

STATISTICAL SUMMARY

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Production and Value of Minerals and Mineral Products in Michigan

1930 to 1934 and Prior Years



IN COOPERATION WITH THE UNITED STATES BUREAU OF MINES

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PRODUCTION AND VALUE OF MINERALS AND MINERAL PRODUCTS
IN MICHIGAN



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PRODUCTION AND VALUE OF MINERALS AND MINERAL PRODUCTS
IN MICHIGAN

General Review

The years 1917, 1920, and 1929 represent peaks in the value of minerals produced in Michigan. The 1917 peak was due chiefly to the demand for copper as a war material, although large quantities of iron ore were also produced. In 1916 copper reached an all time peak of production, but in 1917 the peak price of 22.8 cents per pound was attained. In those years the value of copper produced amounted to about 50 percent of the total value of mineral production in the State.

The year 1920 was a record year for value of mineral production in Michigan. This was due to post-war industrial stimulus which was reflected in the mineral industries in Michigan chiefly by the demand for large quantities of iron ore. The value of iron ore produced in 1920 amounted to more than 50 percent of the total value of mineral products for that year. A reaction set in, however, in 1921, and this was accompanied by a general falling off in production for practically all of the mineral industries. This slump may be attributed to a readjustment to normal rates of production with a tendency toward a healthy growth to the peak attained in 1929. During the period from 1922 to 1929 inclusive, general prosperity ensued with iron ore holding to a steady production, and copper with fair prices prevailing showed a decided increase each year. By 1929 production of these metals had reached a scale exceeded only by war and post-war figures.

The outstanding gains in mineral production during this period, however, were not made by iron and copper but by portland cement, stone, sand and gravel, gypsum, bromine, and petroleum. The period from 1922 to 1929 was one of huge industrial expansion with great volumes of construction in cities and the inauguration of a nation-wide program of highway construction. As a result those minerals and mineral products used in building and highway construction enjoyed a mushroom growth. Salt, which had previously held the distinction of ranking as Michigan's leading non-metallic mineral product, was forced into second position by crushed stone in 1929, and sand and gravel were not far behind in value. Portland cement production increased enormously to give Michigan second rank among the states. The manufactured value of portland cement exceeded the value of any mineral product except that of iron ore and copper. The production of gypsum, another mineral of importance in the building trades, more than doubled in volume during the 8-year period. Other products closely related in application to the maintenance and use of highways are bromine and calcium chloride. These materials, while not as valuable as copper, iron, and cement, nevertheless increased tremendously in volume of production.

The depression years have revealed some interesting contrasts in mineral production in Michigan. Private building and highway construction declined sharply in volume, with the result that those minerals and mineral products

which received the greatest impetus in the previous decade now suffered severely. Prices of copper dropped so low that with the increasing depth of the mines, the metal could no longer be mined at a profit. By 1934 only two mines were in operation. The demand for iron and steel was so light that in 1932 the industry experienced what was probably its worst year since the turn of the century. The year 1932 recorded the lowest total value of mineral production in Michigan since complete records were preserved.

Certain minerals and mineral products, however, have not shared in the general depression. These are chiefly materials for which new uses are being found and rapidly expanded. Salt has remained fairly steady in volume, due to the fact that it is a commodity not readily dispensed with and because of its importance in the chemical industries. Bromine production has increased tremendously, due to the expansion of its use in the manufacture of ethyl gasoline. Magnesium is still a new metal from the competitive standpoint, and its applications are constantly expanding. The large increase in the production of petroleum and natural gas is explained by the regularity with which new pools have been discovered in recent years. In 1932, due to the small amount of iron ore shipped, the value of petroleum produced in Michigan exceeded that of any other mineral or mineral product. Since 1932 oil has ranked second to iron ore in value among the State's mineral products.

The year 1934 finds Michigan retaining first rank among the states in production and value of salt, bromine, natural calcium chloride, magnesium and magnesium salts; second rank in production and value of iron ore and gypsum; third rank in production of crushed stone; fourth in production and value of copper; fifth in quantity of sand and gravel produced; ninth in petroleum; and eleventh in total value of all mineral products.

MICHIGAN'S IRON MINING INDUSTRY

Until 1901 Michigan was the leading state in iron ore production. At that time the shipments from the newly developed Mesabi range in Minnesota had increased in volume to such an extent that Michigan dropped to second place, which position it has held ever since. In recent years the Michigan shipments have usually amounted to approximately one-third of the Minnesota total. Average shipments for the past twenty years (1916-1935 inclusive) have amounted to 12,089,000 tons. The largest shipment during this period was 18,812,972 tons in 1916, and the lowest 978,371 in 1932.

The first discovery of iron ore in Michigan was made in 1844 near Teal Lake, Marquette County, by a party of government surveyors. Regular shipments of ore began ten years later and have continued uninterrupted since that time. Discovery of ore on the Menominee Range in Dickinson County resulted in that range becoming a shipper in 1877, and the first shipments from the Gogebic Range were made in 1884.

In the 80 years which have passed since the first Michigan ore was sent to lower lake ports, the State has shipped more than a half-billion tons, or a tonnage equivalent to the total excavation of the Panama Canal. Of the total shipment, the Marquette Range is responsible for 184,000,000 tons, the Menominee Range 170,000,000, and the Gogebic Range 168,000,000 tons.

Most of the ore produced in the State is mined by means of shafts, some of which exceed 3,000 feet in depth. The ore is mined, loaded into cars, and conveyed to the shaft, where it is hoisted to the surface. It is then either loaded directly into cars to be sent to lake ports, or dumped on stock-pile until it is needed. Of the 34 mines which were active in 1935, all but six were underground mines.

The open pit mines are operated in the same manner as large quarries would be. The ore is first drilled and blasted and is then loaded directly into railroad cars for shipment to docks at Escanaba, Marquette, or Ashland, Wisconsin. If crushing is necessary the ore may be brought to the crusher by means of smaller quarry cars, and then loaded into the railroad cars.

The average person not connected with mining usually does not realize that iron ore is not at all uniform, but varies greatly both in chemical composition and structure. The basis of value is iron units and prices are quoted for ore of 51.50 percent iron with penalties for leaner ore and premiums for ore of higher iron content. In addition to the iron content, the percentage of phosphorous and the percentage of sulphur have much to do with the value and the desirability of an ore. An ore with a satisfactory chemical analysis may be undesirable because of certain characteristics of structure which make it difficult to handle in the blast furnace.

The total reserves of the State on January 1, 1935, were estimated by the State Mine Appraiser at slightly more than 162,000,000 tons, which is not much

lower than the 169,000,000 tons which were estimated in 1911 in spite of shipments of more than 280,000,000 tons since that time. Much of this 280,000,000 tons has been developed by extensions of known ore bodies both laterally and in depth, although drilling has been responsible for the location of some new ore bodies. Nearly 50 properties have been opened and have made their initial shipments since 1911. The peak of reserves came in 1921, when more than 200,000,000 tons were estimated.

Values placed on iron mining properties by the State Tax Commission increased from \$82,000,000 in 1913 to \$117,000,000 in 1921, and have since that time shown a gradual decrease until on January 1, 1935 the total recommended value was set at about \$63,000,000.

Although the total valuation of the iron mines is not impressive when compared to the total State valuation, being only about one percent, the importance of the industry may be understood if it is realized that the mining valuations comprise nearly 25 percent of the total valuation of the entire Upper Peninsula and almost 50 percent of the valuation of Dickinson, Iron, Gogebic, and Marquette counties.

Approximately 8,500 men were employed at the mines during 1930, earning an average annual wage of about \$1,400. The low point of employment was reached in 1933, when only 2,739 men were employed, but 1934 and 1935 have seen improved conditions and 1936 will probably be the best year since 1930. Since the entire population of the cities and villages near which the mines are located is less than 70,000, it is readily apparent that the industry is vitally important to the future of the districts in which it is located.

PRODUCTION AND SHIPMENTS OF IRON ORE IN MICHIGAN
1931 to 1935 By Counties

	1931		1932		1933	
	Tons Mined	Tons Shipped	Tons Mined	Tons Shipped	Tons Mined	Tons Shipped
Dickinson	676,624	454,477	161,444	15,640	69,170	400,855
Gogebic	2,830,971	2,286,632	985,717	313,388	848,605	1,757,587
Iron	1,417,252	1,006,966	622,550	292,081	489,422	1,110,130
Marquette Range	2,658,636	1,809,445	726,961	357,262	942,328	2,807,325
Total	7,583,483	5,557,520	2,496,672	978,371	2,349,525	6,075,897

	1934		1935	
	Tons Mined	Tons Shipped	Tons Mined	Tons Shipped
Dickinson	147,541	317,603	195,930	223,409
Gogebic	1,857,429	1,690,897	1,579,028	2,341,985
Iron	710,534	1,017,424	532,891	1,410,613
Marquette Range	2,330,775	2,473,847	2,865,294	3,265,537
Total	5,046,279	5,499,771	5,173,143	7,241,544

IRON ORE SHIPPED FROM MINES IN MINNESOTA, MICHIGAN, AND ALABAMA
1930-1934

	1930	1931	1932	1933	1934
Minnesota	34,165,777	17,063,591	2,248,727	14,784,763	15,768,418
Michigan	11,154,773	5,555,376	968,789	6,099,031	5,497,953
Alabama	5,637,678	3,629,997	1,470,445	2,156,142	2,270,923
	50,958,228	26,248,964	4,687,961	23,039,936	23,987,294
All other States	4,242,993	2,267,068	643,240	1,584,349	1,805,312
Total U.S.	55,201,221	28,516,032	5,331,201	24,624,285	25,792,606

IRON ORE SHIPMENTS FROM MICHIGAN MINES
1854--1935

Year	Tons	Year	Tons	Year	Tons
Previous	75,083	1880	1,948,334	1908	7,302,060
1854	3,000	1881	2,125,729	1909	12,251,965
1855	1,449	1882	2,656,933	1910	11,955,105
1856	6,790	1883	2,518,048	1911	8,898,554
1857	25,646	1884	2,225,146	1912	12,428,361
1858	22,876	1885	2,205,190	1913	12,463,319
1859	68,832	1886	3,179,511	1914	8,835,274
1860	114,410	1887	3,934,339	1915	13,506,119
1861	49,909	1888	4,113,803	1916	18,812,972
1862	124,169	1889	5,829,828	1917	17,694,731
1863	203,055	1890	7,185,139	1918	17,495,377
1864	247,059	1891	5,728,081	1919	12,816,304
1865	193,758	1892	7,182,344	1920	18,470,354
1866	296,713	1893	4,370,550	1921	5,065,137
1867	565,504	1894	4,689,291	1922	12,433,729
1868	510,522	1895	5,991,968	1923	13,980,769
1869	639,097	1896	5,532,967	1924	10,974,662
1870	859,507	1897	6,429,520	1925	15,116,269
1871	813,984	1898	7,408,060	1926	16,810,160
1872	948,553	1899	9,308,731	1927	14,532,831
1873	1,195,234	1900	9,237,502	1928	14,241,102
1874	899,934	1901	9,403,224	1929	16,838,568
1875	881,166	1902	11,490,273	1930	11,154,773
1876	993,311	1903	9,154,147	1931	5,555,376
1877	1,025,129	1904	7,805,880	1932	978,371
1878	1,127,583	1905	11,684,432	1933	6,075,897
1879	1,420,745	1906	12,149,451	1934	5,499,771
		1907	12,166,929	1935	7,241,544

Total shipments 519,918,813

THE COPPER INDUSTRY OF MICHIGAN

There is conclusive evidence that the mining of copper in Michigan was carried on by some highly intelligent prehistoric race which lived in the region prior to those races known as North American Indians. Old pits have been discovered on Isle Royale and on the Keweenaw Peninsula in which were found masses of copper and crude implements made of stone and copper. That these mining operations were very ancient was testified to by the fact that in the pits were growing huge forest trees requiring several hundred years to mature. The presence of copper had been noted by many of the early white explorers who visited the region, but it was not until 1843 that the first copper was shipped. In that year the Ontonagon boulder, a mass of float copper weighing several tons, was sent to Detroit and from there to Washington, where it now rests at the Smithsonian Institute. This boulder was of almost pure copper and had been transported during the glacial period from its original position in the outcrop to the place where it was discovered.

