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MINERAL RESOURCES OF MICHIGAN
WITH
STATISTICAL TABLES OF PRODUCTION AND VALUE OF MINERAL PRODUCTS FOR
1915 AND PRIOR YEARS.

WITH A TREATISE ON LIMESTONE RESOURCES
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Contents

MISCELLANEOUS NON-METALLIC MINERALS.

COAL.*

Coal mining began in Michigan as early as 1835 but no records of production were kept until 1860, when Michigan was credited with an output of 2,320 tons. Ten years later the production reached 28,150 tons. In 1880, it was 100,800 tons and for the two following years it exceeded the 100,000 ton mark. A sharp decline began in 1883 and in 1884 the production fell to only 36,712 tons and it was not until 1895 that the production again exceeded 100,000 tons. In 1897 the Saginaw and Bay county coal fields were opened and the production reached 223,592 tons. After this the industry grew rapidly, the production in 1901 being 1,241,241 tons. The maximum production of 2,035,858 tons was attained in 1907. Since that year the production has gradually fallen until in 1915 it was only 1,069,672 tons.

Most of the coal is produced in Bay and Saginaw counties, these two counties in 1915 producing respectively 503,002 and 511,184 tons or together 94.5 per cent of the total output of the state. The decrease is chiefly due to competition from higher grade and more cheaply mined coals from Ohio, Pennsylvania and West Virginia. The average cost of mining coal in Michigan, (see table) from 1910 to 1914 inclusive ranged from $1.89 to $1.99 per ton. The cost in Ohio averages less than $1.00 per ton. The Michigan operator is protected by differential freight rates varying from $.75 to $1.40 per ton for coals from Ohio and about $.25 additional for coals from West Virginia. The lower cost of mining, however, enables the Ohio and West Virginia operators to deliver coal at most points in the southern part of the Southern Peninsula at prices ruinous to the Michigan operators. In addition the Ohio coals are of higher average quality.

The markets of the Michigan operators are largely restricted to the central and northern portions of the state. Prior to 1903, less than 10 per cent of the coal was mined by coal cutting machines. Five years later, the percentage had increased to 29.2 per cent, in 1910 to 45.5 per cent, in 1914 and 1915 to 77.8 per cent and 76.1 per cent respectively.

Up to 1904, the coal cutting machines were chiefly of the pick or puncher type. The chain breast machines were then introduced but this type was not so widely used as the pick or puncher type for it is not well adapted to the thin coal seams and the weak roofs which obtain in Michigan. The so-called short wall machine was introduced in 1910 with such success that it threatens to displace all other types.

The problem of the Michigan operators is to reduce mining costs. In 1915 the average cost per ton of coal mined was $1.77, or $.22 less than in 1914. This decrease is said to be due largely to the introduction of

more efficient types of the short wall coal cutting machines.

*For a more complete report of the coal industry in Michigan see Publication 19 (Geol. Ser. 16), Mineral Resources of Michigan for 1914.

PRODUCTION, COST OF MINING, AND VALUE OF COAL IN MICHIGAN, 1900-1915.

YEAR.	*Number active mines.	Average number employees per month.	**Average daily wage.	Total tons of coal mined.	Total cost of coal mined.	Average cost per ton.	***Total tons of coal mined.	***Total value of coal mined.	***Average price received per ton.	Profit made per ton.
1900	31	1,676	$2 34	871,388	$1,209,228	$1.387	849,475	$1,259,683	$1.483	$0.096
1901	30	1,847	2 44	1,016,496	1,442,415	1.419	1,241,241	1,753,064	1.412	.007
1902	32	1,616	2 75	899,967	1,284,342	1.427	964,718	1,653,192	1.714	.287
1903	34	1,886	3 19	1,160,768	2,529,027	1.579	1,367,619	2,767,527	1.979	.400
1904	33	2,733	3 01	1,408,875	2,266,098	1.609	1,342,840	2,424,935	1.806	.197
1905	38	2,776	2 96	1,413,307	2,244,434	1.588	1,473,211	2,512,697	1.705	.117
1906	38	3,106	3 40	1,367,385	2,090,489	1.529	1,346,338	2,427,404	1.803	.274
1907	37	2,897	3 24	1,911,291	3,162,837	1.655	2,035,838	3,660,833	1.798	.143
1908	38	3,115	3 02	1,842,778	3,089,759	1.677	1,835,019	3,322,904	1.811	.134
1909	36	2,907	2 93	1,736,573	2,885,083	1.650	1,784,692	3,199,351	1.793	.143
1910	34	2,471	3 07	1,462,276	2,626,342	1.796	1,534,967	2,930,771	1.909	.103
1911	32	2,339	3 39	1,389,585	2,623,244	1.887	1,476,074	2,791,461	1.891	.004
1912	26	1,886	3 19	1,160,768	2,179,076	1.869	1,201,230	2,399,451	1.989	.120
1913	24	2,076	3 49	1,138,163	2,250,559	1.977	1,231,786	2,455,227	1.993	.016
1914	23	2,146	3 35	1,153,860	2,285,261	1.99	1,283,030	2,559,786	1.99	.000
1915	20	1,942	3 45	1,069,798	1,929,386	1.77				

*Compiled and adapted from reports of State Coal Mine Inspector, Ann. Repts. State Department of Labor.
**For year beginning Dec. 1 and ending Nov. 30.
***From Mineral Resources of United States, U. S. G. S.

PRODUCTION OF COAL BY COUNTIES, 1899-1915.

	Bay.	Eaton.	Ingham.	Jackson.	Saginaw.	Shiawassee.	Tuscola.	Other counties.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
*1915	503,002	a	a	a	511,184	a	a	55,612
*1914	540,319	82	1,376	1,287	545,165	903	†45,195	
*1913	579,123	155	2,953	457	521,848	2,170	31,480	453
*1912	607,740	374	3,874		480,198	24,532	59,252	
1911	766,470	100			667,282	13,000	66,427	19,000
1910	766,470	100			667,282			101,215
1909	822,577	558		1,500	859,434			100,623
1908	782,503	2,286		5,539	999,338			45,353
1907	962,574	5,982		5,645	1,047,927			13,730
1906	481,398	18,307		8,658	835,475			2,300
1905	544,154	4,058		9,196	915,803			
1904	410,634	9,057		16,860	906,289			
1903	325,021	7,303		28,307	1,011,898			
1902	248,645	8,800		23,889	670,304			13,400
1901	253,821	4,803		20,288	938,042			24,284
1900	190,814	4,530		23,317	601,112			
1899	104,588	3,421		21,600	455,607			39,492

*Compiled from Annual Report of State Department of Labor.
†Incomplete returns, tonnage approximate.
(a) Included in other counties.

PRODUCTION OF COAL IN MICHIGAN, 1860-1915, IN SHORT TONS.

Year.	Quantity. Tons.	Year.	Quantity. Tons.	Year.	Quantity. Tons.	Year.	Quantity. Tons.	Year.	Quantity. Tons.
1860	2,320	1871	32,000	1882	135,339	1893	45,979	1904	1,342,840
1861	3,000	1872	33,600	1883	71,296	1894	70,022	1905	1,473,211
1862	5,000	1873	56,000	1884	36,712	1895	112,322	1906	1,346,338
1863	8,000	1874	58,000	1885	45,178	1896	92,882	1907	2,035,838
1864	12,000	1875	62,500	1886	60,434	1897	223,992	1908	1,835,019
1865	15,000	1876	66,000	1887	71,461	1898	315,722	1909	1,784,692
1866	20,000	1877	69,197	1888	83,407	1899	624,708	1910	1,534,967
1867	25,000	1878	85,322	1889	67,431	1900	849,475	1911	1,476,074
1868	28,000	1879	82,015	1890	74,977	1901	1,241,241	1912	1,164,973
1869	29,980	1880	100,800	1891	92,307	1902	964,718	1913	1,138,639
1870	28,150	1881	112,000	1892	77,990	1903	1,367,619	1914	1,283,030
								*1915	1,069,798

*Report of State Coal Mine Inspector, State Department of Labor.

PRODUCTION OF COAL, COST OF MINING, ETC., IN MICHIGAN BY COUNTIES AND MONTHS FOR 1915.[1]

January.

County.	Number of active mines.	Number of employees.	Average number of hours worked per day.	Average number of days worked per month.	Average daily wages.	Aggregate amount paid in wages.	Number of mines using powder.	Number of kegs used.	Number of tons of picked coal mined.	Number of tons of machine coal mined.	Total number of tons of coal mined.	Average cost per ton.	Total cost of output.
Bay	6	997	7.8	19.2	$3 81	$73,019 16	6	991	15,371	35,040	50,411	$1 98	$100,167 01
Saginaw	8	934	7.8	17.0	3 40	54,085 66	8	760	15,394	25,029	40,423	1 85	74,865 64
Calhoun													
Eaton													
Genesee	6	200	8.0	22.2	3 22	14,360 80	1	157	1,547	4,463	6,010	1 92	11,780 94
Ingham													
Jackson													
Tuscola													
Total	20	2,131	7.9	18.5	$3 58	$141,465 62	15	1,908	32,312	64,532	96,844	$1 92	$186,713 59

February.

Bay	5	893	7.9	16.3	$3 69	$53,747 94	5	783	9,165	27,052	36,217	$2 03	$73,650 53
Saginaw	7	858	7.9	16.9	3 24	47,155 53	7	576	12,679	22,860	35,539	1 75	62,388 32
Calhoun													
Eaton													
Genesee	5	205	8.0	23.3	3 24	15,527 28	1	126	1,433	3,790	5,223	1 98	10,321 46
Ingham													
Tuscola													
Total	17	1,956	7.9	17.3	$3 43	$116,390 75	13	1,465	23,277	53,702	76,979	$1 90	$146,358 31

[1]Adapted from the Report of the State Coal Mine Inspector, Ann. Rept. State Department of Labor for 1915.

March.

Bay	5	851	7.7	17.7	$3 67	$55,423 50	5	581	7,295	33,703	40,998	$1 87	$76,717 73
Saginaw	7	1,014	7.9	16.1	3 17	31,858 93	7	659	12,146	24,728	36,874	1 93	71,388 59
Calhoun													
Eaton													
Genesee	4	194	8.0	21.6	3 24	13,571 40	1	104	854	3,587	4,441	1 98	8,821 25
Ingham													
Tuscola													
Total	16	2,059	7.9	17.3	$3 39	$120,853 83	13	1,344	20,295	62,018	82,313	$1 81	$156,927 57

April.

Bay	5	690	7.9	18.1	$3 71	$46,351 10	4	620	5,512	29,124	34,636	$1 77	$61,447 64
Saginaw	5	764	7.8	14.9	3 26	37,170 31	5	480	8,484	18,320	26,804	1 87	50,134 27
Calhoun													
Eaton													
Genesee	3	186	8.0	19.5	3 23	11,755 58	1	82	688	1,970	2,658	1 93	5,147 86
Ingham													
Tuscola													
Total	13	1,640	7.9	16.8	$3 45	$95,276 99	10	1,191	14,684	49,414	64,098	$1 82	$116,729 77

May.

