 in 1895. If we include pyrites, the imports would exceed an average annual value of $2,500,000. The value of the domestic product in the same period has averaged about $360,000 per year, of which approximately 90 per cent was represented by iron pyrites mined for sulphur contents. It will thus be seen that of the total consumption less than 13 per cent is supplied by the mines of the United States. From this it would seem that every encouragement is offered for the development of promising deposits, favorably located for cheap transportation to market, a condition peculiar to the deposits at Sulphur City, near Lake Charles, La. With the bringing in of this product, which at present seems probable, the markets of the United States may become largely independent of Sicilian sulphur. The Utah deposits are so remote from the Eastern markets that the expense of transportation limits the output to a comparatively local consumption. The recently discovered deposits in El Paso County, Tex., are 20 miles from railroad transportation, and until direct railroad communication is established these will not appear as a factor in the industry. The Louisiana deposits, on the contrary, have, while the new methods of mining may still be said to be in the experimental stage, exercised considerable influence on the industry in Sicily. Mr. Louis H. Brühl, United States consul at Catania, in a report to the Department of State, under date of November 14, 1895, states that the press reports of the development of the Louisiana sulphur deposits had caused considerable uneasiness among Sicilian mine owners, the fear being expressed that not only would the American market be cut off from them, but that American sulphur would invade the European markets. The industry in Sicily has been in a demoralized condition for several years, production in excess of legitimate demand having depressed prices, and curtailed, if not destroyed profits.

One of the causes which has adversely affected the Sicilian sulphur industry has been the recovery of sulphur from alkali waste at English chemical works by what is known as the Chance process. This process has been described in previous reports, and needs only be mentioned here as showing its results upon the trade. The table of imports of sulphur into the United States shows that in 1889 we imported from England 305 long tons of sulphur. (The Chance process was discovered in 1887, but had not shown its effect in 1889.) In 1890 the imports from England had increased to 4,898 long tons; to 5,613 long tons in 1891; to 6,522 tons in 1892; to 8,777 tons in 1893; to 12,435 tons in 1894, and to 17,332 tons in 1895. Practically all of this is sulphur recovered from alkali waste, and as English domestic trade, and probably also some continental demand, has been supplied from this source, where Sicilian sulphur had previously held a comparative monopoly, the demoralization in the Sicilian industry is not surprising.

IMPORTS.

Sulphur imported and entered for consumption in the United States, 1867 to 1895.

Year ended—	Crude.		Flowers of sulphur.		Refined.		All other. (a)	Total value.
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Value.	
	Long tons.		*Long tons.*		*Long tons.*			
June 30, 1867....	24,544	$620,373	110	$5,509	251	$10,915	....	$636,797
1868....	18,151	446,547	16	948	65	2,721	....	450,216
1869....	23,590	678,642	97	4,576	645	27,149	....	710,367
1870....	27,380	819,408	76	3,927	157	6,528	$1,269	831,132
1871....	36,131	1,212,448	66	3,514	92	4,328	754	1,221,044
1872....	25,380	764,798	36	1,822	57	2,492	....	769,112
1873....	45,533	1,301,000	55	2,924	36	1,497	....	1,305,421
1874....	40,990	1,260,491	51	2,694	57	2,403	....	1,265,588
1875....	39,683	1,259,472	18	891	....	....	....	1,260,363
1876....	46,435	1,475,250	41	2,114	44	1,927	....	1,479,291
1877....	42,963	1,242,888	116	5,873	1,171	36,962	....	1,285,723
1878....	48,102	1,179,769	159	7,628	150	5,935	....	1,193,332
1879....	70,370	1,575,533	138	6,509	69	2,392	....	1,584,434

a Includes sulphur lac and other grades not otherwise provided for, but not pyrites.

Sulphur imported and entered for consumption in the United States, 1867 to 1895—Cont'd.

Year ended—	Crude.		Flowers of sulphur.		Refined.		All other (a)	Total value.
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Value.	
	Long tons.		*Long tons.*		*Long tons.*			
June 30, 1880....	87,837	$2,024,121	124	$5,516	158	$5,262	....	$2,034,899
1881....	105,097	2,713,485	98	4,226	71	2,555	....	2,720,266
1882....	97,504	2,627,402	159	6,926	59	2,196	....	2,636,524
1883....	94,540	2,288,946	79	3,262	115	4,487	....	2,296,695
1884....	105,112	2,242,697	178	7,869	126	4,765	....	2,255,331
1885....	96,839	1,941,943	121	5,351	114	4,060	....	1,951,354
1886....	117,538	2,237,989	213	8,739	116	3,877	....	2,250,605
1887....	96,882	1,688,360	279	9,980	84	2,383	....	1,700,723
Dec. 31, 1888....	98,252	1,581,583	128	4,202	27	734	....	1,586,519
1889....	135,933	2,068,208	15	1,954	10	299	....	2,070,461
1890....	162,674	2,762,953	12	1,718	103	3,060	....	2,767,731
1891....	116,971	2,675,192	206	6,782	10	1,997	....	2,683,971
1892....	100,938	2,189,481	158	5,439	26	4,106	....	2,199,026
1893....	105,539	1,903,198	241	5,746	43	1,017	....	1,909,961
1894....	125,241	1,703,265	173	4,145	45	1,207	....	1,708,617
1895....	121,286	1,546,481	581	12,888	229	4,379	$50,006	1,613,754

a Includes sulphur lac and other grades not otherwise provided for, but not pyrites.

Statement, by countries and by customs districts, showing the imports into the United States of crude sulphur or brimstone each fiscal year from 1876 to 1895.

Countries whence exported and customs districts through which imported.	1876.		1877.		1878.		1879.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
COUNTRIES.	*Long tons.*		*Long tons.*		*Long tons.*		*Long tons.*	
Dutch West Indies and Guiana	1,515	$15,427	......	......	......	......	......	......
England	30	1,211	425	$14,631	(?)	$16	2	$335
Scotland	24	910	472	13,231	160	3,961	806	19,287
Gibraltar	......	......	290	7,789	......	......	......	......
Quebec, Ontario, Manitoba, etc	......	......	......	......	12	264	......	......
Italy	46,941	1,439,839	41,819	1,194,000	47,494	1,161,367	64,420	1,453,138
Japan	456	16,291	437	13,137	256	7,548	224	4,528
Portugal	......	......	......	......	......	......	467	10,410
Total	48,966	1,473,678	43,443	1,242,788	47,922	1,173,156	65,919	1,487,698
DISTRICTS.								
Baltimore, Md	5,157	157,828	3,882	105,175	5,455	138,202	6,969	157,243
Barnstable, Mass	......	......	......	......	......	......	600	13,780
Boston and Charlestown, Mass	5,031	154,883	3,931	101,215	5,795	131,945	7,841	173,506
Charleston, S. C	......	......	......	......	526	12,267	605	13,812
Delaware, Del	450	13,500	......	......	......	......	890	21,907
Huron, Mich	......	......	......	......	12	264	......	......

Statement by countries and by customs districts, etc.—Continued.

Countries whence exported and customs districts through which imported.	1876.		1877.		1878.		1879.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
DISTRICTS.	*Long tons.*		*Long tons.*		*Long tons*		*Long tons.*	
Newark, N. J	......	....	1,071	$31,802	462	$12,240	443	$10,175
New Orleans, La	172	$5,705	150	4,750	......	....	100	2,087
New York, N. Y	24,524	721,092	21,867	654,997	28,240	690,989	36,543	827,193
Philadelphia, Pa	12,549	385,671	9,216	256,224	6,657	167,222	11,704	263,467
Providence, R. I	600	18,232	1,739	45,487	519	11,479	......	....
San Francisco, Cal	483	17,367	862	27,768	256	7,548	224	4,528
Savannah, Ga	......	....	725	15,370	......	....	......	....
Total	48,966	1,473,678	43,443	1,242,788	47,922	1,173,156	65,919	1,487,698

Countries whence exported and customs districts through which imported.	1880.		1881.		1882.		1883.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
COUNTRIES.	*Long tons.*		*Long tons.*		*Long tons.*		*Long tons.*	
England	1	$22	......	....	......	....	13	$379
Scotland	1,664	36,444	1,668	$43,311	755	$20,294	3	88
France	988	23,580	......	....	526	13,770	34	858
French West Indies	......	....	......	....	2	8	......	....
Greece	......	....	......	....	500	13,927	......	....
Italy	80,301	1,862,712	102,771	2,645,293	92,944	2,504,862	92,861	2,248,870
Japan	282	4,744	691	16,253	2,980	66,356	1,038	23,714
San Domingo	......	....	......	....	240	7,875	......	....
Spain	......	....	308	8,637	......	....	500	12,856
Spanish possessions in Africa and adjacent islands	......	....	......	....	9	310	87	2,030
Total	83,236	1,927,502	105,438	2,713,494	97,956	2,627,402	94,536	2,288,795
DISTRICTS.								
Baltimore, Md	13,827	313,342	16,477	430,917	13,781	364,384	11,977	286,438
Beaufort, S. C	......	....	......	....	540	13,889	......	....
Boston and Charlestown, Mass	8,207	183,486	8,860	226,801	7,467	194,317	7,756	173,569
Charleston, S. C	1,061	25,398	3,065	78,741	6,025	161,281	4,051	106,235
Middletown, Conn	......	....	......	....	9	310	......	....
New Orleans, La	280	7,121	100	2,646	220	6,516	428	10,378
New York, N. Y	46,657	1,083,784	57,608	1,463,082	46,531	1,260,222	45,385	1,110,313
Philadelphia, Pa	10,679	254,892	17,987	477,547	14,839	408,611	22,772	549,095
Providence, R. I	1,255	31,155	650	17,507	1,244	33,036	535	13,830
Richmond, Va	......	....	......	....	660	17,760	......	....
San Francisco, Cal	1,270	28,324	691	16,253	6,054	151,234	1,072	24,572
Savannah, Ga	......	....	......	....	586	15,842	560	14,365
Total	83,236	1,927,502	105,438	2,713,494	97,956	2,627,402	94,536	2,288,795

Statement by countries and by customs districts, etc.—Continued.

Countries whence exported and customs districts through which imported.	1884. (a)		1885.		1886.		1887.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
COUNTRIES.	*Long tons.*		*Long tons.*		*Long tons.*		*Long tons.*	
Belgium			190	$4,766	60	$1,718		
Danish West Indies							861	$5,250
England			606	15,084	81	2,535	162	4,437
France							290	6,951
Quebec, Ontario, Manitoba, and the Northwest Territory						9		
Italy			94,370	1,894,858	112,283	2,166,565	89,924	1,588,146
Japan			1,541	25,683	4,972	66,505	6,146	83,576
Spain			134	1,552				
Total	105,143	$2,242,678	96,841	1,941,943	117,396	2,237,332	97,383	1,688,360
DISTRICTS.								
Baltimore, Md	15,037	303,226	14,505	285,006	19,307	364,958	12,547	225,669
Barnstable, Mass	650	16,163	480	11,040	1,617	35,385	1,152	22,816
Beaufort, S. C	600	13,259	610	12,847				
Boston and Charlestown, Mass	5,294	112,152	5,125	99,712	3,681	69,898	4,850	85,575
Champlain, N. Y						9		
Charleston, S. C	6,125	132,570	8,525	169,564	13,350	265,265	12,420	220,598
New Orleans, La			102	2,282	250	5,102		
New York, N. Y	52,478	1,135,725	45,537	909,123	58,758	1,115,519	46,711	792,114
Philadelphia, Pa	18,786	401,568	18,696	381,010	15,568	300,749	15,267	269,216
Providence, R. I	651	15,517	1,840	37,422	1,265	25,930	600	11,291
San Francisco, Cal	5,522	112,598	1,421	33,937	3,600	54,517	3,176	50,521
All other customs districts							660	10,560
Total	105,143	2,242,678	96,841	1,941,943	117,396	2,237,332	97,383	1,688,360

Countries whence exported and customs districts through which imported.	1888.		1889.		1890.		1891.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
COUNTRIES.	*Long tons.*		*Long tons.*		*Long tons.*		*Long tons.*	
Belgium	83	$1,993	180	$4,086	182	$3,995	267	$6,576
Danish West Indies					550	9,076		
England	310	7,200	305	8,337	4,898	101,100	5,613	127,976
Scotland					20	487		
Italy	92,528	1,499,720	123,260	1,935,368	115,240	1,800,585	101,660	2,140,516
Japan	6,332	72,729	6,441	77,853	21,031	221,316	12,763	168,073
Other countries							501	8,372
Total	99,253	1,581,582	130,191	2,025,644	141,921	2,136,559	120,804	2,451,513
DISTRICTS.								
Baltimore, Md	11,989	182,769	15,791	234,693	21,198	322,018	9,339	247,324
Beaufort, S. C	500	9,000	600	9,213			1,300	26,951
Boston and Charlestown, Mass	3,760	62,298	6,446	104,257	7,410	135,044	6,381	136,402
Charleston, S. C	12,005	199,048	23,377	364,859	15,752	255,106	28,281	557,384
Mobile, Ala							750	14,863

a Sources not reported.

Statement by countries and by customs districts, etc.—Continued.

Countries whence exported and customs districts through which imported.	1888.		1889.		1890.		1891.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
DISTRICTS.	*Long tons.*		*Long tons.*		*Long tons.*		*Long tons.*	
New Orleans, La	200	$3,845			200	$3,397	1,300	$30,474
New York, N. Y	50,486	816,286	60,922	$959,872	66,359	983,754	44,027	910,075
Pensacola, Fla							1,399	23,206
Philadelphia, Pa	10,519	173,699	13,288	202,357	13,919	210,576	10,842	216,763
Providence, R. I	1,310	21,012	570	8,581	1,240	19,160		
San Francisco, Cal	6,352	78,732	4,539	57,925	8,223	87,391	8,819	115,637
Savannah, Ga			2,345	44,244	5,560	86,826	5,245	99,717
Willamette, Oreg							288	11,852
Wilmington, N. C	1,532	25,893	1,753	28,443	2,040	32,800	2,832	60,843
All other customs districts	600	9,000	560	11,200	20	287	1	22
Total	99,253	1,581,582	130,191	2,025,644	141,921	2,136,559	120,804	2,451,513

Countries whence exported and customs districts through which imported.	1892.		1893.		1894.		1895.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
COUNTRIES.	*Long tons.*		*Long tons.*		*Long tons.*		*Long tons.*	
England	6,522	$162,616	8,777	$196,914	12,435	$228,300	17,332	$272,807
Scotland			1,452	27,288				
France	1	23						
Quebec, Ontario, etc	1	49	8	269				
Italy	90,668	2,147,942	103,146	958,303	68,854	1,031,690	96,162	1,296,989
Spain					899	15,343		
Japan	12,227	213,776	8,307	133,455	4,777	62,567	14,241	130,988
Total	109,419	2,524,406	121,690	2,305,464	86,965	1,337,900	127,735	1,700,784
DISTRICTS.								
Baltimore, Md	9,981	263,293	13,759	271,949	9,854	132,272	10,706	150,129
Beaufort, S. C							800	11,669
Boston and Charlestown, Mass	9,086	221,033	11,001	224,624	12,649	227,976	19,683	301,749
Charleston, S. C	14,651	364,593	10,885	209,246	10,560	163,358	11,576	143,915
Mobile, Ala					774	12,740	880	13,027
New Orleans, La	2,118	47,165	2,441	43,970	2,407	34,184	1,260	17,179
New York, N. Y	52,647	1,191,169	57,474	1,085,289	35,319	548,742	55,484	702,998
Norfolk and Portsmouth, Va							700	8,368
Philadelphia, Pa	9,380	211,570	12,625	241,293	5,149	73,980	8,216	110,841
Portland, Me	2,000	42,460						
Providence, R. I					700	9,063	1,604	21,779
San Francisco, Cal	7,256	127,797	7,766	125,507	4,424	59,790	6,356	64,758
Savannah, Ga			4,650	86,562	2,712	42,439	8,965	135,816
Willamette, Oreg	398	6,866	541	7,948	559	6,647	885	9,423
Wilmington, N. C	1,900	48,388	540	8,807	1,858	26,709	620	9,133
Vermont			8	269				
All other customs districts	2	72						
Total	109,419	2,524,406	121,690	2,305,464	86,965	1,337,900	127,735	1,700,784

As will be seen from the foregoing table, the principal source of our supply of sulphur is from Italy, or more properly the island of Sicily.

THE LOUISIANA SULPHUR MINE.

The sulphur deposits of Calcasieu Parish, La., have been fully discussed in previous volumes of Mineral Resources, and, save for a description of the recently inaugurated and unique mining methods, need only be briefly mentioned here. The sulphur bed begins about 450 feet below the surface with a bed about 200 feet thick. Below this sulphur is a bed of gysum of 200 feet thickness. The sulphur commences again below this, and the bottom of this lower stratum has not been reached at 1,500 feet. Above the sulphur, however, lies a bed of quicksand 150 feet thick, and it is this quicksand which has caused the failure of several costly attempts to mine the sulphur. To Mr. Herman Frasch, of Cleveland, Ohio, is due the credit of evolving a new method of recovering this valuable product. The method consists of forcing superheated water through a 10-inch pipe and a 6-inch pipe within the other. The heated water melts the sulphur, which, being the heavier, sinks to the bottom, and is pumped out through a 3-inch pipe inside the 6-inch one. The liquefied sulphur is drawn off into tanks about 65 feet long by 15 feet wide and 12 inches deep. After twenty-four hours of exposure to the atmosphere (the tanks being on the ground and uncovered) the sulphur solidifies and is broken out in lumps ready for shipment. The sulphur obtained is said to 99.93 per cent pure. In the early part of January of the present year (1896) the writer visited the works at Sulphur City, but they were unfortunately temporarily idle. About 800 tons of sulphur had been taken out, when, on account of some accident to the machinery, work was stopped.

The pumping was done as in oil wells, with sucker rods and working valve operating an aluminum working barrel, aluminum not being affected by melted sulphur. All the trouble experienced in the execution of this novel smelting process had been caused by the working valve getting out of order, aluminum valves or zinc valves not being of sufficient strength to withstand the shock which the heavy column of sulphur would cause at change of stroke.

At the time of the writer's visit, a system of lifting the liquefied sulphur by compressed air, a successful method recently invented for raising water from deep wells and known as the "air lift," was in contemplation.[1] The practicability of liquefying the sulphur and obtaining it by pumping is demonstrated by the 800 tons won in a few days'

[1] At the time of writing this report (July, 1896), information has been received directly from Mr. Frasch that this method of pumping the melted sulphur has been successfully introduced, and all the difficulties previously encountered have been overcome. The new system has enabled the owners (the Union Sulphur Company) to pump 265 tons of sulphur per day. The protracted drought which has prevailed in the region during the spring and summer has caused some inconvenience in the matter of water supply, and necessitating the erection of a pumping station on the Houston River, 5 miles away. The sulphur recovered is now upon the markets.

work. The mines are within 3 miles of Sulphur City, on the Southern Pacific Railroad, and a spur has been built from the main track to the mine.

THE TEXAS SULPHUR DEPOSITS.

Dr. Eugene A. Smith, of the University of Alabama, and State geologist of Alabama, in a contribution to Science of May 1, 1896, gives an account of the sulphur deposits in El Paso County, Tex., from which the following is abstracted.

The deposits occur in what is known as the Toyah basin, about 40 miles northwest of Pecos City, and 20 miles west of Guadalupe station, on the Pecos Valley Railroad. The region is bare of foliage, except for a scanty growth of yucca, dwarf mesquite, cactus, and other desert plants. In the deeper ravines, which prevail throughout the basin, erosion has exposed the underlying formations, which are the clays of the Red Beds, or Comanche limestones, according to locality. A few springs of gypseous water are found in the deep ravines or "draws," the flow from the springs being quickly absorbed by the porous earth. Besides these there are several springs strongly impregnated with sulphur. Dr. Smith visited these places, of which he writes as follows:

> The sulphur was found below bare, apparently wind-swept, spots, its presence being usually indicated either by clusters of gypsum crystals in the soil, or by an outcrop of the sulphur itself, sometimes tolerably pure, sometimes cementing the surface pebbles into a conglomerate. When further exposed by pits, the sulphur is seen to occur in nests and irregular veins, filling small fissures or crevices in the soil, the sides of these fissures being often lined with well-developed sulphur crystals up to one-fourth of an inch in size. The whole of the earth, to the depth of 10 feet or more at the three localities visited, appeared to be impregnated with sulphur, sometimes almost imperceptible to the eye, but oftener in minute crystals concentrated along irregular lines. Where thus generally disseminated through the brown or chocolate-colored earth, the sulphur makes some 10 or 15 per cent of the whole weight, but where concentrated along the lines above mentioned the percentage of sulphur goes up to 40 or 50, and even higher, for not infrequent is the occurrence of sulphur in the massive form, very light yellow in color, opaque, and of earthy aspect, resembling a yellowish meerschaum, but of exceptional purity, several analyses of average samples showing 97 per cent sulphur. The average content of sulphur in the material penetrated by the several pits which were examined by me could not be far short of 50 per cent.
>
> In the immediate vicinity of one of the occurrences the surface soil is highly charged with gypsum, which appears in small crystals and in large groups of crystals embedded in the white calcareous sandy material rendered strongly acid by the decomposition products of the sulphur. At one place the sulphur beds rest upon an impure limestone which has been so greatly corroded by these acids as to be very difficult of identification.
>
> The sulphur beds do not appear to underlie uniformly the whole basin, for in the region indicated, within a radius of 20 miles, only three places are as yet known where they occur. The actual outcrop, by natural or artificial exposure, will here cover some 4 or 5 acres, but the probability is that the sulphur in each of the localities underlies a much larger area, for wherever penetrated by borings or pits the sulphur-impregnated earth has been encountered to a depth of at least 10 feet, and a deposit of this thickness could hardly be conceived to thin down so rapidly as to

limit the occurrence of the sulphur to the small area in which it has actually been exposed.

Nor, on the other hand, are the sulphur deposits of Texas confined to the particular region designated in these notes, for there are well-authenticated reports of their occurrence both to the westward and to the northward, the former from cowboys, through whose representations attention was first directed to the beds above described, the latter upon the authority of Capt. John Pope, who had charge of one of the divisions of the survey of the railroad routes to the Pacific. Along the banks of Delaware Creek he collected a sample of earth which contained 18.28 per cent of sulphur, and he comments also upon the frequency of sulphur springs in the same region. Delaware Creek rises among the Guadalupe Mountains and flows into the Pecos River some 50 miles to the northward of the Guadalupe Station.