Michigan assumed the lead among the states in the production of copper in 1847 and held the lead until displaced by Montana in 1887, in which year Montana produced more than 78,000,000 pounds to 76,000,000 pounds for Michigan. With the exception of 1891, Michigan has never regained that lead. In 1934 the leading producers were: Arizona, 177,000,000 pounds; Utah, 86,000,000 pounds; Montana, 63,000,000 pounds; and Michigan, 48,000,000 pounds. The total production of copper in Michigan from 1845 to 1935 inclusive amounts to more than eight and a half billion pounds. The price of copper during that time has varied from a high price of 55 cents per pound in 1864 to a low price of five cents in 1932. The copper of Michigan occurs as the native metal instead of as oxides or sulphides, the occurrence being the most important of its kind in the world. Mining is carried on by means of deep shafts, the bottom levels of some of the mines being more than a mile in vertical depth below surface. Several shafts in the district are more than 9,000 feet deep on the incline.

Until the recent unfavorable metal market forced a drastic curtailment of operations, the copper mines employed about 10,000 men. When it is considered that the total population of Houghton and Keweenaw Counties in 1930 was only slightly more than 50,000 it is easily apparent that the condition of the industry is of vital importance to the entire district.

The valuation of the copper mines of Houghton and Keweenaw counties in 1930 amounted to \$33,368,000 or about 58 percent of the total valuation of all property, which was approximately \$57,500,000. Conditions in the industry since 1930 have resulted in drastic reductions in values, the assessed valuation in 1935 amounting to only about \$7,250,000. Although the price of refined copper has risen from the 1932 low of five cents a pound to about nine and one-half cents a pound, the price is still too low to permit the operation of many of the properties, and in 1935 only three operations were carried on - the Champion mines of the Copper Range Mining Company, the Conglomerate Lode mines, and the Reclamation of the Calumet and Hecla Consolidated Copper Company. Production and price in 1935 were both above the 1934 figures and 1936 may show further increases.

PRODUCTION OF COPPER IN MICHIGAN
1845-1935

<u>Year</u>	<u>Pounds</u>	<u>Year</u>	<u>Pounds</u>
1845	26,880	1890	101,410,277
1846	58,240	1891	114,222,709
1847	477,120	1892	123,198,460
1848	1,032,640	1893	112,605,078
1849	1,505,280	1894	114,308,870
1850	1,281,280	1895	129,330,749
1851	1,744,960	1896	143,524,069
1852	1,744,080	1897	145,282,059
1853	2,905,280	1898	158,491,703
1854	4,074,560	1899	147,400,338
1855	5,808,320	1900	145,461,498
1856	8,211,840	1901	156,289,481
1857	9,531,200	1902	170,609,228
1858	9,157,120	1903	192,400,577
1859	8,926,400	1904	208,309,130
1860	12,069,120	1905	230,287,992
1861	15,037,120	1906	229,695,730
1862	13,585,600	1907	219,131,503
1863	12,985,280	1908	222,289,584
1864	12,490,240	1909	227,005,923
1865	14,358,400	1910	221,462,984
1866	13,749,120	1911	218,185,236
1867	17,525,760	1912	231,112,228
1868	20,935,040	1913	155,715,286
1869	26,624,640	1914	158,009,748
1870	24,622,080	1915	238,956,411
1871	26,750,080	1916	269,794,531
1872	24,552,640	1917	268,508,098
1873	30,089,920	1918	231,096,150
1874	34,332,480	1919	177,594,135
1875	36,039,360	1920	153,483,952
1876	38,270,400	1921	100,918,001
1877	39,025,280	1922	122,545,126
1878	39,690,560	1923	137,691,306
1879	42,848,960	1924	145,333,227
1880	49,736,960	1925	138,029,764
1881	54,573,120	1926	175,441,565
1882	56,982,765	1927	177,537,775
1883	59,702,404	1928	178,442,704
1884	69,353,202	1929	186,393,974
1885	72,148,172	1930	169,297,775
1886	79,890,798	1931	118,495,055
1887	75,471,890	1932	54,396,108
1888	86,472,034	1933	46,853,130
1889	88,175,675	1934	48,215,859
		1935	63,208,689
		Total	8,722,548,075

BROMINE, CALCIUM CHLORIDE, AND MAGNESIUM

These products are considered under one heading, owing to the fact that their manufacture depends upon the recovery of a single raw material, namely, brine obtained from the Marshall formation in the vicinity of Midland and Mount Pleasant, and from the Detroit River formation at Manistee (bromine only). This latter production is a very recent development, but at Midland bromine has been produced for approximately 40 years. In the Porter oil field, Midland County, waste brines produced along with oil from the Dundee formation are gathered into pipe lines and delivered to the Dow Chemical Company at Midland. Large quantities of these valuable brines are being wasted in other fields and their disposal without contaminating the streams and lakes of the state is one of the most serious and difficult of industrial problems at the present time.

BROMINE

Bromine was originally used chiefly for photographic and medicinal purposes, but in the last 15 years an important new use has developed which enormously increased the demand for this product. During the war production of bromine was greatly stimulated by the invention of bromobenzyl cyanide, a tear gas, but this demand naturally ceased with the declaration of peace. The manufacture of ethyl gasoline is the cause for the boom in the bromide industry, large quantities of ethylene dibromide being consumed in the manufacture of this product. There was a temporary lull in 1925 and 1926, owing to alleged poisoning hazards of ethyl gasoline; but these difficulties were soon overcome and since then the demand for bromides has increased by leaps and bounds. The motion picture industry and medical profession have also required increasing quantities of bromine compounds. Michigan produces the bulk of the bromine consumed in the United States. The following table will show how the bromine industry has grown in the United States between the years of 1926 to 1934:

Year	Pounds	Value	Year	Pounds	Value
1926	1,245,760	\$426,837	1931	8,935,330	\$1,854,650
1927	1,756,310	564,689	1932	5,727,561	1,182,569
1928	2,164,000	649,475	1933	10,147,960	2,040,352
1929	6,414,620	1,759,325	1934	15,344,290	3,227,425
1930	8,462,800	2,109,974			

CALCIUM CHLORIDE

The production of calcium chloride from natural brines is another phase of the chemical industry in which Michigan is predominant. The success of calcium chloride as a dust-layer on gravel roads has greatly increased the demand for this product. It has a further extensive use in curing concrete, as a refrigerant and preservative, and in other chemical processes. The following table shows the steady increase in production of calcium chloride from natural brines in the United States during the period from 1921 to 1930 inclusive:

Year	Short Tons	Value	Year	Short Tons	Value
1921	23,672	\$510,723	1928	102,090	\$1,995,603
1922	33,067	571,326	1929	114,240	2,097,061
1923	44,961	663,384	1930	116,160	2,207,800
1924	58,791	1,164,848	1931	86,156	1,687,166
1925	67,870	1,386,639	1932	66,286	1,163,385
1926	82,340	1,710,405	1933	57,813	893,442
1927	95,721	1,947,796	1934	76,719	1,153,159

The above tables do not include a large quantity of calcium chloride produced from limestone and salt incidental to the manufacture of alkalies.

MAGNESIUM

Since 1927 the entire domestic output of primary metallic magnesium has been by the Dow Chemical Company at Midland, by electrolysis of magnesium chloride from the brines of the Marshall sandstone. In contrast to the prevailing industrial trend the magnesium market has expanded rapidly during the depression. This is due to the fact that its production is still comparatively small and its history as a competitive metal is still in the making. The demand for light weight alloys for airplane manufacture, and in recent years the trend toward the lightening of railway stock, busses, trucks, trailers, and other equipment, has brought this metal into keen competition with aluminum. Magnesium is one-third lighter than aluminum and active research on new alloys and properties of this metal promise to further increase its utility. Deoxidizing and desulphurizing of other metals is also an important use of magnesium. The following table of production since 1929 shows the increasing importance of this metal:

Year	Pounds	Average price per pound
1930	559,631	\$0.48
1931	580,463	0.34
1932	791,699	0.29
1933	1,434,893	0.28
1934	4,249,838	0.26

SALT

Salt is produced in Michigan from three distinct geologic horizons, namely, the Marshall, Detroit River, and Salina formations. Salt is produced from the Marshall formation at Midland, Saginaw, and Bay City by evaporation of natural brines; and from the Salina formation at Detroit, St. Clair, and Port Huron by means of artificial brines formed by dissolving beds of rock salt. Rock salt is also mined at Detroit by means of a shaft approximately 1100 feet in depth. The Detroit River formation contains both natural brines and rock salt, which are produced by means of wells at Ludington and Manistee. The salt beds at these latter places were formerly correlated with those of the Salina formation, but recent deep tests for oil have shown these salt beds to lie considerably higher in the geologic section.*

*R. B. Newcombe, Interpretation of Recent Discoveries in the Salt Bearing Rocks of Michigan. Vol. XII, Mich. Academy of Science, Arts, and Letters, 1930.

In addition to the Marshall, Detroit River, and Salina formations, the Dundee, Parma, and Borea formations contain salt brines, the two last named being of some importance in the early days of salt mining in Michigan.

Michigan has ranked as the leading salt-producing State for many years. Since 1911 this State has been in second rank in production of salt only twice - in 1921 during the post-war industrial depression, and again in 1924 when an eastern price war, importation of low priced salt from Germany, and other factors demoralized the salt industry in this country.

The year 1919 was the record year for salt production in Michigan, prior to 1929, the total for the former year amounting to 2,492,328 short tons. The maximum value was, however, attained in 1920 when post-war price inflation prevailed, although the total tonnage was somewhat lower than that of the preceding year. The value of the product in 1920 was \$10,698,674, the only time the industry has ever been over the \$10,000,000 figure. Beginning with 1925, however, a steady increase has been noted each succeeding year to 1929, when a new record production of 2,650,212 tons was reached. Production in 1930, while slightly less than in 1929, was greater than that for any other year. Keen competition, however, and a tendency toward over-production, kept the prices down, with the result that the value of the product was much less than during the war-time years. In 1931 production further declined to 2,053,980 tons valued at \$5,760,001, and in 1932 dropped off to 1,715,304 tons valued at \$4,845,379. In 1933, however, production increased to 2,090,254 tons valued at \$5,679,737, and in 1934 remained fairly steady at 2,012,370 tons valued at \$5,470,684.

The above figures show that the salt industry has remained stable throughout the depression period from 1930 to 1934. This stability is due to its importance as a necessary domestic commodity and the great variety of uses to which it is put, especially in the chemical industries.

PRODUCTION AND VALUE OF SALT IN MICHIGAN 1930-1934
BY METHODS OF MANUFACTURE

Year	Open Pans		Vacuum Pans		Rock salt and Pressed Blocks	
	Short tons	Value	Short tons	Value	Short tons	Value
1930	416,650	\$4,159,719	482,450	\$2,069,839	281,890	\$1,064,649
1931	287,870	2,394,576	462,650	1,815,648	273,110	885,148
1932	262,985	2,208,621	392,910	1,438,874	233,384	709,031
1933	250,143	2,263,548	505,677	1,777,294	293,366	1,043,832
1934	236,030	2,190,417	449,402	1,629,618	291,917	1,025,845

Year	Brine		Total Salt (all grades)	
	Short tons	Value	Short Tons	Value
1930	1,377,300	\$589,865	2,558,290	\$7,884,072
1931	*	*	2,053,980	5,760,001
1932	826,025	488,853	1,715,304	4,845,379
1933	1,041,068	595,063	2,090,254	5,679,737
1934	1,035,021	624,804	2,012,370	5,470,684

* Included in total

PRODUCTION OF SALT IN MICHIGAN 1880-1899*

Year	Quantity Bbls	Percent of U.S.Total	Year	Quantity Bbls	Percent of U.S.Total
1880	2,485,177	41.7	1890	3,838,632	43.7
1881	44.4	1891	3,966,748	39.5
1882	3,036,317	47.4	1892	3,829,478	32.8
1883	2,894,672	46.7	1893	3,057,898	25.7
1884	3,161,806	48.5	1894	3,341,425	26.5
1885	3,297,403	46.8	1895	3,343,395	24.5
1886	3,667,257	47.6	1896	3,164,238	22.9
1887	3,944,309	49.2	1897	3,993,225	24.0
1888	3,866,228	47.0	1898	5,263,564	29.9
1889	3,856,929	48.2	1899	7,117,382	36.1