Bay	5	729	7.9	14.9	$3 79	$41,248 46	4	466	7,529	23,538	31,067	$1 84	$57,306 46
Saginaw	6	845	7.9	15.4	3 33	43,361 91	6	600	8,662	20,311	31,973	1 85	57,404 79
Calhoun													
Eaton													
Genesee	4	180	8.0	21.6	3 23	12,554 50	1	36	883	1,199	2,082	1 86	3,878 17
Ingham													
Tuscola													
Total	15	1,754	7.9	15.8	$3 50	$97,164 87	11	1,092	14,074	51,048	65,122	$1 85	$120,649 42

PRODUCTION OF COAL, COST OF MINING, ETC., IN MICHIGAN BY COUNTIES AND MONTHS FOR 1915.—*Continued.*

June.

County.	Number of active mines.	Number of employees.	Average number of hours worked per day.	Average number of days worked per month.	Average daily wages.	Aggregate amount paid in wages.	Number of mines using powder.	Number of kegs used.	Number of tons of picked coal mined.	Number of tons of machine coal mined.	Total number of tons of coal mined.	Average cost per ton.	Total cost of output.
Bay	4	601	7.8	20.6	$3 23	$40,072 24	4	553	7,160	39,980	48,140	$1 37	$60,887 46
Saginaw	6	878	7.9	15.1	3 38	44,930 20	6	512	8,927	36,378	45,305	1 38	62,888 75
Calhoun													
Genesee													
Ingham	5	215	8.0	18.7	3 72	14,995 38	1	125	1,611	2,683	4,294	1 86	8,022 04
Shiawassee													
Tuscola													
Total	15	1,694	7.9	17.5	$3 37	$99,997 82	11	1,190	17,698	76,041	93,739	$1 40	$131,778 25

July.

Bay	4	595	7.9	17.3	$3 36	$36,657 37	4	395	16,648	8,916	25,566	$2 17	$55,494 67
Saginaw	6	875	7.9	17.3	3 31	50,166 08	6	610	7,803	31,463	39,266	1 73	68,289 55
Calhoun													
Genesee													
Ingham	5	230	8.0	18.7	3 72	15,981 14	1	98	1,391	2,993	4,384	1 85	8,126 53
Shiawassee													
Tuscola													
Total	15	1,700	7.9	17.5	$3 45	$102,804 29	11	1,103	25,842	43,372	69,214	$1 90	$131,910 75

August.

Bay	5	817	7.9	19.5	$3 51	$50,071 80	5	648	11,841	27,813	39,654	$2 01	$79,817 04
Saginaw	6	877	7.9	17.3	3 47	52,780 94	6	586	8,826	33,140	41,966	1 74	73,054 92
Calhoun													
Genesee													
Shiawassee	3	245	8.1	22.7	3 41	18,975 00	1	92	1,197	3,170	4,367	1 86	8,132 72
Tuscola													
Total	14	1,939	8.0	18.9	$3 48	$127,827 74	12	1,326	21,864	64,123	85,987	$1 87	$161,004 73

September.

Bay	5	856	7.9	19.5	$3 50	$58,423 44	5	733	10,858	29,695	40,963	$1 96	$79,376 09
Saginaw	6	891	7.8	21.3	3 31	62,737 38	6	757	8,721	40,820	49,541	1 61	80,045 55
Calhoun													
Genesee													
Shiawassee	4	246	8.0	21.2	3 51	17,826 30	1	85	1,413	3,980	5,393	1 92	10,369 50
Tuscola													
Total	15	1,993	7.9	20.4	$3 41	$138,987 12	13	1,590	20,992	74,495	95,897	$1 77	$169,791 14

October.

Bay	5	898	7.9	20.7	$3 50	$64,963 56	5	696	10,669	33,117	43,786	$2 02	$87,661 52
Saginaw	6	894	7.9	21.3	3 10	59,642 74	6	729	7,740	43,069	50,769	1 65	84,053 06
Calhoun													
Genesee													
Shiawassee	3	237	8.0	21.7	3 25	16,692 90	1	73	1,149	3,907	5,056	1 89	9,598 12
Tuscola													
Total	14	2,029	8.0	21.1	$3 28	$140,699 20	12	1,498	19,518	80,093	99,611	$1 82	$181,314 70

PRODUCTION OF COAL, COST OF MINING, ETC., IN MICHIGAN BY COUNTIES AND MONTHS FOR 1915.—*Concluded.*

November.

County.	Number of active mines.	Number of employees.	Average number of hours worked per day.	Average number of days worked per month.	Average daily wages.	Aggregate amount paid in wages.	Number of mines using powder.	Number of kegs used.	Number of tons of picked coal mined.	Number of tons of machine coal mined.	Total number of tons of coal mined.	Average cost per ton.	Total cost of output.
Bay	6	1,024	7.9	19.9	$3 73	$76,052 01	6	937	10,667	41,004	51,671	$1 95	$100,196 70
Saginaw	7	935	7.9	21.3	3 45	68,842 81	7	719	7,066	47,751	54,816	1 66	91,075 35
Calhoun													
Eaton													
Genesee													
Ingham	5	247	8.0	20.8	2 85	13,737 89	1	76	1,326	4,207	5,533	1 89	10,474 09
Shiawassee													
Tuscola													
Total	18	2,206	7.9	20.6	$3 51	$159,568 71	14	1,732	19,058	92,962	111,120	$1 82	$202,746 14

December.

Bay	6	1,029	7.9	25.0	$3 62	$92,431 83	6	1,070	17,772	46,621	64,393	$1 87	$120,169 67
Saginaw	7	939	8.0	23.1	3 44	73,806 89	7	803	6,478	52,336	58,814	1 59	93,525 64
Calhoun													
Eaton													
Genesee													
Ingham	4	238	8.0	25.1	3 24	19,350 70	3	156	1,595	4,662	6,167	1 58	9,767 89
Shiawassee													
Tuscola													
Total	17	2,206	7.9	24.3	$3 48	$185,588 42	14	2,029	25,755	103,619	129,374	$1 72	$223,461 20
Grand total		1,942	7.9	18.7	$3 45	$1,526,560 36		17,468	255,369	814,429	1,069,798	$1 76	$1,929,385 57

GROWTH OF LIMESTONE INDUSTRY.

The limestone industry in Michigan made a relatively rapid growth after 1899, but the period of most rapid growth was after 1904. In 1899 the total value of the product including lime was only $281,769, while in 1915 the total value exclusive of lime, which amounted to $349,979, was $828,766. The total value of lime and limestone products in 1915 was 7.7 times that in 1899. The gain, exclusive of lime, in 1915 was $370,805, or 25.4 per cent.

The chief increases were in stone for blast furnace flux, the manufacture of soda ash and allied products, and for concrete and railway ballast. The production of flux stone in 1910 was only 341,027 tons valued at $186,046; in 1915 it was 2,254,984 tons valued at $763,029. The increase for five years was 561 per cent in quantity and 310 per cent in value. The large increase in flux stone in 1915 was due to the general industrial prosperity and the development of large deposits of high grade limestone in the northern part of the state very suitable for blast furnace use. This stone is successfully invading the flux stone markets formerly dominated by limestone from other states.

The chief decreases were in crushed stone for roadmaking and stone for sugar manufacture.

Twenty-six quarries were in operation in 1915. Some quarries chiefly small ones, were idle but the loss was compensated by the opening of new or the reopening of old quarries. The Great Lakes Stone & Lime Co. completed their crushing plant at Rockport and began active operation in 1915. Their stone is high calcium limestone, bituminous, and very fossiliferous. The Cheboygan Limestone Products Co. opened a quarry near Mackinac City in high calcium beds belonging to the Dundee limestone.

Owing to the purity and favorable situation of the limestone deposits near water, in which the more recent and larger quarries have been opened, it is very probable that the limestone industry in Michigan will continue to make a steady and rapid growth. With the return of more normal conditions in the iron industry, the season of 1915 proved to be the greatest in the history of the limestone industry in Michigan.

PRODUCTION AND VALUE OF LIMESTONE IN MICHIGAN, BY USES, 1899-1915.

Year.	Rough building. Value.	Dressed building. Value.	Paving. Value.	Curbing. Value.	Flagging. Value.	Rubble. Value.	Riprap. Value.	Crushed stone. Road making. Tons.	Crushed stone. Road making. Value.
1899	$30,299	*	$62,815				$1,111		
1900	32,962	*	105,266				799		
1901	47,785	*		*	$380	$5,098	*		$31,605
1902	76,797	*		$480	200	3,101	5,740		56,261
1903	36,528	*	49,000	250	5,150	710	800		61,342
1904	32,941	$805	37,665			2,800	2,405		58,655
1905	17,071			160		744	1,568		112,113
1906	9,366	641	90,725	75		4,654	1,204		78,437
1907	15,120	100	56,500			1,433	1,224		131,708
1908	7,276		10,825	300	100	15,907	1,574		182,510
1909	4,450	7,445				1,572	3,615		132,902
1910	3,522		35,500			2,205	908		110,184
1911	7,526					165	360	$224,307	113,524
1912	9,997					380	75	603,553	295,449
1913	8,274					3,511	810	532,311	266,316
1914	3,537					1,651	6,727	505,133	242,839
1915	4,262		*			743	104	482,262	104,970
Total	$329,055					$44,674	$28,854		$2,068,865

*Included in total for year.

PRODUCTION AND VALUE OF LIMESTONE IN MICHIGAN, BY USES, 1899-1915.—*Continued.*

Year.	Crushed stone. Railroad ballast. Tons.	Crushed stone. Railroad ballast. Value.	Crushed stone. Concrete. Tons.	Crushed stone. Concrete. Value.	For blast furnace flux. Tons.	For blast furnace flux. Value.	To sugar factories. Value.	To alkali works. Value.
1899						$27,512		
1900						3,200		
1901		$18,200		$75,643		13,488		
1902		40,810		49,430		32,246		
1903		35,340		48,504		15,502		
1904		57,100		60,745		62,566		
1905		43,640		107,396		109,883		
1906		103,442		91,832		81,517	$224,356	
1907		46,516		97,762		109,429	22,334	
1908		53,900		79,200		58,541	32,594	
1909		42,445		112,526		91,915	25,845	
1910		42,358		178,318		100,149	69,647	
1911	91,713	54,998	306,885	137,385	341,027	186,046	65,141	*
1912	54,327	28,368	185,423	97,298	295,941	137,812	36,944	$508,044
1913	116,000	48,400	292,616	145,965	1,202,817	404,495	38,215	320,961
1914	38,000	20,600	362,200	166,939	1,604,240	565,012	69,477	269,087
1915	60,159	19,640	398,948	217,304	2,254,984	763,029	46,143	481,759
Total		$615,766		$1,630,490		$2,850,662	$630,596	

*Concealed—included in total.