The materials filling the basins of the Trans-Pecos region have very generally been considered as of lacustrine origin, and of the truth of this supposition we have very good proof in the great number of fresh-water diatoms discovered in the sulphur-impregnated earth submitted by me to Mr. K. M. Cunningham, of Mobile, for microscopic examination. The basin formation is considered by Mr. Robert T. Hill, of the United States Geological Survey, to be of Pleistocene age, but somewhat more recent than the Llano Estacado.

In regard to the origin of the Texas sulphur beds, the most significant of the associated materials are the beds of gypsum which a few miles to the northeast are of commercial importance because of their great thickness and purity; the springs of sulphur water which are abundant along all the deeper drainage ways, and the ancient lake deposits which practically make the country. These deposits contain much organic matter along with calcareous and siliceous sediments.

Dr. Smith inclines to the belief that the occurrence of the sulphur in this region is similar to that of the deposits in Sicily, which are generally thought to be derived from springs charged with calcium sulphide, or sulphureted hydrogen and carbonate of lime resulting from the decomposition of gypsum in the presence of organic matter.

The deposits are 20 miles from railroad transportation, and until railway facilities have been established these deposits will hardly enter as an important factor in the sulphur trade. On the other hand, the opinion is expressed that there would be no difficulty in constructing a railroad or tramroad to the beds with little or no grading, and sufficient water could be easily obtained from artesian wells. Fuel supply is another problem to be solved, but this would not be difficult or expensive to obtain after the coal fields in Presidio County, south of Chispa station, on the Southern Railroad, have become a commercial producer.

THE SICILIAN SULPHUR INDUSTRY.

Sicily, as is well known, is the main source of the world's supply of sulphur. From there it is exported to every European country, to South America, and to the United States. The latter country is the principal market, its consumption of Sicilian sulphur averaging from 25 to 30 per cent of the total exports. France is the second largest consumer, Italy third, and Great Britain fourth. These four countries consume more than 75 per cent of the product. A dozen other countries absorb the remaining 25 per cent.

Notwithstanding the fact that Sicily has enjoyed a practical monopoly of the sulphur trade (the output from Japan and the amount recovered from alkali waste being comparatively limited quantities), the industry of the island has been in a demoralized condition for several years. The direct cause has been overproduction. For a number of years the use of pyrites for acid making has been steadily increasing, and comparatively little sulphur is now used for acid consumed in fertilizer works. Japanese sulphur and that recovered from alkali waste have also had some effect on the trade, but these factors would have been insignificant alone. Against the three adverse agencies, the increased use of sulphur as a disinfectant and in grape culture has not been a beneficial offset. During 1895 large stocks of sulphur accumulated at the mines and shipping ports, and many mines were closed. About the first of the present year (1896) attempts were made to form a combination looking to the restriction of the product, the maintenance of remunerative prices, and the abolition by the Government of the export tax of $2.12 per ton. So far as the latter is concerned, appearances for favorable action are promising. At the time of writing this report (July, 1896), the ways and means committee of the Italian Parliament is reported to have made a recommendation favorable to the producers, and it is believed that at the next session the tax will either be abolished or considerably reduced. A syndicate of European capitalists has been formed to take control of the industry, and a contract has been offered the producers to maintain the product at about 340,000 tons a year for five years, at a stipulated price. Much depends, however, upon the action of the Government in regard to the abolition of the export tax.

Mr. Brühl, United States consul at Catania, in the report before referred to, says:

> The overproduction can not well be reduced, for obvious reasons. Mines cannot, without serious loss, be left standing unworked, because in most of them the rapidly entering water has constantly to be pumped out, otherwise it would soon fill and ruin the mines, especially those which are worked in a primitive mode (where the sulphur is carried to the surface in bags by men and boys over stairs crudely hewn into the walls of the passages leading out of the mines), or would cause such damage as would require perhaps six months or more (depending, of course, upon the condition of the mine) to reopen and again put in a workable condition; it would ruin the larger mines which contain mostly machinery. * * * With the continued fall in the prices of sulphur, since 1891, especially, the wages of the poor mine laborers have necessarily been correspondingly reduced, until, as has been stated, the hard-working men and boys do not earn, on an average, more than 7 to 8 cents, and at most 10 cents, per day.

Below are given the average prices per ton realized in Sicily for sulphur known as "best thirds unmixed," during the last quarter century.

PRICES OF SICILIAN SULPHUR.

Prices of Sicilian sulphur at shipping ports from 1870 to 1895.

Year.	Price.	Equivalent to—	Year.	Price.	Equivalent to—
	Lire.			*Lire.*	
1870	120.86	$23.33	1883	95.00	$18.34
1871	128.56	24.81	1884	89.00	17.18
1872	126.64	24.44	1885	83.00	16.02
1873	126.40	24.40	1886	76.20	14.71
1874	142.17	27.44	1887	69.80	13.47
1875	141.64	27.34	1888	66.80	12.89
1876	120.00	23.16	1889	67.50	13.03
1877	100.50	19.40	1890	77.99	15.05
1878	99.20	19.15	1891	115.59	22.31
1879	97.41	18.80	1892	95.17	18.37
1880	100.35	19.37	1893	71.80	13.86
1881	115.30	22.25	1894	62.50	12.06
1882	105.00	20.27	1895	55.00	10.62

As the value of the depreciated Italian currency has varied very much during the period, even during the last two years rising from 83 centesimi to 96 centesimi, and is now only about 92 centesimi, the quoted prices are those obtained in Italian lire (the standard lira=19.3 cents). These prices are free on board vessel, but without export tax.

The demoralization in the Sicilian industry is easily measured by the decline in prices since 1891. A decline of 52 per cent in four years is of great significance. A previous period of low prices had prevailed from 1886 to 1889, but at no time during this period did the price reach so low an ebb as in 1894 and 1895.

Owing to the primitive furnaces still in use at the mines, the fusing of sulphur can be done only at certain times of the year (except at the modern works in Catania), after harvesting of crops, which would be ruined by the fumes. This operation begins generally after the end of June; hence, with the end of June also closes the so-called "sulphur year."

EXPORTS OF SICILIAN SULPHUR.

The figures in the following tables, showing exports of sulphur from Sicily, the countries to which exported, and the ports through which the imports into the United States were received, have been furnished by Mr. A. S. Malcomson, of New York.

Total exports of sulphur from Sicily since 1883.

Country.	1883.	1884.	1885.	1886.	1887.	1888.	1889.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
United States	96,629	94,929	99,378	98,590	89,419	128,265	109,008
France	63,602	65,098	58,264	54,280	56,222	52,083	67,340
Italy	66,810	56,292	49,415	48,658	48,997	47,664	43,523
United Kingdom	41,788	40,760	33,402	30,236	30,007	35,634	39,203
Greece	10,494	7,033	13,664	19,697	18,370	5,809	10,158
Portugal	15,298	11,018	17,760	30,943	16,587	15,851	16,799
Russia	10,413	12,831	13,420	10,570	18,441	22,043	17,678
Germany	7,232	6,622	6,103	8,689	9,700	12,402	15,401
Austria	4,915	6,037	5,965	5,800	6,702	8,942	8,984
Turkey	3,043	1,285	3,077	4,598	6,238	1,457	2,231
Spain	5,242	3,920	2,243	5,890	5,873	3,433	6,586
Belgium	7,660	6,793	9,516	6,580	5,318	6,951	7,752
Holland	1,256	696	1,237	2,999	1,747	2,793	2,424
Sweden	1,010	744	328	1,916	1,169	3,004	3,899
South America	....	....	....	....	710	95	23
Australia	....	....	....	....	600	885	....
Denmark	....	....	810	....	202	464	443
Other countries	....	....	....	....	....	....	....
Total	335,392	314,058	314,582	329,446	311,302	347,775	351,451

Country.	1890.	1891.	1892.	1893.	1894.	1895.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
United States	106,656	97,520	84,450	83,901	105,773	99,227
France	71,790	56,168	73,176	89,736	56,932	69,696
Italy	40,231	42,212	38,711	54,486	49,895	49,349
United Kingdom	26,213	23,408	24,853	27,453	22,165	24,043
Greece and Turkey	18,103	11,414	*a*14,845	*a*13,840	*a*16,870	*a*16,195
Portugal	16,695	11,439	13,490	14,545	8,670	14,562
Russia	17,158	11,930	14,178	19,730	17,977	17,962
Germany	15,703	10,629	14,326	16,259	16,437	15,472
Austria	8,746	10,575	9,096	10,169	11,494	12,170
Turkey	4,231	3,000	(*a*)	(*a*)	(*a*)	(*a*)
Spain	5,679	3,845	7,382	3,499	3,445	5,753
Belgium	7,279	5,089	5,133	4,358	5,644	6,410
Holland	....	....	2,183	2,957	2,365	3,335
Sweden	3,314	2,252	4,561	6,579	7,887	5,730
South America	....	....	....	....	....	....
Australia	....	....	1,200	....	....	....
Denmark	400	300	(*b*)	(*b*)	(*b*)	(*b*)
Other countries	2,565	3,542	3,152	1,680	3,376	7,732
Total	344,763	293,323	309,536	349,192	328,930	347,636

a Exports to Greece and Turkey combined after 1892. *b* Included in exports to Sweden.

PORTS IN THE UNITED STATES RECEIVING SICILIAN SULPHUR.

The ports in the United States to which such shipments were made, together with the amount shipped to each since 1883, and the quality of the shipments since 1886, are shown in the following tables:

Ports in the United States receiving Sicilian sulphur and the amount received by each.

Port.	1883.	1884.	1885.	1886.	1887.	1888.	1889.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
New York	41,238	46,460	50,814	49,952	45,979	60,706	55,939
Charleston	5,425	7,706	12,416	10,556	14,324	22,496	12,399
Philadelphia	23,123	19,234	12,153	15,662	11,764	11,793	14,334
Baltimore	16,175	13,986	16,435	15,680	10,306	17,330	15,316
Boston	5,864	4,723	4,200	3,800	3,300	6,300	4,950
Wilmington, N. C	....	....	....	....	1,020	2,355	2,040
Savannah	....	....	....	....	....	3,545	3,240
Pensacola	....	....	....	....	....	....	....
Port Royal	600	610	680	660	1,000	600	....
Providence	650	1,140	1,370	1,180	630	1,250	590
Sundries	670	....	....	....	600	480	....
San Francisco	1,884	500	....	....	296	....	....
New Orleans	350	100	250	....	200	250	200
Woods Hole	650	470	1,060	1,100	....	1,160	....
Mobile	....	....	....	....	....	....	....
Delaware Breakwater	....	....	....	....	....	....	....
Portland, Me	....	....	....	....	....	....	....
Norfolk	....	....	....	....	....	....	....
Total	96,629	94,929	99,378	98,590	89,419	128,265	109,008

Port.	1890.	1891.	1892.	1893.	1894.	1895.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
New York	37,390	49,023	49,090	43,396	46,875	55,863
Charleston	27,563	21,646	4,510	13,525	15,296	9,150
Philadelphia	11,094	6,856	10,400	8,160	5,400	8,350
Baltimore	16,700	11,365	12,355	9,950	15,300	9,720
Boston	2,500	1,950	3,325	500	4,317	4,950
Wilmington, N. C	1,309	2,600	....	1,140	1,890	650
Savannah	5,920	1,550	1,170	5,330	9,795	4,584
Pensacola	1,390	....	....	....	....	....
Port Royal	600	700	....	....	800	....
Providence	650	....	....	....	1,500	1,380
Sundries	....	....	....	....	....	....
San Francisco	....	....	....	....	....	....
New Orleans	800	1,200	2,000	1,900	2,400	1,700

Ports in the United States receiving Sicilian sulphur, etc.—Continued.

Port.	1890.	1891.	1892.	1893.	1894.	1895.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Woods Hole	....	....	....	....	....	....
Mobile	740	....	....	....	800	880
Delaware Breakwater	....	630	....	....	....	....
Portland, Me	....	....	2,000	....	....	1,300
Norfolk	....	....	....	....	1,400	700
Total	106,656	97,520	84,850	83,901	105,773	99,227

Quality of Sicilian sulphur received at the different ports of the United States since 1886.

Port.	1886.		1887.		1888.		1889.		1890.	
	Best unmixed seconds.	Best thirds.	Best unmixed seconds.	Best thirds.	Best unmixed seconds.	Best thirds.	Best unmixed seconds.	Best thirds.	Best unmixed seconds.	Best thirds.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
New York	36,352	13,600	29,919	16,060	35,573	25,133	32,983	22,956	20,801	16,589
Charleston	7,506	3,050	8,875	5,449	15,485	7,011	6,325	6,074	20,873	6,690
Philadelphia	4,660	11,002	2,127	9,637	3,050	8,743	2,000	12,334	1,000	10,094
Baltimore	7,325	8,355	4,463	5,843	11,380	5,950	7,656	7,660	5,930	10,770
Boston	600	3,200	200	3,100	700	5,600	750	4,200	200	2,300
Savannah	......	......	......	......	2,130	1,415	2,790	1,450	2,750	3,170
Wilmington, N. C	......	......	1,020	......	2,355	......	2,040	......	1,309	......
New Orleans	......	......	......	......	......	......	......	......	......	......
Other ports	1,180	1,760	106	2,620	1,500	2,240	200	590	1,540	2,640
Total	57,623	40,967	46,710	42,709	72,173	56,092	53,744	55,264	54,403	52,253

Port.	1891.		1892.		1893.		1894.		1895.	
	Best unmixed seconds.	Best thirds.	Best unmixed seconds.	Best thirds.	Best unmixed seconds.	Best thirds.	Best unmixed seconds.	Best thirds.	Best unmixed seconds.	Best thirds.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
New York	29,358	19,665	34,390	14,700	29,146	14,250	33,150	13,725	35,888	19,975
Charleston	17,196	4,450	4,010	500	11,665	1,860	3,273	12,023	700	8,450
Philadelphia	450	6,406	3,600	6,800	1,900	6,260	350	5,050	1,200	7,150
Baltimore	4,510	6 855	900	11,455	2,050	7,900	600	14,700	1,100	8,620
Boston	1,300	650	1,825	1,500	500	......	1,017	3,300	2,350	2,600
Savannah	850	700	600	570	3,450	1,880	5,695	4,100	3,784	800
Wilmington, N. C	1,900	700	......	......	......	1,140	......	1,890	......	650
New Orleans	......	......	......	......	1,900	......	2,400	......	1,700	......
Other ports	1,200	1,330	4,000	......	......	......	800	3,700	1,880	2,380
Total	56,764	40,756	49,325	35,525	50,611	33,290	47,285	58,488	48,602	50,625

PYRITES.

PRODUCTION.

Although the amount of pyrites mined in the United States was 6,391 tons less in 1895 than in 1894, the product having decreased from 105,940 long tons to 99,549 long tons, its consumption was larger and its use for acid making is on the increase. The increased consumption is shown by the record of domestic production and importations during the past five years. In 1891, the domestic output was 106,536 long tons, the imports 100,648 long tons, a total of 207,184 tons. In 1892, this had increased to 262,147 long tons, of which 109,788 tons were of domestic production and 152,359 tons imported. During the following year the home product fell off to 75,777 long tons, but the imports increased to 194,934 tons, making a total of 270,711 tons. The domestic product increased to 105,940 tons in 1894, while the imports decreased to 163,546, making a total slightly less than the preceding year—269,486; but this unimportant decrease was more than made up in the total for 1895, 289,984 long tons, made up from 99,549 long tons produced in the United States and 190,435 long tons imported. Assuming that the sulphur contents average 45 per cent of the pyrites ore (a very conservative estimate), the amount of sulphur displaced by the use of pyrites at American acid works has increased from 93,233 tons in 1891 to 130,493 tons in 1895, a difference of 37,260 tons.

In 1889, the United States imported 135,933 long tons of crude sulphur and in 1890, 162,674 tons. The use of pyrites for acid making may be said to have begun on a large scale about this time. As a result the imports of sulphur fell off in 1891 to 116,971 tons and in 1892 to 100,938 tons. There was some little increase in 1893, and a further one in 1894, but it was in the face of depressed prices and a demoralized condition of trade. The imports of crude sulphur in 1895 were 4,000 tons less than in the preceding year. The enlarged use of pyrites for acid making has not been confined to America. England, Germany, and France have also become important consumers, and it can be readily understood how this factor has come to exert so potential an influence on the sulphur industry of Sicily, of which mention is made in the discussion of that subject.

There was an insignificant decline in the value of the product of pyrites in 1895, when compared with 1894. In the former year the price averaged $3.43 per ton, falling to $3.34 in 1895.

The amount and value of pyrites mined for sulphur contents in the United States since 1882 have been as follows:

Production of pyrites in the United States from 1882 to 1895.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Long tons.			*Long tons.*	
1882	12,000	$72,000	1889	93,705	$202,119
1883	25,000	137,500	1890	99,854	273,745
1884	35,000	175,000	1891	106,536	338,880
1885	49,000	220,500	1892	109,788	305,191
1886	55,000	220,000	1893	75,777	256,552
1887	52,000	210,000	1894	105,940	363,134
1888	54,331	167,658	1895	99,549	322,845

IMPORTS.

The following table shows the imports of pyrites containing not more than 3.5 per cent of copper from 1884 to 1895:

Imports of pyrites containing not more than 3.5 per cent of copper from 1884 to 1895. (a)

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Long tons.			*Long tons.*	
1884	16,710	$50,632	1892	152,359	$587,980
1885	6,078	18,577	1893	194,934	721,699
1886	1,605	9,771	1894	163,546	590,905
1887	16,578	49,661	1895	190,435	673,812
1891	100,648	392,141			

a Previous to 1884 classed among sulphur ores; 1887 to 1891 classed among other iron ores; since 1891 includes iron pyrites containing 25 per cent and more of sulphur.

CONSUMPTION.

As the imports of iron pyrites for use in the manufacture of sulphuric acid were not stated separately by the Bureau of Statistics of the Treasury Department prior to 1891, a comparison with the preceding years can not be made. The following table shows the amount of pyrites mined and imported for the past five years, and as no exports are reported by the Treasury Department, these figures may be accepted as representing the domestic consumption. The table also shows the estimated amount of sulphur displaced each year on a basis of 45 per cent of sulphur contents.

Amount of pyrites consumed in the United States, and estimated sulphur displaced, from 1891 to 1895.

Source.	1891.	1892.	1893.	1894.	1895.
	Long tons.	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*
Domestic product	106,536	109,788	75,777	105,940	99,549
Imports	100,648	152,359	194,934	163,546	190,435
Domestic consumption	207,184	262,147	270,711	269,486	289,984
Sulphur displaced estimated on basis of 45 per cent contents.	93,233	117,966	121,815	121,269	130,493

PYRITES OCCURRENCES IN THE UNITED STATES.

There are four localities in the United States where pyrites for acid making is produced, namely, in Franklin County, Mass.; Louisa and Prince William counties, Va., and in Gaston County, N. C. The mineral is found in nearly every one of the United States, but either low percentage of sulphur or the smallness or inaccessibility of the deposits has restricted the production to the four localities mentioned. In Mineral Resources for 1885 the various localities of any importance known at that time are described. Some later information in regard to pyrites occurrences in some of the southern States is at hand and will be found of interest. Mr. William M. Brewer, M. E., of Atlanta, who has been very active in the study of the mineral resources of the South, particularly in Alabama, Georgia, and North Carolina, is the authority for the following report on the pyrites localities in those States:

PYRITE IN THE SOUTHERN APPALACHIAN STATES.[1]

A casual examination of the crystalline regions of the Appalachian system usually impresses the observer with the apparently extensive deposits of iron pyrite. Throughout this region in Virginia, North Carolina, Georgia, a portion of Tennessee, and Alabama the visitor finds pyrite on every side. In nearly every gold mine, when water level is reached, and often above that depth, we encounter iron pyrite carrying values in gold as well as sulphur. In the copper mines at Ducktown, Tenn., near Dahlonega, Ga., and in Cleburne and Clay counties, Ala., we encounter this iron pyrite carrying small percentages of copper, traces of arsenic, and a greater or less percentage of sulphur. In the graphitic slates we find small crystals of granular iron pyrite, which often constitute 20 to 50 per cent of the entire mass. In a green semicrystalline slate, known to the geologists in Alabama as "Iwana," we find iron pyrite occurring in the same manner and often constituting as much as 75 per cent of the entire mass.

Therefore, at a casual glance it would appear as though the southern States could easily furnish the domestic market at least with all the pyrite necessary. But casual glances are apt to be misleading, and, as an actual fact, to-day there is

[1] From the Chattanooga Tradesman.

comparatively little domestic pyrite used.[1] The acid plants which use pyrite for the manufacture of sulphuric acid obtain their supply from Spain principally, with a smaller percentage from Virginia and North Carolina.

There are several reasons for this, which may possibly in the future be overcome, and the industry of prospecting and mining for iron pyrite assume the important proportions enjoyed by the industry of mining phosphates.

First. All, or nearly all, of the properties on which indications that pyrite in paying quantities can be mined are located at remote distances from railroad transportation, and the price of the pyrite at the acid plants is not sufficient to warrant any excessive cost for wagon haul, or, indeed, extra long hauls by railroad freight.

Second. The supply of Spanish pyrite possesses all the requisite qualifications and can really be delivered at the plants in Atlanta even at less cost than our domestic pyrite can in the present undeveloped condition of the prospects in the southern States. Consequently, as a business proposition, there is no inducement offered to our acid men to change their policy.

Third. The requisite percentage of sulphur contained by the pyrite to insure successful and profitable treatment must exceed 45 per cent average. Such a grade has up to the present time been higher than the average southern pyrite attains.

The foregoing are some of the reasons why the imported ore is used at present; but of course these, or at least many of them, may be removed in the future, and probably will be.