PRODUCTION AND VALUE OF SALT IN MICHIGAN 1900-1934

Year	Quantity Bbls	Percent of U.S.Total	Rank	Value	Rank
			Quantity		Value
1900	7,210,621	34.6	2	\$2,033,731	2
1901	7,729,641	37.6	1	2,437,677	1
1902	8,131,781	34.1	2	1,535,823	2
1903	4,297,542	22.7	2	1,119,984	2
1904	5,425,904	24.6	2	1,579,206	2
1905	9,492,173	35.2	1	1,851,332	2
1906	9,936,802	36.3	1	2,018,760	2
1907	10,786,630	35.4	1	2,231,129	2
1908	10,194,279	35.3	1	2,458,303	1
1909	9,966,744	33.1	1	2,732,556	1
1910	9,452,022	32.2	2	2,231,262	2
1911	10,320,074	33.1	2	2,633,155	1
1912	10,946,739	32.8	1	2,974,429	1
1913	11,528,800	33.5	1	3,293,032	1
1914	11,670,976	33.9	1	3,299,005	1
1915	12,588,788	32.9	1	4,304,731	1
1916	14,918,278	32.8	1	4,612,567	1
1917	16,078,136	32.3	1	6,817,202	1
1918	17,165,178	33.2	1	9,048,650	1
1919	17,800,564	36.2	1	9,456,138	1
1920	16,163,679	32.5	1	10,698,674	1
1921	10,196,179	28.7	2	7,439,445	1
1922	14,322,057	29.5	1	8,693,604	1
1923	15,195,800	29.8	1	8,684,148	1
1924	13,703,307	28.2	2	7,864,838	1
1925	15,518,571	29.4	1	7,710,331	1
1926	16,145,174	30.7	1	7,594,418	1
1927	16,218,224	30.1	1	7,551,552	1
1928	17,173,413	29.8	1	8,249,437	1
1929	18,922,513	31.2	1	8,343,607	1
1930	18,166,190	31.8	1	7,884,072	1
1931	14,665,417	26.6	1	5,760,000	1
1932	12,252,171	26.7	1	4,845,379	1
1933	18,501,814	27.4	1	5,679,737	1
1934	15,088,357	26.4	1	5,470,684	1

*For production prior to 1880 see Publication 29, Michigan Geological Survey

LIME

Lime burning began in Michigan practically at the time of influx of the first settlers. Monroe County became the initial center for the industry because of the early settlements and the outcrops of easily accessible limestone. Wood was still available for fuel at that time. Lime burning also had an early development on a small scale in Eaton and Jackson counties. However, as the lumbering wastes became less available in the southern part of the State and competition from other states developed, the industry gradually died out in that section. With the extension of the railroads and development of lake transportation, the lime burning industry was transferred to the northern portions of the State where large deposits of more pure limestone exist and where wood was still available as fuel. Only one plant is now using this fuel, however.

The lime industry in Michigan grew very slowly prior to 1915, but was greatly stimulated by the World War. During the time the United States participated in the war lime production increased almost 100 percent over previous records, due to the demand for chemicals used in modern warfare. Following the war an industrial depression set in and production was sharply curtailed, but a peak was again reached during the boom period which ended in 1929.

In recent years the lime industry in general has not prospered, due to severe competition within the industry, with resultant price cutting, and inroads of other materials which serve the same need in building. Since very little of Michigan lime goes to the building trades, curtailment of building activities did not greatly affect the lime industry in this State.

The National Lime Association was organized in 1929 for the purpose of promoting cooperative advertising, developing new uses for the product, and generally creating a better spirit among the members of the industry. The lime industry was one of the first of the non-metallic mineral industries to be granted a code by NRA and this, together with the cooperative agreement, is given credit for the improved conditions now being manifested by this industry.

PRODUCTION AND VALUE OF LIME IN MICHIGAN 1904-1934

Year	Total Lime		Average price per ton	Number 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	349,979	4.29	10	15
1916	86,447	385,341	4.45	7	13
1917	135,920	892,682	6.72	7	7

PRODUCTION AND VALUE OF LIME IN MICHIGAN (Continued)

Year	Quantity	Value	Average Price per ton	No. of plants operating	Rank of State Production
1918	134,813	\$1,186,007	\$8.79	6	6
1919	145,783	1,381,534	9.48	7	6
1920	140,813	1,386,760	9.85	7	8
1921	48,164	445,386	9.24	6	15
1922	53,635	484,945	9.04	7	16
1923	59,629	612,369	10.27	7	18
1924	73,096	702,072	9.60	7	14
1925	95,036	909,952	9.57	8	14
1926	107,671	995,123	9.24	8	12
1927	101,172	931,597	9.28	8	13
1928	104,917	962,708	9.17	8	13
1929	91,468	844,543	9.23	6	15
1930	80,241	630,288	7.85	5	11
1931	46,716	334,015	7.15	5	12
1932	38,610	267,520	6.93	4	11
1933	43,959	292,144	6.65	3	11
1934	32,844	240,181	7.31	2	11

PORTLAND CEMENT

The portland cement industry in Michigan enjoyed a steady growth from its permanent establishment in 1896 up to 1930, although during the peak years the industry suffered because of price wars, keen competition, and over-production.

The cement industry was naturally one which received great stimulus from the nation-wide road building and construction program carried on for the last half of the preceding decade. The demand being thus greatly increased, too many plants were built and reduced prices resulted. The lower prevailing prices were met by a number of Michigan companies through attempts to decrease costs by means of plant improvements. Some of the improvements consisted of new storage and packing plants and arrangements for bulk shipment cement carriers. Foreign competition forced some of the eastern plants to close down, but Michigan plants were protected by freight rates to the interior.

Less cement was manufactured in Michigan in 1933 than in 1910 when the automobile was still in the experimental stage and concrete roads were scarcely dreamed of. Public works programs have not been adequate to supply the demand for cement occasioned by private construction and in extensive road contracts. A slight upturn, however, took place in 1934 and a much better price obtained for the product tended to encourage the industry.

PRODUCTION AND VALUE
of
PORTLAND CEMENT IN MICHIGAN
1896 - 1934

Year	No. of Plants in Operation	Production Bbls	Bbls Shipped	Value Shipped	Price per Bbl	Stock on hand Dec. 31	Rank Value
1896	1	4,000	-	\$7,000	\$1.75	-	-
1897	2	15,000	-	26,250	1.75	-	-
1898	2	77,000	-	134,750	1.747	-	-
1899	4	343,566	-	513,849	1.492	-	4
1900	6	664,750	-	830,990	1.25	-	2
1901	10	1,025,718	-	1,128,290	1.10	-	3
1902	10	1,577,006	-	2,134,396	1.353	-	3
1903	13	1,955,183	-	2,674,780	1.367	-	3
1904	16	2,247,160	-	2,365,656	1.052	-	4
1905	16	2,773,283	-	2,921,507	1.053	-	5
1906	14	3,747,525	-	4,814,965	1.284	-	4
1907	14	3,572,668	-	4,384,731	1.227	-	4
1908	15	2,892,576	-	2,556,215	0.883	-	7
1909	12	3,212,751	-	2,619,259	0.815	-	7
1910	12	3,687,719	-	3,378,940	0.916	-	8
1911	11	3,686,716	-	3,024,676	0.82	506,758	8
1912	11	3,494,621	3,651,094	3,145,001	0.861	370,956	8
1913	11	4,186,236	4,228,879	4,228,879	1.035	473,563	8
1914	11	4,285,345	4,218,429	4,064,781	0.964	538,846	7
1915	11	4,765,294	4,727,768	4,454,608	0.942	569,919	5
1916	11	4,919,023	5,151,818	6,017,911	1.168	338,035	6
1917	11	4,688,899	4,313,771	6,122,887	1.419	701,919	6
1918	10	3,554,872	3,618,088	6,078,167	1.680	635,447	6
1919	11	4,675,244	4,990,308	8,468,196	1.70	219,641	4
1920	11	4,891,457	4,442,455	10,939,633	2.46	666,389	7
1921	11	5,777,533	5,680,156	10,300,289	1.815	760,503	3
1922	12	6,243,805	6,349,751	11,145,573	1.76	759,703	5
1923	14	7,619,792	7,466,283	14,038,322	1.88	738,892	5
1924	15	9,259,781	8,991,270	16,405,761	1.82	782,377	3
1925	16	10,936,181	10,073,453	17,511,908	1.74	1,060,047	3
1926	16	12,037,400	11,959,447	19,499,788	1.82	1,897,474	3
1927	15	13,965,241	13,708,259	20,858,202	1.52	2,205,284	3
1928	14	13,848,561	14,044,230	19,268,707	1.37	2,010,533	3
1929	14	13,748,862	13,325,727	18,916,711	1.42	2,403,185	3
1930	14	11,510,895	10,817,994	14,897,439	1.38	3,096,086	4
1931	14	6,132,768	7,168,720	6,984,725	0.97	2,055,462	5
1932	11	4,295,610	4,886,928	4,442,666	0.91	1,493,778	5
1933	9	3,632,843	3,447,867	4,128,082	1.20	1,678,754	7
1934	10	4,103,902	3,945,375	5,920,214	1.50	1,828,151	5

GYPSUM

Gypsum is one of the earliest known Michigan minerals. It was discovered along Plaster Creek in Kent County in 1827, and has been mined since 1841. In the early days gypsum was ground almost solely for application to the soil and the industry showed little or no growth prior to 1890. Before that time the annual production of gypsum never amounted to 70,000 tons. This is in contrast to the 900,000 tons mined in 1929. The growth of the gypsum industry is due to the manufacture of various kinds of plasters and plaster boards, and more recently to the development of structural materials which can be used in place of wood. These materials include gypsum lath, sheathing boards, partition tile, roof tile, floor tile. Other materials made from gypsum include special cements, water-proof paints, paper filler, sound and fire insulators. Slabs of gypsum are used in the construction of sound-proof stages used in the talking picture industry. Gypsum is also used to considerable extent as a retarder in portland cement.

Like cement, the gypsum industry is almost wholly dependent upon building and construction activities, and the history of the industry has closely paralleled that of cement. A boom was experienced during the period from 1923 to 1929, but the industry in general was disorganized due to excessive competition with resulting over-production and price wars. With the stagnation in the building trades after 1929 the demand for gypsum products dropped in proportion. In an attempt to compensate the lowered demand for gypsum in building there is active research along the lines of developing new uses for this material.

At the present time gypsum is produced at Grand Rapids, and at Alabaster and National City, Iosco County. At Alabaster there is a unique loading device in the form of an aerial tramway delivering the quarry product to a crib 1 1/4 miles out in Lake Huron. This tramway is necessary because of shallow water for a considerable distance offshore.

In 1934 Michigan ranked second in quantity of gypsum mined and in total value of the manufactured product.

PRODUCTION OF GYPSUM IN MICHIGAN 1930 - 1934

Year	Crude Gypsum Tons mined	Sold Crude*		Sold calcined**		Total Value of products
		Tons	Value	Tons	Value	
1930	519,225	182,050	\$292,881	300,524	\$3,462,750	\$3,755,631
1931	383,123	136,060	253,842	253,902	3,284,044	3,537,886
1932	248,542	92,243	174,648	140,402	1,924,392	2,099,040
1933	211,392	71,533	153,700	154,459	2,016,543	2,170,243
1934	281,033	90,481	180,624	163,282	2,288,598	2,469,222

* Mostly to cement mills

** Includes all plasters, stucco, wall board, and building materials.

PRODUCTION OF GYPSUM IN MICHIGAN 1900 - 1934*

Year	Total Mined Tons	Gypsum and gypsum Products Total Value	Rank	
			Quantity	Value
Prior to 1900	2,285,851	\$9,030,533	-	-
1900	129,654	285,119	2	2
1901	185,150	267,243	1	1
1902	240,227	459,621	1	1
1903	269,093	700,912	1	1
1904	238,385	541,197	1	1
1905	247,882	634,434	1	2
1906	341,716	753,878	1	2
1907	317,261	681,351	3	3
1908	327,810	401,928	1	3
1909	394,907	1,213,347	2	1
1910	357,174	667,199	2	2
1911	347,296	523,926	3	4
1912	384,227	621,547	2	3
1913	423,896	721,325	3	3
1914	393,006	705,841	3	3
1915	389,791	686,309	3	4
1916	457,375	1,066,599	3	4
1917	375,803	1,568,655	3	3
1918	286,768	1,761,149	4	4
1919	339,125	2,390,367	3	3
1920	382,212	3,521,028	3	3
1921	408,224	3,212,096	2	2
1922	471,355	2,843,117	3	4
1923	587,987	3,252,993	3	4
1924	577,526	5,950,822	3	2
1925	649,053	5,447,294	3	4
1926	659,685	5,021,465	3	4
1927	668,617	4,216,524	3	4
1928	677,108	3,159,369	3	4
1929	898,547	4,315,334	2	3
1930	519,225	3,755,631	2	2
1931	383,123	3,537,886	2	2
1932	284,542	2,099,044	2	2
1933	211,392	2,170,243	2	2
1934	281,033	2,469,222	2	2

*For annual production prior to 1900 see Publication 37, Mich. Geol. Surv.