PRODUCTION AND VALUE OF LIMESTONE IN MICHIGAN, BY USES, 1899-1915.—*Concluded.*

Year.	To carbonic acid plants. Value.	To paper mills. Value.	Fertilizer. Tons.	Fertilizer. Value.	Other purposes.	To lime burners.	Rank of state. Value.	Total. Value.
1899					$2,875	$157,657		$281,769
1900					124,220	65,000	12	330,847
1901					101,399	136,173	12	429,771
1902					68,164	98,000	13	413,148
1903					4,747	132,600	14	390,473
1904					5,323	180,683	10	501,768
1905					142,790	9,380	12	544,754
1906							10	656,269
1907					278,297		11	760,333
1908					253,990		9	660,017
1909					327,571		11	750,589
1910					299,305		9	842,126
1911		$12,558		$3,003	440,857		8	1,005,751
1912		8,150		3,447	13,596		8	1,120,560
1913		10,723		7,048	395,874		7	1,408,703
1914	$53,138	8,307	$10,907	11,104	39,523			1,457,961
1915	*	8,620		9,746	31,529			1,828,766
Total		$48,358		$34,358	$2,529,560			$13,411,546

*Included in total.

GROWTH OF LIME INDUSTRY.

In the last ten years the lime industry in Michigan has made very little growth in comparison with the limestone industry. This is due to several causes, viz.: (1) the growing scarcity of cheap wood fuel for burning lime, (2) the substitution of concrete for stone and lime mortar in construction work, (3) the rapidly growing use of gypsum wall plaster and plaster substitutes, and (4) the unfavorable location of suitable limestone deposits. Formerly, owing to the abundance of wood fuel, lime was burned at many localities in the state, but now lime is produced only at Menominee, Manistique, Marblehead, and Rexton in the Northern Peninsula, and at Alpena, Afton, Petoskey, Bay Shore, and Charlevoix, and near Omer. No lime is burned in the southern half of the Southern Peninsula. Most of the exposures of limestone are in the northern part of the state relatively distant from large markets and the consequent high transportation charges make it difficult for Michigan operators to compete with lime producers in Ohio, Indiana, and Illinois, situated near cheap coal fuel supplies.

Concrete mortar is more easily and rapidly handled than stone and lime mortar and has largely replaced these materials in the building trades. For similar reasons, gypsum plasters and plaster board have replaced sand lime mortar for plastering.

Most of the lime produced is of the "hot" variety, but considerable mild magnesian lime is burned at Manistique, Marblehead, Petoskey, and Bay Shore. Hydrated lime is produced at Afton, Charlevoix, and Manistique.

The total production in 1915 was 81,359 tons valued at $349,979 as compared with 66,507 tons valued at $287,648 in 1914. This represents a gain of 22.3 per cent in quantity and 21.7 per cent in value. The average price in 1915 was $4.29 per ton, or $.04 less per ton than in 1914.

PRODUCTION AND VALUE OF LIME IN MICHIGAN, 1904-1915.

Year.	Total lime burned.		Average price per ton.	No. of plants operating.	Rank of state. Production.
	Quantity. Tons.	Value.			
1904	63,601	$256,955	$4 04		
1905	48,089	192,844	4 01		
1906	68,133	281,465	4 13	13	
1907	65,822	276,534	4 20	12	16
1908	68,050	282,023	4 14	10	15
1909	83,108	354,135	4 26	12	13
1910	72,345	303,377	4 19	10	14
1911	80,709	352,608	4 37	14	14
1912	74,720	311,448	4 17	11	16
1913	77,088	331,852	4 05	10	14
1914	66,507	287,648	4 33	10	14
1915	81,359	340,979	4 29	10	

*PRODUCTION AND VALUE OF SANDSTONE IN MICHIGAN, 1899-1915.

Year.	Rough building. Value.	Dressed building. Value.	Curbing. Value.	Flagging. Value.	Rubble. Value.	Riprap. Value.	Crushed stone.		Other. Value.	Total. Value.
							Road making. Value.	Concrete. Value.		
1899	$102,447	$51,682	$109	a					$23,800	$178,038
1900	73,850	58,800								132,650
1901	128,909				$26,519	b			19,000	174,428
1902	136,280	25,600			27,393	$800				188,073
1903	80,931	10,365			15,554		$2,050	$3,460		121,350
1904	47,593	14,818			10,857		1,400	400		74,868
1905	64,056	36,035			10,332				12,700	125,123
1906	35,272	18,950			10,403	770				65,395
1907	33,561	10,918		$528	7,900	96				53,003
1908	15,100	18,813			5,190					39,103
1909	12,985	16,805			6,294					36,084
1910	13,312	15,416			2,505					31,233
1911	5,682	2,809			3,068	1,140			286	12,985
1912	c	c			c	c			a	16,438
1913	c	c			c	3,127			c	19,224
1914	d	d			d	d				d
1915	d	d			d	d				d
Totals			$109					$3,860		

a Included under curbing.
b Included under rubble.
c Included in total.
d Figures not given—less than three operators.
*Exclusive of sandstone made into grindstones and scythestones.

SANDSTONE.

The value of the annual production of sandstone in Michigan decreased from $188,073 in 1902 to only $12,983 in 1911. In 1912 and 1913 there were slight increases, the total value of the output in each of these years being $16,438 and $19,224 respectively. In 1914 there was but one operator and in 1915, two, hence no figures on production and value are given.

The decline of the sandstone industry in Michigan may be ascribed (1) to the poor quality of much of the sandstone, (2) to the substitution of concrete in construction work and, (3) to the greater use of brick and artificial stone.

Quarries were formerly operated in Coal Measure sandstones near Ionia and Grand Ledge and at many places in the Marshall sandstone in Calhoun, Hillsdale, Jackson, and Huron Counties. Most of the sandstone in these formations, upon exposure to the weather for a few years, alters uniformly or in spots to an unsightly yellow color. The sandstone near Ionia, however, though soft and friable is streaked and mottled with red, orange, and yellow and makes a pleasing appearance in buildings. Some rubble and riprap incidentally are produced from the Lower Marshall by the Wallace Co. near Port Austin, Huron county.

The production of sandstone for 1915 was derived from the Jacobsville formation, apparently the local equivalent of the Lake Superior or Upper Cambrian sandstone, and from the Lower Marshall. Extensive quarrying operations have been carried on for a number of years near Jacobsville, Houghton county, but the Portage Entry Redstone Co. is now the only active operator. The "redstone" or "brownstone" of the Jacobsville sandstone is well cemented, permanent in color and pleasing in appearance, but the great distance of the beds from markets is a serious obstacle to their development.

Formerly much sandstone was quarried for foundations but now concrete has largely replaced stone for such purposes because of the cheapness of concrete and the rapidity and ease with which it can be handled. Front and fancy brick are relatively cheap and very artistic effects may be obtained by their use. They have largely supplanted stone as a building material, and very probably the sandstone industry in Michigan will not regain its former importance.

GRINDSTONES AND SCYTHESTONES.

Although Michigan ranks second to Ohio in the production of grindstones and scythestones, the latter state produces about eight times as much as Michigan. The "grit" or "grindstone" occurs in the lower part of the Marshall formation in Huron county. The Wallace Company of Port Austin and the Cleveland Stone Company operate quarries at Eagle Mills and Grindstone City respectively, where the gritstone occurs in low-lying and thinly drift covered ledges near the shore of Lake Huron. The surface deposits are removed by stripping, and the stone is cut by channelling machines into square blocks eight feet or more in thickness. These are split with wedges along the bedding planes into thinner slabs which are loaded on cars by derricks, then taken to the mills for sawing into grindstones. The grindstones vary in size from very small ones a foot in diameter up to those seven feet in diameter with a 14-inch face. The broken stone is worked up into various grades of scythestones.

As there are but two producers no tables of production and value can be given.

SAND AND GRAVEL.

PRODUCTION AND VALUE OF SAND AND GRAVEL IN MICHIGAN, 1904-1915.

Year.	Glass sand.		Molding sand.		Building sand.		Fire sand.		Engine sand.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Tons.		Tons.		Tons.		Tons.		Tons.	
1904	.....	.....	167,147	$76,209	69,656	$30,898	.....	.....	.....	.....
1905	.....	.....	19,382	13,247	263,315	148,065	5,000	$2,500	.....	.....
1906	600	$3,000	61,387	26,108	403,199	127,937	.....	.....	4,000	$400
1907	4,300	8,600	54,172	24,190	451,646	157,150	6,000	3,000	1,534	153
1908	17,000	34,000	4,584	2,892	474,238	228,395	.....	.....	1,991	319
1909	65,000	79,000	53,226	20,756	1,090,419	327,247	4,000	2,000	12,415	1,493
1910	16,212	25,675	93,812	24,004	1,151,588	334,336	5,000	3,000	22,270	2,172
1911	*	*	68,878	17,901	833,729	247,997	*	*	25,392	4,447
1912	*	*	152,433	40,145	902,556	294,115	.....	.....	18,575	4,774
1913	*	*	50,763	17,493	1,326,016	415,737	4,542	4,342	4,447	647
1914	26,035	32,593	53,400	36,583	1,088,630	360,152	.....	.....	6,357	1,066
1915	*	*	82,666	25,998	843,887	286,956	4,601	5,751	70,077	2,794
Totals	.....	.....	861,851	$325,616	8,898,899	$2,918,985	.....	.....	167,058	$18,265

Year.	Furnace sand.		Paving sand.		Other sand.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Tons.		Tons.		Tons.	
1904	.....	.....	.....	.....	.....	.....
1905	.....	.....	.....	.....	50,187	$14,476
1906	5,000	$2,500	.....	.....	51,005	12,140
1907	3,858	3,133	.....	.....	173,724	12,187
1908	3,329	3,828	.....	.....	29,187	6,850
1909	3,183	3,660	.....	.....	295,612	50,953
1910	3,185	4,924	.....	.....	372,880	57,385
1911	*	*	152,144	$20,650	114,801	52,005
1912	.....	.....	68,453	16,898	130,624	54,746
1913	†	†	533,261	108,328	113,318	20,342
1914	†	†	320,322	74,866	115,291	107,392
1915	.....	.....	131,466	14,021	111,105	12,248
Totals	.....	.....	1,205,646	$249,763	.....	.....

