STATE OF MICHIGAN

DEPARTMENT OF CONSERVATION
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SUMMARY REPORT NUMBER ONE

Production and Value of Minerals and Mineral Products in Michigan 1927 to 1931 and Prior Years

IN COOPERATION WITH THE
UNITED STATES BUREAU OF MINES
May 1, 1933

Contents

General Review

The year 1929 marks a peak in mineral production in Michigan and in the economic order of the entire world. The decline of national prosperity was prophesied by the stock market crash in the closing months of 1929, but this was too late to affect production for that year, which was the greatest since 1920. Beginning with 1930, however, the demand fell off sharply, and large surpluses of raw materials accumulated. Production was soon curtailed, however, to meet these conditions, with the result that figures for 1930 are considerably less than those for 1929. The 1931 mineral production in Michigan amounted to only 50 per cent of the 1929 total and 1932 produced a further decline.

The year 1920 was a record year for 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 per cent of the total value of mineral products for that year.

The war-time volume of mineral production was due chiefly to the demand for copper, although large quantities of iron ore were also produced. In 1916 copper reached an all time peak of production and 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 per cent of the total value of mineral production in the State.

The post-war reaction which set in, in 1921 was accompanied by a falling off in production for practically all of the mineral industries. This slump, however, 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 nine-year period from 1921 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 since 1920, however, have not been made by iron and copper but by Portland cement, stone, sand and gravel, gypsum, bromine, and petroleum. The period from 1921 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 always maintained the distinction of ranking as Michigan's leading non-metallic mineral product, found its place usurped by crushed stone in 1929, with sand and gravel drawing up into a threatening position. Portland cement production increased enormously to give Michigan second rank among the states. The manufactured value of Portland cement exceeds the

value of any mineral product except that of iron ore and copper. The production of gypsum, another mineral of increasing importance in the building trades, doubled in volume during the nine-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 have increased tremendously in volume of production.

In spite of the great volume of production the industries dependent on construction have not prospered to the extent that they would have appeared to from the face of the situation. Too many plants with resultant severe competition and unrestricted price cutting have played havoc with individual profits of these concerns.

The production of petroleum and natural gas on a fairly large scale is a comparatively new industry in Michigan. The more important fields of the State have been opened up only since 1928.

Based upon the 1929 figures, which represent the last year of large-scale production in the mineral industries, Michigan ranks among the states of the Union as follows:

Rank 1 - Salt - quantity and value
Sand lime brick - quantity and value
Bromine - quantity and value
Calcium chloride (natural) - quantity and value
Magnesium (metallic) - quantity and value
Magnesium sulphate (natural) - quantity and value

Rank 2 - Iron ore - quantity and value
Portland cement - quantity (third in value)
Gypsum - quantity (third in value)
Graphite (amorphous) - quantity and value

Rank 3 - Stone -quantity (fifth in value)
Sand and gravel - quantity (sixth in value)

Rank 4 - Copper - quantity and value

Rank 9 - Total value of mineral products.

METALLIC MINERALS

Michigan's Iron Mining Industry

Until about 1900 Michigan was the leading state in iron ore production. At about 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 (1912 - 1931 inclusive) have amounted to 13,528,000 tons. The largest shipment during this period was 18,996,000 tons in 1915 and the lowest 5,012,000 in 1921. Shipments for 1931 totaled 5,557,000 tons. The average value of the production for the nineteen year period (1912 - 1930 inclusive) as given in U. S. Government publications was $42,763,000 or $3.26 per ton.

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 fromthe 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 175,000,000 tons, the Menominee Range 166,000,000 tons, and the Gogebic Range 162,000,000 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 carried 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 stockpile until it is needed. Of the 40 mines which were active in 1931 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 Jan. 1, 1932 were estimated by the State Mine Appraiser at slightly more than 167,000,000 tons which is not much lower than the 169,000,000 tons which was estimated in 1911 in spite of shipments of 270,000,000 tons since that time. Much of this 270,000,000 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, 1932 the total recommended value was set at about $78,000,000.

Although the total valuation of the iron mines is not impressive when compared to the total State valuation, being only about 1%, the importance of the industry may be understood if it is realized that the mining valuations comprise nearly 25% of the total valuation of the entire Upper Peninsula and almost 50% 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. 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.

TABLE I

DICKINSON COUNTY

Mine	1927 Tons Mined	1927 Tons Shipped	1928 Tons Mined	1928 Tons Shipped	1929 Tons Mined	1929 Tons Shipped
Aragon	227,756	218,017	233,753	250,487	214,112	208,433
Chapin	429,728	411,422	434,852	469,090	438,873	432,275
Loretto	52,380	152,813	148,345	149,241	139,087	136,334
Penn Group	372,118	353,538	352,752	395,898	476,052	472,381
West Chapin	5,621	5,621	12,022	12,022	21,282	21,282
Total	1,087,603	1,141,411	1,181,724	1,276,738	1,289,406	1,270,705

TABLE I (Continued)

Dickinson County

Mine	1930 Tons Mined	1930 Tons Shipped	1931 Tons Mined	1931 Tons Shipped
Aragon	176,839	185,166	44,605	77,168
Chapin	413,547	415,817	234,178	216,150
Loretto	154,143	97,152	186,340	104,166
Penn Group	385,435	343,459	204,979	50,471
West Chapin	26,031	26,031	6,522	6,522
Total	1,155,995	1,067,625	676,624	454,477