COAL

Coal has been mined in Michigan since about 1835. The earliest workings on record took place at Jackson, Jackson County, and at Grand Ledge, Eaton County. Subsequently numerous mines were opened in Jackson, Calhoun, Eaton, Shiawassee, Ingham, Genesee, Arenac, Huron, Tuscola, Saginaw, and Bay counties. In 1905 there were 38 coal mines in operation in Michigan, but the number gradually decreased, due to difficulties involved in mining, and consequently a high per ton cost, which, together with the low value of the material, made the operations unprofitable.

The peak of Michigan coal mining was reached in 1907, when 2,035,858 tons were produced. The value at the mine, however, was only \$1.80 per ton. The maximum value was attained in 1920, when 1,489,765 tons valued at \$7,346,000 were produced with an average price of \$4.93 per ton. The highest price per ton, \$5.05, was obtained in 1922, the result of widespread strikes in the coal fields of the country.

The following table shows only six mines reporting for 1931, while in 1934 twenty-four are recorded. Although the depression has stimulated coal mining in Michigan due to the saving in freight costs, the number of operating mines did not increase to this extent in the three year period. For some years previous to 1933 it had been the policy of the Bureau of Mines to send questionnaires only to the larger railroad shipping mines. In 1933, however, the canvass was extended to include many mines which ship chiefly by truck to local markets. Mines which produce less than 1000 tons per year are commonly known as "wagon mines." The six mines operating in 1931 produced approximately 60 percent of the 1934 State total.

Tests and analyses of some of the earliest mined coal in Michigan showed it to be of a decidedly inferior quality. The coal was generally high in ash, moisture, and sulphur content, and low in fixed carbon. Furthermore it tended to soften and run together on the grates and caused difficulty in handling. Specially devised grates were often necessary. Later mined coals, however, particularly those in the Saginaw Valley, proved to be considerably different from the earlier tested ones and modern methods of treatment at the mines further improve the quality of the product. Excessive ash may be reduced by washing and chemical treatment facilitates the handling of the coal on the grates. Most Michigan coals are good steam coals, but owing to the generally lower B.T.U. content than the eastern coals, it is advisable to make a careful study of heating powers of the different grades of coal with reference to the particular boiler in question. Some coals may be well adapted to one heating plant with a resultant saving in fuel costs, while the same coal may result in greatly decreased efficiency and higher costs in the case of other boiler equipment.

The Michigan "Coal Basin" underlies all or part of approximately 30 counties in the south central part of the Lower Peninsula, but it is probable that in only 12 of these will coal ever be profitably mined. The remaining counties are for the most part rather heavily covered by glacial drift which would make shaft sinking a costly operation unless coal beds of unusual quality or thickness should be discovered. Records of wells that have been drilled to date do not conclusively prove the existence of such beds. The Michigan coal beds are so variable and discontinuous that scattered wells do little except prove that the coal is not continuous over the area designated as the "Coal Basin." The present producing area roughly includes most of the area immediately surrounding Saginaw Bay and extending southwestward through St. Charles, Owosso, Lansing, and Jackson. Sebawaing, Flint, and Jackson represent the approximate eastern boundaries of the belt, while Midland, Grand Ledge, Charlotte, and Marshall are near the western limits. Some portions of this belt, however, are either non-productive or too heavily drift covered to warrant development. Most of the mines are underground, but where the coal is near the surface it is worked as an open pit by removing the overburden with

steam shovels. Coal beds ranging in thickness from a few inches up to five feet have been reported in various parts of the coal basin. However, the commercial seams average little more than three feet, and seams less than 2½ feet in thickness are not profitable to work unless conditions are unusually favorable.

PRODUCTION AND VALUE OF COAL IN MICHIGAN
1900-1934

Year	Number Active Mines	Total Tons of Coal Mined	Total Value of Coal Mined	Average Price Received per ton at mine
1860-1899*	--	3,221,643	--	--
1900	31	849,475	\$1,259,683	\$1.483
1901	30	1,241,241	1,753,064	1.412
1902	32	964,718	1,653,192	1.714
1903	34	1,367,619	2,707,527	1.979
1904	33	1,342,840	2,424,935	1.806
1905	38	1,473,211	2,512,697	1.705
1906	38	1,346,338	2,427,404	1.803
1907	37	2,035,858	3,660,833	1.798
1908	38	1,835,019	3,322,904	1.811
1909	36	1,784,692	3,199,351	1.793
1910	34	1,534,967	2,930,771	1.909
1911	32	1,476,074	2,791,461	1.891
1912	26	1,201,230	2,399,451	1.989
1913	24	1,231,786	2,455,227	1.993
1914	23	1,283,030	2,559,786	1.99
1915	20	1,156,138	2,372,797	2.05
1916	18	1,180,360	2,653,182	2.25
1917	22	1,374,805	4,426,314	3.22
1918	25	1,468,818	5,615,097	3.83
1919	22	996,545	3,864,228	3.87
1920	18	1,489,765	7,346,000	4.93
1921	15	1,141,715	5,555,000	4.87
1922	14	929,390	4,693,376	5.05
1923	15	1,172,075	5,545,000	4.73
1924	9	831,020	3,602,000	4.33
1925	9	808,233	3,391,000	4.20
1926	9	686,707	2,829,000	4.49
1927	8	756,763	3,262,000	4.31
1928	7	617,342	2,631,000	4.26
1929	7	804,869	2,904,000	3.61
1930	6	661,113	2,323,000	3.51
1931	6	359,403	1,094,000	3.04
1932	5	446,149	1,219,000	2.73
1933	13	406,741	1,171,000	2.88
1934	24	621,741	1,940,000	3.12

*For annual production prior to 1900 see Publication 37, Mich.Geol.Surv.

CLAY PRODUCTS

Brick and Tile

Brick has been manufactured in Michigan since a very early date. The wide distribution of clay suitable for brick manufacture resulted in the establishment of many small independent plants scattered over the southern part of the State. Many of these small plants flourished but the mortality rate was very high because of insufficient capital, failure to make a study of markets, transportation, and other vital factors. In 1899 there was a total of 196 brick and tile plants in operation, but practically every subsequent year showed a fewer number of plants. In 1934 there were only 21 plants reporting production.

The most important products manufactured in Michigan are common brick, drain tile, and face brick. Other products manufactured are building tile, roofing tile, silo tile, vitreous and enameled ware, sewer pipe, and wall coping. The best years for brick production in Michigan were those just preceding the World War. Immediately after the war production fell off sharply, but soon recovered in the face of an increased demand and a better price. The three-year period from 1924 to 1926 showed a volume of production almost equal to that of the pre-war years, and the value of the products was almost double that of the 1912 to 1916 period, owing to stimulation of all kinds of building. Following this period, however, there was a noticeable decrease in brick manufacture each year, beginning with 1927.

Pottery and Porcelain Ware

The value of pottery products and porcelain ware in Michigan has increased steadily with but few interruptions since 1899. In 1899 the total value was \$29,741; in 1908, \$62,409; in 1920 it had mounted to \$2,592,625. There was a decline in 1921 and 1922 to \$1,781,923 and \$1,337,000 respectively. In 1923, however, an increase was again noted, the total value for that year being \$1,810,619, and in 1924 the maximum value for pottery products in Michigan was attained, the value for that year being \$3,334,818, or an increase of 85 percent over the previous year.

From 1924 until 1930, the last year for which separate figures are available, production held quite steady at around the \$3,000,000 mark. The values for these years are given in the summary table.

The large increase in the value of pottery products in Michigan is due chiefly to the larger markets and increased production capacities for spark plugs and other porcelain electrical supplies and sanitary ware. It should be pointed out that only a small amount of the pottery made in Michigan is produced from clay mined in this State. The only pottery products for which Michigan clay is suitable are flower pots and similar red earthenware. Clays used for higher grades of pottery and porcelain products are imported from other states and foreign countries. The amount of sales of raw clay produced in Michigan is given in the summary tables at the end of this report.

PRODUCTION OF BRICK AND TILE PRODUCTS IN MICHIGAN
1899-1934

Year	Common Brick		Drain Tile Value	No. of Firms Operating	Total Value All Products
	Quantity Thousands	Value			
1899	200,144	\$ 933,176	\$140,171	196	\$1,254,256
1900	180,892	863,250	114,747	189	1,147,378
1901	215,836	1,095,254	98,972	180	1,497,169
1902	237,254	1,331,752	96,645	182	1,660,942
1903	215,791	1,251,572	129,028	178	1,662,414
1904	205,196	1,116,714	208,088	168	1,670,892
1905	211,558	1,152,505	205,445	154	1,719,746
1906	206,583	1,178,202	314,098	142	1,793,367
1907	200,817	1,181,015	289,658	136	1,786,190
1908	181,049	994,525	327,630	132	1,666,381
1909	219,820	1,250,787	364,006	122	1,947,059
1910	232,551	1,363,316	348,205	118	2,083,525
1911	252,465	1,301,998	313,072	111	1,953,442
1912	271,189	1,592,283	387,945	101	2,350,606
1913	273,571	1,626,287	415,543	95	2,451,242
1914	269,154	1,633,216	421,941	90	2,434,872
1915	277,399	1,461,188	305,156	82	2,248,068
1916	279,175	1,856,587	548,795	73	2,705,054
1917	236,612	1,882,042	734,042	69	2,846,264
1918	94,746	915,599	565,398	61	1,708,736
1919	200,352	2,734,503	737,124	52	3,699,929
1920	186,526	3,062,660	690,816	49	3,979,691
1921	193,730	2,417,809	381,507	31	2,915,919
1922	248,608	3,613,542	169,419	27	3,915,310
1923	193,350	2,775,925	337,833	33	3,723,018
1924	261,614	2,927,123	381,411	31	6,912,135
1925	260,280	3,030,809	361,130	37	4,287,422
1926	275,294	3,057,589	360,593	36	4,227,731
1927	201,143	2,305,276	393,943	39	3,989,726
1928	159,538	1,747,378	342,942	34	3,019,297
1929	153,110	1,764,400	389,474	35	3,076,403
1930	71,046	856,628	326,065	34	3,322,901
1931	a	a	a	--	3,417,585 b
1932	a	a	a	--	2,632,226 b
1933	4,276	40,215	103,763	21	2,657,248 b
1934	26,208	249,872	22,621	21	3,286,382 b

(a) Separate figures not available

(b) Includes pottery and porcelain and other clay products

SAND LIME BRICK

The manufacture of sand lime brick was introduced into this country from Germany about 35 years ago, and Michigan very early assumed the lead in this industry. With the exception of the years marked by industrial depressions

the industry has enjoyed a general upward trend with an increasing popularity of the product. The year 1927 was a record for the industry, 112,181,000 brick valued at \$1,402,647 being produced. Since 1927, however, owing to the slump in building and to the general economic depression, production has fallen off each year.