Year.	Railroad ballast.		Gravel.		Total.		Rank.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Tons.		Tons.		Tons.		Tons.	
1904	.....	.....	.....	.....	236,803	$107,197	.....	.....
1905	.....	.....	76,625	$32,321	414,509	210,609	10	11
1906	.....	.....	72,598	23,614	597,789	197,699	12	13
1907	.....	.....	329,407	81,182	1,024,641	280,595	10	11
1908	.....	.....	312,262	94,081	842,591	370,365	8	9
1909	.....	.....	695,902	200,523	2,219,757	685,632	8	8
1910	.....	.....	1,197,791	364,841	2,862,738	816,337	7	8
1911	.....	.....	935,072	203,218	2,185,165	565,969	9	10
1912	.....	.....	1,409,180	407,925	2,681,821	818,603	9	8
1913	.....	.....	3,928,874	915,205	6,422,818	1,528,892	4	5
1914	7,565	$781	2,140,359	530,338	3,757,979	1,143,771	8	7
1915	.....	.....	2,457,094	671,970	3,776,726	1,036,739	.....	.....
Total	.....	.....	13,555,164	$3,527,218	27,123,337	$7,771,408	.....	.....

*Included under other sand. †Included under fire sand.

Michigan has very large sand and gravel resources. The most important deposits occur in the form of ridges known as "hogbacks" or eskers, in irregular hills, called kames, in out-wash plains and deltas, and in old beach ridges, features resulting from the last glacial invasion. Only a small portion of the sand and gravel resources have been developed. The chief developments are in the vicinity of cities, in river channels, and along the shores of the Great Lakes where means of transportation are favorable. Large pits are locally developed in building state award roads. The chief localities and counties in order of importance are: Detroit and St. Clair rivers and Kent, Washtenaw, Macomb, Ingham, Livingston, Manistee, Oakland, Berrien, Jackson, Kalamazoo, and Calhoun counties.

In 1915 Michigan produced 3,776,726 tons of sand and gravel valued at $1,036,739. This represents a gain of 18,747 tons and a loss of $107,032 in value. The chief increases in quantity were in glass and molding sand, engine sand, and gravel and the chief losses in building sand and paving sand. There were but two producers of glass sand in 1915, hence figures of production and value are not given.

SALT.

PRODUCTION AND VALUE OF SALT IN MICHIGAN AND UNITED STATES, 1860-1915.

Year.	U. S. production. Quantity, bbls.	Michigan production.		Per cent of total. Michigan.	Quantity.	Value. Michigan.	Michigan.	
		State Salt Inspectors.* Quantity, bbls.	U. S. G. S.† Quantity, bbls.				Rank. Value.	Price, bbl.
1860	.....	4,000	.....	.....	.....	.....	.....	.....
1861	.....	125,000	.....	.....	.....	.....	.....	.....
1862	.....	243,000	.....	.....	.....	.....	.....	.....
1863	.....	466,000	.....	.....	.....	.....	.....	.....
1864	.....	529,073	.....	.....	.....	.....	.....	.....
1865	.....	477,200	.....	.....	.....	.....	.....	.....
1866	.....	407,997	.....	.....	.....	$734,395	.....	$1.80
1867	.....	474,721	.....	.....	.....	840,255	.....	1.77
1868	.....	555,690	.....	.....	.....	1,028,027	.....	1.85
1869	.....	561,288	.....	.....	.....	786,835	.....	1.38
1870	.....	621,352	.....	.....	.....	820,185	.....	1.32
1871	.....	728,175	.....	.....	.....	1,063,135	.....	1.46
1872	.....	724,481	.....	.....	.....	1,057,742	.....	1.46
1873	.....	821,346	.....	.....	.....	1,127,984	.....	1.37
1874	.....	1,026,970	.....	.....	.....	1,220,094	.....	1.19
1875	.....	1,081,856	.....	.....	.....	1,190,042	.....	1.10
1876	.....	1,482,729	.....	.....	.....	1,556,865	.....	1.05
1877	.....	1,660,997	.....	.....	.....	1,411,847	.....	0.85
1878	.....	1,855,884	.....	.....	.....	1,577,501	.....	0.85
1879	.....	2,058,040	.....	.....	.....	2,099,200	.....	1.02
1880	5,961,060	2,676,588	2,485,177	41.69	1	2,271,931	.....	0.75
1881	6,200,000	2,750,299	.....	44.35	1	2,418,171	.....	0.85
1882	6,412,373	3,037,317	3,037,317	47.36	1	2,126,122	.....	0.70
1883	6,192,231	2,894,672	2,894,672	46.74	1	2,344,684	.....	0.81
1884	6,514,937	3,161,806	3,161,806	48.53	1	2,392,648	.....	0.757
1885	7,038,653	3,297,403	3,297,403	46.84	1	2,967,663	.....	0.900
1886	7,707,081	3,667,257	3,667,257	47.58	1	2,426,989	.....	0.661
1887	8,093,962	3,944,309	3,944,309	49.17	1	2,291,842	.....	0.581
1888	8,055,881	3,866,228	3,866,228	47.99	1	2,261,743	.....	0.585
1889	8,005,565	3,846,979	3,856,929	48.17	1	2,088,909	.....	0.541
1890	8,776,991	3,838,637	3,838,632	43.72	¶	2,302,579	.....	0.600
1891	9,087,945	3,927,671	3,966,748	39.52	1	2,037,289	.....	0.513
1892	11,698,890	3,812,504	3,829,478	32.81	1	2,046,963	.....	0.523
1893	11,897,208	3,514,485	3,057,898	25.70	2	888,837	.....	0.287
1894	12,968,417	3,138,941	3,341,425	26.53	2	1,243,619	.....	0.375
1895	13,669,649	3,529,362	3,343,395	24.46	2	1,048,251	.....	0.315
1896	13,850,726	3,336,242	3,164,238	22.80	2	718,408	.....	0.229
1897	15,973,202	3,622,764	3,993,225	24.99	2	1,243,619	.....	0.313
1898	17,612,634	4,171,916	5,263,564	29.88	2	1,628,081	.....	0.311
1899	19,708,614	4,732,669	7,117,382	36.14	2	2,205,924	.....	0.309
1900	20,869,342	4,738,085	7,210,621	34.55	2	2,033,731	2	0.282
1901	20,566,661	5,580,101	7,729,641	37.58	1	2,437,677	1	0.328
1902	23,849,231	4,994,245	8,131,781	34.10	2	1,535,823	2	0.188
1903	18,968,089	4,387,982	4,297,542	22.65	2	1,119,984	2	0.260
1904	22,030,002	5,390,812	5,425,904	24.62	2	1,579,206	2	0.309
1905	25,966,122	5,671,253	9,492,173	35.24	1	1,851,332	2	0.196
1906	28,172,380	5,644,559	9,936,802	36.31	1	2,018,760	2	0.203
1907	29,704,128	6,298,463	10,786,630	35.39	1	2,231,129	2	0.208
1908	28,822,062	6,247,073	10,194,279	35.34	1	2,458,303	1	0.241
1909	30,107,646	6,055,661	9,966,744	33.10	1	2,732,556	1	0.274
1910	30,305,656	5,597,276	9,452,022	31.18	2	2,231,262	2	0.236
1911	31,183,968	.....	10,320,074	33.10	2	2,633,155	1	0.255
1912	33,324,808	.....	10,946,739	32.84	1	2,974,426	1	0.277
1913	34,393,227‡	.....	11,528,800	33.52	1	3,293,052	1	0.285
1914	34,402,772	.....	11,670,976	33.92	1	3,299,005	1	0.283
1915	.....	.....	12,588,788	.....	1	4,304,731	1	0.342
Total	.....	.....	221,806,600	.....	.....	$94,202,404	.....	.....

*Office of State Salt Inspector abolished in 1911.
†In cooperation with the Michigan Geological Survey after 1909.
‡Includes production of Porto Rico.

The amount and value of salt produced in Michigan in 1915 were greater than any previous year. The total quantity produced in 1915 was 12,588,788 barrels or 917,812 barrels more than in 1914. The value in 1915 was $4,304,731 or nearly $1,015,726 more than in 1914. The large gain was due not only to the increase in production but to a considerably higher average price per barrel. The average price in 1915 was $0.342 per barrel or $0.039 more than in 1914. Since 1905 the average price per barrel has risen from $0.196 per barrel to $0.342 per barrel.

From 1880 to 1892, Michigan held first rank in the United States in amount of production. In 1893, New York took first rank and held it continuously, with the exception of 1901, until 1905 when Michigan regained the leadership. Michigan has since held first rank with the exception of the years 1910 and 1911.

PRODUCTION AND VALUE OF SALT IN MICHIGAN BY GRADES, 1906-1915.

Year.	Table and dairy.		Packers.			
			Common fine.		Common coarse.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Barrels.		Barrels.		Barrels.	
1906	509,905	$362,368	2,927,478	$757,470	2,021,287	$618,727
1907	657,509	392,641	3,601,270	914,154	1,743,840	471,378
1908	584,452	620,647	3,454,062	968,617	2,020,956	610,286
1909	585,370	732,907	3,530,303	1,125,095	2,103,719	647,878
1910	708,434	565,653	2,216,181	734,828	1,992,465	596,301
1911	817,486	742,702	2,362,075	698,208	2,070,745	743,720
1912	905,503	920,782	2,225,337	645,692	2,686,492	835,673
1913	1,028,900	1,037,402	2,704,936	852,135	2,259,164	896,521
1914	1,092,344	1,025,164	2,668,989	911,016	2,380,378	870,715
1915	1,233,117	1,420,382	3,096,644	1,181,337	2,265,352	1,001,167

Year.	Packers.		Other rock, etc.		Brine and other.*	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Barrels.		Barrels.		Barrels.	
1906	91,698	$33,733	.....	.....	4,387,043	$246,462
1907	119,459	48,455	.....	.....	4,664,552	235,729
1908	134,726	53,669	.....	.....	3,991,083	205,084
1909	93,357	3,983	.....	.....	3,648,395	185,051
1910	92,426	43,942	.....	.....	4,104,934	211,317
1911	105,401	45,421	576,595	$181,865	4,387,772	219,244
1912	223,866	84,638	763,908	250,680	4,737,038	236,852
1913	50,557	25,271	727,364	244,172	4,756,779	237,431
1914	†	†	712,530	252,024	4,816,735	240,086
1915	.....	.....	.....	.....	5,073,940	380,491

Year.	Total.	
	Quantity.	Value.
	Barrels.	
1906	9,936,802	$2,018,760
1907	10,786,630	2,062,357
1908	10,194,270	2,458,303
1909	9,966,744	2,732,556
1910	9,452,022	2,231,262
1911	10,320,074	2,633,153
1912	10,946,730	2,074,429
1913	11,528,800	3,293,032
1914	11,670,976	3,299,005
1915	12,588,788	4,304,731

*Brine only after 1910.
†See common fine and common coarse after 1913.

The center of the salt industry in Michigan thirty years ago was in Saginaw valley, especially along Saginaw river from Saginaw to Bay City. The industry was carried on in connection with the saw mills. More than 100 mills utilized their waste steam and fuel in evaporating natural brine obtained from the Upper Marshall sandstone. With the decline of the lumber industry in Saginaw valley, the salt industry has become relatively unimportant.