Considerable prospecting work has been carried on in North Carolina, Georgia, and Alabama during the past year, searching for a suitable ore to supply the demand in the southern States,[2] with what degree of success can hardly yet be determined. But shipments of the loose granular ore have been made from Paulding and Haralson counties, Ga., to plants in South Carolina, where the furnaces are arranged for treating this class of ore, and these sample shipments have been pronounced satisfactory, as I am reliably informed. However, the occurrences of this ore are not yet being worked on any extensive scale, and have not yet gone beyond the experimental stage. In mining this class of ore there are three essential points to be settled, viz:

First. Is the percentage of pyrite carried by the slates large enough to admit of profitable separation?

Second. Is the average percentage of sulphur carried by the pyrite sufficiently high?

Third. Can the mines be worked and the ore delivered at a cost that will render it advisable to make the necessary alterations in the furnaces?

When these pertinent questions can be answered in the affirmative,a new era will be marked in the progress of the pyrite mining industry.

In Lumpkin County, Ga., considerable interest is manifested over the fact that Colonel Scott, one of the leading fertilizer manufacturers of Atlanta, has acquired title, by purchase, to a property on the banks of the Chestatee river, known locally as the "old copper mines." Since August, 1894, he has had a gang of men employed in prospecting and sinking test holes with a diamond drill. Two hundred tons of the pyrite, which occurs massive, have been hauled 20 miles to the railroad and shipped to Atlanta for testing at the acid plant owned by Colonel Scott and associates. During a recent visit the superintendent at the mine stated that he had received instructions to continue the shipments.

Of course the building of a railroad is in contemplation if the pyrite proves adaptable. In the event of such a result there is no doubt but that the product would be used nearly universally at the interior plants, because it could be delivered free on board at the furnaces in Atlanta and vicinity for less cost than the imported article and still insure a good net profit for the mine owners.

The ore body at the point where a cross cut has been run proves to be upward of 30 feet in thickness, apparently interstratified with hornblende slates and schists,

[1] The domestic product in 1895 was a little more than half the imports.

[2] Since the above was written the deposits in Gaston County, N. C., have been developed, and 8,900 tons were shipped in 1895.

because at one point, after cutting through more than 25 feet of solid pyrite, a seam of hornblende slate was encountered about 6 inches in thickness, followed by another solid body of pyrite, which had been cross cut 5 or 6 feet at the time of my visit, and the face was still solid pyrite.

Heretofore the only domestic pyrite which has been tested at Atlanta in any quantity has come from North Carolina.

ARKANSAS.

Considerable prospecting has been done on some deposits of pyrites near Hot Springs, Ark. The material has been analyzed by Memminger and Brown, of Nashville, Tenn.; Milner and Brown, of Colorado City, Colo., and the Chappell Chemical Company, of Chicago, Ill., the various analyses showing from 48 to 52 per cent of sulphur, 40 per cent of iron, 10 per cent of zinc, and a small amount of copper, with traces of silver and gold. J. L. Gebhart, M. D., of Hot Springs, who is interested in some of the deposits, states in a letter to the Survey that he has made several analyses of the ore and found the average percentage of sulphur to be about 53.19, with 4 per cent of copper, a trace of gold, but free from arsenic, zinc, or antimony. The pyrite showing the zinc contents was from prospects on the property of Dr. S. Reamy, of Malvern. Dr. Gebhart claims that chemically pure acid can be made from his ore. He states that the present prospect presents a true fissure vein 90 feet thick between rock walls that are nearly vertical on their faces and consist of a metamorphic sandstone. Inside of the rock walls the fissure material consists of a black quartzite from the very surface, fully one-half of which is a gangue consisting of about one-half diffused pyrite and one-half the quartzite of the fissure vein. Through this gangue at least five vertical veins of pure pyrite pass down, growing rapidly thicker as they descend, with the gangue on each side from 4 to 8 feet thick, also growing richer in pyrite as the exposure deepens. One vein of pure pyrite is 3 inches thick at the surface and 30 inches thick at a depth of 23 feet.

The opinion is expressed that at a depth of 200 feet there will be a thickening of 45 to 50 feet of pure pyrite, all now in sight as gangue concentrating into one vast lode, so as to be practically inexhaustible. This vein is easily traced on the surface for over a mile in a direction of east 30° north.

A shaft with drainage cut has been sunk 23 feet, and a drift of 30 feet has been run on the vein, showing uniform thickness. Another shaft is now being sunk, to continue at least 200 feet deep, and as much deeper as the indications for a profitable output will justify. This property will probably soon pass into the hands of parties who have ample means for a full development and output.

Dr. Reamy's mine is in Magnet Cove, Hot Springs County, 3 miles from Cove Creek station on the Hot Springs Railroad. A vein of the ore runs through the cove. It appears to be a fissure vein 8 or 10 feet wide, and in great quantity. A pit 15 feet deep has been sunk on the vein, but no ore has been shipped, as work was delayed by encountering a large amount of water. Work was suspended until steam pumping facilities could be obtained.

GYPSUM.

By Edward W. Parker.

OCCURRENCE.

Large deposits of gypsum are found in many of the United States. East of the Mississippi River the principal localities are in New York, where it occurs in beds of great thickness and extent in a line of counties extending westward from Oneida to Niagara; in Ohio, near the city of Sandusky; in Michigan, on the Grand River, near Grand Rapids, and at Alabaster Point, Iosco County, and in Bay County; in Virginia, along the north fork of the Holston River, and in Smyth and Washington counties. Gypsum is also reported in Alabama and Louisiana, but the deposits are not worked at the present time. West of the Mississippi River and east of the Rocky Mountains extensive gypsum deposits are found in Iowa, Kansas, Arkansas, Texas, Oklahoma, and the Indian Territory. Operations are carried on in Webster County, Iowa; Barber, Saline, Marion, Marshall, and Dickinson counties, Kans.; at Quanah, Tex., and at Okarche, Okla.

The Rocky Mountain States producing gypsum are Colorado, Montana, Utah, South Dakota, and Wyoming, and deposits are reported in Arizona, Idaho, and New Mexico. Among the Pacific States California is the only producer of gypsum, though extensive deposits have recently been reported in Oregon. The Oregon deposits are on Snake River in Baker County, and the gypsum is said to be very pure (95 per cent). It is claimed that plaster of paris can be manufactured and laid down in Portland at $3.50 per ton.

In nearly all cases the gypsum deposits are found in close proximity to those of salt. This is particularly the case in New York, Virginia, Kansas, Texas, and in Bay County, Mich.[1]

PRODUCTION.

The gypsum product of the United States in 1895 amounted to 265,503 short tons, with a total value of $797,447, against an output in 1894 of 239,312 short tons, worth $761,719, indicating an increase in 1895 of 26,191 short tons, and a gain in value of $35,728. The increase in value was not in proportion to the increase in tonnage, as a decline from $3.18 to $3 is noted in the average value per ton; but in a year of

[1] For detailed descriptions of the gypsum deposits of the United States see Mineral Resources U. S., 1882, 1883-84, 1885, and 1886.

phenomenally depressed prices, this decrease of 6 per cent is of small import, and the industry, compared with many others, may be considered as satisfactory. The production of gypsum was the largest with one exception of any year for which there is any record, and it is certain that the output for any year prior to the recorded period never exceeded the product in recent years. The year in which the product exceeded that of 1895 was the census year of 1889, when the output was 267,769 short tons, but the value of the product in 1889 was less than that of 1895.

With the exceptions of Michigan and Virginia, the increased production was general throughout the gypsum-producing States. Michigan's output decreased from 79,958 tons in 1894 to 66,519 tons in 1895, but owing to the fact that there was a large amount of calcined plaster made in the latter year, the value decreased only about $15,000. Virginia's product decreased 2,306 tons (more than 25 per cent) with a loss in value of about $7,000, about the same percentage. California's output increased both in quantity and value, but as only one producer was reported in 1894 no comparisons can be made. The same may be said of Colorado. Iowa's product shows an increase of nearly 8,000 tons in amount and a decrease of about the same figure in value. Kansas increased her output about the same as Iowa, but shows a decline in value of nearly $30,000. New York's output increased about 2,000 tons in quantity and decreased about $1,000 in value. Ohio increased slightly both in quantity and value, and encouraging increases are noted in South Dakota and Texas.

As will be seen in the following table, the value of the gypsum product is taken at the condition in which it is first sold, so that an increase or decrease in the product of calcined plaster will show a material difference when comparing the total product with the total value:

Product of gypsum in the United States in 1895, by States.

State.	Total product.	Sold crude.		Ground into land plaster.		Calcined into plaster of paris.			Total value.
		Quantity.	Value.	Quantity.	Value.	Before calcining.	After calcining.	Value of calcined plaster.	
	Short tons.	*Short tons.*		*Short tons.*		*Short tons.*	*Short tons.*		
California	5,158			1,368	$13,194	3,790		$37,820	$51,014
Colorado	1,371					1,371	1,060	8,281	8,281
Iowa	25,700			1,200	600	24,500	16,000	36,000	36,600
Kansas	72,947	290	$452	250	500	72,407	54,465	271,579	272,531
Michigan	66,519	6,488	15,732	9,003	13,965	51,028	40,895	144,310	174,007
New York	33,587	12,182	6,492	16,765	36,664	4,640	3,480	16,165	59,321
Ohio	21,662	6,914	13,411	3,048	9,531	11,700	9,350	48,262	71,204
South Dakota	6,400					6,400	5,100	20,600	20,600
Texas	10,750					10,750	7,166	36,511	36,511
Virginia	5,800	750	1,750	3,201	10,001	1,849	1,648	5,618	17,369
Other States (*a*)	15,609			244	900	15,365	11,637	49,109	50,009
Total	265,503	26,624	37,837	35,079	85,355	203,800	150,801	674,255	797,447

a Includes Indian Territory, Utah, and Wyoming, in each of which the output is reported from only one company.

COMPARATIVE STATISTICS OF PRODUCTION FOR SIX YEARS.

For the purposes of comparison, the following tables, showing the statistics of production during 1893 and 1894, and the total product and value for the past six years, are given:

Product of gypsum in the United States in 1893, by States.

State.	Total product.	Sold crude.		Ground into plaster.		Calcined into plaster of paris.			Total value.
		Quantity.	Value.	Quantity.	Value.	Before calcining.	After calcining.	Value of calcined plaster.	
	Short tons.	*Short tons.*		*Short tons.*		*Short tons.*	*Short tons.*		
Iowa	21,447	109	$82	2,853	$2,296	18,485	14,273	$53,160	$55,538
Kansas	43,631	196	510	57	114	43,378	29,975	180,975	181,599
Michigan	124,590	31,000	62,000	16,263	28,562	77,327	62,031	213,359	303,921
New York	36,126	10,979	8,198	22,802	49,221	2,345	1,813	7,973	65,392
South Dakota	5,150	....	....	50	150	5,100	4,080	12,400	12,550
Virginia	7,014	22	66	5,579	19,181	1,413	1,131	5,112	24,359
Other States (*a*)	15,657	502	1,004	2,804	6,841	12,351	9,624	45,411	53,256
Total	253,615	43,108	72,010	50,408	106,365	160,399	122,937	518,390	696,615

a Includes Ohio and Texas. In each of these States the output is reported from only one company.

Product of gypsum in the United States in 1894, by States.

State.	Total product.	Sold crude.		Ground into plaster.		Calcined into plaster of paris.			Total value.
		Quantity.	Value.	Quantity	Value.	Before calcining.	After calcining.	Value of calcined plaster.	
	Short tons.	*Short tons.*		*Short tons.*		*Short tons.*	*Short tons.*		
Iowa	17,906	....	....	1,900	$2,700	16,006	13,000	$42,000	$44,700
Kansas	64,889	87	$174	560	1,680	64,242	49,273	300,030	301,884
Michigan	79,958	20,000	40,000	11,982	21,127	47,976	38,555	128,493	189,620
New York	31,798	10,554	7,885	16,804	36,993	4,440	3,335	15,384	60,262
Ohio	20,827	2,955	6,410	3,472	10,416	14,400	11,472	52,771	69,597
South Dakota	4,295	500	750	460	1,850	3,335	2,660	13,450	16,050
Texas	6,925	....	....	....	....	6,925	4,750	27,300	27,300
Virginia	8,106	600	900	6,728	20,853	778	623	2,678	24,431
Other States (*a*)	4,608	6	30	90	325	4,512	3,490	27,520	27,875
Total	239,312	34,702	56,149	41,996	95,944	162,614	127,158	609,626	761,719

a Includes California, Colorado, Montana, Oklahoma Territory, Utah, and Wyoming. In each of these States the output is reported from only one company.

Comparative statistics of gypsum production for six years.

State.	1889.		1890.		1891.		1892.	
	Product.	Value.	Product.	Value.	Product.	Value.	Product.	Value.
	Short tons.		*Short tons.*		*Short tons.*		*Short tons.*	
California	....	....	....	....	....	....	(a)	(a)
Colorado	7,700	$28,940	4,580	$22,050	....	....	(a)	(a)
Iowa	21,789	55,250	20,900	47,350	31,385	$58,095	(a)	(a)
Kansas	17,332	94,235	20,250	72,457	40,217	161,322	46,016	$195,197
Michigan	131,767	373,740	74,877	192,099	79,700	223,725	139,557	306,527
New York	52,608	79,476	32,903	73,093	30,135	58,571	32,394	61,100
Ohio	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
South Dakota	320	2,650	2,900	7,750	3,615	9,618	....	....
Texas	....	....	....	....	....	....	....	....
Virginia	6,838	20,336	6,350	20,782	5,959	22,574	6,991	28,207
Other States	29,420	109,491	20,235	138,942	17,115	94,146	31,301	104,461
Total	267,769	764,118	182,995	574,523	208,126	628,051	256,259	695,492

State.	1893.		1894.		1895.	
	Product.	Value.	Product.	Value.	Product.	Value.
	Short tons.		*Short tons.*		*Short tons.*	
California	(a)	(a)	(a)	(a)	5,158	$51,014
Colorado	(a)	(a)	(a)	(a)	1,371	8,281
Iowa	21,447	$55,538	17,906	$44,700	25,700	36,600
Kansas	43,631	181,599	64,889	301,884	72,947	272,531
Michigan	124,590	303,921	79,958	189,620	66,519	174,007
New York	36,126	65,392	31,798	60,262	33,587	59,321
Ohio	(a)	(a)	20,827	69,597	21,662	71,204
South Dakota	5,150	12,550	4,295	16,050	6,400	20,600
Texas	....	....	6,925	27,300	10,750	36,511
Virginia	7,014	24,359	8,106	24,431	5,800	17,369
Other States	15,657	53,256	4,608	27,875	15,609	50,009
Total	253,615	696,615	239,312	761,719	265,503	797,447

a Included in other States.

The following table shows the annual production of gypsum in the United States since 1880. It will be noticed that the largest production was in 1889, though the value in that year was less than in 1895.

Production of gypsum in the United States since 1880.

Year.	Product.	Value.	Year.	Product.	Value.
	Short tons.			*Short tons.*	
1880	90,000	$400,000	1888	110,000	$550,000
1881	85,000	350,000	1889	267,769	764,118
1882	100,000	450,000	1890	182,995	574,523
1883	90,000	420,000	1891	208,126	628,051
1884	90,000	390,000	1892	256,259	695,492
1885	90,405	405,000	1893	253,615	696,615
1886	95,250	428,625	1894	239,312	761,719
1887	95,000	425,000	1895	265,503	797,447

IMPORTS.

The imports of gypsum are chiefly from Canada, the product from the Dominion being very pure and well adapted for the manufacture of plaster of paris. The following table exhibits the total amount and value of gypsum imported into the United States since 1867:

Gypsum imported into the United States from 1867 to 1895.

Year ended—	Ground or calcined.		Unground.		Value of manufactured plaster of paris.	Total.
	Quantity.	Value.	Quantity.	Value.		
	Long tons.		*Long tons.*			
June 30, 1867...	....	$29,895	97,951	$95,386	....	$125,182
1868...	....	33,988	87,694	80,362	....	114,350
1869...	....	52,238	137,039	133,430	$844	186,512
1870...	....	46,872	107,237	100,416	1,432	148,720
1871...	....	64,465	100,400	88,256	1,292	154,013
1872...	....	66,418	95,339	99,902	2,553	168,873
1873...	....	35,628	118,926	122,495	7,336	165,459
1874...	....	36,410	123,717	130,172	4,319	170,901
1875...	....	52,155	93,772	115,664	3,277	171,096
1876...	....	47,588	139,713	127,084	4,398	179,070
1877...	....	49,445	97,656	105,629	7,843	162,917
1878...	....	33,496	89,239	100,102	6,989	140,587
1879...	....	18,339	96,963	99,027	8,176	125,542
1880...	....	17,074	120,327	120,642	12,693	150,409
1881...	....	24,915	128,607	128,107	18,702	171,724
1882...	5,737	53,478	128,382	127,067	20,377	200,922
1883...	4,291	44,118	157,851	152,982	*a*21,869	218,969
1884...	4,996	42,904	166,310	168,000	....	210,904
1885...	6,418	54,208	117,161	119,544	....	173,752
1886...	5,911	37,642	122,270	115,696	....	153,338
1887...	4,814	37,736	146,708	162,154	....	195,890
Dec. 31, 1888...	3,340	20,764	156,697	170,023	....	190,787
1889...	5,466	40,291	170,965	179,849	....	220,140
1890...	7,568	55,250	171,289	174,609	....	229,859
1891...	9,560	97,316	110,257	129,003	....	226,319
1892...	6,882	75,608	181,104	232,403	....	308,011
1893...	3,363	31,670	164,300	180,254	....	211,924
1894...	2,027	16,823	162,500	179,237	....	196,060
1895...	3,295	21,526	192,549	215,705	10,352	247,583

a Not specified since 1883.

As the imports of gypsum into the United States are principally from the Provinces of Ontario, New Brunswick, and Nova Scotia, in the Dominion of Canada, the following table, showing the production in and exports from the Dominion, will be found interesting:

Production and exports of Canadian gypsum from 1886 to 1895.

Year.	Production.		Exports.	
	Quantity.	Value.	Quantity.	Value.
	Short tons.		*Short tons.*	
1886	162,000	$178,742	142,833	$155,213
1887	154,008	157,277	132,724	146,542
1888	175,887	179,393	125,508	121,389
1889	213,273	205,108	178,182	194,404
1890	226,509	194,033	175,691	192,254
1891	203,545	192,096	172,496	184,977
1892	226,568	225,260	175,518	194,304
1893	192,568	196,150	176,489	178,979
1894	223,631	202,031	....	....
1895	226,178	202,608	....	....

SALT.

By Edward W. Parker.

PRODUCTION.

The salt product of the United States in 1895 amounted to 13,669,649 barrels of 280 pounds, valued at $4,423,084, against 12,967,417 barrels, worth $4,739,285, in 1894, and 11,897,208 barrels, valued at $4,154,668, in 1893. The amount of salt made and mined in the United States has increased annually since 1883, with the exception of 1889, when the product was about 50,000 barrels less than in the preceding year. In 1883 the total product was 6,192,231 barrels, so that in the twelve years of which there is any reliable record the output has more than doubled. The product in 1894 was more than twice that of 1883, while the product of 1895 was about 2.2 times that of 1883. The average annual increase in domestic production has been about 10 per cent, while the average percentage of increase in the total mineral production in fifteen years has been about 4. It is true that during the ten years following 1883 salt of domestic production replaced a great deal of English and other imported salt, due to improved methods of refining adopted in this country, which have enabled producers to successfully compete in quality of the product with the output of the best works of the Old World. In 1881 the imports of salt exceeded 1,000,000,000 pounds, though this was exceptional. The importations in 1883 amounted to 867,915,603 pounds; in 1888, five years later, they had decreased to 625,030,735 pounds, and in another five years (1893) to 348,519,173 pounds. The placing of salt on the free list in August, 1894, increased importations in that year to 434,155,708 pounds, and in 1895 to 559,161,669 pounds.

Of the domestic product in 1895, 2,089,763 barrels were rock salt; 983,870 barrels were produced by solar evaporation; 8,272,603 barrels were of the three finer grades of "table," "dairy," and "common fine," and of the remainder, 2,323,413 barrels, part consists of the salt contents of brine, used in making soda ash, etc. Rock salt was obtained from 7 mines. Solar heat was employed at 35 works, while at the places using artificial heat for evaporating brine the grainer process is most popular, there being 73 concerns reporting this method to 17 using open pans, 9 using vacuum pans, and 7 open kettles. At 28 places heat was applied direct, and steam heat was used at 84 works.

These figures do not quite agree with the total number of works reporting an output in 1895. At some establishments heat is applied both direct and by steam, and at some places more than one process is employed, the same place using both the open pan and grainer. The total number of works reporting was 153. Direct heat was reported from 28 and steam heat from 84 establishments, which with 35 solar works and 7 rock-salt mines make a total of 154. The total of grainer and other artificial processes employed was 106, which, with the 35 solar works and 7 rock-salt mines, makes a total of 148.

The following tables exhibit the details of salt production in the United States during 1894 and 1895, by States, with the approximate distribution according to grades:

Production of salt in 1895, by States and grades.

State	Table.	Dairy.	Common fine.	Common coarse.	Packer's.	Coarse solar.
	Barrels.	*Barrels.*	*Barrels.*	*Barrels.*	*Barrels.*	*Barrels.*
California	21,536	14,571	3,321	14,286	33,929	193,571
Illinois			67,119			
Kansas	47,499	33,815	924,625	10,714		
Louisiana						
Michigan	105,021	36,405	2,977,507	122,000	61,031	30,000
Nevada	*a* 7,000					
New York:						
Onondaga dist. (*b*)			55,247			632,870
Genesee district	131,257	236,473	118,179	14,980	2,827	
Warsaw district		*a*1,178,166	985,082	79,153	13,000	
Rock salt						
Ohio		*a* 295,256	458,832	21,366	3,000	
Pennsylvania	787	609	141,855	849		13,143
Texas			125,000			
Utah	14,300	39,250	21,171	7,936	5,014	114,286
Virginia	4,000		52,000	9,000		
West Virginia	7,178		169,542			
Total	338,578	1,834,545	6,099,480	280,284	118,801	983,870

State.	Rock.	Milling.	Other grades.	Total product.	Total value.
	Barrels.	*Barrels.*	*Barrels.*	*Barrels.*	
California	24,864		12,857	318,935	$158,683
Illinois				67,119	31,548
Kansas	313,714		11,250	1,341,617	483,701
Louisiana	159,771			159,771	78,169
Michigan			11,431	3,343,395	1,048,251

a Includes both dairy and table salt.

b Salt in brine used in chemical works at Syracuse is included in product of Onondaga district, although the wells are not within the reservation.