TABLE II

GOGEBIC COUNTY

	1927		1928		1929	
Anvil Group	490,713	403,426	334,400	326,278	410,747	480,244
Eureka-Asteroid	415,305	375,127	413,499	553,100	401,680	407,338
Iron-Colby	599,500	500,388	625,100	653,677	608,800	587,646
Newport-Bonnie	679,142	654,007	586,229	593,904	636,138	652,012
Norrie Group	1,427,430	1,326,997	1,025,831	1,053,647	1,053,022	1,272,308
Plymouth	606,900	606,900	556,401	556,401	505,513	505,513
Puritan	291,765	303,927	401,934	371,844	498,701	560,680
Sunday Lake	358,540	349,805	334,586	370,038	620,161	589,826
Tilden	124,315	140,301	48,852	32,798	113,600	54,686
Townsite	100,025	85,897	79,532	13,196	84,202	171,862
Wakefield	507,262	507,262	616,762	626,762	620,636	631,316
Total	5,601,167	5,254,037	5,023,126	5,151,645	5,553,200	5,913,431

TABLE II (Continued)

Gogebic County

	1930		1931	
Anvil Group	290,012	221,018	198,556	133,499
Eureka-Asteroid	461,085	417,682	293,697	8,174
Ironton-Colby	517,200	281,747	284,500	338,428
Newport-Bonnie	544,735	474,744	307,193	263,295
Norrie Group	950,349	834,576	591,772	585,356
Plymouth	404,292	404,292	303,686	303,686
Puritan	553,277	436,146	301,984	253,775
Sunday Lake	460,072	365,651	254,223	126,389
Tilden	66,600	54,126		
Townsite	111,710	82,863	42,358	31,348
Wakefield	401,233	404,123	253,002	242,682
Total	4,760,565	3,976,968	2,830,971	2,286,632

TABLE III

IRON COUNTY

Mine	1927 Tons Mined	1927 Tons Shipped	1928 Tons Mined	1928 Tons Shipped	1929 Tons Mined	1929 Tons Shipped
Balkan-Judson	235,396	228,981	223,265	228,353	220,715	216,257
Baltic-Buck-Fogarty	219,004	219,564	75,527	90,737	161,312	153,675
Bates	152,835	156,225	164,234	151,404	159,565	125,843
Bengal	249,573	215,513	223,034	238,262	251,008	241,790
Berkshire	307,750	299,107	307,169	253,347	229,491	215,635
Bristol	373,237	402,917	355,427	333,092	501,115	562,836
Carpenter	33,930	8,858		76,147		
Caspian	305,219	282,891	247,997	281,606	303,051	335,885
Davidson Group	291,375	245,425	225,764	251,252	289,645	311,631
Dunn		10,625				
Forbes	164,348	152,342	131,493	152,181	154,550	161,569
Hiawatha	133,334	169,755	190,070	171,062	201,400	208,960
Homer	180,060	182,431	167,560	195,747	166,250	176,749
James	321,103	302,891	259,565	233,052	263,023	302,301
Monongahela	182,400	63,255				
Newman	8,291	15,912	6,244	8,120		
Odgers	251,903	185,106	39,100	42,499		30,441
Porter		410				
Riverton Group	201,805	185,215	220,499	239,822	235,558	240,375
Rogers	259,220	285,922	243,710	179,927	249,020	323,883
Sherwood						
Spies-Virgil	156,004	16,168	180,403	22,334	165,163	175,078
Tobin		67,945	112,035	67,648	143,100	135,098
Warner	172,153	152,375	144,717	156,403	182,422	177,429
Wauseca	55,246	41,306	60,367	75,543	68,366	50,305
Zimmerman	164,579	180,706	162,475	157,223	179,320	149,860
Total	4,418,225	4,071,845	3,740,655	3,605,791	4,124,074	4,295,600

TABLE III (continued)

IRON COUNTY

Mine	1930 Tons Mined	1930 Tons Shipped	1931 Tons Mined	1931 Tons Shipped
Balkan-Judson	180,223	145,157	69,432	30,337
Baltic-Buck-Fogarty	167,242	106,799	33,781	23,370
Bates	135,324	110,658	120,779	117,489
Bengal	49,122	41,633		
Berkshire	187,461	146,477	64,176	
Bristol	306,283	174,296	12,426	85,688
Carpenter				
Caspian	216,687	148,252	102,802	33,422
Davidson Group	249,829	176,678	159,550	82,735
Dunn				
Forbes	149,426	91,221	51,155	
Hiawatha	160,840	151,589	132,550	116,444
Homer	129,040	136,866		
James	231,317	176,847	70,110	69,953
Monongahela				18,014
Newman				
Odgers		16,719		
Porter				
Riverton Group	199,186	161,076	120,068	64,568
Rogers	201,460	128,721	168,690	169,692
Sherwood			1,027	1,027
Spies-Virgil	142,827	137,854	93,580	79,497
Tobin	172,200	187,004	47,800	
Warner	186,617	178,332	119,398	79,430
Wauseca	27,503	0	10,658	0
Zimmerman	132,780	62,740	39,270	35,300
Total	3,225,367	2,478,919	1,417,252	1,006,966