PRODUCTION OF SAND LIME BRICK IN
MICHIGAN AND THE UNITED STATES
1904-1934

Year	No. of Firms Reporting		Quantity Thousands	Value	Total Value U.S.	Rank	
	Mich.	U.S.				Produc- tion	Value
1904	10	57	9,886	\$64,034	\$463,128	1	1
1905	12	84	24,841	155,883	972,064	1	1
1906	11	87	27,281	162,879	1,170,005	1	2
1907	13	94	25,488	158,606	1,225,769	1	1
1908	10	87	21,997	131,827	1,029,699	1	1
1909	11	74	34,217	207,082	1,150,580	1	1
1910	10	76	37,648	218,627	1,169,153	1	1
1911	10	66	32,889	192,224	897,664	1	1
1912	11	71	48,129	307,106	1,200,228	1	1
1913	12	68	49,373	315,882	1,238,325	1	1
1914	12	62	41,456	248,113	1,058,512	1	1
1915	11	56	46,513	281,009	1,135,104	1	1
1916	12	53	71,116	491,866	1,474,073	1	1
1917	11	47	46,979	362,246	1,420,330	1	1
1918	7	42	22,248	195,636	883,929	1	1
1919	8	35	42,063	507,010	1,705,163	1	1
1920	8	37	38,810	632,112	2,490,283	1	1
1921	--	26	*33,658	---	1,268,502	--	--
1922	8	--	*46,558	557,647	---	--	--
1923	9	33	*64,650	777,693	2,471,536	--	--
1924	11	37	*89,239	1,052,435	3,334,503	1	1
1925	--	42	*97,828	1,175,776	3,780,639	1	1
1926	13	42	*108,434	1,341,284	2,981,492	1	1
1927	12	45	*112,181	1,402,647	3,645,842	1	1
1928	12	41	*103,056	1,270,778	3,654,590	1	1
1929	12	40	*96,511	1,107,708	2,909,635	1	1
1930	13	37	*45,391	551,187	1,950,709	1	1
1931	11	31	*28,819	222,223	1,236,825	--	--
1932	10	31	*8,420	75,717	433,118	--	--
1933	2	10	a	a	195,318	--	--
1934	4	16	*5,575	45,129	355,560	--	--

* Includes common and face brick

(a) Not permissible to publish separate figures for Michigan.

PETROLEUM AND NATURAL GAS

PORT HURON FIELD

Production of oil in the Petrolia field of Ontario supplied the incentive for explorations at Port Huron beginning about 1886. In the course of the next 25 years about 22 wells were drilled on a low anticline to the west and northwest of the city, and the first commercial production of oil in Michigan was obtained. The wells obtained their yield from the Dundee limestone formation and ranged from 500 to 650 feet in depth. At one time these wells were said to produce about 70 barrels of heavy black oil per week. After 1920, however, production was insignificant and the wells were abandoned.

SAGINAW FIELD

The presence of a structure at Saginaw favorable to the accumulation of gas and oil was known as early as 1902. No tests were made, however, until 1912, when a company was formed by Saginaw business men and 10 wells were drilled. Unfortunately these wells missed the crest of the anticline and only a very small production was obtained. Nothing further was done until 1925, when the Saginaw Prospecting Company drilled three wells north of the city limits, which definitely proved the presence of oil in commercial quantities. Other companies became interested and by June 1, 1927, there were 190 wells, producing 1400 barrels per day, the maximum output obtained in the field. The total number of wells drilled was about 300. The bulk of the oil was obtained from the Berea sandstone at a depth of slightly more than 1800 feet, but a small amount was derived from the Traverse ("Saginaw sand") and Dundee formations. The wells ranged in initial output from 10 to 90 barrels per day, but one well in the "Saginaw sand" yielded 500 barrels of a very light oil the first 24 hours. The oil from the Saginaw field is of exceptionally high grade, but unfortunately a large part of the field is located within the city limits and too close spacing of wells, due to town lot drilling, greatly reduced the importance of the field.

Late in 1934 production was obtained from the Berea sandstone near Birch Run in southeastern Saginaw county. By the end of 1935 this field was producing more oil from 19 wells than the original Saginaw field was yielding from 83 wells.

MUSKEGON FIELD

The discovery well in the Muskegon field was completed in December, 1927, with an initial flow of about 300 barrels per day. That there was a strong possibility for production of oil and gas in Muskegon County and other places in Western Michigan has been known since about 1870, when several wells were drilled for salt. Dr. A. C. Lane, former State Geologist, had shown from the records of these old wells that a structure existed to the north of Muskegon Lake. The first production was obtained from near the top of the Traverse formation at depths of 1620 to 1680 feet, but deeper drilling found larger pays in the Dundee formation about 400 feet lower.

The peak of production was reached in August, 1929, when the average daily yield was 18,570 barrels. By 1936, however, production has declined to an average of 280 barrels per day. The largest single well brought in yielded 3,000 barrels per day and the largest initial gas flow from a single well was in excess of 25,000,000 cubic feet. The Muskegon field was subject to the same disadvantage regarding location as in the case of the Saginaw field. Town lot subdivision permitted close spacing of wells, with consequent overdrilling, which greatly decreased the life of the field.

CENTRAL MICHIGAN FIELDS

The discovery well in the Central Michigan area was completed in February 1928 in Greendale township, Midland county about 10 miles east of the city of Mt. Pleasant. The Central Michigan Fields now include the Mount Pleasant pool and East Extension, Porter pool, Yost-Jasper pool, Vernon pool, Leaton pool, Crystal pool, Edmore pool, Beaverton pool, and the Clare, Broomfield, Austin, and Belvidere-Hinton-Millbrook gas fields. In addition there is a scattered production from various parts of Midland, Gratiot, Montcalm, Mecosta, and Bay counties. The most productive of these fields to date have been the "East Extension", Porter pool and Crystal pool. Several wells in these fields have been gauged for an hours run as having an open flow capacity of more than 5,000 barrels per day, while one well in the Porter field was estimated to produce at the rate of more than 20,000 barrels per day.

The Dundee limestone is the chief producing formation in the Central Michigan fields although some wells have found commercial amounts of oil in the Traverse limestone. In the Crystal field the producing formation is dolomitized and possibly should be correlated with the Monroe. This would imply that the Dundee is absent in that field. The "Dundee" oil is found at depths ranging from 3,200 to 3,800 feet while the Traverse oil occurs from 400 to 600 feet higher up. The oil produced in these fields is a high gravity, paraffin base crude but the Dundee crude has certain properties which demand "cracking" processes in order to produce a gasoline with a high anti-knock rating. The "topping" or "skimming" plants produce chiefly kerosenes, naphthas and fuel oils. Gasoline produced by these plants from Dundee crude has a lower anti-knock rating.

WEST BRANCH FIELD

The West Branch field is the most productive of Michigan fields discovered to date outside of the Central Michigan area. It is also noteworthy for having the greatest extent along its axis, this being approximately 10 miles. The wells are as a rule not large but are remarkably consistent in production. Some wells in the Traverse formation, however, had a large initial flow but production thereafter has been inconsistent and the wells have declined rapidly. The bulk of the production is, however, from the Dundee limestone which has three known "pay" zones, and is thicker than the Dundee of any other Michigan fields. The crude is black in color and of low gravity but produces a good grade of gasoline when refined.

OTHER FIELDS

Aside from the Saginaw, Muskegon, Central Michigan, and West Branch fields, oil in commercial quantities has been found near Hart, Oceana County; Deerfield, Lenawee County; Lapeer, Lapeer County; and Union, Cass County. Smaller quantities have been found near Howell, Livingston County; Owosso, Shiawassee County; Decatur, Van Buren County; Allegan, Allegan County; White Cloud, Newaygo County; Manistee, Manistee County; Wellsville, Mason County; and Caledonia, Kent County.

NATURAL GAS

Natural gas produced in Michigan is of two types - that which is produced with oil, and the "dry" gas with which no oil is associated. The "dry" gas is obtained from the Michigan "Stray sand" which lies about 2000 feet or more above the oil producing Dundee limestone. The principal fields producing the Michigan "stray" gas are located near Clare in both Clare and Isabella counties, in Broomfield township west of Mount Pleasant, southeast of Big Rapids in Austin township, Mecosta County, and near Six Lakes and Millbrook, Montcalm and Mecosta counties.

Commercial utilization of natural gas has developed slowly, due to lack of pipe line facilities leading from the gas fields, and uncertainty as to available reserves. The "casing head" gas produced along with the oil is used chiefly in the fields for drilling and pumping operations and some natural gasoline is manufactured. Conservation of this gas is also necessary to raise the oil to the surface without pumping.

Natural gas from the Muskegon field was utilized in that city as long as the supply lasted. Muskegon now obtains its supply from the Austin pool, as does Big Rapids. Gas from the Broomfield and Six Lakes pools goes to Midland, Saginaw, Bay City, and other cities and communities in the Saginaw Valley. Mount Pleasant, Rosebush, and Clare are served by nearby pools, and developments are under way to deliver natural gas to Grand Rapids and Lansing from the prolific pools in Montcalm and Mecosta counties.

PRODUCTION AND MARKETS

In 1935 Michigan produced 15,776,237 barrels of oil and ranked eighth among the oil producing states. During the last quarter of the year the daily average output exceeded that of Pennsylvania, and Michigan became the leading oil-producing state east of the Mississippi. Including plants under construction, approximately 20 refineries in the State will process about one-half of the output, while the balance will go to out-of-State refineries. A recently completed 140-mile 8-inch pipe line from the Crystal field to Toledo has a capacity of 25,000 barrels daily.

The average price of Michigan crude at the well in 1935 was approximately \$1.04 per barrel, and the total value of oil produced amounted to \$16,337,476.* By January 15, 1936, the general price had increased to \$1.32 per barrel, the highest for Michigan crude in six years. Natural gas produced and consumed in Michigan in 1935 amounted to 5,498,174,175 cubic feet, which sold for \$537,400.*

*Figures from State Tax Commission.

MICHIGAN OIL FIELD PRODUCTION 1925-1935

Field	1925	1926	1927	1928	1929	1930	1931
Saginaw	4,000	94,000	434,000	231,000	113,559	89,387	61,876
Muskegon			1,928	334,601	3,157,668	1,297,962	531,147
Mt. Pleas. & East Ext.				27,019	1,367,836	2,378,775	2,647,879
Leaton					1,948	138,470	299,621
Vernon						22,616	244,166
Porter							944
Yost-Jasper							
Hart							
West Branch							
Edmore							
Birch Run							
Beaverton							
Crystal							
Others*							
Total for State	4,000	94,000	435,928	522,620	4,641,239	3,228,229	3,785,633
	1932	1933	1934	1935	Total	1,019	Producing Wells
Saginaw	63,616	55,066	47,675	27,198	1,221,377	83	December 31, 1935
Muskegon	478,728	276,174	158,425	101,988	6,338,621	117	
Mt. Pleas. & E. Ext.	5,795,860	3,128,804	1,512,933	1,130,326	17,989,432	284	
Leaton	237,870	303,023	244,950	363,891	1,589,773	48	
Vernon	322,354	538,708	907,239	632,361	2,668,444	38	
Porter	7,381	3,354,175	7,168,161	8,317,098	18,847,759	332	
Yost-Jasper	19,362	219,485	275,807	874,762	1,389,416	26	
Hart		45,853	58,814	11,279	115,946	3	
West Branch		18,974	124,922	523,969	667,865	104	
Edmore		1,661	102,600	107,447	211,708	7	
Birch Run			551	35,588	36,139	19	
Beaverton				23,487	23,487	5	
Crystal				3,605,264	3,605,264	93	
Others*	494	72	682	20,579	23,074	9	
Total for State	6,925,665	7,941,995	10,602,759	15,776,237	54,728,305	1,167	

*For 1929 Gratiot County; for 1930 Cass and Shiawassee counties; for 1932 Cass and Oceana counties; for 1933 Cass County; for 1934 Mason, Cass, and Isabella (Broomfield) counties; for 1935 Midland (Mt. Haley, Geneva, Larkin), Monroe, Isabella (Broomfield), Bay, Montcalm (Bushnell) counties.

STONE

Limestone and Dolomite

Limestone is by far the most important type of crushed stone produced in Michigan. There are large deposits of high grade limestone in Alpena, Presque Isle, Choboygan, Emmet, Charlevoix, Mackinac, and Schoolcraft counties, and similarly extensive belts of pure dolomite in Chippewa, Mackinac, and Schoolcraft counties. Limestone and dolomite beds of lesser importance are found in Arenac, Huron, Wayne, Monroe, and Eaton counties in the southern part of the State. Quarries are in operation at Alpena, Alpena County; Rogers City and Presque Isle, Presque Isle County; Afton, Choboygan County; Petoskey, Emmet County; Bayport, Huron County; Monroe, Monroe County; and Sibley, Wayne County; and in the Upper Peninsula at Fiborn, Ozark, and Hunt Spur, Mackinac County; Groos, Delta County; and Felch, Dickinson County. Quarries at Hunt Spur, Alpena, and Presque Isle have been developed within the past five years.