The chief salt producing districts are along the Detroit-St. Glair rivers and at Ludington and Manistee. In these districts artificial brines are obtained by forcing water through casings down to the salt beds and then back to the surface.

In 1915, Wayne county produced 6,977,500 barrels of salt valued at $1,088,507, or less than $0.16 per barrel. Much of the brine is used directly in the manufacture of soda ash, black caustic, etc., and this accounts for the abnormally low price of the salt per barrel. In 1915, St. Glair county produced 2,429,889 barrels of salt valued at $1,899,712, or over $0.78 per barrel. In this county, a large part of the product is table and dairy salt and this accounts for the abnormally high average price.

Rock salt is mined by the Detroit Rock Salt Co. at Oakwood, a small suburb on the west side of Detroit. The salt is obtained from a 20-foot bed at the depth of 1,040 feet. Much of the product is used in curing meats, fish, hides, and in the manufacture of ice cream.

In the Manistee-Ludington district, salt is made at Manistee and Filer City, Manistee county and at Ludington, Mason county. In this district, the salt is still made largely by the waste steam from lumber mills.

In 1915, this district produced 2,725,533 barrels of salt valued at $1,109,237 or about $0.246 per barrel. Most of the product is of the common fine and common coarse grades. Only one company produces table and dairy salt.

Bromine and bromides are produced from natural brines from the Marshall formation at Midland and Mt. Pleasant, and calcium chloride at Mt. Pleasant and Saginaw.

PRODUCTION AND VALUE OF SALT IN MICHIGAN BY COUNTIES IN 1915.

County.	Table and dairy.		Packers.			
			Common fine.		Common coarse.	
	Barrels.	Value.	Barrels.	Value.	Barrels.	Value.
Bay, Isabella, Mason, Midland	*	*	974,236	$362,185	734,763	$338,933
Manistee	.....	.....	382,763	124,486	589,986	258,824
Saginaw	*	*	394,809	184,473	9,210	4,438
St. Clair	956,117	$1,251,436	934,394	401,292	497,728	234,006
Wayne	237,597	138,581	410,442	108,901	433,665	164,066
Total, barrels.	1,233,117	$1,420,382	3,096,644	$1,181,337	2,265,352	$1,001,167
Tons	172,636	.....	433,530	.....	317,149	.....

County.	Other grades.		Rock salt.		Brine.	
	Barrels.	Value.	Barrels.	Value.	Barrels.	Value.
Bay, Isabella, Mason, Midland	37,650	$10,824	.....	.....	*	*
Manistee	*	*	.....	.....	*	*
Saginaw	10,754	1,440	.....	.....	*	*
St. Clair	*	*	.....	.....	*	*
Wayne	22,428	8,309	*	*	*	*
Total, barrels.	113,148	$32,806	*	*	5,073,940	$380,491
Tons	15,841	.....	*	*	710,352	.....

County.	Total.		Quantity, per cent.	Value, per cent.
	Barrels.	Value.		
Bay, Isabella, Mason, Midland	1,786,027	$742,247	12.18	11.78
Manistee	980,377	383,639	8.92	12.80
Saginaw	414,995	190,626	3.40	5.79
St. Clair	2,429,889	1,899,712	19.00	42.88
Wayne	6,977,500	1,088,507	56.50	26.75
Total, barrels.	12,588,788	$4,304,731	.....	.....
Tons	1,762,430	.....	.....	.....

*Included in total.

CEMENT.

Growth of Industry.

Less than 1,000,000 barrels of Portland cement were made in the United States in 1895, a little more than a fifth of the present production of Michigan. In 1895, the rotary kiln, using powdered coal as a fuel, was successfully introduced, and inaugurated the present era of concrete construction. Growth from 1895 to 1907 was

phenomenal, the production in the latter year nearly reaching 48,000,000 barrels. The financial depression of 1907 caused a temporary check, but growth was resumed the following year and continued almost uninterruptedly up to 1913 when the maximum of 88,689,377 barrels were produced. Over production in 1913 followed by general business depression in 1914 caused decreases in production for 1914 and 1915, the total production being respectively 86,437,956 and 85,914,907 barrels.

A vertical kiln plant was erected near Kalamazoo, Michigan, as early as 1878 for manufacturing cement from marl and clay. The enterprise failed in 1892 because of the high cost of production. The Peerless Portland Cement Co., in 1896, erected a vertical kiln plant at Union City, Branch county, and began the successful manufacture of cement from marl and shale. By 1902, however, rotary kilns replaced the old vertical types. In 1897 the Bronson Portland Cement Co. erected a plant at Bronson, Branch county, and next year the Coldwater Portland Cement Co., now the Wolverine Portland Cement Co., built a plant at Coldwater and Quincy, also in Branch county.

The "boom" years of the Portland Cement industry in Michigan were between 1899 and 1901, twenty companies being organized in this period for the manufacture of cement from marl. Some companies made very elaborate plans but never got beyond that stage. Only ten reached the productive stage and but five are now in operation. Since 1896, thirty-four different cement plants have been projected or built in Michigan. Twelve are now in operation.

Raw Materials.

In Michigan, the principal raw materials for the manufacture of Portland cement are marl and limestone, and clay and shale. A small quantity of gypsum is also used. The early companies planned to use marl and clay or shale. Limestone has been substituted for marl by some of the companies on account of the great increase in kiln capacity secured through its use. Of eleven plants, seven are using marl and clay and four limestone and shale or clay.

The following table shows that Michigan produced 4,765,295 barrels in 1915 as compared with 4,285,345 barrels in 1914, an increase of 479,949 barrels. Shipments increased from 4,218,429 barrels in 1914 to 4,727,768 barrels in 1915, a gain of 509,339 barrels. Both production and shipments were the largest in the history of the industry in Michigan. The value of cement sold in 1915 was $4,454,608, as against $4,064,781 in 1914, a gain of $389,827. The average price in 1915 was $0.942 per barrel or $0.022 per barrel lower than in 1914.

PRODUCTION, VALUE, ETC., OF PORTLAND CEMENT IN MICHIGAN AND UNITED STATES, 1896-1915.

Year.	No. of plants in operation.	Michigan Rank.	No. of kilns, Rotary.	Daily capacity, Bbls.	Michigan, Cement made, Bbls.	U. S., Cement made, Bbls.	Michigan, per cent made.	*Change per cent cement made.	Michigan, Cement shipped, Bbls.	Michigan, Cement shipped, Value.	U. S., Cement shipped, Value.	Michigan, per cent of value.	Michigan, stock on hand Dec. 31, Bbls.	Michigan, average price per barrel.	U. S., average price per barrel.
1896	1	..	..	..	4,000	1,543,923	0.25	..	..	$7,000	$2,424,011	0.29	..	$1.75	$1.57
1897	2	..	..	..	15,000	2,677,775	0.56	275.0	..	26,250	4,315,893	0.6	..	1.75	1.61
1898	3	..	..	..	77,000	3,692,384	2.11	413.3	..	134,750	5,070,773	2.6	..	1.747	1.62
1899	4	8	..	..	343,566	5,652,266	6.1	346.2	..	533,840	8,074,371	6.36	..	1.492	1.43
1900	6	2	..	..	664,750	8,482,620	7.8	93.4	..	830,900	9,280,525	8.9	..	1.25	1.09
1901	10	3	..	..	1,025,718	12,711,225	8.0	54.1	..	1,128,290	12,532,360	9.0	..	1.10	0.99
1902	10	3	..	..	1,577,006	17,230,644	9.1	53.7	..	2,134,396	20,864,078	10.2	..	1.353	1.21
1903	13	3	..	..	1,955,193	22,342,978	8.7	23.0	..	2,674,780	27,713,319	9.7	..	1.367	1.24
1904	16	4	..	..	2,247,160	26,505,851	8.5	14.9	..	2,365,656	28,355,119	10.1	..	1.052	0.88
1905	16	5	..	..	2,773,283	35,246,812	7.9	23.4	..	2,921,597	33,245,867	8.7	..	1.055	0.94
1906	14	6	..	..	3,747,525	48,463,424	8.06	35.5	..	4,814,065	52,466,186	9.2	..	1.284	1.13
1907	14	6	..	..	3,572,688	48,785,390	7.3	-4.6	..	4,384,731	53,092,551	8.1	..	1.227	1.11
1908	15	7	..	..	2,892,576	51,072,612	5.6	-19.0	..	2,556,215	43,547,679	5.8	..	0.883	0.85
1909	12	7	..	..	3,212,751	64,991,431	4.9	11.0	..	2,619,259	52,858,354	4.9	..	0.815	0.813
1910	12	8	..	..	3,687,719	76,549,951	4.8	11.7	..	3,378,940	68,205,800	4.9	..	0.916	0.891
1911	11	8	96	22,400	3,680,716	78,528,657	4.69	-0.03	..	3,024,676	66,248,817	4.56	506,758	0.82	0.843
1912	11	8	92	19,450	3,404,621	82,438,996	4.23	-5.21	3,651,094	3,185,093	69,109,800	4.55	370,956	0.861	0.813
1913	11	8	83	19,000	4,180,256	92,097,131	4.21	19.79	4,081,281	4,228,879	88,689,377	4.77	473,563	1.036	1.005
1914	11	7	77	19,100	4,285,345	88,230,170	4.85	2.87	4,218,429	4,064,781	80,437,956	4.70	538,846	0.964	0.927
1915	11	7	71	20,800	4,765,294	85,914,907	5.55	11.2	4,727,768	4,454,608	86,891,681	5.11	576,222	0.942	0.86

*Minus sign indicates decrease.

GYPSUM.

The annual production of gypsum in Michigan from 1868 to 1890 never reached 75,000 tons. The growth of the industry began in 1891, and the production reached 139,557 tons in 1892. The financial depression in the United States in 1892-3 caused a decrease in the production to only 66,519 tons in 1895. Growth was resumed the following year and in 1899 the production reached 144,776 tons. From 1899 to the present the growth has been almost uninterrupted. The maximum production of 423,896 tons was attained in 1913. The production decreased to 393,006 in 1914, and to 389,791 in 1915.

The growth of the industry is chiefly due to the invention of wall plaster, plaster board, fire-proofing, calcimines, and various cements. From 1869 to 1887, more than 50 per cent of the mine product was ground for land plaster. Since 1887, the grinding of land plaster has become relatively unimportant in comparison with the manufacture of other gypsum products. Land plaster formed but 2.5 per cent of the total production in 1915.

In 1915 there were 8 mines and 8 mills in operation. Seven mines and mills were located near Grand Rapids and one mine and mill at Alabaster, Arenac county.

Three gypsum beds are worked in Kent county. The two upper beds, respectively 6 and 12 feet in thickness, are near the surface. The first is quarried and the second is both quarried and mined. The third bed about 22 feet thick, is about 60 feet below the second, and is mined. At Alabaster, the gypsum bed is from 18 to 23 feet thick and is quarried on an extensive scale.