TABLE IV

MARQUETTE RANGE

Mine	1927 Tons Mined	1927 Tons Shipped	1928 Tons Mined	1928 Tons Shipped	1929 Tons Mined	1929 Tons Shipped
Archibald	118,929	76,550	242,690	264,159	220,821	193,292
Athens	232,748	247,078	241,530	320,200	343,147	485,940
Austin	79,087	65,348		9,483		77,426
Barnes-Hecker		78,778				
Blueberry					52,727	42,741
Cambria	145,530	111,780	128,266	139,898	161,844	246,747
Cleveland		356				
Cliffs Shaft	402,532	366,319	391,862	388,734	421,314	510,930
Empire	75,575	75,575	95,766	95,766		
Francis		21,686		23,603		58,009
Gardner-Mackinaw		49,445	90,866	70,675	117,224	95,397
Imperial	107,017	105,129	89,996	73,286	91,374	102,850
Isabella	89,326	90,844	137,966	131,348	112,824	120,129
Maas	270,006	320,454	261,454	328,025	331,922	479,812
Maitland	66,926	66,925	47,577	47,556		
Mary Charlotte	107,464	120,562	89,951	165,572		
Morris-Lloyd	326,814	297,288	356,164	393,184	435,430	638,234
Negaunee	487,880	534,562	430,015	472,733	552,417	637,960
Ogden	174,106	175,500	116,415	116,415		
Princeton		11,507		3,864		7,162
Republic	64,978	46,763	27,536	47,166		19,868
Richmond	191,357	191,357	153,556	153,556	164,503	164,503
Rolling Mill	124,571	167,991		37,341		
Sec.16-Holmes	470,188	419,479	411,238	396,755	477,272	651,662
Stephenson	109,318	127,571		208,735		99,318
Tilden					441,769	441,769
Volunteer	378,287	378,930	410,604	410,604	335,963	333,963
Total	4,022,619	4,147,777	3,753,512	4,298,698	4,260,551	5,409,712

TABLE IV (Continued)

MARQUETTE RANGE

Mine	1930 Tons Mined	1930 Tons Shipped	1931 Tons Mined	1931 Tons Shipped
Archibald	259,302	245,405	43,837	41 754
Athens	382,756	345,640	251,580	167,965
Austin				
Barnes-Hecker				
Blueberry	189,103	172,552	229,465	232,970
Cambria	164,726	114,936	54,358	28,925
Cleveland				
Cliffs Shaft	407,925	275,261	291,057	112,820
Empire				
Francis		92,828	0	9,233
Gardner-Mackinaw	125,157	60,384	80,767	18,871
Imperial	89,342	68,976	88,967	94,437
Isabella	186,020	95,984	154,911	56,297
Maas	416,653	253,852	309,176	233,367
Maitland				
Mary Charlotte				
Morris-Lloyd	465,371	299,791	349,158	172,615
Negaunee	579,740	417,376	340,838	159,449
Ogden				
Princeton		3,230		7,891
Republic				
Richmond	126,543	126,543	107,958	107,958
Rolling Mill				
Sec.16-Holmes	448,603	434,857	153,573	137,279
Stephenson		68,353		24,623
Tilden	287,044	287,044	137,010	137,010
Volunteer	270,956	270,956	65,981	65,981
Total	4,399,241	3,633,968	2,658,636	1,809,445

TABLE V - STATE

	1927 Tons Mined	1927 Tons Shipped	1928 Tons Mined	1928 Tons Shipped	1929 Tons Mined	1929 Tons Shipped
Dickinson County	1,087,603	1,141,411	1,181,724	1,276,738	1,289,406	1,270,705
Gogebic County	5,601,167	5,254,037	5,023,126	5,151,645	5,553,200	5,913,431
Iron County	4,418,225	4,071,755	3,740,655	3,605,791	4,124,074	4,295,600
Marquette Range	4,022,619	4,147,777	3,753,512	4,298,698	4,260,551	5,409,712
Total	15,129,614	14,614,980	13,699,017	14,332,872	15,227,231	16,889,448

TABLE V - STATE

	1930 Tons Mined	1930 Tons Shipped	1931 Tons Mined	1931 Tons Shipped
Dickinson County	1,155,995	1,067,625	676,624	454,477
Gogebic County	4,760,565	3,976,968	2,830,971	2,286,632
Iron County	3,225,367	2,478,919	1,417,252	1,005,966
Marquette Range	4,399,241	3,633,968	2,658,636	1,809,445
Total	13,541,168	11,157,480	7,583,483	5,557,520

TABLE VI

Michigan Ore Reserves and Assessed Valuation

County	1928 Tonnage	1928 Value	1929 Tonnage	1929 Value	1930 Tonnage	1930 Value
Dickinson	5,250,962	$3,720,000	4,886,465	$3,520,000	4,087,207	$3,330,000
Gogebic	48,681,075	38,184,000	48,587,126	37,171,000	51,347,176	36,893,000
Iron	59,501,715	21,688,000	58,035,954	20,835,000	57,260,057	21,162,000
Marquette Range	60,219,781	30,005,000	57,920,862	28,232,000	55,655,383	28,523,000
Total	173,653,533	$93,597,000	169,430,407	$89,758,000	168,349,823	$89,908,000

TABLE VI (Continued)

Michigan Ore Reserves and Assessed Valuation

County	1931 Tonnage	1931 Value	1932 Tonnage	1932 Value
Dickinson	3,881,103	$3,205,000	2,924,465	$2,277,000
Gogebic	51,143,511	36,748,000	50,793,057	31,996,000
Iron	58,297,221	21,118,000	57,015,573	17,888,000
Marquette Range	57,665,510	28,913,000	56,335,788	25,572,000
Total	170,967,345	$89,984,000	167,068,903	$77,733,000

TABLE VII

IRON ORE SHIPPED FROM MINES IN MINNESOTA, MICHIGAN & ALABAMA

These three states account for about 92 % of the total iron ore shipments of the United States.