Production of salt in 1895, by States and grades—Continued.

State.	Rock.	Milling.	Other grades.	Total product.	Total value.
	Barrels.	*Barrels.*	*Barrels.*	*Barrels.*	
Nevada				7,000	$5,600
New York:					
Onondaga dist. (*a*)			1,651,707	2,339,824	576,999
Genesee district			82,955	586,671	108,537
Warsaw district			64,735	2,320,136	916,662
Rock salt	1,585,700			1,585,700	341,200
Ohio			2,579	781,033	326,520
Pennsylvania				157,243	67,411
Texas				125,000	55,000
Utah	5,714	40,107	46,707	294,485	121,762
Virginia				65,000	40,000
West Virginia				176,720	63,041
Total	2,089,763	40,107	1,884,221	13,669,649	4,423,084

State.	Processes employed.					Artificial heat.		Number of works reporting.
	Solar.	Open pan.	Vacuum pan.	Kettle.	Grainer.	Direct.	Steam.	
California	7						*b* 2	*c* 10
Illinois					1		1	1
Kansas	1	4			5	4	5	*c* 13
Louisiana								*c* 1
Michigan	1	2	7		41	3	49	55
Nevada	1							1
New York:								
Onondaga dist. (*a*)	20	1		6		7		29
Genesee district	1	1			2	2	1	2
Warsaw district		7	2		12	7	10	13
Rock salt								*c* 3
Ohio				1	6	3	8	10
Pennsylvania					2		2	3
Texas	1	1			1	1	1	1
Utah	3	1				1	2	6
Virginia								1
West Virginia					3		3	4
Total	35	17	9	7	73	28	84	153

a Salt in brine used in chemical works at Syracuse is included in product of Onondaga district, although the wells are not within the reservation.

b Artificial heat used only for making refined salt for table and dairy use.

c Rock salt was mined at one establishment each in California and Louisiana, two in Kansas, and three in New York.

Production of salt in 1894, by States and grades.

State.	Table.	Common fine.	Dairy.	Common coarse.	Packers.	Solar.
	Barrels.	*Barrels.*	*Barrels.*	*Barrels.*	*Barrels.*	*Barrels.*
California	29,929	2,771	11,786	98,314	32,857	121,071
Illinois		50,000				
Kansas		60,100	889,496			
Louisiana						
Michigan	114,667	3,026,497	25,883	127,379	16,081	29,500
Nevada	179	500		1,548		
New York	923,750	1,232,146	611,028	69,094	33,617	434,591
Ohio	50,000	352,884	96,699	22,428	3,500	
Pennsylvania		160,000		28,236	15,000	
Texas	4,379	138,478				
Utah	42,764	21,429	25,729	82,121	1,986	2,143
Virginia	3,601	51,667		8,954		
West Virginia	9,250	185,282				
Total	1,178,519	5,281,754	1,660,621	438,074	103,041	587,305

State.	Rock.	Milling.	Other.	Total.	Value.
	Barrels.	*Barrels.*	*Barrels.*	*Barrels.*	
California	24,864	8,857	1,797	332,246	$172,678
Illinois				50,000	27,500
Kansas	432,813			1,382,409	529,392
Louisiana	186,050			186,050	86,134
Michigan			1,418	3,341,425	1,243,619
Nevada		1,443		3,670	4,030
New York	1,616,629		*a* 1,349,733	6,270,588	1,999,146
Ohio			3,485	528,996	187,432
Pennsylvania				203,236	83,750
Texas				142,857	101,000
Utah	6,250	85,321	443	268,186	209,077
Virginia				64,222	43,580
West Virginia				194,532	51,947
Total	2,266,606	95,621	*a* 1,356,876	12,967,417	4,739,285

a Includes salt contents of brine used in manufacture of chemicals.

In reporting production some operators use the bushel as a unit of measurement, some the short ton, and some the barrel. For the sake of convenience the product of each State in the preceding and following tables has been reduced to one unit, the barrel, containing 280 pounds, or 5 bushels of 56 pounds, and a ton being equal to $7\frac{1}{7}$ barrels.

Comparative table of production of salt in States and Territories from 1883 to 1895.

State or Territory.	1883.		1884.	
	Quantity.	Value.	Quantity.	Value.
	Barrels.		*Barrels.*	
Michigan	2,894,672	$2,344,684	3,161,806	$2,392,536
New York	1,619,486	680,638	1,788,454	705,978
Ohio	350,000	231,000	320,000	201,600
West Virginia	320,000	211,000	310,000	195,000
Louisiana	265,215	141,125	223,964	125,677
California	214,286	150,000	178,571	120,000
Utah	107,143	100,000	114,285	80,000
Nevada	21,429	15,000	17,857	12,500
Illinois, Indiana, Virginia, Tennessee, Kentucky, and other States and Territories (*a*)	400,000	377,595	400,000	364,443
Total	6,192,231	4,251,042	6,514,937	4,197,734

State or Territory.	1885.		1886.	
	Quantity.	Value.	Quantity.	Value.
	Barrels.		*Barrels.*	
Michigan	3,297,403	$2,967,663	3,677,257	$2,426,989
New York	2,304,787	874,258	2,431,563	1,243,721
Ohio	306,847	199,450	400,000	260,000
West Virginia	223,184	145,070	250,000	162,500
Louisiana	299,271	139,911	299,691	108,372
California	221,428	160,000	214,285	150,000
Utah	107,140	75,000	164,285	100,000
Nevada	28,593	20,000	30,000	21,000
Illinois, Indiana, Virginia, Tennessee, Kentucky, and other States and Territories (*a*)	250,000	243,993	240,000	352,763
Total	7,038,653	4,825,345	7,707,081	4,825,345

a Estimated.

Comparative table of production of salt in States and Territories from 1883 to 1895—Cont'd.

State or Territory.	1887.		1888.	
	Quantity.	Value.	Quantity.	Value.
	Barrels.		*Barrels.*	
Michigan	3, 944, 309	$2, 291, 842	3, 866, 228	$2, 261, 743
New York	2, 353, 560	936, 894	2, 318, 483	1, 130, 409
Ohio	365, 000	219, 000	380, 000	247, 000
West Virginia	225, 000	135, 000	220, 000	143, 000
Louisiana	341, 093	118, 735	394, 385	134, 652
California	200, 000	140, 000	220, 000	92, 400
Utah	325, 000	102, 375	151, 785	32, 000
Kansas	....	....	155, 000	189, 000
Other States and Territories (*a*)	250, 000	150, 000	350, 000	143, 999
Total	8, 003, 962	4, 093, 846	8, 055, 881	4, 374, 203

State or Territory.	1889.		1890.	
	Quantity.	Value.	Quantity.	Value.
	Barrels.		*Barrels.*	
Michigan	3, 856, 929	$2, 088, 909	3, 837, 632	$2, 302, 579
New York	2, 273, 007	1, 136, 503	2, 532, 036	1, 266, 018
Ohio	250, 000	162, 500	231, 303	136, 617
West Virginia	200, 000	130, 000	229, 938	134, 688
Louisiana	325, 629	152, 000	273, 553	132, 000
California	150, 000	63, 000	62, 363	57, 085
Utah	200, 000	60, 000	427, 500	126, 100
Kansas	450, 000	202, 500	882, 666	397, 199
Other States and Territories (*a*)	300, 000	200, 000	300, 000	200, 000
Total	8, 005, 565	4, 195, 412	8, 776, 991	4, 752, 286

a Estimated.

Comparative table of production of salt in States and Territories from 1883 to 1895—Cont'd.

State or Territory.	1891.		1892.	
	Quantity.	Value.	Quantity.	Value.
	Barrels.		*Barrels.*	
Michigan	3,966,784	$2,037,289	3,829,478	$2,046,963
New York	2,839,544	1,340,036	3,472,073	1,662,816
Ohio	(*a*)	(*a*)	899,244 (Ohio and West Virginia)	394,720 (Ohio and West Virginia)
West Virginia	(*a*)	(*a*)		
Louisiana	173,714	102,375	200,000	100,000
California	200,949	90,303	235,774	104,938
Utah	969,000	265,350	1,292,471	340,442
Nevada	60,799	39,898	22,929	22,806
Kansas	855,536	304,775	1,480,100	773,989
Illinois	39,670	34,909	60,000	48,000
Virginia	70,442	70,425	60,000	50,000
Pennsylvania	....	....	25,571	10,741
Texas	....	....	121,250	99,500
Other States and Territories (*b*)	811,507	430,761	....	....
Total	9,987,945	4,571,121	11,698,890	5,654,915

State or Territory.	1893.		1894.	
	Quantity.	Value.	Quantity.	Value.
	Barrels.		*Barrels.*	
Michigan	3,057,898	$888,837	3,341,425	$1,243,619
New York	5,662,074	1,870,084	6,270,588	1,999,146
Ohio	543,963	209,393	528,996	187,432
West Virginia	210,736	68,222	194,532	51,947
Louisiana	191,430	97,200	186,050	86,134
California	292,858	137,962	332,246	172,678
Utah	189,006	130,075	268,186	209,077
Nevada	6,559	4,481	3,670	4,030
Kansas	1,277,180	471,543	1,382,409	529,392
Illinois	59,161	30,168	50,000	27,500
Virginia	....	....	64,222	43,580
Pennsylvania	280,343	136,436	203,236	83,750
Texas	126,000	110,267	142,857	101,000
Total	11,897,208	4,154,668	12,967,417	4,739,285

a Included in "Other States." *b* Estimated.

Comparative table of production of salt in States and Territories from 1883 to 1895—Cont'd.

State or Territory.	1895.	
	Quantity.	Value.
	Barrels.	
Michigan	3,343,395	$1,048,251
New York	6,832,331	1,943,398
Ohio	781,033	326,520
West Virginia	176,720	63,041
Louisiana	159,771	78,169
California	318,935	158,683
Utah	294,485	121,762
Nevada	7,000	5,600
Kansas	1,341,617	483,701
Illinois	67,119	31,548
Virginia	*a* 65,000	40,000
Pennsylvania	157,243	67,411
Texas	125,000	55,000
Total	13,669,649	4,423,084

a Estimated.

REVIEW OF THE INDUSTRY IN 1895.

In spite of depressed trade conditions and prices which brought the total value of salt produced in the United States in 1895 below that of 1894 by over $300,000, the product was the largest ever obtained. The total product, including salt contents of brine used in manufacture of soda ash, was 13,669,649 barrels of 280 pounds, against 12,967,417 barrels in 1894, an increase of 702,232 barrels, or a little more than 5 per cent. The actual decrease in value was $316,201, or about 7 per cent. Part of this decrease in value may be attributed to a smaller production of the finer grades of salt in 1895. In 1894 the output of salt especially refined for table and dairy use was 2,839,140 barrels, while in 1895 the total amount of these two higher grades was 2,173,123 barrels, a decrease of 666,017 barrels. This decrease was more than made up for in an increase of about 800,000 barrels in the grade known as "common fine." A difference of 25 cents per barrel in the price of these grades (table and dairy being nearly the same) would account for about $150,000 of the decrease in value. At the same average price which obtained in 1894, the value of the product in 1895 would have been $5,126,118, or allowing for the decreased output of table and dairy salts, say, $4,976,118, instead of $4,423,084, so that in proportion to the amount of business done there was a difference in the value of the product of 1895, below that of 1894, or a loss to the producers of about $550,000. As the prices received in 1894 were not by any means satisfactory or remunerative, there is good reason to believe that the balance sheets of many concerns showed the balances on the wrong side of the page on January 1, 1896.

In August, 1894, salt imported into the United States was placed upon the free list, which induced larger importations. The imports increased from 348,519,173 pounds, or about 1,245,000 barrels in 1893, to 434,155,708 pounds, or about 1,550,000 barrels in 1894. In 1895 the imports had increased to 559,151,669 pounds, or about 2,000,000 barrels. The exports of domestic salt do not have much influence on the trade, amounting to but 10,853,759 pounds, or 38,763 barrels in 1894, and 7,203,024 pounds, or 25,725 barrels in 1895. The imports added to the domestic product and the exports deducted from the total in 1894 and 1895 show that the salt consumed or placed upon the market in the United States increased from 14,479,209 barrels to 15,640,894 barrels, adding 1,161,685 barrels to an already overstocked trade. This is illustrated in the following table:

Supply of salt for domestic consumption in 1893, 1894, and 1895.

Sources.	1893.	1894.	1895.
	Barrels.	*Barrels.*	*Barrels.*
Domestic product	11,897,208	12,967,417	13,669,649
Imports	1,244,711	1,550,555	1,996,970
Total	13,141,919	14,517,972	15,666,619
Exports	20,686	38,763	25,725
Domestic consumption	13,121,233	14,479,209	15,640,894
Increase over preceding year	....	1,357,970	1,161,685

IMPORTS AND EXPORTS.

The imports of salt into the United States have shown an almost constant decrease since 1881. The decrease has been particularly noticeable in the imports of refined salt, due in great measure to the improvements recently inaugurated in the manufacture of table and dairy salts by American producers, which has placed the domestic product on a line with, if not ahead of, salts of foreign make.

Salt imported and entered for consumption in the United States, 1867 to 1895, inclusive.

Year ended—	In bags, barrels, and other packages.		In bulk.	
	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*	
June 30, 1867	254, 470, 862	$696, 570	229, 304, 323	$336, 302
1868	308, 446, 080	915, 546	219, 975, 096	365, 458
1869	297, 382, 750	895, 272	256, 765, 240	351, 168
1870	288, 479, 187	797, 194	349, 776, 433	507, 874
1871	283, 993, 799	800, 454	274, 730, 573	355, 318
1872	258, 232, 807	788, 893	257, 637, 230	312, 569
1873	239, 494, 117	1, 254, 818	388, 012, 132	525, 585
1874	358, 375, 496	1, 452, 161	427, 294, 209	649, 838
1875	318, 673, 091	1, 200, 541	401, 270, 315	549, 111
1876	331, 266, 140	1, 153, 480	379, 478, 218	462, 106
1877	359, 005, 742	1, 059, 941	444, 044, 370	532, 831
1878	352, 109, 963	1, 062, 995	414, 813, 516	483, 909
1879	375, 286, 472	1, 150, 018	434, 760, 132	532, 706
1880	400, 970, 531	1, 180, 082	449, 743, 872	548, 425
1881	412, 442, 291	1, 242, 543	529, 361, 041	658, 068
1882	329, 969, 300	1, 086, 932	399, 100, 228	474, 200
1883	312, 911, 360	1, 035, 946	412, 938, 686	451, 001
1884	340, 759, 010	1, 093, 628	441, 613, 517	433, 827
1885	351, 276, 969	1, 030, 029	412, 322, 341	386, 858
Dec. 31, 1886	319, 232, 750	966, 993	366, 621, 223	371, 000
1887	275, 774, 571	850, 069	343, 216, 331	328, 201
1888	238, 921, 421	620, 425	272, 650, 231	246, 022
1889	180, 906, 293	627, 134	234, 499, 635	249, 232
1890	172, 611, 041	575, 260	243, 756, 044	252, 848
1891	150, 033, 182	492, 144	220, 309, 985	224, 569
1892	150, 799, 014	488, 108	201, 366, 103	196, 371
1893	98, 037, 648	358, 575	146, 945, 390	63, 404
1894	60, 793, 685	206, 229	101, 525, 281	86, 718
1895	601, 086	1, 723	1, 874, 644	1, 874

Salt imported and entered for consumption in the United States, etc.—Continued.

Year ended—	For the purpose of curing fish.		Not elsewhere specified.		Total value.
	Quantity.	Value.	Quantity.	Value.	
	Pounds.		*Pounds.*		
June 30, 1867					$1, 032, 872
1868					1, 281, 004
1869					1, 246, 440
1870	68, 597, 023	$87, 048			1, 392, 116
1871	64, 671, 139	66, 008			1, 221, 780
1872	57, 830, 929	60, 155			1, 161, 617
1873	86, 756, 628	86, 193			1, 866, 596
1874	105, 613, 913	126, 896			2, 228, 895
1875	110, 294, 440	119, 607			1, 869, 259
1876	118, 760, 638	126, 276			1, 741, 862
1877	132, 433, 972	140, 787			1, 733, 559
1878	100, 794, 611	96, 898			1, 643, 802
1879	94, 060, 114	95, 841			1, 778, 565
1880	109, 024, 446	119, 667			1, 848, 174
1881	133, 395, 065	144, 347			2, 044, 958
1882	134, 777, 569	147, 058			1, 708, 190
1883	142, 065, 557	154, 671			1, 641, 618
1884	126, 605, 276	122, 463			1, 649, 918
1885	140, 067, 018	121, 429			1, 538, 316
Dec. 31, 1886	103, 360, 362	94, 721			1, 432, 714
1887	105, 577, 947	107, 089			1, 285, 359
1888	113, 459, 083	111, 120			977, 577
1889	97, 960, 624	100, 123			976, 489
1890	98, 279, 719	96, 648			924, 756
1891	103, 990, 324	89, 196			805, 909
1892	105, 192, 086	90, 327			774, 806
1893	103, 536, 135	87, 749			509, 728
1894	93, 723, 885	79, 482	178, 112, 857	$263, 707	636, 136
1895	8, 668, 490	12, 195	548, 007, 449	739, 122	754, 914

Salt of domestic production exported from the United States from 1790 to 1895, inclusive.

Year ended—	Quantity.	Value.	Year ended—	Quantity.	Value.
	Bushels.			*Bushels.*	
Sept. 30, 1790..	31, 935	$8, 236	June 30, 1862..	397, 506	$228, 109
1791..	4, 208	1, 052	1863..	584, 901	277, 838
1830..	47, 488	22, 978	1864..	635, 519	296, 088
1831..	45, 847	26, 848	1865..	589, 537	358, 109
1832..	45, 072	27, 914	1866..	[illegible]70, 644	300, 980
1833..	25, 069	18, 211	1867..	605, 825	304, 030
1834..	89, 064	54, 007	1868..	624, 970	289, 936
1835..	126, 230	46, 483	1869..	442, 947	190, 076
1836..	49, 917	31, 943	1870..	298, 142	119, 582
1837..	99, 133	58, 472	1871..	120, 156	47, 115
1838..	114, 155	67, 707	1872..	42, 603	19, 978
1839..	264, 337	64, 272	1873..	73, 323	43, 777
1840..	92, 145	42, 246	1874..	31, 657	15, 701
1841..	215, 084	62, 765	1875..	47, 094	16, 273
1842..	110, 400	39, 064	1876..	51, 014	18, 378
June 30, 1843*a*.	40, 678	10, 262	1877..	65, 771	20, 133
1844..	157, 529	47, 755	1878..	72, 427	24, 968
1845..	131, 500	45, 151	1879..	43, 710	13, 612
1846..	117, 627	30, 520	1880..	22, 179	6, 613
1847..	202, 244	42, 333	1881..	45, 455	14, 752
1848..	219, 145	73, 274	1882..	42, 085	18, 265
1849..	312, 063	82, 972	1883..	54, 147	17, 321
1850..	319, 175	75, 103	1884..	70, 014	26, 007
1851..	344, 061	61, 424	1885..	*b*4, 101, 587	26, 488
1852..	1, 467, 676	89, 316	Dec. 31, 1886..	4, 828, 863	29, 580
1853..	515, 857	119, 729	1887..	4, 685, 080	27, 177
1854..	548, 185	159, 026	1888..	5, 359, 237	32, 986
1855..	536, 073	156, 879	1889..	5, 378, 450	31, 405
1856..	698, 458	311, 495	1890..	4, 927, 022	30, 079
1857..	576, 151	190, 699	1891..	4, 448, 846	23, 771
1858..	533, 100	162, 650	1892..	5, 208, 935	28, 399
1859..	717, 257	212, 710	1893..	5, 792, 207	38, 375
1860..	475, 445	129, 717	1894..	10, 853, 759	46, 780
1861..	537, 401	144, 046	1895..	7, 203, 024	30, 939

a Nine months. *b* Pounds from 1885.

In connection with the above tables it is interesting to note the sources from which our imported salt is obtained and the markets supplied by our exports of domestic salt. For this purpose the following tables, showing the countries from which we import, the amount and value of the salt received from each, and also the amount and value of the salt exported to each country and the ports through which exported, are given for the two fiscal years ending June 30, 1894 and 1895. It will be observed that the principal source of supply is the United Kingdom, from which we imported 136,550,196 pounds out of a total of 345,479,066 in 1894, and 266,090,597 pounds out of a total of 496,810,501 in 1895. The imports from Great Britain were about 40 per cent of the total in 1894 and more than 50 per cent in 1895. Italy exported over 93,000,000 pounds to this country in 1894, and the West Indies nearly 100,000,000 pounds, so that the amount received from these three sources was 329,016,443 pounds, or 95 per cent of the total. In 1895 the imports from Italy fell off to 81,725,686 pounds, while those from the West Indies increased to 137,325,128 pounds. The total from the same three sources was 485,141,411 pounds, or about 97.7 per cent.

The principal exports are through the port of San Francisco, and to the Central American States, Mexico, the Hawaiian Islands, Japan, and Asiatic Russia. About 25 per cent, or a little more, goes across the Great Lakes to the Dominion of Canada.

The imports and exports for the past two fiscal years, with the countries from which imported and to which exported, have been as follows:

Imports of salt during the fiscal years ending June 30, 1894 and 1895, with the countries from which exported.