The high purity of many of the Michigan limestones especially adapts them for use as blast furnace flux and for chemical purposes. Since approximately 50 percent of Michigan limestone is sold for flux, the limestone industry in Michigan generally reflects the condition of the steel industry. An additional large quantity of limestone is used in the manufacture of alkalis, calcium carbide, portland cement, and there are various other chemical uses.

Michigan ranked third among the states in total tons of limestone produced in 1933, but was sixth in value of the product owing to the necessarily low price for metallurgical and chemical limestone. Pennsylvania, New York, Michigan, and Ohio are the leading states in limestone production. Ohio and New York produce chiefly crushed stone for road construction, while the Pennsylvania and Michigan stone is largely sold for blast furnace flux. In view of the recent large quarry developments in Alpena, Presque Isle, and Mackinac counties, it is quite possible that Michigan will assume an even higher rank among the states when the steel industry again reaches a high plane of production. The location of large deposits of very pure limestone near to the shores of the Great Lakes with resulting low cost shipments to steel mills, accounts for Michigan's high position in the stone industry. The year 1929 was a record year in the stone industry for Michigan, 13,572,010 tons valued at \$8,425,261 being produced. In that year the value of stone produced was slightly greater than that for salt, it being the first time that any non-metallic mineral has out-ranked salt in value in Michigan.

PRODUCTION AND VALUE OF LIMESTONE IN MICHIGAN 1930-1934 (By uses)

Year	Road Metal, Concrete, and R.R. Ballast		Furnace Flux		Alkali Works	
	Tons	Value	Tons	Value	Tons	Value
1930	1,444,520	\$982,598	5,161,490	\$3,237,042	2,738,138	\$1,215,748
1931	729,740	490,828	2,708,380	1,629,346	2,002,140	946,891
1932	669,280	400,310	792,330	460,851	1,808,813	892,918
1933	469,410	277,631	2,276,180	1,273,440	2,612,749	1,157,408
1934	576,170	381,477	2,739,350	1,482,139	2,369,806	1,108,427

Production and Value of Limestone in Michigan 1930-1934 (Continued)

Year	Paper Mills		Sugar Plants		Agriculture	
	Tons	Value	Tons	Value	Tons	Value
1930	**	**	**	**	126,670	\$131,632
1931	**	**	**	**	89,900	67,876
1932	**	**	70,000	\$42,510	23,200	19,020
1933	56,660	\$85,487	89,150	52,602	30,680	22,847
1934	51,870	83,974	77,920	40,851	35,260	29,545

Year	Other Uses*		Total	Total	Rank of State	
	Tons	Value	Tons	Value	Tons	Value
1930	962,212	\$1,039,693	10,432,950	\$6,596,713	4	5
1931	529,610	670,666	6,059,770	3,805,607	5	7
1932	229,107	102,947	3,592,020	1,918,556	4	7
1933	99,691	103,346	5,634,520	2,972,761	3	6
1934	664,114	483,160	6,514,590	3,608,543	-	-

* Includes stone sold for riprap, rubble, rough construction, glass manufacture, calcium carbide, paint and asphalt filler, stucco, art stone, cast stone, poultry grit, dolomite for refractory purposes.

** Included in "Other uses".

PRODUCTION AND VALUE OF LIMESTONE IN MICHIGAN 1899-1934

Year	Rank of State	Total		Year	Rank of State	Total	
		Tons	Value			Tons	Value
1899	---	---	\$ 281,769	1917	5	---	\$3,320,895
1900	12	---	330,847	1918	3	---	5,186,867
1901	12	---	429,771	1919	5	7,186,760	3,797,522
1902	13	---	413,148	1920	5	9,766,550	5,943,229
1903	14	---	390,473	1921	6	5,395,780	3,387,722
1904	10	---	501,708	1922	6	7,646,550	4,533,998
1905	12	---	544,754	1923	6	10,589,070	5,848,649
1906	10	---	656,269	1924	6	9,901,910	5,578,642
1907	11	---	760,333	1925	6	11,460,000	6,327,634
1908	9	---	669,017	1926	7	10,788,740	6,411,828
1909	11	---	750,589	1927	6	11,335,780	6,243,751
1910	9	---	842,126	1928	6	12,381,240	7,407,149
1911	8	---	1,005,751	1929	5	13,572,010	8,425,261
1912	8	---	1,139,560	1930	5	10,432,950	6,596,713
1913	7	---	1,408,703	1931	7	6,059,770	3,805,607
1914	8	---	1,457,961	1932	7	3,592,020	1,918,556
1915	7	---	1,828,766	1933	6	5,634,520	2,972,761
1916	6	---	2,389,763	1934	-	6,514,590	3,608,543

MISCELLANEOUS STONE
Trap Rock

In addition to limestone there are appreciable amounts of other types of stone produced in Michigan. In the western part of the Upper Peninsula considerable quantities of trap rock (basalt, diabase, amygdaloid) are quarried for road metal, concrete work, and railroad ballast. Much of the production is by county road commissions and city engineering departments for municipal and county work, but additional quantities are produced by private companies and sold as roofing granules and railroad ballast. There are large resources of this type of stone in the western half of the Upper Peninsula.

Sandstone

The Cleveland Quarries Company operates intermittently a quarry in the Marshall sandstone at Grindstone City, Huron County, for the manufacture of grindstones. Building stone is again being produced near Ionia, Ionia County, under the trade name "Rainbow Valley" stone. Quarries were opened in Ionia County many years ago, but subsequently closed down due to outside competition and preference for uncolored stone. In recent years, however, it is claimed that new strata have been uncovered which show a very pleasing combination of colors and which has found some favor in the market. Sandstone is also produced in Marquette County for road and concrete purposes. There are large reserves of sandstone available in the Lake Superior region.

Marble and Verde Antique

For a number of years a dolomitic marble has been quarried at Randville and Felch, Dickinson County. The stone is variegated in color, ranging from pure white to pink, green, gray, and purple. The material available at the present time is too badly shattered for use as building stone, although it polishes well and is very attractive. It is, however, well suited for use as cast stone for art and ornamental purposes, and for paint filler.

The Vertique Marble Company carried on exploration work near Ishpeming several years ago preparatory to the production of slabs and blocks of serpentine marble for ornamental work and other types of construction to which the material is adapted. This material was formerly quarried chiefly for use as terrazzo and stucco, but no production has been reported in recent years. The stone is very attractive when polished and appears to be equal or superior to much of the serpentine and verde antique now on the market. Drill holes in the vicinity of the quarry site show sound marble to be present to depths of 300 feet. The sound blocks of stone can be sawed and polished, while the shattered material is suitable for terrazzo.

Slate

Prior to 1900 slate quarries were in operation near Arvon, Baraga County. The slate was said to compare favorably with that from eastern quarries. Several years ago the Ford Motor Company shipped 125,000 slate shingles from Arvon for use in roofing some of the buildings on the Ford Museum grounds at Dearborn. The shingles were taken from the stock piles which had existed since the quarry was operated many years ago. The shingles were reported to show very few traces of weathering. It is probable that slate of good quality exists in other parts of the Upper Peninsula.

SAND AND GRAVEL

The sand and gravel industry naturally received tremendous impetus in the decade following the war, owing to the great volume of construction in cities and the extensive highway programs. Prior to 1926 building in cities constituted a larger market than road making, but subsequent to 1926 the road construction market has been considerably more important than the city building trade.

Prior to the war the record production for sand and gravel was attained in 1913 when 6,422,818 tons valued at \$1,528,892 were produced. Production decreased during the war but subsequently a gradual increase was noted to 1923, when the production jumped to 9,601,562 tons, which represented an increase of 60 percent over that of the preceding year. By 1926, which year found the State launched on an elaborate program of concrete road construction, the production had increased to 14,398,338 tons, and sand and gravel were exceeded only by salt in value among the non-metallic minerals. This large production placed Michigan in third position among the states in quantity of sand and gravel produced. The production continued to increase through 1929, when a record of 16,884,099 tons was reported. The industry, however, was rather badly demoralized by keen competition, both from within the State and from Canadian operators who had the advantage of water shipment into Detroit, the largest market.

Since a large percentage of all sand and gravel produced is used for concrete aggregates, the sand and gravel industry naturally parallels the cement industry quite closely. Due to the relative abundance of sand and gravel deposits in Michigan and the general use of these materials for roads and building construction, there are more commercial sand and gravel plants than any other type of mineral operation, - oil and gas wells excepted. Prior to 1930 too many plants were in existence; hence when road construction and private building fell off a large number of operators were forced to close down. The chief producing centers of the State at the present time are as follows: Oxford, Oakland County; Grand Haven, Ottawa County; Grand Rapids, Kent County; Brighton, Livingston County; Tecumseh, Lenawee County; Kalamazoo, Kalamazoo County; Port Austin, Huron County; Manistee, Manistee County; Muskegon, Muskegon County; Hersey, Osceola County; Flint, Genesee County; and in the Upper Peninsula the chief centers are at Champion, Marquette County; Beechwood, Iron County; Loretto, Dickinson County; and Groos, Delta County. Considerable sand and gravel is produced from the Great Lakes and connecting waters by lease from the State Conservation Department. Lake St. Clair and the St. Clair River are the most important areas in this respect.

PRODUCTION AND VALUE OF SAND AND GRAVEL IN MICHIGAN
1930 - 1934 By Uses
SAND

Year	Molding Sand		Building Sand		Paving and roadmaking sand	
	Tons	Value	Tons	Value	Tons	Value
1930	521,452	158,561	1,219,592	454,431	1,890,094	726,899
1931	421,635	146,420	996,580	356,418	1,164,563	384,141
1932	236,141	92,902	497,548	183,325	762,186	260,427
1933	416,704	128,111	175,950	62,938	529,253	172,344
1934	522,544	163,975	321,533	119,612	607,429	241,451

PRODUCTION AND VALUE OF SAND AND GRAVEL IN MICHIGAN (cont'd.)
SAND

Year	Railroad Ballast		Other Sand*	
	Tons	Value	Tons	Value
1930	85,850	\$ 20,089	426,739	\$ 196,591
1931	101,259	26,087	345,105	229,430
1932	**	**	659,513	285,316
1933	none reported		805,158	307,107
1934	**	**	249,115	254,275

* Glass sand, cutting, grinding, and blast sand, furnace and engine sand, fill and filter sand.

**Included in "Other Sand".

GRAVEL

Year	Building Gravel		Paving and road-making Gravel		Railroad Ballast	
	Tons	Value	Tons	Value	Tons	Value
1930	1,573,059	\$845,959	4,812,224	\$2,484,826	800,888	\$ 269,873
1931	1,112,013	502,848	3,405,843	1,448,006	578,519	259,974
1932	530,702	262,476	2,709,306	1,184,779	41,644	13,671
1933	219,333	118,734	2,224,553	929,076	97,686	34,375
1934	348,766	207,435	3,120,710	1,122,246	212,769	88,746

Year	Other Gravel*		Total Sand and Gravel	
	Tons	Value	Tons	Value
1930	59,221	\$ 5,947	11,389,119	\$ 5,161,176
1931	29,228	5,531	8,164,571	3,361,729
1932	31,623	8,210	5,468,663	2,291,106
1933	150,586	55,675	4,619,223	1,805,360
1934	19,205	10,098	5,432,071	2,197,838

*Mostly fill.

PRODUCTION AND VALUE OF SAND AND GRAVEL IN MICHIGAN 1905-1934

Year	Total Sand and Gravel		Rank	
	Quantity Tons	Value	Quantity Tons	Value
1905	414,509	\$ 210,609	10	11
1906	597,789	197,699	12	13
1907	1,024,641	289,595	10	11
1908	842,591	370,365	8	9
1909	2,219,757	685,632	8	8
1910	2,862,738	816,337	7	8
1911	2,185,165	565,969	9	10
1912	2,681,821	818,603	9	8
1913	6,422,818	1,528,892	4	5
1914	3,757,979	1,143,771	8	7
1915	3,776,726	1,036,739	8	7

PRODUCTION AND VALUE OF SAND AND GRAVEL IN MICHIGAN 1905-1934 (cont'd.)