	1927 Tons	1928 Tons	1929 Tons	1930 Tons	1931 Tons
Minnesota	35,563,177	38,129,018	46,470,243	34,165,777	17,063,591
Michigan	14,532,831	14,241,102	16,838,568	11,154,773	5,555,376
Alabama	6,508,419	6,159,863	6,637,299	5,637,678	3,629,997
Total	61,232,473	63,432,826	75,602,734	55,201,221	28,516,032

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 1930 the four leading producers were Arizona - 571,000,000 pounds, Utah - 205,000,000 pounds, Montana - 199,000,000 pounds, and Michigan - 143,000,000 pounds.

The total production of copper in Michigan from 1845 to 1932 inclusive amounts to more than eight and a half billions 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 5 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 since 1930 have resulted in decidedly lower values, the assessed valuation in 1932 amounting to slightly less than $20,000,000. Several factors have operated in the past two years to make the outlook for the future of Michigan's copper industry none too bright. The demand for the metal has fallen off sharply and consequently the price has dropped to the unheard of low of 5 cents per pound. Such a price is far below the average cost of production which since 1919 has never been less than 11.44 cents and which amounted, to 12.5 cents in 1930. The development of rich deposits in Africa which could deliver copper in London for less than 5 cents per pound seemed tn spell the doom of deep high-cost mining.

The recent action of Congress in establishing an import duty of 4 cents per pound on copper has given the industry new hope. It does not solve the problem, but it does give some of the lower cost Michigan mines a fighting chance for existence. Because of the large stocks of the metal on hand this protective tariff will not, provide immediate relief, but eventually it may prove to be the saviour of this 90 year old industry.

TABLE I

Pounds of Copper Produced in Michigan

1927 - 1931 Inclusive

	1927	1928	1929	1930	1931
Calumet & Hecla	108,760,000	121,204,000	123,830,000	105,740,000	72,367,000
Baltic	4,207,819	3,415,082	2,127,926	3,251,705	3,311,727
Champion	16,098,926	19,563,535	20,660,701	19,999,564	14,409,543
Trimountain	2,354,808	1,275,515	1,403,689	542,649	-
Isle Royale	11,391,338	19,520,771	10,864,085	10,659,413	7,731,418
Mohawk	22,124,840	21,243,265	20,043,265	13,306,762	13,100,000
Quincy	9,718,662	1,220,536	4,459,426	10,939,787	7,575,367
Seneca	2,881,382	-	2,999,882	4,857,895	-
Total	177,537,775	178,442,704	186,393,974	169,297,775	118,495,055

TABLE II

Average Cost per Pound of Producing Copper in Michigan 1927-1930 inclusive

	1927	1928	1929	1930
General Expense	.6032	.6226	.6615	.6648
State Taxes	.5339	.6017	.4964	.5502
Cost of Mining	6.5796	6.6886	8.2175	7.2647
Milling Smelting	2.1046	2.2263	2.4775	2.3301
Marketing Expense	.4173	.4321	.4240	.4214
Depreciation	1.2452	1.3884	1.4167	1.2765
Total Gross Cost	11.4838	11.9597	13.6936	12.5077
Silver Credit	.0511	.0002	-	-
Net Cost	11.4409	11.9595	13.6936	12.5077
Receipts per pound	13.2801	14.0114	17.8511	12.4647
Net Cost	11.4409	11.9595	13.6936	12.5077
Profit (+) or (-)Loss	+ 1.8392	+ 2.0519	+ 4.1575	- .0430

TABLE III

General Facts of Copper Mining Industry

	1927	1928	1929	1930
Tons Copper Rock Treated	7,983,333	7,361,658	7,595,553	6,659,207
Pounds Copper Produced	177,537,775	178,442,704	186,393,974	169,297,775
Pounds Copper Produced per ton of Rock Treated	22.239	24.239	24.539	25.42
Average price received	13.2725	14.3105	17.8511	12.50
Gross Value of Copper Produced	$22,914,089	$25,536,043	$30,222,947	$15,386,007
Average number of men employed per day	10,640		9,117	7,864
Average days worked	290	309	310	278
Tons per man per day	3.84	3.359	3.89	4.18

NON-METALLIC MINERALS

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. The original uses for bromine were in photography and for medicinal purposes; but in the last decade 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 Brombenzyl 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 1931.

Year	Pounds	Value	Year	Pounds	Value
1926	1,245,760	$ 426,837	1929	6,414,620	$ 1,759,325
1927	1,756,310	564,689	1930	8,462,800	2,109,974
1928	2,164,000	649,475	1931	8,935,330	1,854,650

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 1931 inclusive:

Year	Short Tons	Value	Year	Short Tons	Value
1921	23,672	$ 510,723	1926	82,340	$ 1,710,405
1922	33,067	571,326	1927	95,721	1,947,796
1923	44,961	663,384	1928	102,020	1,995,603
1924	58,791	1,164,848	1929	114,240	2,097,061
1925	67,870	1,386,639	1930	116,160	2,207,800
			1931	86,156	1,687,166

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

Since 1927 the entire domestic output of primary metallic magnesium has been by the Dow Chemical Company at Midland, from the brines of the Marshall sandstone. The magnesium market has expanded rapidly in recent years. The most extensive use at the present time is for deoxidizing and desulphurizing metals, but other uses are growing in importance, the chief of which is the development of light weight alloys for aircraft and other industries demanding a strong, light weight metal. In 1929 the domestic magnesium sold or used by producers in the United States amounted to 908,351 pounds, valued at $512,313. These figures represent an increase of approximately 60 per cent over those for 1928. In 1930, however, sales amounted to only 559,631 pounds valued at $268,864. The 1931 total was slightly greater; 580,463 pounds valued at $199,633 were sold by producers.