Country from which exported.	Year ending June 30, 1894.		Year ending June 30, 1895.			
			Free.		Dutiable. (a)	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Belgium	10,286	$14	2,020	$30		
France	4,783,980	3,636			1,400	$46
Germany	672,963	1,748			186,413	871
Italy	93,205,163	67,148	65,461,114	42,761	16,264,572	11,388
Portugal	2,572,735	1,833	419,844	348	3,618,272	3,259
Spain	2,349,078	1,596			3,680,272	3,376
United Kingdom:						
England	136,538,796	422,007	244,566,953	431,642	21,523,644	46,025
Scotland	11,400	56				
Canada:						
Nova Scotia, New Brunswick, etc	4,415,581	9,549	275,400	425	2,297,390	6,528
Quebec, Ontario	1,141,350	6,183	840	7	327,284	1,413
Central America:						
Nicaragua	7,500	50				
Mexico	226,413	387			230,580	440
West Indies:						
British	93,549,034	72,023	56,993,688	55,788	50,978,337	40,101
Dutch	4,726,544	5,201	21,726,311	26,073	1,851,386	2,075
French	984,506	993	2,847,905	4,028	1,466,650	1,573
Danish			27,000	45	233,851	243
Puerto Rico					1,200,000	1,613
Brazil	99,853	80				
Hongkong	284	2				
Portuguese Africa	183,600	216			527,275	361
Hawaiian Islands			100,000	330		
Egypt			2,100	13		
Total	345,479,066	592,722	392,423,175	561,490	104,387,326	119,312

a The tariff act of 1894 provides that salt is free of duty, but when in bags or other packages the coverings shall pay duty as if imported separately, and salt imported from countries imposing a duty on salt exported from the United States shall pay the rate of duty imposed prior to the act of 1894.

Exports of salt during the fiscal years ending June 30, 1894 and 1895, and countries to which exported.

Country to which exported.	Year ending June 30, 1894.		Year ending June 30, 1895.	
	Pounds.	Value.	Pounds.	Value.
United Kingdom	....	....	112,000	$350
British Honduras	4,600	$47	2,462	33
Dominion of Canada:				
Nova Scotia, New Brunswick, etc	663,150	5,635	195,900	1,753
Quebec, Ontario, etc	3,743,978	10,245	2,344,683	5,457
British Columbia	748,952	3,574	224,100	1,618
Central American States:				
Costa Rica	99,320	735	41,057	535
Guatemala	328,277	1,761	475,040	2,279
Honduras	23,370	422	30,897	412
Nicaragua	208,482	1,749	238,955	2,134
Salvador	1,791,200	8,818	1,405,000	7,241
Mexico	590,640	6,329	810,575	6,652
West Indies:				
British	2,000	15	1,500	12
Colombia	11,910	94	7,300	70
Japan	146,000	438	20,000	78
Russia, Asiatic	2,954,000	8,959	2,180,000	7,340
French Oceanica	79,450	439	69,000	374
Hawaiian Islands	495,450	2,811	541,300	2,721
Total	11,890,779	52,071	8,699,769	39,059

FLUORSPAR AND CRYOLITE.

FLUORSPAR.

Production.—The output of fluorspar decreased from 7,500 short tons, valued at $47,500, in 1894, to 4,000 short tons, worth $24,000, in 1895. In 1893 the product exceeded 12,000 short tons, and the price received for it at the mines was a little more than $6.75 per ton. The product in 1895 was less than one-third that of two years before, while the price dropped to $6 per ton. Rosiclare, Ill., has furnished the entire domestic supply of fluorspar since its utility in the manufacture of opalescent glass, in iron smelting, and in the preparation of hydrofluoric acid, has made it a desirable commercial product.

The following table shows the annual production of fluorspar since 1882:

Production of fluorspar in the United States from 1882 to 1895.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Short tons.			*Short tons.*	
1882	4,000	$20,000	1889	9,500	$45,835
1883	4,000	20,000	1890	8,250	55,328
1884	4,000	20,000	1891	10,044	78,330
1885	5,000	22,500	1892	12,250	89,000
1886	5,000	22,000	1893	12,400	84,000
1887	5,000	20,000	1894	7,500	47,500
1888	6,000	30,000	1895	4,000	24,000

CRYOLITE.

This mineral is used to a considerable extent in the manufacture of alum and sodium salts, for making white, porcelain-like glass, and for other technical purposes. In the preparation of alum and sodium salts from cryolite, alumina is left as a residue; and from this, metallic aluminum is extracted by electrolytic process. The only source of supply of the mineral is Greenland, although traces of this mineral were long ago shown by Cross and Hillebrand to occur in the neighborhood of Pikes Peak, Colorado.

IMPORTS.

The imports of cryolite for a series of years are shown in the following table:

Imports of cryolite from 1871 to 1895.

Year ended—	Amount.	Value.	Year ended—	Amount.	Value.
	Long tons.			*Long tons.*	
June 30, 1871..	....	$71,058	June 30, 1884..	7,390	$106,029
1872..	....	75,195	Dec. 31, 1885..	8,275	110,750
1873..	....	84,226	1886..	8,230	110,152
1874..	....	28,118	1887..	10,328	138,068
1875..	....	70,472	1888..	7,388	98,830
1876..	....	103,530	1889..	8,603	115,158
1877..	....	126,692	1890..	7,129	95,405
1878..	....	105,884	1891..	8,298	76,350
1879..	....	66,042	1892..	7,241	96,932
1880..	....	91,366	1893..	9,574	126,688
1881..	....	103,529	1894..	10,684	142,494
1882..	3,758	51,589	1895..	9,425	125,368
1883..	6,508	97,400			

MICA.

PRODUCTION.

The output from the mica mines of the United States in 1895 consisted of 44,325 pounds of cut or sheet mica, valued at $49,218; 40,083 pounds of small sizes, worth $1,163, and 148 short tons of "scrap" mica, valued at $5,450. The total value of the product is thus shown to have been $55,831, a slight increase over 1894, when the total value of the output was $52,388, though the industry was still in an unsatisfactory condition. The following table shows the annual production of mica in the United States since 1880:

Production of mica since 1880.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Pounds.			*Pounds.*	
1880	81,669	$127,825	1890	60,000	$75,000
1881	100,000	250,000	1891	75,000	100,000
1882	100,000	250,000	1892	75,000	100,000
1883	114,000	285,000	1893	51,111 *a* 156	88,929
1884	147,410	368,525			
1885	92,000	161,000	1894	35,943 *a* 191	52,388
1886	40,000	70,000			
1887	70,000	142,250	1895	*b* 44,325 *c* 40,083 *a* 148	55,831
1888	48,000	70,000			
1889	49,500	50,000			

a Scrap, tons. *b* Sheet. *c* Small.

IMPORTS.

The following table shows the imports of unmanufactured mica from 1869 to 1895:

Unmanufactured mica imported and entered for consumption in the United States, 1869 to 1895, inclusive.

Year ending—	Value.	Year ending—	Value.
June 30, 1869	$1,165	June 30, 1883	$9,884
1870	226	1884	28,284
1871	1,460	1885	28,685
1872	1,002	Dec. 31, 1886	a 56,354
1873	498	1887	a 49,085
1874	1,204	1888	a 57,541
1875	....	1889	a 97,351
1876	569	1890	a 207,375
1877	13,085	1891	95,242
1878	7,930	1892	218,938
1879	9,274	1893	147,927
1880	12,562	1894	126,184
1881	5,839	1895	174,886
1882	5,175		

a Including mica waste.

USES.

The greater part of the cut or sheet mica produced is used by stove manufacturers. The remainder goes into the manufacture of electrical dynamos, for which its nonconductive properties, when free from iron, render it very valuable. Ingenuity has developed a method of using also the smaller sizes of mica for electrical purposes, and some demand has been created for them. Heretofore they went to the scrap pile and were either wasted or ground. Scrap mica usually brings about $10 a ton, though some reported as scrap in 1895 was valued at about $60 per ton. This probably included a considerable amount of small-sized mica which should have been reported separately. The small sizes were reported for the first time in 1895, 40,083 pounds, or about 20 short tons, valued at $1,163, as against a valuation of about $200 as scrap. This difference is noteworthy and will doubtless have a beneficial effect in reviving the mica industry. Scrap mica is ground for the manufacture of lubricants, for giving a crystal effect to wall papers, and for other decorative purposes.

CONDITION OF THE INDUSTRY.

The mica mining industry has been in a depressed condition for several years. This has been due to several causes. In North Carolina, from which State the bulk of the product is obtained, mining has been carried on by antiquated methods, and miners have not kept pace with the march of progress. Under such circumstances, as mines were deepened the difficulties and expense increased, and without any advance in price. Transportation in the region is of the primitive kind, most of the product being hauled over bad mountain roads for from 25 to 50 miles to the railroad. In winter seasons the roads are frequently impassable, and this renders the supply uncertain. The effects of such conditions is shown by a glance at the tables of production and imports. From 1880 to 1885 the domestic product ranged in value from $127,825 in 1880 to $368,525 in 1894, the average exceeding $240,000 in the six years. The imports ranged in the same period from $5,175 in 1882 to $28,685 in 1885, averaging less than $15,000, while for the eleven years preceding 1880 the average annual imports were but little more than $3,000. From 1890 to 1895 the importations show a total valuation of $970,552, an average for six years of $161,759, while the domestic product averaged only $78,691 a year, less than one-half the imports, whereas ten years previous the domestic product was sixteen times the imports. It is to be hoped that in 1896 an improved condition will become manifest. It is reported that one firm owning large interests in North Carolina has introduced modern machinery and methods, and expects to turn out $100,000 worth of mica annually. Larger production is also promised from New Hampshire and the development of extensive deposits in Alabama are reported. All of the product in 1895 was from three States—New Hampshire, New Mexico, and North Carolina.

The principal mica mines in North Carolina which contributed to the product of 1895 were the following:

The Cloudland mine, 4 miles east of Bakersville; the Meadow, English, and Plumtree mines, near Plumtree; the Flatrock mine, 4 miles northwest of Spruce Pine; the Little Zeff Young mine, 7 miles west of Spruce Pine; the Chestnut, Flat, Gopher, and Childers mines, 1 to 2½ miles southwest of Spruce Pine; the Silver Ridge mine, on Crabtree Creek—all in Mitchell County; the Sleepy Hollow and Burton and White mines, in Yancey County, and the Black Mountain mine, in the northeastern part of Buncombe County.

Several of these mines have been worked at intervals for a number of years, but others of them, especially the Plumtree, English, and the Black Mountain mines, are comparatively recent discoveries; and since the close of 1895 several other promising new mines are being opened up, notably the Deal, Sparks, and McGee mines, in Mitchell County; the White mine, in the southern end of Yancey; the Harry Martin mine, in the eastern part of Buncombe County, and several others of less importance in these and other counties, while the mines of Whitehurst and Smith, near Roanoke, Va., are being opened up on a larger scale and with greater promise.

FUTURE SUPPLY.

The opinion has sometimes been expressed by mica men that all of the valuable mica deposits in the southern Appalachian region have been discovered and worked to a depth where the supply of water and the increasing hardness of the rock add so greatly to the expense of mining as to make it unprofitable, and consequently that this region would no longer be a conspicuous factor in the world's supply of mica. The opening of several new mines, however, during 1895 and the early part of 1896 has encouraged the belief that other workable deposits may be found in the near future if careful search is made. And when the fact is borne in mind that much the greater part of the mica-bearing areas of this southern Appalachian Mountain region from Alabama to Virginia are still covered with dense forests, so that the rock surfaces are covered with an accumulation of humus and living plants, it is seen that the region has been as yet only partially explored, and there must be numerous undiscovered mica veins which will yield as rich returns as those already discovered and partially worked. The question is often asked, also, whether or not those mica mines which have already been worked to a considerable depth can be considered as future producers of mica. Bearing upon this, it may be said that a majority of these mines have been worked only to a depth of less than 100 feet and for a horizontal distance of only 100 to 200 yards along the line of the vein. In some cases, as was true with the famous Clarissa mine, they were abandoned, with valuable deposits of mica still in sight, owing to the inability of the miners with their crude methods (having no steam pumps) to contend with the water flowing into the mines. In many other cases, where there was no great trouble from water, mines have been abandoned at depths where the vein matter began to be too hard to be worked easily with a pick, for the reason that there were still other and softer deposits which could be worked at or near the surface.

There can be but little doubt that in the case of a considerable number of these mines, by the use of the steam pump, the steam drill, and other modern mining appliances, a number of these old mica mines could be opened up anew and worked at considerable profit. And thus, like the Clarissa, the Sink Hole, the Hawk, and Cloudland, in Mitchell County; the Ray mine, of Yancey County; the Iola, the Ray, and Burningtown mines, of Macon County, which together have yielded considerably more than a million dollars' worth of mica while being worked by crude mining methods, if opened up anew under more favorable conditions would undoubtedly yield a supply of mica for many years to come as great or greater than that which they have yielded in the past.

ASBESTOS.

By Edward W. Parker.

PRODUCTION.

The asbestos product of the United States in 1895 took a decided step forward. This was due to the increased production at the mines of the Sall Mountain Asbestos Company, at Sautee, White County, Ga., mention of the opening of which was made in the report for 1894. During 1894 these mines were developed and produced 250 tons of fiber. In 1895 the product was 700 short tons. In addition to this California contributed 90 tons, and 5 tons were mined in South Dakota. The promises of good supplies of asbestos from Oregon and Washington have not been realized. Owners of the deposits in Loudoun County, Va., expect to begin mining during the present year (1896), and the work on the deposits near Casper, Wyo., has been confined to the assessment work necessary to hold title. In regard to the asbestos deposits of Wyoming, Mr. R. W. Burkhardt, M. E., of Laramie, states that they are on the North Laramie River, and lie entirely in a serpentine formation. The veins run in all directions and sometimes open into quite large pockets from 3 to 5 feet in width. Some of the fibers are very strong but coarse, and many of them are from 18 to 28 inches long. The deepest hole so far made for development work is only 18 feet deep, but the cuts are several hundred feet long. Should the asbestos improve in fineness as greater depth is reached and approach the quality of the Canadian, the deposits will prove of great value.

The Wyoming material is similar to the Canadian in occurrence, the gangue rock being serpentine, and belongs, from a mineralogical standpoint, to the chrysotile family and not to the true asbestos species, which usually occurs in pockets dispersed through masses of soapstone. The occurrence of the Virginia material is similar to that of Canada and Wyoming and belongs also to the chrysotile family. The Georgia, California, and Oregon minerals belong to the asbestos class and occur associated with soapstone. The chrysotile of Canada is of superior quality in strength, elasticity, and fineness of fiber to any other known. The supply is unlimited and mining operations are carried on under modern scientific principles, so that for many reasons this source of supply has almost entirely superseded the Italian in the American markets, where nearly all of the asbestos goods of commerce are manufactured. This Canadian chrysotile is never referred to in trade circles as anything but asbestos, the latter name being applied indiscriminately to all varieties. For the purposes of this report, and by reason of this adopted nomenclature, the two minerals are treated as one.

The production of asbestos in the United States in 1895 approached somewhat the output in 1882, 1883, and 1884, when the product from California was 1,000 short tons or over each year. In 1885 it dropped to 300 tons, and did not reach the latter figure again until 1894, when owing to the development of the Georgia deposit it increased to 325 tons, and in 1895, when it increased 145 per cent over that of 1894.

The following table exhibits the annual production of asbestos in the United States since 1880, with the value:

Annual product of asbestos from 1880 to 1895.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Short tons.			*Short tons.*	
1880	150	$4,312	1888	100	$3,000
1881	200	7,000	1889	30	1,800
1882	1,200	36,000	1890	71	4,560
1883	1,000	30,000	1891	66	3,960
1884	1,000	30,000	1892	104	6,416
1885	300	9,000	1893	50	2,500
1886	200	6,000	1894	325	4,463
1887	150	4,500	1895	795	13,525

Comparing the above table with that of the table of imports, which is given below, it will be seen that there is a profitable market to be supplied with domestic fiber if any be found which is equal in quality to that of the Canadian chrysotile, nearly all of the imports into the United States being from the Canadian mines.

IMPORTS.

The following table shows the value of asbestos imported since 1869:

Value of asbestos imported from 1869 to 1895.

Year ended—	Unmanufactured.	Manufactured.	Total.
June 30, 1869		$310	$310
1870		7	7
1871		12	12
1872			
1873	$18		18
1874	152		152

Value of asbestos imported from 1869 to 1895—Continued.

Year ended—	Unmanufactured.	Manufactured.	Total.
June 30, 1875	$4, 706	$1, 077	$5, 783
1876	5, 485	396	5, 881
1877	1, 671	1, 550	3, 221
1878	3, 536	372	3, 908
1879	3, 204	4, 624	7, 828
1880	9, 736	....	9, 736
1881	27, 717	69	27, 786
1882	15, 235	504	15, 739
1883	24, 369	243	24, 612
1884	48, 755	1, 185	49, 940
Dec. 31, 1885	73, 026	617	73, 643
1886	134, 193	932	135, 125
1887	140, 264	581	140, 845
1888	168, 584	8, 126	176, 710
1889	254, 239	9, 154	263, 393
1890	252, 557	5, 342	257, 879
1891	353, 589	4, 872	358, 461
1892	262, 433	7, 209	269, 642
1893	175, 602	9, 403	185, 005
1894	240, 029	15, 989	256, 018
1895	225, 147	19, 731	244, 878

CANADIAN PRODUCTION.

As the supply of asbestos for the United States is drawn almost entirely from Canada, the following table of production for that country will be found of interest:

Annual product of asbestos in Canada since 1879.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Tons.			*Tons.*	
1879	300	$19, 500	1889	6, 113	$426, 554
1880	380	24, 700	1890	9, 860	1, 260, 240
1881	540	35, 100	1891	9, 000	1, 000, 000
1882	810	52, 650	1892	6, 042	388, 462
1883	955	68, 750	1893	6, 473	313, 806
1884	1, 141	75, 079	1894	7, 630	420, 825
1885	2, 440	142, 441	1895	8, 756	368, 175
1886	3, 458	206, 251	Total	72, 921	5, 284, 516
1887	4, 619	226, 976			
1888	4, 404	255, 007			

GRAPHITE.

PRODUCTION.

Including the output of graphitic coal from Rhode Island under the head of graphite, the product in 1895 amounted to 3,115 short tons. In addition to the Ticonderoga product, which was less in 1895 than for several years past, 20 tons of graphite were mined in Clay County, Ala., and 103 tons in Wake County, N. C. Eighty-five tons mined in Baraga County, Mich., in 1894, and used in the manufacture of pigments in 1895, are added to the output of the latter year, as this product was not included in the product of 1894.

The following table shows the annual production of graphite in the United States since 1880. The product in 1895 has been reduced to short tons, and only the total product given in order to maintain the confidence of individual statistics.

Production of graphite since 1880.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Pounds.			*Pounds.*	
1880	....	$49,800	1888	400,000	$33,000
1881	400,000	30,000	1889	....	72,662
1882	425,000	34,000	1890	....	77,500
1883	575,000	46,000	1891	1,559,674	110,000
1884	....	....	1892	1,398,365	87,902
1885	327,883	26,231	1893	843,103	63,232
1886	415,525	33,242	1894	918,000	64,010
1887	416,000	34,000	1895	a3,115	52,582

a Short tons.

IMPORTS.

Graphite imported into the United States from 1867 to 1895.

Year ended—	Unmanufactured.		Manufactured.	Total.
	Quantity.	Value.		
	Cwt.			
June 30, 1867	27, 113	$54, 131	....	$54, 131
1868	68, 620	149, 083	....	149, 083
1869	74, 846	351, 004	....	351, 004
1870	80, 795	269, 291	$833	270, 124
1871	51, 628	136, 200	3, 754	139, 954
1872	96, 381	329, 030	....	329, 030
1873	157, 539	548, 613	....	548, 613
1874	111, 992	382, 591	....	382, 591
1875	46, 492	122, 050	....	122, 050
1876	50, 589	150, 709	17, 605	168, 314
1877	75, 361	204, 630	18, 091	222, 721
1878	60, 244	154, 757	16, 909	171, 666
1879	65, 662	164, 013	24, 637	188, 650
1880	109, 908	278, 022	22, 941	300, 963
1881	150, 927	381, 966	31, 674	413, 640
1882	150, 421	363, 835	25, 536	389, 371
1883	154, 893	361, 949	21, 721	383, 670
1884	144, 086	286, 393	1, 863	288, 256
1885	110, 462	207, 228	....	207, 228
1886	83, 368	164, 111	....	164, 111
1887	168, 841	331, 621	....	331, 621
Dec. 31, 1888	184, 013	353, 990	....	353, 990
1889	177, 381	378, 057	....	378, 057
1890	255, 955	594, 746	....	594, 746
1891	212, 360	555, 080	....	555, 080
1892	233, 540	667, 775	....	667, 775
1893	288, 740	865, 379	....	865, 379
1894	*a*5, 814	225, 720	....	225, 720
1895	*a*8, 814	260, 090	....	260, 090

a Long tons.

OCCURRENCES OF GRAPHITE IN THE SOUTH.

By WILLIAM M. BREWER.

Previous to 1893 and during a period extending over a few years graphite was mined and prepared for market in one locality situated about 3 miles in a southerly direction from Enitachopco, Clay County, Ala., as well as in Bartow County, Ga.

The occurrence of this mineral in Alabama was discovered about twenty years ago in the area occupied by the fully crystalline schists. There are also occurrences in the area occupied by the semicrystalline slates, and in Georgia the graphite occurs associated only with this last-named formation, so far as is at present known. The demand, though, for the southern graphite has never been sufficiently active to urge prospectors to make any very extensive search for it; consequently but little is known relative to the extent or number of the occurrences in this portion of the South.

Considered from a geological standpoint, the discoveries of graphite have so far been made in four belts in the crystalline area in Alabama and in one belt in Georgia. In both States we find it at irregular intervals along the extreme northwestern border of the semicrystalline slates occurring immediately southeast of the Paleozoic area, the line of demarcation between these formations being known as the "Cartersville fault." In Alabama we also find it associated with that variety of slate locally designated as the "Turkey Heaven," and situated in the Turkey Heaven Mountains in Cleburne County. Another belt of graphite associated with semicrystalline slate occurs several miles to the south and southeast of the first mentioned, and in what is known as the Silver Hill gold belt, the southwestern extremity of which is about 20 miles northeast of the town of Wetumpka, in Elmore County, Ala. This, so far as at present known, does not extend into the State of Georgia, nor does the slate possess its graphitic characteristic to any appreciable extent east of the Tallapoosa River. The belt of fully crystalline schists in which graphite has been discovered in Alabama extends across the counties of Clay and Randolph and into Cleburne County, in a northeasterly direction, crossing Randolph County in the extreme northwestern corner.