Year	Total Sand and Gravel		Rank	
	Quantity Tons	Value	Quantity Tons	Value
1916	4,407,475	\$1,295,717	7	7
1917	3,814,445	1,641,748	7	6
1918	2,837,371	1,239,874	8	9
1919	3,772,535	1,944,143	6	7
1920	4,386,582	2,867,466	8	6
1921	5,515,253	2,916,917	4	6
1922	5,962,916	3,222,043	5	6
1923	9,601,562	5,096,071	5	5
1924	11,381,084	5,975,757	5	5
1925	10,878,375	5,684,474	6	5
1926	14,398,338	7,265,161	3	5
1927	15,419,499	7,800,541	3	6
1928	15,893,090	6,828,431	4	6
1929	16,844,099	7,928,744	3	6
1930	11,389,119	5,161,176	6	7
1931	8,164,571	3,361,729	7	9
1932	5,468,663	2,291,106	6	8
1933	4,619,223	1,805,360	5	7
1934	5,432,071	2,197,838	5	7

MISCELLANEOUS MINERALS AND MINERAL PRODUCTS

Miscellaneous minerals and mineral products regularly or intermittently produced in Michigan are, graphite, iron ore for paint, manganiferous iron ore, mineral waters, marl, peat, coke, pig iron, and silver. Where possible to disclose figures the production and value of these minerals will be found in the summary table; otherwise they are included under "Miscellaneous." There is no canvass of mineral waters, marl, and peat, considerable quantities of which are produced. The value for pig iron is not included in the total value of mineral production in the State, as this would result in duplication of figures, most of the iron manufactured being made from iron ore mined in the State. Coke manufactured in Michigan is a by-product of the production of gas for domestic uses, and the manufacture of various oils and chemicals. Coke produced in Michigan is made entirely from coals mined in other states. Silver occurs associated with native copper and some production is generally reported. Silver free from copper occurs near Ontonagon.

EXPLORATIONS

Gold

Prior to 1897 several mines were operated in the vicinity of Ishpeming and about \$625,000 in gold was recovered. Most of this was produced from a single property known as the Ropes Mine. This property has recently been taken over by the Calumet and Hecla Consolidated Copper Company and exploration and development work is in progress. The old Michigan mine is also being explored with a view to reopening and other tracts in the vicinity are being prospected. During the course of the exploratory and development work at these mines a small amount of gold has been recovered. This amounted to 58.63 ounces in 1934.

TALC

The Michigan Talc Mining Company was organized in 1933, and development work was carried on at the property north of Ishpeming. Some talc was shipped in 1934, but in 1935 operations were largely confined to exploration. It is uncertain whether or not operations will be continued.

OTHER MINERALS

Granite, quartzite, and feldspar of commercial grade are known to exist in the western part of the Northern Peninsula. Small concentrations of mica, kaolin, or asbestos may also be present. Various kinds of gem stones are found on Isle Royale. More than 100 other minerals have been identified in the iron and copper mining regions, but these are of scientific interest only. Strontium-bearing minerals are found in quarries in Wayne and Monroe counties.

SUMMARY TABLE OF PRODUCTION AND VALUE OF MINERALS AND MINERAL PRODUCTS IN MICHIGAN

	1931		1932	
	Quantity	Value	Quantity	Value
Cement, bbls shipped	7,168,720	\$6,984,725	4,886,928	\$4,442,666
Clay products	—	3,417,585 ^a	—	2,632,226 ^a
Coal, tons	359,403	1,094,000	446,149	1,219,000
Coke, tons	2,436,630	11,632,284	2,165,109	10,144,218
Copper, pounds	118,059,491	10,743,414	54,396,108	3,426,955
Gold, ounces	—	—	—	—
Gypsum, tons mined, Value products	383,123	3,537,886	248,542	2,099,040
Iron ore, long tons shipped, Value f.o.b. mine	5,555,376	15,986,273	968,789	2,703,900
Iron, pig, long tons sold	519,643	8,964,439 ^b	280,536	4,269,528 ^b
Lime, tons	46,716	334,015	38,610	267,520
Limestone, tons	6,059,770	3,805,607	3,592,020	1,918,556
Magnesium, lbs. sold	580,463	199,633	791,699	228,653
Manganiferous ore, tons	—	c	9,582	29,356
Natural gas, M.cu.ft.	594,363	77,000	1,433,159	272,000
Petroleum, bbls	3,785,263	2,840,000	6,925,665	4,917,222
Salt, bbls	14,665,417	5,760,000	12,252,171	4,845,379
Sand and gravel, tons	8,164,571	3,361,729 ^d	5,468,663	2,291,106 ^d
Sand lime brick, number of brick	28,819,000	222,223	8,420,000	75,717
Silver, ounces	1,437	417	71,408	20,137
Trap rock and miscellaneous stone	235,430	232,041	116,690	144,192
Miscellaneous minerals	—	4,137,988 ^e	—	2,907,708 ^e
TOTAL		\$74,385,483		\$44,585,551

(a) Includes brick and tile, pottery and porcelain ware.

(b) Not included in total for State; covered by iron ore.

(c) Included under miscellaneous.

(d) Includes glass sand.

(e) Includes bromine, calcium chloride, clay, graphite, grindstones, iron ore for paint, magnesium salts, and minerals indicated by (c) in table.

Summary Table of Production and Value of Minerals and Mineral Products (Continued)

	1933		1934	
	Quantity	Value	Quantity	Value
Cement, bbls shipped	3,447,867	\$4,128,082	3,965,531	\$5,920,214
Clay products	—	2,657,248 ^a	—	3,286,382 ^a
Coal, tons	406,584	1,171,000	621,741	1,940,000
Coke, tons	2,341,081	9,911,010	2,547,747	14,348,536
Copper, pounds	46,853,130	2,998,600	48,215,859	3,857,269
Gold, ounces	10	247	59	2,049
Gypsum, tons mined, Value products	211,392	2,170,243	281,033	2,469,222
Iron ore, long tons shipped, value f.o.b. mine	6,099,031	18,442,073	5,497,953	15,646,165
Iron, pig, long tons sold	407,011	6,181,318 ^b	644,895	9,987,451 ^b
Lime, tons	43,959	292,144	32,844	240,181
Limestone, tons	5,634,520	2,972,761	6,514,590	3,608,543
Magnesium, tons sold	1,434,893	377,181	4,249,838	c
Manganiferous ore, tons	6,445	19,817	595	c
Natural gas, M cu.ft.	1,697,628	203,000	3,008,085	355,750
Petroleum, bbls	7,941,995	7,330,461	10,602,759	10,789,398
Salt, bbls.	14,912,520	5,679,737	—	5,470,684
Sand and gravel, tons	4,619,223	1,805,360 ^d	5,432,071	2,197,838 ^d
Sand lime brick, number brick	—	c	5,575,000	45,129
Silver, ounces	125,926	44,074	529	342
Trap rock and miscellaneous stone	67,480	122,151	107,113	119,363
Miscellaneous	—	3,551,407 ^e	—	4,073,077 ^e
TOTAL		\$63,754,445		\$73,542,142

(a) Includes brick and tile, pottery and porcelain ware.

(b) Not included in total for State; covered by iron ore.

(c) Included under miscellaneous.

(d) Includes glass sand.

(e) Includes bromine, calcium chloride, clay, graphite, grindstones, iron ore for paint, magnesium salts, marl, natural gasoline, peat, talc, and minerals indicated by (c) in table.

APPENDIX

DIRECTORY OF THE PRODUCERS OF MINERALS
AND MINERAL PRODUCTS IN MICHIGAN IN 1934 AND 1935

BRICK AND TILE MANUFACTURERS - 1935

County	Operator	Office	Works
Allegan	Allegan Brick Co.	Allegan	Allegan
Dickinson	Vulcan Brick Works	Vulcan	Vulcan
Eaton	American Vitriified Prod.Co.	Alron, Ohio	Grand Ledge
	Grand Ledge Clay Prod.Co.	Grand Ledge	Grand Ledge
	Grand Ledge Face Brick Co.	Grand Ledge	Grand Ledge
Gratiot	North Star Tile Co.	North Star	North Star
	Riverside Brick & Tile Yard	Sumner	Sumner
	St.Louis Clay Products Co.	St.Louis	St.Louis
Ingham	Mich.Clay Prod.Corp.	Williamston	Williamston
Lenawee	Comfort Brick & Tile Co.	Tecunseh	Tecunseh
Maconb	Trombly Brick Co.	4945 Iroquois, Detroit	Warren
Saginaw	Miller City Tile Co.	Findlay, Ohio	Saginaw
Shiawassee	Now Corunna Brick Co.	Corunna	Corunna
Wayne	Bunte Bros. Tile Co.	Flat Rock	Flat Rock
	Clippert Brick Co.	Wyoming & Southern, Detroit	Detroit
	Jacob Daniel Brick Co.	2213 Atkinson, Detroit	Detroit
	John S.Haggerty	10450 Michigan, Detroit	Dearborn
	Mercier, Bryan, Larlins Co.	Miller & Mich., Detroit	Dearborn and Detroit
	Pewabic Pottery	10125 E.Jefferson, Detroit	Detroit
	Porath Brothers	816 Transportation Bldg., Detroit	Dearborn
	Standard Fuel Eng.Co.	667 S.Post, Detroit	Detroit
	Walker & Frank Brick Co.	8810 Dix, Detroit	Detroit

BRICK (Sand Line) MANUFACTURERS 1935

Huron	Sebewaing Sandstone Brick Co.	Sebewaing	Sebewaing
Kent	Grande Brick Co.	1456 Fuller, Gr.Rapids	Grand Rapids
Oakland	Boice Brothers	545 Telegraph Rd., Pontiac	Pontiac
Saginaw	Saginaw Brick Co.	321 N.Hamilton, Saginaw	Saginaw
Wayne	Michigan Pressed Brick Co.	Lawton at MCRR, Detroit	Detroit
	Boomer Company	545 E.Hancock, Detroit	Detroit

CEMENT PRODUCERS 1935

Company	Office	Works
Aetna Portland Cement Co.	2349 Union Guard.Bldg., Detroit	Bay City and Fenton
Consolidated Cement Corp.	Cement City	Cement City
Huron Portland Cement Co.	1325 Ford Bldg., Detroit	Alpena and Wyandotte
Peerless Egyptian Cement Co.	1144 Free Press Bldg., Detroit	Detroit
Petoskey Portland Cement Co.	Petoskey	Petoskey
Wolverine Portland Cem.Co.	5 S.Monroe St., Coldwater	Coldwater & Quincy
Ford Motor Company	Dearborn	Dearborn

CLAY PRODUCERS - 1934

County	Operator	Office	Pit
Eaton	Grand Ledge Clay Products	Grand Ledge	Grand Ledge
Ontonagon	Ermond Estate	Rockland	Rockland
Wayne	Pewabic Pottery	Detroit, 10125 E.Jefferson	Detroit

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COAL MINES OPERATING IN 1935

Location of Mine County	Operator - Name of Mine	Office
Bay	Crescent Coal Company	Bay City
"	Monitor Coal Company	Bay City, RFD #4
"	New Michigan Coal Company	" "
Clinton	Cheesemond Coal Co.(Johnson mine)	Grand Ledge
Eaton	Black Diamond Coal Company	" "
"	Garrow Coal Company	" "
"	Cheesemond Coal Company	" "
"	Follitt Coal Company	" "
"	Riverside Coal Company	" "
"	Watson-Bennett Coal Company	" "
Ingham	Corsaut Mining Company	Mason
"	Davidson Coal Company	Williamston
"	Grand River Coal Company	"
"	Williamston Tile & Coal Company	"
Saginaw	Aurora Coal Company	St.Charles
"	Brady Coal Company	Oakley
"	Chippewa Coal Co., 317 Lyon St.,	Saginaw
"	Commercial Coal Company	"
"	Hodd Coal Company	St.Charles
"	St.Charles & Chesaning Coal Co.	" "
"	*St.Charles & Garfield Coal Co.	" "
Shiawassee	Barry Coal Company	Corunna, RFD #2
"	Central Michigan Coal Company	Owosso, RFD #6
"	Owosso River Valley Coal Co.	Corunna, RFD #2
"	Parti Coal Company	" RFD #2
"	Consolidated Coal Company	"
"	Crapo Mine	Saginaw
Midland	*Randall Mine	"
Bay	*Wolverine Mine	"
Saginaw	Robert Gage Coal Company	Bay City
Tuscola	*No.9	"
	*No.10	"