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 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 above named formations the Dundee, Parma, and Berea 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 a 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.

PRODUCTION AND VALUE OF SALT IN MICHIGAN 1927-1931 BY METHODS OF MANUFACTURE

	Open Pans		Vacuum Pans		Rock Salt and Pressed Blocks	
Year	Short Tons	Value	Short Tons	Value	Short Tons	Value
1927	360,250	$3,703,932	392,290	$2,239,325	264,710	$1,013,193
1928	389,660	3,931,086	477,120	2,772,793	262,200	930,109
1929	450,100	4,114,877	513,856	2,406,342	286,380	1,168,717
1930	416,650	4,159,719	462,450	2,069,839	281,690	1,064,649
1931	287,870	2,394,576	462,650	1,815,648	273,110	885,148

	Brine		Total	
	Short Tons	Value	Short Tons	Value
1927	1,254,210	$595,102	2,271,460	$7,551,552
1928	1,276,260	615,449	2,405,240	8,249,437
1929	1,399,876	653,671	2,650,212	8,343,607
1930	1,377,300	589,865	2,558,290	7,884,072
1931	*	*	2,053,980	5,760,001

* Included in total

PRODUCTION AND VALUE OF SALT IN MICHIGAN 1880–1931

Year	Quantity Bbls	Per cent of U.S. Total	Rank Quantity	Value	Rank Value
1880	2,485,177	41.7	1	$2,271,931	--
1881	.....	44.4	1	2,418,171	--
1882	3,036,317	47.4	1	2,126,122	--
1883	2,894,672	46.7	1	2,344,684	--
1884	3,161,806	48.5	1	2,392,648	--
1885	3,297,403	46.8	1	2,967,663	--
1886	3,667,257	47.6	1	2,426,989	--
1887	3,944,309	49.2	1	2,291,842	--
1888	3,866,228	47.0	-	2,261,743	--
1889	3,856,929	48.2	1	2,088,909	--
1890	3,838,632	43.7	1	2,302,579	--
1891	3,966,748	39.5	1	2,037,289	--
1892	3,829,478	32.8	1	2,046,963	--
1893	3,057,898	25.7	2	988,837	--
1894	3,341,425	26.5	2	1,243,619	--
1895	3,343,395	24.5	2	1,048,251	--
1896	3,164,238	22.9	2	718,408	--
1897	3,993,225	24.0	2	1,243,619	--
1898	5,263,564	29.9	2	1,628,081	--
1899	7,117,382	36.1	2	2,205,924	--
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	9,906,744	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	7,984,072	1
1931	14,665,417	26.6	1	5,760,000	1

For production prior to 1880 see Publication 29, Mich. Geol. Survey

LIME

The lime industry in general has been on the decline for a number of years. This appears to be partly due to inroads of other materials which serve similar needs in construction. Competition and price cutting have also hurt the industry in recent years. In Michigan, however, the situation is perhaps not so acute as in other states, since the bulk of the lime manufactured in thir State is consumed by the chemical industries.

The lime industry in Michigan enjoyed great prosperity during the War when large amounts of lime were required for the manufacture of chemicals used in modern warfare. After the War the bottom fell out of the market, but since 1921 the production has gradually mounted until 1926 when the production was considerably greater than in any other year except during the war. Production was steady through 1928, but beginning with 1929, due to the industrial depression, the production of lime fell off considerably. In 1931 the production was only one-third of the 1926 total.

The organization of the National Lime Association in 1929 should bring about a better feeling among the members of the industry through cooperative advertising which will do much toward establishing a higher price for the product, developing new uses, and generally placing the lime industry on a higher plane. At the present time all Michigan lime-burning plants are located in the northern portion of the Lower Peninsula and the southern part of the Upper Peninsula adjacent to water transportation and the large deposits of pure limestone.

PRODUCTION AND VALUE OF LIME IN MICHIGAN 1904–1931

Year	Total Lime: Quantity Tons	Total Lime: Value	Average price per ton	Number of plants operating	Rank of State Production
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
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	107,571	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	

PORTLAND CEMENT

The Portland cement industry in Michigan has enjoyed a steady growth from its permanent establishment in 1894 up to the present time, although in recent years the industry has suffered because of price wars, keen competition, and over-production. Between 1896 and 1901 the number of plants increased from one to ten and production jumped from 4,000 barrels to over 1,000,000 barrels. From 1901 to 1917 the growth was slow but steady, with new plants coming into production from time to time, and others dropping out. During the World War production decreased slightly, but beginning with 1919 the volume increased each year, and from 1921 to 1927 a new record was established each year. Production in 1928 and 1929 was only slightly less than the 1927 record, but 1930 produced a marked decline and 1931 shows a decrease of 50 per cent from the banner years of 1927, 1928, and 1929.

The cement industry was naturally the one which received the greatest stimulus from the nation-wide road building and construction program carried on for the past decade. The demand being thus greatly increased, too many plants were built and price wars resulted, to the detriment of the industry. 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. The Michigan plants did not suffer as much from foreign competition as some of the eastern plants which were forced to close down.