No operations have ever been conducted in Alabama in mining graphite in the semicrystalline slates, but in the State of Georgia all the work that has been done in the past has been in formations of that class. In Bartow County the material, consisting mainly of slate and quartz, was quarried out of the hillsides in mass. This was crushed, but the graphite was not separated in any systematic manner. The material thus prepared was, it is said, shipped from two plants to the fertilizer companies for use as a filler or for coloring material for chemical fertilizers. The writer examined all of the known occurrences of graphite in Georgia and Alabama, and it is very much to be doubted whether that found associated with the semicrystalline slates is of such a grade as is necessary to render it desirable for use for lubricating purposes or for the manufacture of crucibles. Besides the slate and quartz there is a very large percentage of iron pyrites closely associated with the graphite; so great, indeed, is the proportion of this mineral at one location in Cleburne County, Ala., that the question was considered whether it would not be profitable to carry on mining operations for the purpose of winning the pyrites only, for shipment to the acid plants in Atlanta.

The only attempt that has been made in either of these States to mine graphite for use as a lubricator or for facings in foundries has been in Clay County, Ala. There the occurrence already mentioned has been mined by two or three different concerns, and the graphite separated from the gangue, sacked, and shipped. The grade of this has, it is learned, been pronounced by experts as satisfactory, while the owner of the property states that the amount of graphite contained in the rock averages 3 per cent.

In 1893 the operations on this property were carried on by Mr. Paul Gilardoni, of Birmingham, Ala. The suspension of work was caused by the lack of demand, but the excessive freight rates were to a great extent responsible. The mine being located nearly 20 miles from the nearest railroad point, with the Blue Ridge Mountains to cross, causes the wagon haul to be very expensive.

MINERAL PAINTS.

By Edward W. Parker.

MINERALS USED AS PIGMENTS.

The number of mineral substances which are used in the manufacture of mineral paints is quite large. They include peculiar qualities of iron ore used in making red and brown pigments, and classed as metallic paints; clay and other earthy substances containing iron, and known as ochers, umbers, and siennas, producing yellow and brown colors; barytes or barium sulphate, producing a white pigment, used as a substitute for or adulterant in white lead; graphite and slate, used for making black paints; terra alba, as its name implies, a white paint made from gypsum of pure quality; asbestos, used in making fireproof paints; soapstone, etc. The foregoing are all made into paints direct from the crude mineral, and may be considered natural pigments. Zinc white is also made directly from the ores. To the pigments mentioned should be added the preparations made from lead, white lead, red lead, litharge, and orange mineral; venetian reds, made from iron sulphate by roasting; vermilion or artificial cinnabar, blanc fixe or artificial barytes, and chrome yellow, made from potassium bichromate, etc.

The amount of lead used in the manufacture of white lead, etc., is included in the production of pig lead. The amount of quicksilver used in the manufacture of vermilion is included in the production of quicksilver, and that of chrome yellow in that of chromium.

PRODUCTION.

The pigments usually classed as mineral paints, whose production is not included elsewhere, are ocher, umber, sienna, iron ore ground for paint, slate, soapstone, and zinc white. Venetian reds made by roasting copperas (sulphate of iron) is also included, as the amount of iron so used is comparatively insignificant when compared with the total product of iron or iron ore, while the value is considerably greater in proportion. Zinc white, like barytes, is treated separately. As will be seen in the following table, there was a general increase in the production of pigments. The aggregate production of ocher, umber, and sienna had shown a steady decline since 1891, until in 1894 the output was less than 60 per cent of that three years before; so that notwithstanding the general depression it is not surprising that there should have been an increase in 1895. There was also an advance in price. The combined product in 1894 brought an average price a little more than $10. In 1895 the average price received was about $11.90. The average price of ocher advanced from about $10 to $11.50; that of umber decreased from $14.52 to $13.60, and sienna advanced from $20 to $25.

In the production of metallic paint there was an increase of 3,484 short tons, but the declining tendency in prices noted in the report for 1894 continued through 1895. The average price per ton received by producers in 1893 was $14.89; in 1894 it had declined to $11.23, while in 1895 it fell to $11.06, a drop in two years of $3.83, or nearly 26 per cent.

The average price for venetian reds declined from $24.57 per ton in 1894 to $22.40 in 1895, while the output increased from 2,983 to 4,595 short tons. Soapstone used for paint increased in both the amount of the product and the price received for it, and the same is true of slate ground for pigment.

The production of mineral paints for the past three years has been as follows:

Production of mineral paints in 1893, 1894, and 1895.

Kind.	1893.		1894.		1895.	
	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.
Ocher	10,517	$129,393	9,768	$96,935	12,045	$139,328
Umber	480	7,560	265	3,830	320	4,350
Sienna	150	4,875	160	3,250	275	6,950
Metallic paint	19,960	297,289	25,375	284,883	28,859	319,142
Venetian reds	3,214	64,400	2,983	73,300	4,595	102,900
Mineral black	70	840	650	14,000	(a)	(a)
Soapstone	100	700	75	525	270	3,200
Slate	3,183	24,727	2,650	21,370	4,331	45,682
Other colors	50	600				
Total	37,724	530,384	41,926	498,093	50,695	621,552

a Included in slate.

OCHER, UMBER, AND SIENNA.

PRODUCTION.

Eleven States contributed to the production of ocher in 1895. They were Alabama, California, Georgia, Iowa, Maryland, Missouri, New York, Pennsylvania, Vermont, Virginia, and Wisconsin. Kentucky and Massachusetts, which reported a production in 1894, had no output in 1895, while California, Iowa, and New York appear as producers in 1895, the two former for the first time, while New York had not reported any product since 1891. Umber was produced in three States—Missouri, New York, and Pennsylvania. The entire product of sienna was from New York and Pennsylvania, principally the latter. The production by States in 1895 is shown in the following table:

Production of ocher, umber, and sienna in 1895, by States.

State.	Ocher.		Umber.		Sienna.	
	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.
California	375	$2,800				
Georgia	2,105	31,080				
Missouri	1,065	9,468	(a)	(a)		
Pennsylvania	6,800	74,300	b 320	b $4,350	c 275	c $6,950
Other States (d)	1,700	21,680				
Total	12,045	139,328	320	4,350	275	6,950

a Included in Pennsylvania.
b Includes Missouri and New York.
c Includes New York.
d Alabama, Iowa, Maryland, New York, Vermont, Virginia, and Wisconsin having each but one establishment.

For the purposes of comparison the production in the preceding six years is shown in the following table. Prior to 1889, when the statistics were compiled for the Eleventh Census, the production for each State was not published.

Production of ocher, umber, and sienna from 1889 to 1894, by States.

State.	1889.		1890.		1891.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Short tons.		*Short tons.*		*Short tons.*	
Alabama	336	$3,500	350	$4,100	524	$5,840
Colorado	50	150	1,000	15,000		
Georgia	2,512	29,720	800	12,800	600	9,000
Maryland	616	12,000				
Massachusetts	80	750	300	2,700	300	2,700
Missouri			2,200	30,000	1,850	27,500
New Jersey					600	7,200
New York			365	4,493		
Pennsylvania	7,922	103,797	4,173	61,458	4,535	56,588
Vermont	1,884	7,800			935	11,095
Virginia	1,658	18,755	1,367	22,972	1,950	29,900
Wisconsin	100	1,000				
Other States			a 7,000	84,000	a 7,000	84,000
Total	15,158	177,472	17,555	237,523	18,294	233,823

a Includes all of Maryland and estimated products of some firms in other States not reporting.

Production of ocher, umber, and sienna from 1889 to 1894, by States—Continued.

State.	1892.		1893.		1894.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Short tons.		*Short tons.*		*Short tons.*	
Alabama	375	$4, 050	350	$3, 000		
Colorado						
Georgia	1, 748	26, 800	2, 600	39, 000	1, 690	$17, 840
Maryland	1, 000	10, 000				
Massachusetts	46	418				
Missouri	1, 922	28, 220	555	5, 413	1, 800	23, 160
New Jersey	175	3, 600				
New York						
Pennsylvania	7, 055	90, 755	5, 375	71, 575	4, 975	47, 830
Vermont	544	5, 731	523	5, 280	336	3, 384
Virginia	1, 500	23, 500				
Wisconsin						
Other States			*a* 1, 744	17, 560	*b* 1, 392	11, 801
Total	14, 365	193, 074	11, 147	141, 828	10, 193	104, 015

a Includes Kentucky, Maryland, Massachusetts, and Virginia.
b Includes Alabama, Kentucky, Maryland, Massachusetts, Virginia, and Wisconsin.

Annual production of ocher, etc., since 1884.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Short tons.			*Short tons.*	
1884	7, 000	$84, 000	1890	17, 555	$237, 523
1885	3, 950	43, 575	1891	18, 294	233, 823
1886	6, 300	91, 850	1892	14, 365	193, 074
1887	8, 000	75, 000	1893	11, 147	141, 828
1888	10, 000	120, 000	1894	10, 193	104, 015
1889	15, 158	177, 472	1895	12, 640	150, 628

IMPORTS.

The following tables show the amount and value of ochers, etc., from 1867 to 1895:

Ocher, etc., imported from 1867 to 1883.

Fiscal year ended June 30—	All ground in oil.		Indian red and Spanish brown.		Mineral, French, and Paris green.		Other, dry, not otherwise specified.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*		*Pounds.*		*Pounds.*	
1867...	11,373	$385	....	$35,374	....	$2,083	1,430,118	$9,923
1868...	6,949	333	....	11,165	....	500	3,670,093	32,102
1869...	65,344	2,496	2,582,335	31,624	8,369	2,495	5,379,478	39,546
1870...	149,240	6,042	3,377,944	41,607	9,618	3,444	3,935,978	32,593
1871...	121,080	4,465	2,286,930	40,663	33,488	11,038	2,800,148	24,767
1872...	277,617	9,225	2,810,282	38,763	41,422	10,341	5,645,343	56,680
1873...	94,245	3,850	135,360	2,506	34,382	8,078	3,940,785	51,318
1874...	98,176	4,623	263,389	3,772	102,876	18,153	3,212,988	35,365
1875...	280,517	12,352	646,009	9,714	64,910	13,506	3,282,415	37,929
1876...	63,916	3,365	2,524,989	19,555	21,222	5,385	3,962,646	47,405
1877...	41,718	2,269	2,179,631	24,218	27,687	6,724	3,427,208	32,924
1878...	25,674	1,591	2,314,028	23,677	67,655	14,376	3,910,947	33,260
1879...	17,649	1,141	2,873,550	26,929	17,598	3,114	3,792,850	42,563
1880...	91,293	4,233	3,655,920	32,726	16,154	3,269	4,602,546	52,120
1881...	99,431	4,676	3,201,880	30,195	75,465	14,648	3,414,704	46,069
1882...	159,281	7,915	3,789,586	34,136	18,293	2,821	5,530,204	68,106
1883 *a* .	137,978	6,143	1,549,968	13,788	6,972	885	7,022,615	90,593

a Since 1883 classified as "dry" and "ground in oil."

Imports of ocher of all kinds from 1884 to 1895.

Year ended—	Dry.		Ground in oil.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*		*Pounds.*	
June 30, 1884..	6,164,359	$63,973	108,966	$4,717	6,273,325	$68,690
1885..	4,983,701	51,499	79,666	3,616	5,063,363	55,115
Dec. 31, 1886..	4,939,183	53,593	112,784	6,574	5,051,967	60,167
1887..	5,957,200	58,162	54,104	7,337	6,011,304	65,499
1888..	6,574,608	64,123	43,142	9,690	6,617,750	73,813
1889..	5,540,267	52,502	51,063	9,072	5,591,330	61,574
1890..	....	....	....	....	6,471,863	71,953
1891..	6,246,890	63,040	52,206	5,272	6,299,096	68,312
1892..	8,044,836	97,946	49,714	5,120	8,094,550	103,066
1893..	6,225,789	55,074	52,468	3,354	6,278,257	58,428
1894..	4,937,738	45,276	22,387	2,100	4,960,125	47,376
1895..	7,107,987	56,020	41,153	2,239	7,149,140	58,259

Imports of umber from 1867 to 1895.

Year ended—	Quantity.	Value.	Year ended—	Quantity.	Value.
	Pounds.			*Pounds.*	
June 30, 1867..	2, 147, 342	$15, 946	June 30, 1882..	1, 923, 648	$20, 494
1868..	345, 173	2, 750	1883..	785, 794	8, 419
1869..	570, 771	6, 159	1884..	2, 946, 675	20, 654
1870..	708, 825	6, 313	1885..	1, 198, 060	8, 504
1871..	470, 392	7, 064	Dec. 31, 1886..	1, 262, 930	9, 187
1872..	1, 409, 822	18, 203	1887..	2, 385, 281	16, 536
1873..	845, 601	8, 414	1888..	1, 423, 800	14, 684
1874..	729, 864	6, 200	1889..	1, 555, 070	20, 887
1875..	513, 811	5, 596	1890..	1, 556, 823	19, 329
1876..	681, 199	7, 527	1891..	633, 291	6, 498
1877..	1, 101, 422	10, 213	1892..	1, 028, 038	6, 256
1878..	1, 038, 880	8, 302	1893..	1, 488, 849	16, 636
1879..	986, 105	6, 959	1894..	632, 995	6, 275
1880..	1, 877, 645	17, 271	1895..	a1, 560, 786	13, 075
1881..	1, 475, 835	11, 126			

a Includes 6,137 pounds "ground in oil" and 1,554,649 pounds "dry."

METALLIC PAINT.

Manufacturers of metallic paint, as a usual thing, reported trade conditions in 1895 as more unsatisfactory than in 1894, and this is borne out in the continued decline in price, which in 1893 averaged $14.89 per ton, declining to $11.23 in 1894 and again to $11.04 in 1895. In spite of this, however, an increased production is reported for the latter year. Returns were received from 29 out of 31 producers, and the product of the two not reporting was estimated at a less figure than in 1894. Had these been considered as nonproductive, the total would not have been affected as much as 5 per cent. The total product, as shown in the following table, indicates an increase in tonnage of 3,544 short tons, and an increase in the aggregate value of $34,259. The annual product of metallic paint for the past seven years has been as follows:

Production of metallic paint since 1889, by States.

State.	1889.		1890.		1891.	
	Product.	Value.	Product.	Value.	Product.	Value.
	Short tons.		*Short tons.*		*Short tons.*	
Colorado	90	$2, 500	1, 300	$22, 100	....	....
New York	3, 658	63, 698	5, 224	72, 952	7, 352	$99, 487
Ohio	540	11, 123	637	16, 341	800	14, 500
Pennsylvania	8, 849	128, 036	8, 955	145, 243	9, 175	134, 138
Tennessee	3, 057	24, 237	5, 386	46, 088	4, 000	30, 000
Vermont	....	....	500	6, 000	400	5, 000
Wisconsin	1, 832	26, 700	2, 125	31, 035	2, 343	34, 375
Other States (a)	3, 000	30, 000	50	610	1, 072	16, 955
Total	21, 026	286, 294	24, 177	340, 369	25, 142	334, 455

a Includes Alabama, California, Delaware, Kentucky, Maryland, Missouri, New Jersey, and Virginia; also Ohio and Vermont in 1895.

Production of metallic paint since 1889, by States—Continued.

State.	1892.		1893.	
	Product.	Value.	Product.	Value.
	Short tons.		*Short tons.*	
Colorado	....	....	....	....
Missouri	....	....	....	....
New York	5, 200	$76, 500	3, 885	$57, 500
Ohio	879	17, 090	710	5, 750
Pennsylvania	10, 289	176, 785	8, 300	143, 875
Tennessee	5, 000	32, 000	3, 000	27, 500
Vermont	400	5, 000	338	4, 600
Wisconsin	2, 448	33, 826	2, 246	29, 500
Other States (*a*)	1, 495	20, 765	1, 481	28, 564
Total	25, 711	362, 966	19, 960	297, 289

State.	1894.		1895.	
	Product.	Value.	Product.	Value.
	Short tons.		*Short tons.*	
Colorado	....	....	....	....
Missouri	....	....	860	$11, 565
New York	4, 787	$48, 899	6, 083	67, 161
Ohio	1, 006	13, 516	(*b*)	(*b*)
Pennsylvania	8, 683	119, 674	9, 098	126, 400
Tennessee	5, 510	37, 870	5, 936	38, 602
Vermont	280	3, 500	(*b*)	(*b*)
Wisconsin	3, 057	41, 889	3, 486	44, 476
Other States (*a*)	2, 052	19, 535	3, 456	30, 938
Total	25, 375	284, 883	28, 919	319, 142

a Includes Alabama, California, Delaware, Kentucky, Maryland, Missouri, New Jersey, and Virginia; also Ohio and Vermont in 1895.
b Included in other States.

VENETIAN REDS.

The production of venetian reds in 1895 increased from 2,983 short tons, valued at $73,300, in 1894, to 4,595 short tons, valued at $102,900, in 1895. This was the largest production obtained since 1890, with the exception of 1892, when the output attained a total of 4,900 tons. The annual production since 1890 has been as follows:

Production of venetian red since 1890.

Year.	Short tons.	Value.	Year.	Short tons.	Value.
1890..........	4, 000	$84, 100	1893..........	3, 214	$64, 400
1891..........	4, 191	90, 000	1894..........	2, 983	73, 300
1892..........	4, 900	106, 800	1895..........	4, 595	102, 900

SLATE AS A PIGMENT.

Including the amount of black shale ground for paint, the output of slate pigments in 1895 was 4,331 short tons, valued at $45,682. In 1894 the product was 3,300 tons, valued at $35,370, of which 650 tons were from black shale and 2,650 tons from slate. The annual product of these pigments since 1880 has been as follows:

Amount and value of slate and shale ground for pigment since 1880.

Year.	Short tons.	Value.	Year.	Short tons.	Value.
1880..........	1, 120	$10, 000	1888..........	2, 800	$25, 100
1881..........	1, 120	10, 000	1889..........	2, 240	20, 000
1882..........	2, 240	24, 000	1890..........	2, 240	20, 000
1883..........	2, 240	24, 000	1891..........	2, 240	20, 000
1884..........	2, 240	20, 000	1892..........	3, 787	23, 523
1885..........	2, 212	24, 687	1893..........	3, 253	25, 567
1886..........	3, 360	30, 000	1894..........	3, 300	35, 370
1887..........	2, 240	20, 000	1895..........	4, 331	45, 682

WHITE LEAD, ETC.

PRODUCTION.

The production of white lead, red lead, litharge and orange mineral, dry and in oil, with the value of each, in 1895, was as follows:

Production of white lead, etc., dry and in oil, in 1895.

	White lead.		Red lead.	
	Pounds.	Value.	Pounds.	Value.
Dry	29,113,819	$1,198,710	13,272,191	$616,093
In oil	151,912,669	7,524,922	240,794	12,040
Total	181,026,488	8,723,632	13,512,985	628,133
	Litharge.		**Orange mineral.**	
	Pounds.	Value.	Pounds.	Value.
Dry	12,212,018	$519,524	731,305	$44,749
In oil	1,761,805	81,743	....	....
Total	13,973,823	601,267	731,305	44,749

Reducing these totals to short tons for the purpose of comparison with the product of previous years, it is seen that the product of white lead in 1895 was 90,513 short tons, against 76,343 short tons in 1894, an increase of 14,170 short tons, and an increase in value of over $2,000,000. Red lead increased from 6,465 tons to 6,756 tons, and in value from $623,021 to $628,133. The amount of litharge produced increased from 5,652 short tons, valued at $495,406, to 6,987 short tons, valued at $601,267, and orange mineral from 319 short tons to 366 short tons, with an increase in value from $43,517 to $44,749. The imports of all four pigments increased largely. Of white lead the imports in 1895 were two and one-half times those of 1894, but the value was a little less than double. The imports of red lead increased not quite 100 per cent both in amount and value, and litharge a little more than 150 per cent. Orange mineral imports increased about 18 per cent in amount and about 12 per cent in value. With the exception of the last, however, the amount of the imports is insignificant when compared with the home product. In white lead the imports in 1895 were a little more than 1 per cent of the domestic output; the percentage of the imports of red lead to the domestic product was about 14, and litharge about 7 per cent. The imports of orange mineral were more than double the amount made in the United States.

The following table exhibits the annual production of white lead, red lead, etc., for a series of five years. Previous to 1894 the values were based on white lead in oil. The statistics for 1894 and 1895 include the amount of lead sold "dry" and "in oil," with the value in the condition in which it was sold.

Production of white lead, etc., for five years.

	1891.		1892.		1893.	
	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.
White lead	78,018	$10,454,029	74,485	$8,733,620	72,172	$7,695,130
Red lead	4,607	591,730	6,122	757,787	6,377	732,968
Litharge	5,759	720,925	5,764	611,726	11,757	1,154,819
Orange mineral	330	43,300	395	60,170	217	32,893
Zinc white	23,700	1,600,000	27,500	2,200,000	24,059	1,804,420
Total	112,414	13,409,984	114,266	12,363,303	114,582	11,420,230

	1894.		1895.	
	Short tons.	Value.	Short tons.	Value.
White lead	76,343	$6,623,071	90,513	$8,723,632
Red lead	6,465	623,021	6,756	628,133
Litharge	5,652	495,406	6,987	601,267
Orange mineral	319	43,517	366	44,749
Zinc white	21,443	1,500,975	25,000	2,000,000
Total	110,222	9,285,990	129,622	11,997,781

The annual production of white lead since 1884 has been as follows:

Production of white lead in the United States since 1884.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Short tons.			*Short tons.*	
1884	65,000	$6,500,000	1890	77,636	$9,382,967
1885	60,000	6,300,000	1891	78,018	10,454,029
1886	60,000	7,200,000	1892	74,485	8,733,620
1887	70,000	7,560,000	1893	72,172	7,695,130
1888	84,000	10,080,000	1894	76,343	6,623,071
1889	80,000	9,600,000	1895	90,513	8,723,632

IMPORTS.

The following table shows the imports of white lead, red lead, litharge, and orange mineral since 1867:

Red lead, white lead, litharge, and orange mineral imported from 1867 to 1895.