A higher bed has been discovered south of Alabaster in the vicinity of Turner, Twining, and the deserted village of Harmon City, Arenac county. It is from 50 to 100 feet above the Alabaster bed. This bed is known as the Turner bed and appears to be from 5 to 22 feet thick. Test holes north of Alabaster show the presence of a number of deeper gypsum beds from 5 to 25 feet in thickness. Thick gypsum beds are reported by well drillers at Ionia, Ionia county, and near Cass City, Tuscola county. Beds 6 to 12 feet in thickness were struck in shallow wells at Bellevue and Eaton Rapids, Eaton county. Gypsum was formerly quarried on the west side of St. Ignace peninsula.

Gypsum also occurs on the east side of the peninsula and on St. Martin's Island.

For a more complete report on the gypsum industry in Michigan, the reader is referred to Publication 19, (Geol. Ser. 16) Mineral Resources for 1914.

PRODUCTION OF GYPSUM IN MICHIGAN, 1868-1915.

Year.	Ground into land plaster. Tons.	Gypsum calcined into plaster. Tons.	Sold crude. Tons.	Total production. Tons.	Total value.	Rank. Quantity.	Rank. Value.
Before 1868.	132,043	14,285	.....	146,328	$671,022	.....	.....
1868	28,837	6,244	.....	35,081	165,208	.....	.....
1869	29,996	7,355	.....	37,351	178,824	.....	.....
1870	31,437	8,246	.....	39,683	191,718	.....	.....
1871	41,126	8,694	.....	49,820	234,054	.....	.....
1872	43,536	10,673	.....	54,209	259,524	.....	.....
1873	44,972	14,724	.....	59,696	297,678	.....	.....
1874	39,126	14,723	.....	53,849	274,284	.....	.....
1875	27,019	10,914	.....	37,933	195,386	.....	.....
1876	39,131	11,498	.....	50,629	248,504	.....	.....
1877	40,000	9,819	.....	49,819	238,550	.....	.....
1878	40,000	8,634	.....	48,634	229,070	.....	.....
1879	43,658	9,070	.....	52,728	247,192	.....	.....
1880	49,570	18,929	.....	68,499	349,710	.....	.....
1881	33,178	20,145	.....	53,323	293,872	.....	.....
1882	37,821	24,136	.....	61,957	344,374	.....	.....
1883	40,082	28,410	.....	68,492	377,567	.....	.....
1884	27,888	27,959	.....	55,847	335,382	.....	.....
1885	28,184	25,281	.....	53,465	286,802	.....	.....
1886	29,373	27,370	.....	56,748	308,094	.....	.....
1887	28,794	30,376	.....	59,170	329,392	.....	.....
1888	22,177	35,125	.....	57,302	347,531	.....	.....
1889	19,823	36,800	.....	56,623	353,869	.....	.....
1890	12,714	47,163	15,000	74,877	192,099	.....	.....
1891	15,100	53,600	11,000	97,700	223,725	.....	.....
1892	14,458	77,599	47,500	139,557	306,527	.....	.....
1893	16,263	77,327	31,000	124,590	303,921	.....	.....
1894	11,982	47,976	20,000	79,958	189,620	.....	.....
1895	9,003	51,028	6,488	66,519	174,007	.....	.....
1896	6,582	60,352	700	67,634	146,424	.....	.....
1897	7,193	71,680	16,001	94,874	193,576	.....	.....
1898	13,345	77,852	1,984	93,181	204,310	.....	.....
1899	17,196	88,315	39,266	144,776	283,537	.....	.....
1900	10,354	86,972	33,328	129,654	285,119	2	2
1901	9,808	129,256	46,086	185,150	267,243	1	1
1902	13,022	158,320	68,885	240,227	459,621	1	1
1903	18,409	198,119	52,565	269,093	700,912	1	1
1904	18,294	185,422	34,669	238,385	541,197	1	1
1905	20,285	203,313	24,284	247,882	634,434	1	2
1906	30,220	208,715	27,517	341,716	753,878	1	2
1907	15,500	197,666	36,543	317,261	681,351	3	3
1908	11,414	192,403	40,324	327,810	491,928	1	3
1909	11,890	344,171	45,781	394,907	1,213,347	2	1
1910	7,097	240,905	64,566	357,174	667,199	2	2
1911	15,548	206,299	79,050	347,296	523,926	3	4
1912	10,103	243,656	63,819	384,297	621,547	2	3
1913	9,604	278,368	60,706	423,806	721,325	3	3
1914	9,322	249,648	61,227	393,006	705,841	3	3
1915	9,799	245,484	69,572	389,791	686,309	.....	.....
Totals	1,242,276	4,431,119	997,861	7,284,367	$18,931,620	.....	.....

PRODUCTION OF GYPSUM IN MICHIGAN, 1911-1915.

Year.	Crude gypsum mined.	Gypsum sold crude. To Portland cement mills.		As land plaster.		For other purposes.		Total sold crude.	
	Quantity.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Tons.	Tons.		Tons.		Tons.		Tons.	
1911	347,296	63,489	$69,497	15,548	$15,706	13	$52	79,050	$85,255
1912	384,297	53,711	52,420	10,103	9,375	5	50	63,819	61,845
1913	423,806	*	*	9,604	10,222	10,320	9,011	60,706	55,969
1914	393,006	*	*	9,322	10,761	.....	.....	61,227	51,242
1915	389,791	*	*	9,799	9,894	*	*	69,572	63,236

Year.	Gypsum sold calcined. As mixed wall plaster.		As plaster of Paris, etc.		As stucco.		As dental plaster.		To plate glass works.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Tons.		Tons.		Tons.		Tons.		Tons.	
1911	146,920	$381,362	47,989	$88,168	.....	.....	20	$110	11,370	$19,031
1912	146,099	368,676	937	3,229	82,010	$168,734	3	12	6,214	8,078
1913	166,711	437,720	*	*	95,402	202,675	*	*	*	*
1914	163,972	475,038	*	*	83,780	173,172	*	*	.....	.....
1915	155,861	426,432	*	*	80,172	177,317	*	*	*	*

*Included in total.

PRODUCTION OF GYPSUM IN MICHIGAN, 1911-1915.—*Concluded.*

Year.	Gypsum sold calcined. For other purposes.		Total sold calcined.		Total value.	Kettles in mill. No.	Kettles in mill. Size.	Daily capacity of mill. 24 hrs.	Shifts run by mills during year. Total No.	Shifts run by mills during year. Hrs. in shift.	No. mines and quarries.	No. mills.
	Quantity.	Value.	Quantity.	Value.								
	Tons.		Tons.					Tons.				
1911	.....	.....	206,299	$488,671	$573,926	29	8 x 10	2,200+	.....	.....	8	8
1912	8,393	$10,973	243,656	559,792	621,547	28	8 x 10	2,140	1,850	11	6	8
1913	9,897	15,850	278,368	665,356	721,325	28	8 x 10	1,785	1,368	11	7	8
1914	1,811	5,433	249,648	654,599	705,841	28	8 x 10	1,860	2,043	11	8	8
1915	*	*	245,484	623,073	686,309	26	.....	.....	.....	.....	8	8

*Included in total.

CLAY.

The clays of Michigan are of three general classes, viz.: (1) morainic or drift clays (2) lake clays and (3) river silts. Deposits of kaolin or china clays are not known in Michigan and the chances for the occurrence of commercial deposits of such clays appear to be small. Deposits of kaolin have been reported at various places in the Northern Peninsula, but these as far as investigated, proved to be white or calcareous lake clays of the slip variety. The morainic clays—boulder and till clays, are always calcareous, some of them being very high in lime. The lake clays are generally less calcareous but locally, as in limestone areas, they may contain a large percentage of lime. The river silts are the least calcareous but they are usually gritty. On account of the high content of lime most of the clays burn white. In many beds, however, there is an upper portion relatively free from lime which burns red, and a lower one very high in lime which burns white or cream color. The absence of lime in the upper portion is due to leaching.

The morainic or drift clays contain pebbles, and boulders hence the name "boulder clay," and locally lime concretions. Screening and washing have been resorted to in some cases but the extra expense is generally prohibitive except in districts where good clays are wanting or where the clays possess exceptional burning qualities. The lake clays are comparatively free from pebbles and coarse sand but some contain much very fine grit. These clays are generally suitable for making common brick and tile. There are inexhaustible supplies of such clays in the eastern portion of the Southern Peninsula from Arenac county south to the Ohio boundary. Large areas of lake clays also occur in Chippewa and Ontonagon counties.

The morainic or boulder clays have been developed for the manufacture of common brick and tile at many places in the state but generally on a small scale. The lake clays in the vicinity of West Detroit have been developed very extensively for making common brick. Important developments have also been made near Paines and West Saginaw, Saginaw county, and at numerous places in Lenawee, Monroe, and Macomb counties.

In Ontonagon county some of the clays are of the slip variety and are suitable for glazing pottery. A deposit of slip clay is also reported near Harriette, Wexford county.

Most of the surface clays in Michigan are low grade and generally the mining of such clays is merely incidental to the manufacturing of common brick and tile. Nearly all of the clay sold as clay in Michigan is slip clay. It is mined chiefly near Rockland, Ontonagon county, and shipped to potteries in Ohio and other states for glazing. The great distance of the beds from the centers of the pottery industry is an effective obstacle in retarding development. In some years a small amount of clay is sold for medicinal purposes.

PRODUCTION OF CLAY IN MICHIGAN, 1910-1915.

Year.	Slip clay.		Brick clay.		Miscellaneous clay.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Tons.		Tons.		Tons.		Tons.	
1910	1,363	$3,880	60	$105	1	$400	1,424	$4,394
1911	1,744	5,000	18	32	2	150	1,764	5,272
1912	2,034	6,164	.....	.....	9	9	2,043	6,173
1913	1,710	6,504	.....	.....	.....	.....	1,710	6,504
1914	1,463	4,572	.....	.....	.....	.....	1,463	4,572
1915	1,198	3,805	*	*	*	*	3,142	5,605
Total	.....	.....	.....	.....	.....	.....	11,546	$32,520

*Included in total.

POTTERY.

From 1899 to 1904, the development of the pottery industry in Michigan was erratic, the total value increasing from $29,741 in 1899 to $83,098 in 1902 and then decreasing to only $40,621 in 1904. Since then the industry has made a substantial growth every year and the value in 1915 was the largest in the history of the industry. In 1909, the total value was $95,439 and in 1915, $521,989, or over five times that of 1909. The largest gain was made in 1915, the value increasing from $265,194 to $521,989, a gain of 96.7 per cent.

The products are chiefly flower pots, white ware, and porcelain electrical supplies. Of six firms, three, the Detroit Flower Pot Co., Anton Hupprich of Detroit, and the Ionia Pottery Co., manufacture flower pots almost exclusively. The Jeffery-DeWitt Co., of Detroit, manufactures various porcelain products—sanitary ware, insulators, tumbling jars, crucibles, etc. The Mount Clemens Pottery Co., Macomb county, manufactures decorated ware.