Two consolidations were effected during the period from 1927 to 1929. The Peerless Portland Cement Company merged with the New Egyptian Portland Cement Company under the name of the Peerless Egyptian Portland Cement Company. These companies operated plants at Union City, Fenton, Port Huron, and Detroit. The Union City plant has been subsequently discontinued. The erection of this latter plant in 1896 established the Portland cement industry on a permanent basis in Michigan. In 1929 the Newaygo Portland Cement Company merged with the Medusa Portland Cement Company under the name of the latter company. This company proposed to build a mill at Charlevoix where it has extensive limstone holdings, but developments have apparently been temporarily postponed.

In 1929 (the last year of peak production) Michigan ranked second among the states in quantity of cement produced and sold, but was third in value of the cement shipped, owing to a slightly higher price prevailing in California, which state ranked second in value.

PRODUCTION AND VALUE
of
PORTLAND CEMENT IN MICHIGAN
1896 - - - 1931

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

PRODUCTION AND VALUE of PORTLAND CEMENT IN MICHIGAN 1896 - - - 1931

(con't)

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	4,185,236	4,228,879	4,228,879	1.035	473,563	8
1914	11	4,285,345	4,218,429	4,054,781	0.964	538,846	7
1915	11	4,765,294	4,727,768	4,454,608	.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	666,369	7
1921	11	5,777,533	5,620,156	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	20,853,202	1.52	2,205,284	3
1928	14	13,848,561	14,044,230	19,258,707	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

GYPSUM

The gypsum industry as a whole suffered for several years prior to 1929, due to lack of cooperative regulation of production and prices. Disorganization began the latter part of 1926 when demand for gypsum products in building commenced to fall off. Production, however, was not regulated to conform to the curtailed demand, plants became overstocked, excessive competition developed, and as a result a severe price war involved all members of the industry. This competition continued through 1927 and 1928 and into 1929, when the operators finally decided to get together and discontinue throat-cutting practices. As a result of this agreement the industry should regain something of its lost prosperity when business finally begins to pick up.

Possibly some good was derived from the price war in that many companies in order to continue operations were forced to check up on and eliminate inefficiencies in the plant and to make improvements and additions to meet competition from newer or more economical plants. Another point emphasized by the decreased demand and low prices is that the industry must not depend in the future upon increased activity alone in the building trades, but must build up new markets by the development of a diversification of products. A number of companies have made important progress in this direction. Some of the products developed are gypsum lumber and lath to replace wood in house building and load-bearing tile for light construction. These products can all be sawed and nailed. Other products are special cements, water proof paints, paper filler, sound and fire insulators. Slabs of gypsum are used in the construction of the sound proof stages used in the talking moving picture industry.

Notable developments in the gypsum industry in Michigan in 1927, 1928, and 1929 were the consolidation of the Beaver Products Company and the Certainteed Products Corporation in 1928, the completion and operation of a new plant on the River Rouge at Detroit by the United States Gypsum Company in 1929. This plant operates on rock received from Alabaster where a new loading device in the way of an aerial tramway extending 1¼ miles to a crib in Lake Huron was completed in 1928 to facilitate shipments to the new plant.

Aside from Alabaster, gypsum is produced near Emory Junction, also in Iosco County, and at Grand Rapids, Kent County.

The Alabaster quarry also supplies a new gypsum products plant at Chicago. The object of the United States Gypsum Company in constructing these new plants is to remove the manufacture of gypsum products from the remote mining sites to the large consuming centers; thus taking advantage of low rate water shipments for bulk gypsum and providing a much more highly efficient service for users of gypsum products by bringing the factories to the source of demand.

In 1931 Michigan ranked second in total quantity of gypsum mined and in total value of crude gypsum and manufactured products. Practically all of the crude gypsum sold goes to Portland cement mills.

Prices were somewhat better in 1930 and 1931 in spite of the decreased tonnage.

Production of Gypsum in Michigan – 1927-1931 – By Uses

Gypsum Sold Crude

Year	Crude Gypsum Tons Mined	To Portland Cement Mills Quantity Tons	To Portland Cement Mills Value	Land Plaster Quantity Tons	Land Plaster Value	Total Sold Crude Quantity Tons	Total Sold Crude Value
1927	668,617	177,694	$328,097	684	$3,740	178,378	$331,837
1928	677,103	198,273	240,168	763	3,723	199,036	243,891
1929	898,547	212,989	295,821	488	2,492	213,657	299,249
1930	519,225	165,268	270,984	596	3,506	182,050	292,881
1931	383,123	126,659	233,051	1,155	7,449	136,060	253,842

Gypsum Sold Calcined

Year	Mixed Plasters and Stucco Quantity Tons	Mixed Plasters and Stucco Value	Plaster Board, Wall Board Tile, Lath, and other Building Material Quantity Tons	Plaster Board, Wall Board Tile, Lath, and other Building Material Value	Other Uses * Quantity Tons	Other Uses * Value
1927	311,742	$2,089,576	89,118	$1,543,833	28,779	$251,278
1928	303,774	1,480,003	136,577	1,329,300	19,792	103,346
1929	296,620	1,498,761	130,323	2,196,711	59,929	320,613
1930	188,549	1,410,629	86,896	1,918,125	25,079	132,996
1931	157,423	1,300,950	79,545	1,893,253	9,029	55,300

*Includes plaster of Paris, Keene's cement, to plate glass works, and other uses.