Year ended—	Red lead.		White lead.		Litharge.		Orange mineral.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*		*Pounds.*		*Pounds.*	
June 30, 1867	926, 843	$53, 087	6, 636, 508	$430, 865	230, 382	$8, 941		
1868	1, 201, 144	76, 773	7, 533, 225	455, 698	250, 615	12, 225		
1869	808, 686	46, 481	8, 948, 642	515, 783	187, 333	7, 767		
1870	1, 042, 813	54, 626	6, 228, 285	365, 706	97, 398	4, 442		
1871	1, 295, 616	78, 410	8, 337, 842	483, 392	70, 889	3, 870		
1872	1, 513, 794	85, 644	7, 153, 978	431, 477	66, 544	3, 396		
1873	1, 583, 039	99, 891	6, 331, 373	408, 986	40, 799	2, 379		
1874	756, 644	56, 305	4, 771, 509	323, 926	25, 687	1, 450		
1875	1, 048, 713	73, 131	4, 354, 131	295, 642	15, 767	950		
1876	749, 918	54, 884	2, 546, 776	175, 776	47, 054	2, 562		
1877	387, 260	28, 747	2, 644, 184	174, 844	40, 331	2, 347		
1878	170, 608	9, 364	1, 759, 608	113, 638	28, 190	1, 499		
1879	143, 237	7, 237	1, 274, 196	76, 061	38, 495	1, 667		
1880	217, 033	10, 397	1, 906, 931	107, 104	27, 389	1, 222		
1881	212, 423	10, 009	1, 068, 030	60, 132	63, 058	2, 568		
1882	288, 946	12, 207	1, 161, 889	64, 493	54, 592	2, 191		
1883	249, 145	10, 503	1, 044, 478	58, 588	34, 850	1, 312		
1884	265, 693	10, 589	902, 281	67, 918	54, 183	1, 797		
1885	216, 449	7, 641	705, 535	40, 437	35, 283	1, 091		
Dec. 31, 1886	597, 247	23, 038	785, 554	57, 340	51, 409	1, 831		
1887	371, 299	16, 056	804, 320	58, 602	35, 908	1, 302		
1888	529, 665	23, 684	627, 900	49, 903	62, 211	2, 248		
1889	522, 026	24, 400	661, 694	56, 875	41, 230	1, 412		
1890	450, 402	20, 718	742, 196	57, 659	48, 283	2, 146		
1891	651, 577	23, 807	718, 228	40, 773	94, 586	3, 108		
1892	812, 703	28, 443	744, 838	40, 032	56, 737	1, 811	1, 409, 601	$64, 133
1893	854, 982	27, 349	686, 490	34, 145	42, 582	1, 310	1, 385, 828	61, 360
1894	947, 873	29, 064	796, 480	40, 939	38, 595	1, 064	1, 386, 464	58, 614
1895	1, 764, 274	53, 139	1, 897, 892	79, 887	97, 667	2, 812	1, 689, 367	66, 492

PRICES.

The following table is of interest, as it shows the average yearly prices of pig lead and white lead in oil (both at New York) and the difference between the two since 1874:

Average yearly net prices, at New York, of pig lead and white lead in oil since 1874.

[Per 100 pounds.]

Year.	Pig lead in New York.	White lead in oil in New York.	Difference.	Year.	Pig lead in New York.	White lead in oil in New York.	Difference.
1874.....	$6.00	$11.25	$5.25	1885.....	$3.95	$6.00	$2.05
1875.....	5.95	10.50	4.55	1886.....	4.63	6.25	1.62
1876.....	6.05	10.00	3.95	1887.....	4.47	5.75	1.28
1877.....	5.43	9.00	3.57	1888.....	4.41	5.75	1.34
1878.....	3.58	7.25	3.67	1889.....	3.80	6.00	2.20
1879.....	4.18	7.00	2.82	1890.....	4.33	6.25	1.92
1880.....	5.05	7.60	2.55	1891.....	4.33	6.37	2.05
1881.....	4.80	7.25	2.45	1892.....	4.05	6.39	2.34
1882.....	4.90	7.00	2.10	1893.....	3.73	6.03	2.30
1883.....	4.32	6.88	2.56	1894.....	3.28	5.26	1.98
1884.....	3.73	5.90	2.17	1895.....	3.12	5.05	1.93

In considering the variations between the value of pig lead and white lead in oil allowance should be made for the fluctuations in the value of linseed oil, which enters largely into the manufacture of lead in oil. The fluctuations in the price of linseed oil in two years have ranged from 30 cents to 58 cents a gallon.

BARYTES.

By EDWARD W. PARKER.

PRODUCTION.

The only significant feature of the barytes mining industry in 1895 was of a negative character. The production continued on the decline, the total amount of crude barytes reported being less than in any year since 1889. There has been a steady decrease in the annual product since 1892, and what makes the decreased output in 1895 more marked is the sharp decline in value. The amount of the product decreased from 23,335 short tons in 1894 to 21,529 short tons in 1895, a loss of 1,806, or a little less than 8 per cent. The value declined from $86,983 to $68,321, a loss of over $18,500, or considerably more than 20 per cent. The depression in prices was severely felt in the barytes mining regions of Missouri, and nearly all of the small contributors ceased operations. The product from Missouri in 1895 was almost entirely obtained as a by-product of the lead mines around Cadet, Old Mines, and Potosi. Formerly it was a custom among the farmers in the vicinity to work barytes or "tiff" mines at seasons when they were not otherwise engaged, but the low prices of the past two years have cut off this source of supply. The peculiar association of barytes with the lead deposits of Missouri has given it the local name of "lead blossom," and one of the largest manufacturers in St. Louis has, from this, adopted the name of "lead bloom" as a trade name for his product.

The product in 1895 was from three States, Missouri, North Carolina, and Virginia. Missouri produced about one-third of the total, Virginia about 2,000 tons more than one-third, and North Carolina about 2,000 tons less than one-third. Georgia and New Jersey were nonproducers. The production of crude barytes in the United States since 1882 has been as follows:

Production of crude barytes from 1882 to 1895.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Short tons.			*Short tons.*	
1882	22,400	$80,000	1889	21,460	$106,313
1883	30,240	108,000	1890	21,911	86,505
1884	28,000	100,000	1891	31,069	118,363
1885	16,800	75,000	1892	32,108	130,025
1886	11,200	50,000	1893	28,970	88,506
1887	16,800	110,000	1894	23,335	86,983
1888	22,400	75,000	1895	21,529	68,321

IMPORTS.

The following table shows the imports of barytes into the United States from 1867 to 1895:

Imports of barium sulphate from 1867 to 1895.

Year ended—	Manufactured.		Unmanufactured.	
	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*	
June 30, 1867	14, 968, 181	$141, 273	....	....
1868	2, 755, 547	26, 739	....	....
1869	1, 117, 335	8, 565	....	....
1870	1, 684, 916	12, 917	....	....
1871	1, 385, 004	9, 769	....	....
1872	5, 804, 098	43, 521	....	....
1873	6, 939, 425	53, 759	....	....
1874	4, 788, 966	42, 235	....	....
1875	2, 117, 854	17, 995	....	....
1876	2, 655, 349	25, 325	....	....
1877	2, 388, 373	19, 273	....	....
1878	1, 366, 857	10, 340	....	....
1879	453, 333	3, 496	....	....
1880	4, 924, 423	37, 374	....	....
1881	1, 518, 322	11, 471	....	....
1882	562, 300	3, 856	....	....
1883	411, 666	2, 489	....	....
Dec. 31, 1884	3, 884, 516	24, 671	5, 800, 816	$8, 044
1885	4, 095, 287	20, 606	7, 841, 715	13, 567
1886	3, 476, 691	18, 338	6, 588, 872	8, 862
1887	4, 057, 831	19, 769	10, 190, 848	13, 290
1888	3, 821, 842	17, 135	6, 504, 975	9, 037
1889	3, 601, 506	22, 458	13, 571, 206	7, 660
1890	*a* 1, 563	16, 453	*a* 4, 815	13, 133
1891	2, 149	22, 041	2, 900	8, 816
1892	1, 389	15, 419	2, 789	7, 418
1893	1, 032	11, 457	2, 983	7, 612
1894	836	10, 556	1, 884	5, 270
1895	1, 629	17, 112	2, 551	7, 561

a Tons since 1890.

MINERAL WATERS.

By A. C. PEALE.

PRODUCTION.

For the year 1895 the total number of springs on the list is 370, which is a gain of 13 over 1894. The new springs added to the list number 29, and 16 have been dropped because no reports have been received from them for several years. The number of springs actually reporting sales in 1895 is 297, as compared with 286 in 1894. The list of springs not included in the returns numbers 73. Many of these report that no sales were made in 1895. Among the springs included in this delinquent list are many that in previous years have been among the largest producers and have long been well known in the market.

In 1895 the total production (including an estimate for the delinquent springs of one-half their last reported production) is 21,463,543 gallons, an apparent loss of 106,665 gallons over the figures of 1894. The valuation of the product is $4,254,237, as compared with $3,741,846 in 1894, a gain of $512,391. When the figures given by the 297 springs actually reporting are compared with the 286 springs reporting in 1894, there is shown a gain of 311,927 gallons and an increase in valuation of $610,630. The average price per gallon in 1895 was 19 cents.

The North Atlantic States are credited with 115 springs, a net gain of 10 over 1894. Four springs, the water from which is no longer sold, have been dropped, and 14 springs new to the list have been added. The springs reporting sales in 1895 number 88, and their figures show a gain of 451,379 gallons and an increase of $84,520 in the value of the product. The new springs added to the list are as follows:

Maine: Blue Hill Mineral Spring, Pine Spring.
New Hampshire: Amherst Mineral Spring.
Vermont: Vermont Mineral Spring.
Massachusetts: Abajone Spring, Cohanet Spring.
Connecticut: Arethusa Springs.
New York: Salubria Springs, Great Bear Spring.
New Jersey: Pine Grove Mineral Spring.
Pennsylvania: Aquatone Spring, Great Indian Spring, Ponce de Leon Spring, Tuscarora Lithia Spring.

In the South Atlantic States the list of 1894 is reduced by 4 springs, leaving the total number for the section at 71 for 1895. Of these, 51 report sales, showing an increase of 287,623 gallons and an increase in valuation of $158,480.

The South Central States show little change from 1894. Two new springs have been added to the list and 1 has been dropped. The total number credited to the section is 43. The springs reporting sales in 1895 number 35. The figures show an increase in production of 26,993 gallons, but there is a decrease in valuation of $112,764. The springs not on the list of 1894, and which appear for the first time on the list of 1895, are the following:

Tennessee: Dixie Mineral Spring.
Mississippi: Mount Pleasant Mineral Spring.

The North Central States show a net gain of 6 springs, 10 springs having been added to the list of 103 of 1894 and 4 being dropped. Sales are reported from 92. Although there is a decrease of 486,318 gallons in the production, there is an increase in valuation of $461,796. The 10 springs new to the list are the following:

Ohio: Midland Mineral Springs, Wewoka Spring.
Indiana: Greenwood Sanitarium Well.
Illinois: Apollo Springs, Magnesia Spring, Min-ni-Ni-yan Spring, Aurora Lithia Spring.
Michigan: No-chee-mo Mineral Spring.
Wisconsin: Castalia Spring, Elein Spring.

The Western States and Territories show little change, the last remaining at 42, as in 1894. Three new springs have been added to the list and 3 have been taken away from it. Reports of sales have been received from 31 springs, showing a gain of 26,280 gallons, with an increased valuation of $18,597. The springs new to the list are as follows:

Oregon: Lehman Springs.
California: California Elixir Mineral Spring, Mount Lowe Springs.

Production of mineral waters for 1895, by States and Territories.

State or Territory.	Springs reporting.	Product.	Value.
		Gallons.	
Alabama	3	16,300	$14,921
Arkansas	6	532,110	10,011
California	16	653,935	229,907
Colorado	4	60,900	19,450
Connecticut	3	36,520	1,904
Georgia	2	54,000	10,400
Illinois	12	164,550	29,375
Indiana	10	136,560	17,531
Iowa	4	50,900	6,290
Kansas	5	19,300	8,375

Production of mineral waters for 1895, by States and Territories—Continued.

State or Territory.	Springs reporting.	Product.	Value.
		Gallons.	
Kentucky	6	88,650	$12,300
Maine	9	362,580	35,359
Maryland	4	116,000	14,860
Massachusetts	25	2,583,285	139,148
Michigan	13	525,100	178,320
Minnesota	2	214,000	18,800
Mississippi	6	179,531	42,137
Missouri	8	413,044	127,670
New Jersey	2	66,000	7,750
New Hampshire	3	1,613,200	642,540
New Mexico	3	22,500	3,025
New York	24	2,232,097	550,421
North Carolina	8	121,017	31,300
Ohio	12	246,968	43,439
Oregon	3	22,850	4,830
Pennsylvania	15	1,594,875	173,884
Rhode Island	3	121,000	6,650
South Carolina	2	55,500	11,050
Tennessee	4	50,645	9,604
Texas	10	1,479,570	72,100
Vermont	4	59,350	15,225
Virginia	29	579,187	214,209
Washington	2	39,000	4,020
West Virginia	5	23,009	4,554
Wisconsin	24	3,150,960	395,018
Other States (*a*)	6	1,599,200	785,150
Total	297	19,284,193	3,891,527
Estimated production of springs not reporting sales	73	2,179,350	362,710
Grand total	370	21,463,543	4,254,237

a These include the States in which only 1 spring each has reported. They are Florida, Idaho, Montana, Nebraska, South Dakota, and Utah.

Production of natural mineral waters from 1883 to 1895.

Geographic division.	Springs reporting.	Gallons sold.	Value.
1883.			
North Atlantic	38	2, 470, 670	$282, 270
South Atlantic	27	312, 090	64, 973
North Central	37	1, 435, 809	323, 600
South Central	21	1, 441, 042	139, 973
Western	6	169, 812	52, 787
	129	5, 829, 423	863, 603
Estimated	60	1, 700, 000	256, 000
Total	189	7, 529, 423	1, 119, 603
1884.			
North Atlantic	38	3, 345, 760	328, 125
South Atlantic	27	464, 718	103, 191
North Central	37	2, 070, 533	420, 515
South Central	21	1, 526, 817	147, 112
Western	6	307, 500	85, 200
	129	7, 715, 328	1, 084, 143
Estimated	60	2, 500, 000	375, 000
Total	189	10, 215, 328	1, 459, 143
1885.			
North Atlantic	51	2, 527, 310	192, 605
South Atlantic	32	908, 692	237, 153
North Central	45	2, 925, 288	446, 211
South Central	31	540, 436	74, 100
Western	10	509, 675	86, 776
	169	7, 411, 401	1, 036, 845
Estimated	55	1, 737, 000	276, 000
Total	224	9, 148, 401	1, 312, 845
1886.			
North Atlantic	49	2, 715, 050	177, 969
South Atlantic	38	720, 397	123, 517
North Central	40	2, 048, 914	401, 861
South Central	31	822, 016	58, 222
Western	14	781, 540	137, 796
	172	7, 087, 917	899, 365
Estimated	53	1, 862, 400	384, 705
Total	225	8, 950, 317	1, 284, 070

Production of natural mineral waters from 1883 to 1895—Continued.

Geographic division.	Springs reporting.	Gallons sold.	Value.
1887.			
North Atlantic	40	2,571,004	$213,210
South Atlantic	34	614,041	147,149
North Central	38	1,480,820	208,217
South Central	29	741,080	87,946
Western	12	1,236,324	288,737
	153	6,643,269	945,259
Estimated	62	1,616,340	316,204
Total	215	8,259,609	1,261,463
1888.			
North Atlantic	42	2,856,799	247,108
South Atlantic	32	1,689,387	493,489
North Central	38	2,002,373	325,839
South Central	19	426,410	71,215
Western	15	1,853,679	421,651
	146	8,828,648	1,559,302
Estimated	52	750,000	120,000
Total	198	9,578,648	1,679,302
1889.			
North Atlantic	60	4,106,464	471,575
South Atlantic	47	646,239	198,032
North Central	86	6,137,776	604,238
South Central	33	500,000	43,356
Western	32	1,389,992	431,257
Total	258	12,780,471	1,748,458
1890.			
North Atlantic	55	5,043,074	1,175,512
South Atlantic	39	647,625	245,760
North Central	71	5,050,413	737,672
South Central	30	604,571	81,426
Western	25	869,504	253,578
	220	12,215,187	2,493,948
Estimated	53	1,692,231	106,802
Total	273	13,907,418	2,600,750

Production of natural mineral waters from 1883 to 1895—Continued.

Geographic division.	Springs reporting.	Gallons sold.	Value.
1891.			
North Atlantic	62	5,724,752	$1,591,746
South Atlantic	41	796,439	313,443
North Central	68	8,010,556	482,082
South Central	29	629,015	106,022
Western	27	1,123,640	414,564
	227	16,284,402	2,907,857
Estimated	61	2,108,330	88,402
Total	288	18,392,732	2,996,259
1892.			
North Atlantic	65	6,853,722	1,933,416
South Atlantic	47	1,062,945	353,193
North Central	74	11,566,440	1,834,732
South Central	32	693,544	109,334
Western	24	1,261,453	594,469
	242	21,438,104	4,825,144
Estimated	41	438,500	80,826
Total	283	21,876,604	4,905,970
1893.			
North Atlantic	79	8,351,192	1,844,845
South Atlantic	49	1,092,829	304,736
North Central	78	8,833,712	1,073,427
South Central	35	1,139,959	122,331
Western	29	675,041	307,623
	270	20,092,733	3,652,962
Estimated	60	3,451,762	593,772
Total	330	23,544,495	4,246,734
1894.			
North Atlantic	83	8,217,528	1,488,361
South Atlantic	55	660,120	129,143
North Central	82	6,914,900	1,115,322
South Central	37	2,319,813	273,836
Western	29	859,905	274,235
	286	18,972,266	3,280,897
Estimated	71	2,677,342	460,949
Total	357	21,569,608	3,741,846

Production of natural mineral waters from 1883 to 1895—Continued.

Geographic division.	Springs reporting.	Gallons sold.	Value.
1895.			
North Atlantic	88	8, 668, 907	$1, 572, 881
South Atlantic	51	953, 713	287, 623
North Central	92	6, 428, 582	1, 577, 118
South Central	35	2, 346, 806	161, 073
Western	31	886, 185	292, 832
	297	19, 284, 193	3, 891, 527
Estimated	73	2, 179, 350	362, 710
Total	370	21, 463, 543	4, 254, 237

LIST OF COMMERCIAL SPRINGS.

ALABAMA.

One spring has been dropped from the list for Alabama, and of the 4 remaining the following 3 report sales in 1895:

Bailey Springs, Bailey Springs, Lauderdale County.
Healing Springs, Healing Springs, Washington County.
Wilkinson's Matchless Mineral Water, Greenville, Butler County.

ARKANSAS.

Of the 7 springs credited to Arkansas the following 6 report:

Arkansas Lithia Springs, Hope, Hempstead County.
Blancoe Springs, near Hot Springs, Garland County.
Dovepark Springs, Dovepark, Hot Spring County.
Eureka Springs, Eureka Springs, Carroll County.
Potash Sulphur Spring, Hot Springs, Garland County.
Sulphur Springs, Sulphur Springs, Benton County.

CALIFORNIA.

California's list is increased by 2 new springs, and 1 has been dropped, leaving the total at 20 springs. Of these, the following 16 report:

Ætna Springs, Lidell, Napa County.
Alhambra Mineral Spring, Martinez, Contra Costa County.
Almaden Vichy Springs, New Almaden, Santa Clara County.
Azule Natural Seltzer Water, San Jose, Santa Clara County.
Bartlett Springs, Bartlett Springs, Lake County.
California Elixir Mineral Spring, near South Riverside, Riverside County.
Castalian Mineral Water, Inyo County.
Coronado Mineral Spring, Coronado, San Diego County.

El Toro Spring, Novato, Marin County.
Mount Lowe Springs, near Pasadena, Los Angeles County.
Napa Soda Springs, Napa Soda Springs, Napa County.
Ojai Hot Springs, Matilija, Ventura County.
Pacific Congress Springs, Saratoga, Santa Clara County.
Shasta Mineral Spring, Shasta Springs, Siskiyou County.
Tolenas Soda Spring, Fairfield, Solano County.
Tuscan Springs, Redbluff, Tehama County.

COLORADO.

One spring is dropped from the list, and of the 8 remaining 4 are delinquent in 1895. The following 4 report:

Canyon City Vichy Springs, Canyon City, Fremont County.
Carlile Soda and Iron Springs, near Pueblo, Pueblo County.
Colorado Carlsbad Springs, Barr, Arapahoe County.
Hiawatha Spring, Manitou, El Paso County.

CONNECTICUT.

One new spring is added to Connecticut's list, making the total 8, but of these only the 3 following report for 1895:

Althea Spring, Waterbury, New Haven County.
Arethusa Springs, Seymour, New Haven County.
Oxford Chalybeate Spring, Oxford, New Haven County.

FLORIDA.

One spring taken from Florida's list leaves only the following, which reports:

Magnolia Springs, Magnolia Springs, Clay County.

GEORGIA.

Two of the 3 springs credited to Georgia report for 1895. They are:

Bowden Lithia Springs, Lithia Springs, Douglas County.
Hughes Mineral Spring, near Rome, Floyd County.

IDAHO.

There is no change reported for Idaho. It is still represented by 1 spring, as follows:

Idanha Spring, Soda Springs, Bannock County.

ILLINOIS.

Four new springs are added to the list, making the total for the State 16; of these 12 report sales, as follows:

American Carlsbad, Nashville, Washington County.
Apollo Springs, Dupage County.
Aurora Lithia Spring, Montgomery, Kane County.
Black Hawk Springs, Rock Island, Rock Island County.
Diamond Mineral Spring, Grantfork, Madison County.

Magnesia Spring, Montgomery, Kane County.
Min-ni-Ni-yan Spring, Bristol, Kendall County.
Perry Springs, Perry Springs, Pike County.
Red Avon Mineral Springs, Avon, Fulton County.
Sailor Springs, Sailor Springs, Clay County.
Sanicula Springs, Ottawa, Lasalle County.
Tivoli Spring, Chester, Randolph County.

INDIANA.

One spring has been taken from the list and 1 has been added, so that the total for 1895 remains at 11, as in 1894. The following report:

Emerald Spring, Indiana Mineral Springs, Warren County.
French Lick Springs, French Lick, Orange County.
Greenwood Sanitarium Well, Greenwood, Johnson County.
Indiana Mineral Springs, Indiana Mineral Springs, Warren County.
Kickapoo Magnetic Springs, Kickapoo, Warren County.
King's Mineral Springs, Muddyfork, Clark County.
Lodi Artesian Well, Silverwood, Fountain County.
Magnetic Mineral Springs, Terre Haute, Vigo County.
Magnetic Mineral Well, Fort Wayne, Allen County.
West Baden Springs, West Baden, Orange County.