*Railroad shipping mine

COKE PRODUCERS - 1934

County	Operator	No.of ovens	Office	Location of Plant
Calhoun	Battle Creek Gas Co.	18	Battle Creek	Battle Creek
Saginaw	Consumers Power Co.	161	Jackson	Flint, Jackson, Kalamazoo, Pontiac, Zilwaukee
Wayne	Ford Motor Company	240	Dearborn	Detroit(Rouge plant)
	Michigan Alkali	39	Wyandotte	Wyandotte
	Semet-Solvay Company	216	61 Broadway, New York	Detroit

COPPER MINING COMPANIES 1935

Operator	Location of Mine:	Address
Calumet & Hecla Consolidated Copper Company	Calumet, Ahmeek (Reclamation at Lake Linden)	Calumet
Copper Range Company	Painesdale	Painesdale

PRODUCERS OF GYPSUM AND GYPSUM PRODUCTS 1934

Operator	Office	Mine or Quarry	Mill
Certainfeed Prods. Corp.	100 E. 42d St., New York	Grand Rapids	Gr. Rapids
Grand Rapids Plaster Co.	1204 Gr. Rapids Savs. Bk. Bldg., Grand Rapids	Grand Rapids Grandville	Gr. Rapids Grandville
Michigan Gypsum Co.	Grand Rapids	Grand Rapids	Gr. Rapids
National Gypsum Co.	188 Delaware Ave., Buffalo New York	National City	Nat'l City
U.S. Gypsum Co.	300 W. Adams, Chicago, Ill.	Grand Rapids, Alabaster	Gr. Rapids, Alabaster, Detroit

IRON MINING COMPANIES 1935

Operator	Location of Mine:	Address
Cleveland Cliffs Iron Company	Negaunee, Ishpeming	Cleveland, Ohio
Davidson Ore Mining Company	Iron River	Buffalo, N.Y.
M.A. Hanna Company	Iron River, Stanbaugh, and Wakefield	Cleveland, Ohio
Inland Steel Company	Ishpeming	Chicago, Ill.
North Range Company	Ishpeming	Negaunee
Oglebay Norton & Company	Ransay	Cleveland, Ohio
Oliver Iron Mining Company	Bessemer	Duluth, Minn.
Pickands Mather & Company	Ironwood, Bessemer, Palmer, Stanbaugh, Iron River, Wakefield	Cleveland, Ohio
Republic Steel Corporation	Negaunee, Crystal Falls, Bessemer, Ironwood	Cleveland, Ohio

IRON (PIG) PRODUCERS 1934

Operator	Office	Location of Furnace
Antrim Iron Company	Mich. Trust Bldg., Gr. Rapids	Mancelona
Newberry Lumber & Chem. Co.	Newberry	Newberry
Cleveland Cliffs Iron Co.	Cleveland, Ohio	Marquette
Delta Chemical & Iron Co.	Wells	Wells
Ford Motor Company	Detroit	Dearborn
Great Lakes Steel Corp.	Pittsburgh, Penna.	Detroit

LIMESTONE & LIME PRODUCERS 1934

County	Operator	Office	Quarry
Alpena	Michigan Alkali Co Thunder Bay Quarries	Wyandotte 2925 Koppers Bldg., Pittsburgh, Penna	Alpena Alpena
Cheboygan	Campbell Stone Co. (also lime)	Indian River	Afton
Delta	Bichler Brothers	703 Ludington, Escanaba	Groos
Dickinson	Metronite Company	Milwaukee, Wis., 1529 E. Hartford Ave.)	Felch
Emmet	Antrim Lime Co. (also lime)	904 Mich. Tr. Bldg., Grand Rapids	Petoskey Petoskey
Huron	Petoskey Portland Cement Wallace Stone Co.	Petoskey Bayport	Bayport
Mackinac	Fiborn Limestone Co. Inland Lime & Stone Co.	Sault Ste. Marie, Ont. Manistique	Ozark, Fiborn Hunt Spur
Menominee	Central West Coal Co. (lime only)	Menominee	None (buys stone)
Monroe	France Stone Co.	1800 2d Nat. Bk. Bld., Toledo	Monroe
Presque Isle	Mich. Limestone & Chem. Co. Kelley Island Lime & Transport Co.	Rogers City Cleveland, Ohio	Calcite Presque Isle
Schoolcraft	Inland Lime & Stone Co. (dolomite)	Manistique	Port Inland
Wayne	Solvay Process Co.	Syracuse, N.Y.	Tronton

POTTERY PRODUCERS 1935

County	Operator	Office	Works
Ionia	Ionia Pottery Company	Ionia	Ionia
Macomb	Mt. Clemens Pottery Co.	Mt. Clemens	Mt. Clemens
Monroe	South Rockwood Pottery Co.	South Rockwood	So. Rockwood
Wayne	Pewabic Pottery Champion Porcelain Co.	10125 E. Jefferson 8525 Butler, Detroit	Detroit Detroit

OIL REFINERIES - 1935

Name of Company	Location of Plant
Acme Refining Company	Alma
*American Petroleum Chemical Company	Detroit
Bair Oil Company Refinery	Grand Ledge
*Bay Refining Company	Bay City
Central Michigan Oil & Refining Company	St. Louis
Crystal Refining Company	Carson City

Oil Refineries 1935 (Continued)

- **Henry Cross Refining Company
- *Inland Refining Company
- *Inter-Lakes Refining Company
- *Kent Refining Company
- McClanahan Refineries, Inc.
- Mid-West Refineries, Inc.
- Naph-Sol Refining Company
- North American Oil Company
- Old Dutch Refining Company
- **Peerless Refining Company
- Pentagon Refining Company
- Roosevelt Oil Company
- Socony-Vacuum Oil Company, Inc.
- ***Standard Oil Company of Indiana
- Superior Oil Corporation
- Sweet Oil Refining Company
- The Pure Oil Company
- *W. J. Sovereign
- Wolverine Refining Company

- *Plant under construction.
- **Plant dismantled.
- ***Plant shut down.

NATURAL GASOLINE PLANTS 1935

Apex Gas, Inc.	Porter township (Midland County)
Bell Gasoline Company	Greendale " (Midland ")
Otto H. Grines, Inc.	Greendale " (Midland ")

SALT PRODUCERS - 1934

County	Operator	Office	Works
Manistee	Manistee Salt Works (also bromine)	4200 Forest Park Blvd, St.Louis, Mo.	Manistee
Mason	Morton Salt Company	208 W.Washington,Chicago	Manistee
Midland	Morton Salt Company	208 W.Washington,Chicago	Ludington
	Dow Chemical Co.(also bromine, magnesium, and calcium chloride)	Midland	Midland
Saginaw	Marshon,Eddy,Parker & Co.	Saginaw	Carrollton
	Saginaw Salt Products Co.	Saginaw	Carrollton
	Strable Lumber & Salt Co.	1560 Holland, Saginaw	Saginaw
St.Clair	Morton Salt Company	208 W.Washington,Chicago	Fort Huron
	Diamond Crystal Salt Co.	250 Park Ave.,New York	St.Clair
Wayne	Detroit Rock Salt Co.	Scranton, Pa.	Detroit
	Mich.Alkali Co.(brine)	Wyandotte	Wyandotte
	Pennsylvania Salt Mfg.Co. (also brine)	1000 Widener Bldg., Philadelphia, Pa.	Wyandotte
	Solvay Process Company	Syracuse, N.Y.	Detroit

COMMERCIAL SAND AND GRAVEL PRODUCERS 1934

County	Operator	Office	Pit
Alcona	Michigan Gravel Co.	502 Eddy Bldg.Saginaw	Greenbush
Berrien	Ireland and Lester Producers Core Sand Corp.	Benton Harbor Michigan City, Ind.	Benton Harbor Bridgman
Calhoun	Battle Creek Sand and Gravel Co.	Battle Creek	Battle Creek
	West Side Sand & Gravel Co.	Battle Creek,R.1,Box 83	Battle Creek
Chippewa	Soo Sand & Gravel Co. I.L.Whitehead	Sault Ste.Marie Sault Ste.Marie	Lake Superior Sault Ste.Marie
Clinton	Walling Gravel Co.	St.Johns, RFD #6	St.Johns
Delta	Bichler Brothers	Gladstone, RFD #1	Groos
Dickinson	Champion Gravel Co.	Iron Mountain	Loretto
Genesee	Kurtz & Russell Gravel Co. Bayer Brice Gravel Co. Gillespie & Hodge Genesee Gravel Co.	Flint, RFD #6 Flint, 4417 N.Saginaw Flint, 219 W.Hodge Mt.Morris	Flint Flint Mundy Township Mt.Morris
Gratiot	North Star Washed Sand & Gravel Co.	North Star	North Star
Huron	Sand Products Co. (mold- ing sand)	Detroit, 2489 First National Bank Bldg	Port Crescent
Ingham	Leonard Gravel Co. Mt.Hope Gravel Co. Scarlett & Earl	South Lansing, Box 115 Lansing, 1326 E.Michigan Lansing, 1109 E.Hazel	Lansing Lansing Lansing
Ionia	Grand River Gravel Co.	Lafayette, Ind.	Ionia
Iron	Champion Gravel Co.	Iron Mountain	Beechwood
Kalamazoo	American Aggregates Corp.	Kalamazoo	Kalamazoo
Kent	Wm.J.Breen Gezon-Battzes Co. Grand Rapids Gravel Co.	Grand Rapids, Box B,Roosevelt Sta. Grand Rapids, 2550 Byron Road Grand Rapids, 431 Mich. Trust Bldg	Grand Rapids Grand Rapids Wyoming Park Grand Rapids
Lenawee	Lenawee Sand & Gravel Co. Tecumseh Gravel Co.	Tecumseh Tecumseh	Tecumseh Tecumseh
Livingston	American Aggregates Corp. Ohio & Michigan Sand and Gravel Co.	Greenville, Ohio Toledo, Ohio 1305 Nicholas Bldg	Brighton Chilson
Macomb	Multiplex Builders Sply.Co.	Mt.Clemens, RFD #5	Roseville
Manistee	Sand Products Co. (molding sand)	Detroit, 2489 First National Bank Bldg	Manistee
Marquette	Champion Gravel Co.	Iron Mountain	Champion
Mason	Sand Products Co.(molding sand)	Detroit, 2489 First National Bank Bldg	Ludington
Muskegon	Sand Products Co. (molding sand)	Detroit, 2489 First National Bank Bldg	Muskegon
	Nugent Sand Co.	Muskegon	Muskegon
Oakland	Standard Gravel Co. Koenig Coal & Supply Co. Foley & Beardslee Ward Sand & Gravel Co. American Aggregates Corp. Ray Sand & Gravel Co.	Pontiac, Box 357 Detroit, 1480 Gratiot Clarkston, RFD #3 Oxford Greenville, Ohio Detroit, 2508 Book Bl.	New Hudson Oxford Clarkston Oxford Oxford Rochester

Commercial Sand and Gravel Producers 1934 (continued)

Osceola	Grand Rapids Gravel Co.	Gr. Rapids, 431 Mich. Trust Bldg.	Hersey
	Hersey Gravel Co.	Hersey	Hersey
Ottawa	Tom Johnson Gravel Co.	Grand Haven, 114 Lafayette St.	Grand River
	Construction Materials Co.	Chicago, Ill. 33 N. LaSalle St.	Bass River
	West Michigan Construction Co.	Holland	Holland
Saginaw	Valley Sand Co.	Bay City, 209 South Chilson	Saginaw River
Tuscola	Cass City Sand and Gravel Co.	Cass City	Cass City
	Great Lakes Foundry Sand Co. (molding sand)	Detroit, 2100 Penobscot Bldg.	Juniata
	Anderson Sand & Gravel Co.	Saginaw, 207 Eddy Bl.	Juniata
Washtenaw	Killins Gravel Co.	Ann Arbor, RFD #3	Ann Arbor
Wayne	W.L. Emory	Detroit, Foot of Mt. Elliott	Detroit River
	Michigan Silica Co. (Glass sand)	Rockwood	Rockwood

 TRAP ROCK PRODUCERS 1934

County	Operator	Office	Quarry
Gogebic	Wakefield Crushed Stone Company	Wakefield	Wakefield
Houghton	Houghton County Road Commission	Hancock	Houghton, Calumet
Iron	Iron County Road Commission	Crystal Falls	Crystal Falls
Keweenaw	Keweenaw County Road Commission	Ahneek	Phoenix
Marquette	City of Ishpeming	Ishpeming	Ishpeming
	City of Negaunee	Negaunee	Negaunee