Year	Total Sold Calcined Quantity Tons	Total Sold Calcined Value	Total Value Crude and Calcined
1927	429,539	$3,884,681	$4,216,524
1928	460,143	2,915,478	3,159,369
1929	481,872	4,016,085	4,315,334
1930	300,524	3,462,750	3,755,631
1931	253,902	3,284,044	3,537,886

PRODUCTION OF GYPSUM IN MICHIGAN 1868 – 1931

Year	Total Mined Tons	Gypsum and Gypsum Products Total Value	Rank Quantity	Rank Value
Before 1868	146,328	$671,022		
1868	35,081	165,293		
1869	37,351	178,824		
1870	39,683	191,718		
1871	49,820	284,054		
1872	54,209	259,524		
1873	59,696	297,678		
1874	53,849	274,284		
1875	37,933	195,386		
1876	50,629	248,504		
1877	49,819	238,550		
1878	48,634	229,070		
1879	52,728	247,192		
1880	68,499	349,710		
1881	53,323	298,872		
1882	61,957	344,374		
1883	68,492	377,567		
1884	55,847	335,382		
1885	53,465	286,892		
1886	56,748	308,094		
1887	59,170	329,392		
1888	57,302	347,531		
1889	56,623	353,869		
1890	74,877	192,099		
1891	97,700	223,725		
1892	139,557	306,527		
1893	124,590	303,921		
1894	74,958	189,620		
1895	66,519	174,007		
1896	67,633	146,424		
1897	94,874	193,576		
1898	93,181	204,310		
1899	144,776	283,537		
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	239,395	541,197	1	1
1905	247,862	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	1,056,599	3	4
1917	375,803	1,568,655	3	3
1918	286,768	1,761,149	4	4

COAL

Coal has been mined in Michigan since about 1835. The earliest workings on record took place at Jackson, 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. In 1929 there were only 7 mines in operation and in 1931 only 4 reported production. Some of these did not operate on a normal production schedule. There are a number of small local operators, however, which do not report production to the Bureau of Mines. Several of these in the vicinity of Williamston, Grand Ledge, Jackson, Charlotte, and Saginaw have been recently opened to provide fuel and employment for local residents.

The peak of Michigan coal mining was reached in 1907, when 2,035,858 tons were produced. The value at the mine was, however, 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.

Michigan coal is of the bituminous variety but generally of a somewhat lower grade than the coals of the Appalachian field. The principal mines are at Saginaw, Bay City, St. Charles, and Midland.

PRODUCTION OF COAL IN MICHIGAN 1860-1899 SHORT TONS

Year	Quantity Tons	Year	Quantity Tons	Year	Quantity Tons
1860	2,320	1873	56,000	1886	60,434
1861	3,000	1874	58,000	1887	71,461
1862	5,000	1875	62,500	1888	81,407
1863	8,000	1876	66,000	1889	67,431
1864	12,000	1877	69,197	1890	74,977
1865	15,000	1878	85,322	1891	80,307
1866	20,000	1879	82,015	1892	77,990
1867	25,000	1880	100,800	1893	45,979
1868	28,000	1881	112,000	1894	70,922
1869	29,980	1882	135,339	1895	112,332
1870	23,150	1893	71,296	1896	92,882
1871	32,000	1884	36,712	1897	223,592
1872	33,600	1885	45,178	1898	315,722
				1899	624,702

PRODUCTION AND VALUE OF COAL IN MICHIGAN 1900-1931

Year	Number Active Mines	Total tons of coal mined	Total Value of coal mined	Average price received per ton
1900	31	849,475	$1,259,683	$1.483
1901	30	1,241,241	1,753,054	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	1,345,338	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	1,534,937	2,930,771	1.909
1911	32	1,476,074	2,791,461	1.891
1912	26	1,201,230	2,399,451	1.998
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	7,348,000	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	803,233	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	3.91
1930	6	661,113	2,323,000	3.51
1931	4	359,403	1,084,000	3.04

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 owing to lack of foresight and business acumen on the part of the operators, 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 1930 there were only 34 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, dut soon recovered in the face of an increased demand and a better price. The three-yeer 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. In 1930 the production was only about 25 per cent of the high total for 1926. According to estimates the 1931 total will amount to only about 30 per cent of the 1930 production.

Pottery and Porcelain Ware

The value of pottery products 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 in $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 per cent over the previous year. The total value for 1925 and 1926 was slightly under the figure for 1924, but was still well over the $3,000,000 mark for each year. Since 1926 production has been quite steady, averaging about $3,000,000 in annual value of the product. The value of 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 Michigan. 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 1899-1930