IOWA.

Iowa loses 1 spring in 1895, leaving the total at 6. Of these the following 4 report:

Colfax Mineral Spring, Colfax, Jasper County.
Mynster Springs, Council Bluffs, Pottawattamie County.
Siloam Springs, Iowa Falls, Hardin County.
White Sulphur Spring, White Sulphur, Scott County.

KANSAS.

The 1895 list for Kansas remains the same as for 1894, viz, 7. The following 5 report:

Blazing's Natural Medical Spring, Manhattan, Riley County.
Geuda Mineral Springs, Geuda Springs, Cowley County.
Jewell County Lithium Spring, Montrose, Jewell County.
Topeka Mineral Wells, Topeka, Shawnee County.
Waconda Springs, Cawker City, Mitchell County.

KENTUCKY.

All of Kentucky's springs report sales in 1895. They are 6 in number, as follows:

Anita Springs, Lagrange, Oldham County.
Bedford Springs, Bedford, Trimble County.
Blue Lick Springs, Blue Lick Springs, Nicholas County.
Crab Orchard Springs, Crab Orchard, Lincoln County.
St. Patrick's Well, Louisville, Jefferson County.
Upper Blue Lick Springs, Blue Lick Springs, Nicholas County.

LOUISIANA.

No reports of sales have been received from any of the springs of Louisiana.

MAINE.

Two springs are added to the list and 2 have been taken from it, leaving the total for 1895 the same as in 1894. Of the 14 springs credited to the State the following 9 report sales:

Blue Hill Mineral Spring, Blue Hill, Hancock County.
Cold Bowling Spring, Steep Falls, Limington, York County.
Crystal Springs, Auburn, Androscoggin County.
Keystone Spring, East Poland, Androscoggin County.
Paradise Spring, Brunswick, Cumberland County.
Pine Spring, Topsham, Sagadahoc County.
Underwood Springs, Falmouth Foreside, Cumberland County.
Wilson Spring, North Raymond, Cumberland County.
Windsor Mineral Spring, Lewiston, Androscoggin County.

MARYLAND.

One spring is delinquent for 1895. The remaining 4 report sales. They are:

Carroll Spring, Forest Glen, Montgomery County.
Chattolanee Springs, Chattolanee, Baltimore County.
Strontia Mineral Spring, Brooklandville, Baltimore County.
Takoma Springs, Takoma, Montgomery County.

MASSACHUSETTS.

Two springs are taken from the list for Massachusetts and 2 are added, leaving the total 27, as in 1894. Of these the following 25 report for 1895:

Abajone Spring, Woburn, Middlesex County.
Ballardville Lithia Spring, Lowell, Middlesex County.
Belmont Hill Spring, Everett, Middlesex County.
Belmont Natural Spring, Belmont, Middlesex County.
Blue Hill Silver Spring, Milton, Norfolk County.
Burnham Spring, Methuen, Essex County.
Cohanet Spring, Taunton, Bristol County.
Columbia Lithia Spring, Revere, Suffolk County.
Commonwealth Mineral Spring, Waltham, Middlesex County.
Crystal Mineral Spring, Methuen, Essex County.
Crystal Mineral Spring, Stoneham, Middlesex County.
Diamond Spring, Lawrence, Essex County.
Electric Spring, Lynn, Essex County.
Everett Crystal Spring, Everett, Middlesex County.
Goulding Spring, Whitman, Plymouth County.
Harvard Crystal Spring, Allston, Suffolk County.
Indian Spring, Brighton, Suffolk County.
Leland Mineral Spring, Lowell, Middlesex County.
Massasoit Spring, Springfield, Hampden County.

Middlesex Mountain Spring, Malden, Middlesex County.
Moose Hill Spring, Swampscott, Essex County.
Nobscot Mountain Spring, Framingham, Middlesex County.
Robbins Spring, Arlington, Middlesex County.
Sheep Rock Spring, Lowell, Middlesex County.
Simpson Spring, South Easton, Bristol County.

MICHIGAN.

The list for Michigan stands at 14, 2 springs having been taken from it and 1 added. The following 13 report sales in 1895:

Americanus Spring, Lansing, Ingham County.
Blue Rock Spring, Grand Rapids, Kent County.
Clarke Red Cross Well, Big Rapids, Mecosta County.
Magnetic Mineral Springs, Spring Lake, Ottawa County.
Medea Spring, Mount Clemens, Macomb County.
Moorman Well, Ypsilanti, Washtenaw County.
Mount Clemens Pagoda Spring, Mount Clemens, Macomb County.
Mount Clemens Sprudel Water, Mount Clemens, Macomb County.
No-che-mo Mineral Spring, Reed City, Osceola County.
Plymouth Rock Well, Plymouth, Wayne County.
Salutaris Spring, St. Clair Springs, St. Clair County.
Ypsilanti Mineral Spring, Ypsilanti, Washtenaw County.
Zauber Wasser, Hudson, Lenawee County.

MINNESOTA.

Two of Minnesota's 3 springs report sales in 1895. They are:

Indian Medical Spring, Elk River, Sherburne County.
Mankato Mineral Springs, near Mankato, Blue Earth County.

MISSISSIPPI.

Mississippi gains 1 spring over 1894, the total for 1895 being 6. All the springs report. They are:

Brown's Wells, Browns Wells, Copiah County.
Castalian Springs, Durant, Holmes County.
Godbold Mineral Well, Summit, Pike County.
Mount Pleasant Mineral Spring, Mount Pleasant, Marshall County.
Robinson Mineral Spring, Madison County.
Stafford Mineral Springs, near Vosburg, Jasper County.

MISSOURI.

All of Missouri's springs report for 1895. They are 8 in number, as follows:

B. B. Mineral Springs, Bowling Green, Pike County.
Blue Lick Springs, Blue Lick, Saline County.
Eldorado Springs, Cedar County.
Excelsior Springs, Excelsior Springs, Clay County.
Lineville Mineral Springs, Mercer County, near Lineville, Iowa.
Paris Springs, Paris Springs, Lawrence County.
Randolph Springs, Randolph Springs, Randolph County.
Sweet Springs, Sweet Springs, Saline County.

MONTANA.

Only 1 spring in Montana reports sales for 1895. It is:

Lissner's Mineral Springs, Helena, Lewis and Clarke County.

NEBRASKA.

Nebraska's 1 spring reports for 1895. It is:

Victoria Mineral Springs, New Helena, Custer County.

NEW HAMPSHIRE.

One spring is added to the list, making the total for the State 4. Of these the following 3 report for 1895:

Amherst Mineral Spring, Amherst, Hillsboro County.
Londonderry Lithia Spring, Londonderry, Rockingham County.
Pack Monadnock Lithia Spring, Temple, Hillsboro County.

NEW JERSEY.

One new spring is added to the list for New Jersey, bringing the total up to 2. Both report for 1895. They are:

Kalium Springs, Collingswood, Camden County.
Pine Grove Mineral Spring, Woodbury, Gloucester County.

NEW MEXICO.

One spring is taken from the list, leaving 3 as the total for the Territory. All report for 1895, as follows:

Coyote Soda Spring, Coyote Canyon, Bernalillo County.
Harsch's Iron Springs, Coyote Canyon, Bernalillo County.
Ojo Caliente Spring, Ojo Caliente, Taos County.

NEW YORK.

The list for New York is increased by 2 new springs, making the total 31. Of these the following 24 report sales in 1895:

Avon Sulphur Spring, Avon, Livingston County.
A. D. Ayer Amherst Mineral Springs, near Williamsville, Erie County.
Boonville Mineral Springs, Boonville, Oneida County.
Cayuga Water, Cayuga, Cayuga County.
Colonial Mineral Springs, West Deer Park, Suffolk County.
Deep Rock Springs, Oswego, Oswego County.
Esperanza Mineral Springs, Lake Keuka, Yates County.
Great Bear Spring, Fulton, Oswego County.
Massena Springs, Massena, St. Lawrence County.
Salubria Springs, Watkin, Schuyler County.
Saratoga Springs, Saratoga County:
  Champion Spring.
  Empire Spring.
  Excelsior Spring.
  Hathorn Spring.
  Old Putnam Spring.

Saratoga Springs, Saratoga County—Continued.
- Patterson Spring.
- Royal Spring.
- Saratoga Kissingen Spring.
- Saratoga Vichy Spring.
- Saratoga Victoria Spring.
- Union Spring.

Sulphur Springs, Richfield Springs, Otsego County.
Table Rock Mineral Spring, Honeoye Falls, Monroe County.
White Sulphur Spring, Sharon Springs, Schoharie County.

NORTH CAROLINA.

Two springs are taken from North Carolina's list, leaving the total 8, all of which report for 1895. They are:

Ashley Bromine and Arsenic Spring, Ashe County.
Barium Springs, Barium Springs, Iredell County.
Lemon Springs, Lemon Springs, Moore County.
Park's Spring, Caswell County, near Danville, Va.
Panacea Springs, Warren County.
Seven Springs, Seven Springs, Wayne County.
Shaw's Healing Springs, Littleton, Halifax County.
Thompson's Bromine Arsenic Springs, Crumpler, Ashe County.

OHIO.

Two new springs increase Ohio's list from 12 in 1894 to 14 in 1895. The following 12 report sales:

Crum Mineral Springs, Austintown, Mahoning County.
Crystal Rock Spring, Erie County.
Devonian Mineral Spring, Lorain, Lorain County.
La Fountain Mineral Springs, Fountain Park, Champaign County.
Magnetic and Saline Spring, Marysville, Union County.
Midland Mineral Springs, Midland, Midland County.
Mustcash Spring, Erie County.
Puritas Mineral Springs, Rockport, Cuyahoga County.
Purtlebaugh Mineral Springs, Urbana, Champaign County.
Rex Mineral Spring, New Richmond, Clermont County.
Sulphur Lick Springs, Anderson, Ross County.
Wewoka Spring, near Richards Station, Lucas County.

OREGON.

One new spring is added to the list, bringing the total up to 3. All report as follows:

Lehman Springs, Hubbard, Marion County.
Siskiyou Spring, Soda Springs, Jackson County.
Wilhoit Springs, Wilhoit, Clackamas County.

PENNSYLVANIA.

Four new springs added to the list bring the total up to 21. Of these the following 15 report sales in 1895:

Aquatone Mineral Spring, Aquetong, Bucks County.
Black Barren Mineral Spring, Pleasant Grove, Lancaster County.

Cloverdale Lithia Springs, Newville, Cumberland County.
Cresson Springs, Cresson, Cambria County.
Eureka Springs, Saegerstown, Crawford County.
Gettysburg Katalysine Spring, Gettysburg, Adams County.
Gray Spring, Cambridgeboro, Crawford County.
Great Indian Spring, Glen Summit, Luzerne County.
Parker Mineral Spring, Gardeau, McKean County.
Pavilion Spring, Wernersville, Berks County.
Ponce de Leon Spring, Meadville, Crawford County.
Pulaski Natural Mineral Springs, Pulaski, Lawrence County.
Rosscommon Springs, Wind Gap, Monroe County.
Susquehanna County Mineral Springs, Rush, Susquehanna County.
Tuscarora Lithia Spring, McClaysville, Juniata County.

RHODE ISLAND.

There is no change in the Rhode Island list for 1895, and the 3 springs report sales. They are:

Gladstone Spring, Narragansett Pier, Washington County.
Holly Spring, Woonsocket, Providence County.
Ochee Mineral and Medical Springs, Johnson, Providence County.

SOUTH CAROLINA.

Only 2 of South Carolina's springs report sales in 1895. They are:

Chicks Springs, Chicks Springs, Greenville County.
Harris Lithia Spring, Waterloo, Laurens County.

SOUTH DAKOTA.

The 1 spring credited to South Dakota reports sales in 1895. It is:

Hot Springs of South Dakota, Hot Springs, Fall River County.

TENNESSEE.

One new spring is added to the list, making the total 6. Of these the following 4 report for 1895:

Dixie Mineral Spring, Knoxville, Knox County.
Idaho Springs, St. Bethlehem, Montgomery County.
Red Boiling Springs, Red Boiling Springs, Macon County.
Tate Epsom Springs, Tate Spring, Grainger County.

TEXAS.

The list for Texas shows no change in 1895, remaining at 13. Of these the following 10 report sales:

Capp's Well, Longview, Gregg County.
Dalby Springs, Dalby Springs, Bowie County.
Hynson's Natural Iron Spring, Marshall, Harrison County.
Mineral Wells, Mineral Wells, Palo Pinto County.
Montvale Springs, Marshall, Harrison County.
Overall Mineral Wells, Franklin, Robertson County.

Rosborough Springs, Marshall, Harrison County.
Slack's Wells, Fayette County, near Waelder, Gonzales County.
Tioga Mineral Wells, Grayson County.
Wootan Wells, Wootan Wells, Robertson County.

UTAH.

Only 1 of Utah's two springs reports sales for 1895. It is:

Wasatka Springs, Salt Lake City, Salt Lake County.

VERMONT.

One new spring is added to the list, making the total for the State 5. Of these the following 4 report sales for 1895:

Clarendon Springs, Clarendon Springs, Rutland County.
Equinox Spring, Manchester, Bennington County.
Missisquoi Mineral Springs, Sheldon, Franklin County.
Vermont Mineral Spring, Brookline, Windham County.

VIRGINIA.

There is no change in the list for Virginia. Of the 34 springs credited to the State, 29 report sales in 1895. They are:

Blue Ridge Springs, Botetourt County.
Buffalo Lithia Springs, Buffalo Lithia Springs, Mecklenburg County.
Chase City Mineral Springs, Chase City, Mecklenburg County.
Cove Lithia Springs, near Wytheville, Wythe County.
Crockett Arsenic Lithia Spring, Shawsville, Montgomery County.
Farmville Lithia Springs, Cumberland County, near Farmville, Prince Edward County.
Harris Anti-Dyspeptic and Tonic Spring, Burkeville, Nottoway County.
Healing Springs, Healing Springs, Bath County.
Iron Lithia Springs, Tip Top, Tazewell County.
Jordan White Sulphur Spring, Stephenson, Frederick County.
Lake Como Lithia Spring, Henrico County.
Massanetta Springs, Harrisonburg, Rockingham County.
Nye Lithia Springs, Wytheville, Wythe County.
Osceola Springs, near Pleasant Valley, Rockingham County.
Otterburn Lithia and Magnesia Springs, Amelia, Amelia County.
Pæonian Springs, Loudoun County.
Powhatan Lithia and Alum Springs, Tobaccoville, Powhatan County.
Pine Mountain Springs, Washington County.
Rawley Springs, Rawley Springs, Rockingham County.
Rockbridge Alum Springs, Goshen Bridge, Rockbridge County.
Seawright Magnesian Lithia Spring, Staunton, Augusta County.
Seven Springs, near Glade Spring, Washington County.
Shenandoah Alum Springs, Shenandoah Alum Springs, Shenandoah County.
Steephill Ferro-phospho-magnesium Spring, North Staunton, Augusta County.
Swineford's Arsenic Lithia Springs, Osceola.
Virginia Magnesian Alkaline Springs, near Staunton, Augusta County.
Virginia Waukesha Lithia Springs, Staunton, Augusta County.
Wallawhatoola Alum Springs, near Millboro Spring, Bath County.
Wolf Trap Lithia Springs, Wolf Trap, Halifax County.

WASHINGTON.

Two of the 3 springs credited to the State of Washington report sales for 1895. They are:

Cascade Springs, near Cascades, Skamania County.
Medical Lake, Medical Lake, Spokane County.

WEST VIRGINIA.

One spring is taken from the list, leaving the total 6, of which 5 report. They are:

Capon Springs, Capon Springs, Hampshire County.
Irondale Springs, Independence, Preston County.
Salt Sulphur Springs, Salt Sulphur Springs, Monroe County.
Triplet Well, Calf Creek, Grant District, Pleasants County.
White Sulphur Springs, White Sulphur Springs, Greenbrier County.

WISCONSIN.

Two new springs are added to Wisconsin's list, making the total 28. Of these 24 report in 1895. They are:

Allouez Mineral Springs, Green Bay, Brown County.
Bay City Springs, Ashland, Ashland County.
Bethania Mineral Spring, Osceola, Polk County.
Castalia Springs, Wauwatosa, Milwaukee County.
Darlington Mineral Springs, Darlington, Lafayette County.
Fort Crawford Springs, Prairie du Chien, Crawford County.
Great Geyser Spring, Palmyra, Jefferson County.
Lebens Wasser, Green Bay, Brown County.
Nee-Ska-Ra Mineral Spring, Wauwatosa, Milwaukee County.
Salvator Springs, Green Bay, Brown County.
Shealtiel Springs, Waupaca, Waupaca County.
Sheboygan Spring, Sheboygan, Sheboygan County.
Sparkling Spring, Milwaukee, Milwaukee County.
St. John Mineral Spring, Green Bay, Brown County.
Wautoma Mineral Spring, Waushara County.
Waukesha Springs, Waukesha County:
- Almanaris Springs.
- Arcadian Spring.
- Bethesda Mineral Spring.
- Elein Springs.
- Fountain Spring.
- Horeb Spring.
- Siloam Spring.
- Waukesha Hygeia Mineral Spring.
- Silurian Mineral Spring.

Summary of reports of mineral springs for 1895.

States and Territories.	Springs reporting.	Springs not reporting.	Total used commercially.
NORTH ATLANTIC STATES.			
Maine	9	5	14
New Hampshire	3	1	4
Vermont	4	1	5
Massachusetts	25	2	27
Rhode Island	3	0	3
Connecticut	3	5	8
New York	24	7	31
New Jersey	2	0	2
Pennsylvania	15	6	21
SOUTH ATLANTIC STATES.			
Delaware	0	0	0
Maryland	4	1	5
District of Columbia	0	0	0
Virginia	29	5	34
West Virginia	5	1	6
North Carolina	8	0	8
South Carolina	2	2	4
Georgia	2	1	3
Florida	1	0	1
SOUTH CENTRAL STATES.			
Kentucky	6	0	6
Tennessee	4	2	6
Alabama	3	1	4
Mississippi	6	0	6
Louisiana	0	1	1
Texas	10	3	13
Indian Territory	0	0	0
Arkansas	6	1	7
Oklahoma	0	0	0
NORTH CENTRAL STATES.			
Ohio	12	2	14
Indiana	10	1	11
Illinois	12	4	16
Michigan	13	1	14
Wisconsin	24	4	28
Minnesota	2	1	3
Iowa	4	2	6
Missouri	8	0	8

Summary of reports of mineral springs for 1895—Continued.

States and Territories.	Springs reporting.	Springs not reporting.	Total used commercially.
NORTH CENTRAL STATES—continued.			
North Dakota	0	0	0
South Dakota	1	0	1
Nebraska	1	0	1
Kansas	5	2	7
WESTERN STATES AND TERITORIES.			
Alaska	0	0	0
Wyoming	0	0	0
Montana	1	1	2
Colorado	4	4	8
New Mexico	3	0	3
Arizona	0	0	0
Utah	1	1	2
Nevada	0	0	0
Idaho	1	0	1
Washington	2	1	3
Oregon	3	0	3
California	16	4	20
Total	297	73	370

IMPORTS AND EXPORTS.

Prior to 1884 the Treasury Department did not distinguish natural mineral waters from those that were artificial; since 1883 the distinction has been made, but the artificial waters have not been classified according to the receptacles in which they have been imported. The importation is shown in the two tables following, with a table of exports appended.

Mineral waters imported and entered for consumption in the United States 1867, to 1883, inclusive.

Fiscal year ended June 30—	In bottles of 1 quart or less.		In bottles in excess of 1 quart.	
	Quantity.	Value.	Quantity.	Value.
	Bottles.		*Quarts.*	
1867	370,610	$24,913	3,792	$360
1868	241,702	18,438	22,819	2,052
1869	344,691	25,635	9,739	802
1870	433,212	30,680	18,025	1,743
1871	470,947	34,604	2,320	174
1872	892,913	67,951		
1873	35,508	2,326		
1874	7,238	691		
1875	4,174	471		
1876	25,758	1,899		
1877	12,965	1,328		
1878	8,229	815		
1879	28,440	2,352		
1880	207,554	19,731		
1881	150,326	11,850		
1882	152,277	17,010		
1883	88,497	7,054		

Fiscal year ended June 30—	Not in bottles.		All not artificial.		Total value.
	Quantity.	Value.	Quantity.	Value.	
	Gallons.		*Gallons.*		
1867		$137			$25,410
1868	554	104			20,594
1869	1,042	245			26,682
1870	2,063	508			32,931
1871	1,336	141			34,919
1872	639	116			68,067
1873	355	75	394,423	$98,151	100,552
1874	95	16	199,035	79,789	80,496
1875	5	2	395,956	101,640	102,113
1876			447,646	134,889	136,788
1877		22	520,751	167,458	168,808
1878			883,674	350,912	351,727
1879	3	4	798,107	282,153	284,509
1880			927,759	285,798	305,529
1881	55	26	1,225,462	383,616	395,492
1882			1,542,905	410,105	427,115
1883			1,714,085	441,439	448,493

Imports for years 1884 to 1895.

Year ended—	Artificial mineral waters.		Natural mineral waters.	
	Gallons.	Value.	Gallons.	Value.
June 30, 1884	29,366	$4,591	1,505,298	$362,651
1885	7,972	2,157	1,660,072	397,875
Dec. 31, 1886	62,464	16,815	1,618,960	354,242
1887	13,885	4,851	1,915,511	385,906
1888	12,752	4,411	1,716,461	341,695
1889	36,494	8,771	1,558,968	368,661
1890	22,328	7,133	2,322,008	433,281
1891	26,700	8,700	2,019,833	392,894
1892	16,052	9,089	2,266,123	497,660
1893	6,086	2,992	2,321,081	506,866
1894	7,753	3,047	1,891,964	417,500
1895	101,115	19,151	2,104,811	506,384

Exports of natural mineral waters of domestic production from the United States.

Fiscal year ending June 30—	Value.	Fiscal year ending June 30—	Value.
1875	$162	1881	$1,029
1876	80	1882	421
1879	1,529	1883	a 459
1880	1,486		

a None reported since 1883.

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