The clays used for the manufacture of flower pots are obtained from Michigan but those used for porcelain electrical supplies and white ware are imported from other states or countries.

VALUE OF POTTERY PRODUCTS IN MICHIGAN, 1899-1915.

Year.	Rank of state.	No. firms.	Red earthenware, value.	Porcelain electrical supplies, value.	C. C. ware, value.	Miscellaneous, value.	Total value.	Gain per cent.	Per cent. of total product in U. S.
1899	18	4	$29,641	.....	$100	.....	$29,741	.....	.17
1900	17	4	34,317	.....	.....	.....	34,317	15.4	.17
1901	16	5	42,465	.....	.....	$2,400	44,865	30.2	.20
1902	14	4	44,098	.....	.....	39,000	83,098	87.4	.41
1903	19	4	42,007	.....	.....	6,000	48,007	−42.2	.19
1904	17	4	40,621	.....	.....	3,000	43,621	−9.1	.17
1905	15	5	*	.....	*	7,000	45,961	4.5	.16
1906	12	6	43,510	.....	.....	7,600	51,110	11.2	.16
1907	16	6	54,474	.....	.....	7,100	61,574	18.5	.20
1908	16	6	54,650	.....	.....	7,750	62,400	1.5	.25
1909	13	5	60,939	.....	.....	34,500	95,439	52.9	.31
1910	13	6	90,450	*	.....	13,300	112,607	18.1	.33
1911	13	6	80,580	*	*	*	130,490	15.8	.38
1912	10	6	99,555	*	.....	*	194,892	49.3	.53
1913	10	5	65,000	*	.....	*	222,133	20.8	.59
1914	9	5	106,452	*	*	*	265,194	33.0	.75
1915	8	6	112,863	*	*	*	521,989	96.7	1.40
Totals	.....	.....	.....	.....	.....	.....	$2,047,537	.....	.....

*Included in the total.

BRICK AND TILE PRODUCTS.

Raw materials. Most of the surface clays (see Clay) in Michigan are of low grade and of three general classes, (1) morainic or drift clays, (2) lake clays, and (3) river silts. The morainic clays are usually calcareous, generally containing from 10 to 15 per cent of lime. They, also contain sand, pebbles and boulders, hence the name boulder clay. Due to their sandy or calcareous nature, most of the clays are adapted for making common brick and tile or low grade pottery. The high lime content causes most of the clays to burn white or cream colored. In some places, leaching has removed the lime to the depth of a few feet and clay from this surface portion burns red.

Exposures of clay or shale beds suitable for the manufacture of fire, vitrified and front brick, vitrified tile, fire-proofing and other higher grade products are not abundant. Near Rockland, Ontonagon county, some of the lake clays belong to the slip varieties and are used for glazing pottery. At Grand Ledge, Jackson, Corunna, near Bay City and Flushing, shales belonging to the coal measures have been utilized for vitrified and front brick, vitrified tile, sewer pipe, conduits, fire-proofing, etc. A project for the manufacture of front brick from Coal Measure shales is now under way at Williamston. The Baker Clay Products Co., at Grand Ledge have a modern plant equipped with continuous kilns and have begun the manufacture of front brick.

Production. In 1915, the value of brick and tile products in Michigan was $2,248,068, exclusive of pottery, as compared with $2,434,872 in 1914. This represents a decrease of $186,804 or 7.6 per cent. The quantity of common brick increased from 269,154,000 in 1914 to 277,399,000 in 1915, a gain of 3.7 per cent. The value however, decreased from $1,633,216 in 1914 to $1,461,188, a loss of $172,028 or 10.5 per cent. The average price of common brick in 1915 was only $5.23 as against $6.07 in 1914. The value of drain tile decreased from $421,941 in 1914 to $305,156, a loss of $126,785 or 30 per cent. The cause of the decreases in many of the smaller plants was the abnormally wet season, which prevented operation.

The manufacture of common brick has made great development in the vicinity of Detroit where extensive beds of suitable lake clays occur.

In 1915, of a total of 277,399,000 common brick, 225,015,000 were made in Wayne county. Drain tile is next to common brick in importance with a reported value of $305,156. Sewer pipe is manufactured on a large scale at Grand Ledge and Jackson, but there are only two producers, hence no figures of production and value are given. Grand Ledge is also the chief center in the state for the production of drain tile. The manufacture of front brick in Michigan is in its infancy but with one new plant in operation at Grand Ledge and another being promoted at Williamston, the industry bids fair to become an important one. This will meet a great need in the state, since large quantities of front brick are annually imported from bordering states.

ANNUAL PRODUCTION OF BRICK AND TILE PRODUCTS IN MICHIGAN, 1899-1915.

Year.	Common brick.		Average price per M.	Front brick.		Average price per M.	Vitrified brick.		Average price per M.	Fire brick.		Average price per M.
	Quantity.	Value.		Quantity.	Value.		Quantity.	Value.		Quantity.	Value.	
1899	200,144,000	$933,176	$4 66	4,290,000	$58,920	$13 73	*	*	.....	.....	.....	.....
1900	189,492,000	963,390	4 77	8,421,000	48,411	5 75	*	*	$12 42	.....	.....	.....
1901	215,836,000	1,095,254	5 07	9,476,000	64,031	6 76	*	*	12 30	.....	.....	.....
1902	237,254,000	1,331,792	5 61	5,564,000	42,792	7 69	*	*	12 26	.....	.....	.....
1903	215,791,000	1,251,572	5 80	2,225,000	19,000	8 54	*	*	13 27	.....	.....	.....
1904	205,196,000	1,116,714	5 44	1,080,000	7,500	6 94	*	*	13 28	.....	.....	$13 00
1905	211,558,000	1,152,505	5 45	693,000	5,995	8 65	6,112,000	$81,706	13 37	.....	.....	19 37
1906	206,583,000	1,178,202	5 70	1,474,000	14,162	9 61	6,229,000	81,814	13 13	.....	.....	10 05
1907	200,817,000	1,181,015	5 88	3,956,000	32,116	8 12	7,911,000	94,601	11 96	.....	.....	12 00
1908	181,049,000	994,525	5 49	1,896,000	19,496	10 28	6,165,000	76,630	12 43	.....	.....	.....
1909	219,820,000	1,250,787	5 69	2,379,000	18,654	7 84	10,473,000	129,283	12 34	.....	.....	.....
1910	252,551,000	1,363,316	5 86	2,209,000	27,533	12 46	9,080,000	116,446	12 82	.....	.....	.....
1911	252,665,000	1,301,898	5 16	2,498,000	31,572	12 64	5,597,000	78,336	14 00	.....	.....	18 08
1912	271,189,000	1,592,283	5 87	3,934,000	41,476	10 54	6,600,000	92,000	13 94	*	*	17 78
1913	273,571,000	1,620,287	5 94	585,000	5,941	11 76	8,571,000	126,062	14 71	*	*	16 41
1914	269,154,000	1,633,216	6 07	1,488,000	21,121	14 19	7,733,000	120,562	15 59	*	*	19 78
1915	277,399,000	1,461,188	5 23	*	*	11 28	*	*	14 50	.....	.....	.....
Totals	3,851,269,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

*Concealed; less than three producers.

ANNUAL PRODUCTION OF BRICK AND TILE PRODUCTS IN MICHIGAN, 1899-1915.—*Concluded.*

Year.	Stove linings.	Drain tile.	Sewer pipe.	Fire-proofing.	Tile (not drain.)	Miscellaneous.	Hollow building tile or blocks.	Per cent of total product in U. S.	Rank of state.	No. of firms operating.	Total value.
	Value.	Value.	Value.	Value.	Value.	Value.	Value.				
1899	.....	$140,171	$59,300	$5,900	.....	$22,709	.....	1.68	13	196	$1,254,256
1900	.....	114,747	57,916	2,350	.....	406	.....	1.50	17	189	1,147,378
1901	.....	98,972	*	1,880	.....	637	.....	1.71	14	180	1,497,160
1902	.....	96,645	*	3,290	.....	.....	.....	1.60	13	182	1,660,942
1903	.....	129,026	*	.....	.....	.....	$19,138	1.58	14	178	1,662,414
1904	.....	208,088	*	.....	.....	.....	8,080	1.58	14	168	1,670,892
1905	.....	295,445	*	*	.....	.....	3,085	1.41	16	154	1,719,746
1906	.....	314,098	*	.....	.....	.....	4,290	1.38	16	142	1,793,367
1907	.....	289,868	*	.....	.....	1,500	6,386	1.39	17	136	1,786,190
1908	.....	327,630	*	4,100	.....	40,100	.....	1.54	16	132	1,660,381
1909	.....	364,096	*	.....	.....	66,128	.....	1.44	16	122	1,947,059
1910	.....	348,205	*	.....	.....	*	.....	1.56	15	118	2,083,525
1911	$3,971	313,072	*	*	*	228,330	*	1.53	15	111	1,953,442
1912	*	387,915	*	1,461	*	255,459	*	1.73	13	101	2,350,606
1913	.....	415,543	*	*	*	350,000	*	1.73	13	95	2,451,242
1914	*	421,941	*	3,752	*	234,280	*	1.88	10	90	2,434,872
1915	.....	305,156	*	10,850	*	49,755	*	.....	.....	82	2,248,068
Totals	.....	$4,480,560	.....	.....	.....	.....	.....	.....	.....	.....	$31,327,549

*Concealed under miscellaneous; less than three producers.

ANNUAL PRODUCTION AND VALUE OF SAND-LIME BRICK IN MICHIGAN AND UNITED STATES, 1904-1915.

Year.	No. of operating firms reporting—Mich.	No. of operating firms reporting—U. S.	Michigan production. Common brick. Quantity. (thousands).	Common brick. Value.	Common brick. Average price per thousand.	Front brick. Quantity. (thousands).	Front brick. Value.	Front brick. Average price per thousand.	Fancy brick. Quantity. (thousands).	Fancy brick. Value.	Total value Michigan.	Change per cent.—Michigan.	Total value United States.	Per cent. of total production of U. S.	Rank. Production.	Rank. Value.
1904	10	57	9,886	$64,034	$6 64	380	$5,234	$9 02	19	$497	$69,765	.....	$463,128	15.6	1	1
1905	12	84	21,841	155,883	6 28	1,577	12,893	8 37	24	526	169,302	142.7	972,064	17.4	1	1
1906	11	87	27,281	162,875	5 97	1,796	12,022	6 69	7	20	174,921	3.3	1,176,005	15.0	1	2
1907	13	94	25,488	158,606	6 22	*2,000	14,234	7 37	.....	.....	172,840	−1.2	1,225,760	14.1	1	1
1908	10	87	21,997	131,827	5 99	*900	6,982	7 76	.....	.....	138,809	−19.7	1,029,609	13.5	1	1
1909	11	74	34,217	207,082	6 05	*1,000	11,144	6 97	.....	.....	218,226	57.2	1,150,580	19.0	1	1
1910	10	76	37,648	218,627	5 81	3,256	22,022	6 76	.....	.....	240,649	10.3	1,169,153	20.6	1	1
1911	10	66	32,889	192,224	5 84	2,726	17,777	6 52	.....	.....	210,001	−12.7	897,664	23.4	1	1
1912	11	73	48,129	307,106	6 38	1,163	9,626	8 27	.....	.....	316,732	50.8	1,200,223	26.4	1	1
1913	12	68	49,573	316,882	6 40	†	†	.....	†	†	321,245	1.7	1,238,325	25.9	1	1
1914	12	62	41,456	248,113	5 98	†	†	.....	†	†	255,784	−20.4	1,058,512	23.5	1	1
1915	11	....	46,513	281,009	6 04	†	†	.....	†	†	286,948	+11.8	1,133,104	25.3	1	1
Total	.....	.....	399,718	$2,443,272	$6 11	.....	.....	.....	.....	.....	$2,575,222	.....	.....	.....	.....	.....

*Estimated. †Included in total.

SAND LIME BRICK.

The growth of the sand lime brick industry has been in the average output of the plants rather than in the number of plants. In 1904 ten plants were in operation and in 1915, eleven. In 1904, ten plants produced 9,886,000 common brick and in 1915, eleven plants produced 46,513,000 or over 4½ times as many. The average price of common brick in 1904 was $6.64 per thousand, but in 1910 it had fallen to only $5.81 per thousand. The price in 1915 was $6.04 per thousand.

MINERAL AND SPRING WATERS.

The amount and value of mineral and spring waters produced in Michigan fluctuate greatly from year to year. The principal factors affecting the production are (1) general business conditions, (2) local conditions affecting municipal supplies. The largest decreases in production in Michigan occurred in the general business depression of 1906 and 1907 and of 1914. The municipal water supplies in certain cities are unsafe or unpalatable, and consequently a thriving business of vending spring waters has grown up in these cities. During the past three or four years, the quality of the supplies has been greatly improved through the installation of filtration plants or the development of new sources.

A general though intermittent decrease in the production of mineral and spring waters in Michigan has occurred since 1902, the production falling from 8,653,690 gallons in that year to only 884,893 gallons in 1913. The production in 1914 and 1915 was respectively 931,343 gallons and 913,765 gallons.

PRODUCTION AND VALUE OF MINERAL WATERS IN MICHIGAN, 1900-1915.

Year.	Rank. Quantity.	Rank. Value.	No. of Springs active.	Total. Quantity. Gals.	Total. Value.	Medicinal. Value.	Table. Value.	Average price per gal.
1900	6	4	28	3,398,996	$411,935	.....	.....	$0.121
1901	2	1	28	7,019,168	1,195,614	.....	.....	0.170
1902	1	9	28	8,653,690	275,763	.....	.....	0.032
1903	1	9	19	6,919,107	200,668	.....	.....	0.029
1904	7	13	19	3,385,675	118,422	.....	.....	0.035
1905	4	4	17	2,684,800	277,188	$38,900	$238,288	0.100
1906	13	23	19	902,528	73,357	.....	.....	0.081
1907	8	15	19	1,472,679	127,133	35,091	92,042	0.086
1908	8	16	24	2,004,433	88,910	5,995	82,915	0.044
1909	5	16	19	2,760,604	104,454	6,099	98,355	0.035
1910	9	17	17	1,454,020	69,538	100	69,438	0.048
1911	11	24	23	1,713,401	72,253	12,156	60,097	0.042
1912	12	19	17	1,420,465	75,611	777	74,834	0.053
1913	17	24	20	884,893	52,642	3,605	49,037	0.059
1914	16	20	22	931,343	70,310	12,252	58,058	0.075
*1915	.....	.....	18	913,765	72,711	5,165	67,546	0.080
Total	.....	.....	.....	46,519,567	$3,286,509	$114,140	$890,610	$0.071

*Figures subject to revision.

NATURAL GAS.

Michigan produces very little natural gas, and most of this is produced in the southeastern part of the state in Macomb, Oakland, and St. Clair counties. Gas also occurs in Manistee county. In Oakland and Manistee counties the supply is obtained from the surface deposits. The gas usually occurs in small volume and under low pressure. The source of the gas is presumably the bituminous and petroliferous Devonian formations which underlie these counties. The wells are usually sufficient only for a family or two and usually last for a number of years. Some wells "play out" in a few weeks, others last for many years. In Oakland and Macomb counties 25 or 30 of such wells are utilized by farmers for heating and lighting. According to reports the gas wells in the vicinity of Warren and Royal Oak in these counties have been declining rapidly in volume and pressure during the past two years.

There are many artesian wells around Portage Lake, Manistee county, which yield considerable gas. In 1913, a gas well was struck near Onekama on the north side of the lake. It yielded a large volume of gas under a pressure of nearly 190 pounds per square inch. Some of the other wells yield sufficient quantities of gas for heating and lighting one or more dwellings.

In the Port Huron oil field, oil is obtained from the Dundee limestone at depths varying from about 500 to 710 feet and many of the wells yield gas along with the oil. The wells of the G. B. Stock Xylite Grease & Oil Co. yield gas more than sufficient for pumping the wells. A number of the wells of the Michigan Central Oil & Gas Co. are reported to yield from 20,000 to 40,000 cubic feet of gas per day under pressures varying from 125 to over 250 pounds per square inch. A project was under way for utilizing the gas in lighting a small suburb of Port Huron. A number of other wells in and about the city bored for oil or water also yield more or less gas, which has been utilized for domestic and industrial purposes.

At Mt. Clemens, some of the mineral wells yield gas nearly sufficient for heating the boilers used in pumping.

The following table shows the production of natural gas for the past five years:

PRODUCTION OF NATURAL GAS IN MICHIGAN, 1911-1915.

Year.	No. of producers.	Domestic.		Industrial.		Other.		Total.	
		Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
		M. cu. ft.		M. cu. ft.		M. cu. ft.		M. cu. ft.	
1911	22	930	$930	.....	.....	800	$400	1,730	$1,330
1912	17	.....	1,020	900	$450	.....	.....	900	1,470
1913	.....	.....	.....	.....	.....	.....	.....	1,805	1,405
1914	.....	.....	.....	.....	.....	.....	.....	2,442	1,442
1915	16	960	960	.....	.....	1,100	550	2,060	1,510
Total	.....	.....	.....	.....	.....	.....	.....	8,937	$7,357

PETROLEUM.

Oil has been found in small quantities at many places in Michigan, notably at Port Huron, Allegan, and Saginaw. At Port Huron there are about thirty productive wells, but they are very small, the average yield being about one half barrel per day. The depth to the oil horizon in the vicinity of Port Huron is from about 500 to 650 feet. All of the wells yield gas which is utilized in operating the wells. A part of the oil is used by G. B. Stock Xylite Grease and Oil Co. in the manufacture of lubricants. The oil horizon at Allegan is about 1,300 feet in depth and at Saginaw 2,300 to 3,000 feet. The flows of oil were similar in quantity to those obtained at Port Huron but the greater depth made operation impracticable. There are but two producers of oil, hence figures of production are not given.

The reader is referred to Publication 14 (Geol. Ser. 11), Occurrence of Oil and Gas in Michigan. Publication 19, (Geol. Ser. 16) Mineral resources of Michigan for 1914, contains a history of the developments in the Port Huron oil field up to 1915.

TRAP ROCK.

There are inexhaustible resources of trap rock in the western half of the Northern Peninsula, chiefly in the iron and copper bearing districts. Trap rock is quarried at Marquette and Negaunee, Marquette county. Large quantities of amygdaloidal trap is produced incidentally in copper mining. The trap rock from Marquette county is harder, tougher, and less altered than that from the copper mines. The inferior wearing qualities of the amygdaloidal trap however is partially compensated by superior cementing power.

Most of the quarry product is crushed for road material and concrete. In some years a small amount is sold for rip rap. The great distance from markets is a serious obstacle to the development of the trap rock resources of the state.

PRODUCTION AND VALUE OF TRAP ROCK IN MICHIGAN, 1911-1915.

Year.	No. of producers.	Crushed stone.				Riprap. Rubble. Value.	Total. Value.	Rank. Value.
		Road making.		Concrete.				
		Quantity.	Value.	Quantity.	Value.			
		Tons.		Tons.				
1911	3	.....	.....	45,250	$38,429	.....	$51,000	8
1912	5	21,805	$18,366	11,355	9,340	$8,500	36,206	8
1913	5	24,920	23,369	*	*	*	92,201	10
1914	5	25,600	24,863	4,448	4,771	.....	34,406	12
1915	6	28,362	29,764	18,775	22,047	*	105,855	.....
Total	.....	100,677	$96,362	.....	.....	.....	$319,368	.....

*Included in total.

SHALE.

Shale is quarried in Michigan for use in making Portland cement and vitrified and front brick, sewer pipe, conduit and vitrified tile. It is quarried for Portland cement near Coldwater, at Paxton, Alpena county, and in Charlevoix county, and for the manufacture of ceramic products at Grand Ledge, (Eaton county), Jackson, Corunna (Shiawassee county), and Flushing, (Genesee county). A project is now under way for the development of shale beds at Williamston for the manufacture of front brick.

Excellent exposures of Coldwater shale occur at Richmondville, Sanilac county, and along the shore of Lake Huron from Forestville to White Rock in Sanilac and Huron counties. Numerous exposures also occur near Coldwater, Union City, Quincy, and Bronson, Branch county. A number of exposures of Antrim black shale occur in Charlevoix, Cheboygan and Alpena counties. Exposures of the blue Bell shale of the Traverse formation occur near Rockport, Alpena county and near Bell, Presque Isle county.

GRAPHITE.

Graphitic slate is quarried about 9 miles from L'Anse, Baraga county, by the Northern Graphite Works and the Detroit Graphite Company of Detroit. The graphitic material is ground for paint. The mines have not been operated during the past three years.

QUARTZ.

Vein quartz is mined near Ishpeming by the Michigan Quartz Silica Co. of Milwaukee and ground chiefly for wood filler and paint. Some of the product is used in making polishes. The quartz rock is practically pure silica. The mills are located at Ishpeming, Michigan, and at Milwaukee, Wisconsin. There is but one producer hence figures of production are not given.

MINERAL PAINTS.

Certain iron ores are mined in Iron county by Pickands Mather Co. of Cleveland, Ohio, for the manufacture of paint. The Acme White Lead & Color Co. of Detroit, manufactures a large amount and a variety of mineral

paints. These are the only producers of mineral paints, hence figures of production and value cannot be given.