	Common Brick			Drain Tile	Miscellaneous *		
Year	Quantity Thousands	Value	Average Price Per M	Value	Value	No. of firms Operating	Total Value
1899	200,144	$ 933,176	$4.66	$140,171	$180,909	196	$1,254,256
1900	180,892	863,250	4.77	114,747	169,381	189	1,147,378
1901	215,836	1,095,254	5.07	98,972	302,943	180	1,497,169
1902	237,254	1,331,752	5.61	96,645	232,545	182	1,660,942
1903	215,791	1,251,572	5.80	129,028	281,814	178	1,662,414
1904	205,196	1,116,714	5.44	208,088	346,090	168	1,670,892
1905	211,558	1,152,505	5.45	205,445	361,796	154	1,719,746
1906	206,583	1,172,202	5.70	314,098	301,067	142	1,793,367
1907	200,817	1,181,015	5.88	289,868	315,307	136	1,786,190
1908	181,049	994,525	5.49	327,630	344,226	132	1,666,381
1909	219,820	1,250,787	5.69	364,006	332,266	122	1,947,059
1910	232,551	1,363,316	5.86	348,205	372,004	118	2,083,525
1911	252,465	1,301,998	5.16	313,072	338,372	111	1,953,442
1912	271,189	1,592,283	5.87	367,945	370,378	101	2,330,606
1913	273,571	1,626,237	5.94	415,543	409,412	95	2,451,242
1914	269,154	1,633,216	6.07	421,941	379,715	90	2,434,872
1915	277,399	1,461,188	5.23	305,156	481,724	82	2,248,068
1916	279,175	1,856,587	6.65	548,795	299,672	73	2,705,054
1917	236,612	1,882,042	7.95	734,042	230,180	69	2,846,264
1918	94,746	915,599	9.65	565,398	227,739	61	1,708,736
1919	200,352	2,734,503	13.64	737,124	228,302	52	3,699,929
1920	186,526	3,062,660	16.42	690,816	226,215	49	3,979,691
1921	193,730	2,417,809	12.47	381,507	116,603	31	2,915,919
1922	248,603	3,613,542	14.53	169,419	132,349	27	3,915,310
1923	193,350	2,775,925	14.36	337,833	609,260	33	3,723,018
1924	261,614	2,927,123	11.18	381,411	3,603,601	31	6,912,135
1925	260,280	3,030,809	11.64	361,130	895,483	37	4,287,422
1926	275,294	3,057,589	11.11	330,593	809,549	36	4,227,731
1927	201,143	2,305,276	11.41	393,943	1,593,450	39	3,989,726
1928	159,538	1,747,378	10.95	342,942	928,977	34	3,019,297
1929	153,110	1,764,400	11.52	339,474	595,126	35	3,076,403
1930	71,045	856,628	12.57	326,065	819,286	34	3,322,901

*Includes face brick, fire brick, hollow building tile, floor tile, wall tile, sewer pipe, flue lining, wall coping, decorative tile, faience tile.

SAND LIME BRICK

The manufacture of sand lime brick is typically a Michigan industry since this State has more plants and produces more sand lime brick than any other State. Sand lime brick plants have been in operation in Michigan for about 30 years and with the exception of the years marked by industrial depressions have enjoyed a general upward trend with an increasing popularity of the product. The year of 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. In 1930 only 45,391,000 brick valued at $551,187 were produced. This represented a total of less than 50 per cent of the record production of 1927. Sand lime brick, however, has not suffered so much on account of the

depression as has its competitor, clay brick. For certain types of construction sand lime brick has advantages over clay brick and new applications are being constantly devised.

PRODUCTION OF SAND LIME BRICK IN MICHIGAN AND THE UNITED STATES
1904 – 1930

Year	No. of Operating firms Reporting		Common Brick		Avg. Price per M	Total Value U.S.	Rank	
	Mich.	U.S.	Quantity (Thousands)	Value			Production	Value
1904	10	57	9,886	$ 64,034	$6.64	$ 463,128	1	1
1905	12	84	24,841	155,883	6.28	972,064	1	1
1906	11	87	27,281	162,879	5.97	1,170,005	1	2
1907	13	94	25,488	158,606	6.22	1,225,769	1	1
1908	10	87	21,997	131,227	5.99	1,029,699	1	1
1909	11	74	34,217	207,082	6.05	1,150,580	1	1
1910	10	76	37,648	218,027	5.81	1,169,153	1	1
1911	10	66	32,889	192,224	5.84	897,664	1	1
1912	11	71	48,129	307,106	6.38	1,200,228	1	1
1913	12	68	49,373	315,862	6.40	1,238,325	1	1
1914	12	62	41,456	248,113	5.98	1,058,512	1	1
1915	11	56	46,513	281,009	6.04	1,135,104	1	1
1916	12	53	71,116	491,866	6.92	1,474,073	1	1
1917	11	47	45,979	352,246	7.71	1,420,330	1	1
1918	7	42	22,248	195,636	8.79	883,929	1	1
1919	8	35	42,063	507,010	12.05	1,705,153	1	1
1920	8	37	38,810	632,112	16.60	2,490,283	1	1
1921	--	26	*33,658	------	-----	1,268,502	-	-
1922	8	--	* 46,558	557,647	11.97	----------	-	-
1923	9	33	* 64,650	777,693	12.03	2,471,536	-	-
1924	11	37	* 89,239	1,052,435	11.79	3,334,503	1	1
1925	--	42	* 97,828	1,175,776	12.02	3,750,639	1	1
1926	13	42	*108,434	1,341,284	12.36	2,931,492	1	1
1927	12	45	*112,181	1,402,647	12.50	3,645,842	1	1
1928	12	41	*103,056	1,270,776	12.33	3,654,590	1	1
1929	12	40	* 96,511	1,107,708	11.47	2,909,635	1	1
1930	13	37	* 45,391	551,187	12.14	1,950,709	1	1

*Includes common and face brick

PETROLEUM AND NATURAL GAS*

The first commercial production of oil and gas in Michigan was obtained at Port Huron, beginning about 1886. Initiative for this enterprise was supplied by the small production across the river in Canada. In this course of 25 years about 22 wells were drilled on a low anticline to the west and northwest of the city. The wells penetrated the Dundee 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.

The presence of a structure at Saginaw favorable to the accumulation of gas and oil was signalized by Dr. A. C. Lane, former State Geologist of Michigan, 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. The chief “pays” were in the top of the Traverse formation (“Saginaw sand”) and about 35 feet below the top of the Dundee formation. Only small shows were obtained from the Berea sandstone.

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.

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 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 crude oil from the Traverse formation at Muskegon is a high grade, paraffin base, sweet oil; but the Dundee crude, while of a slightly higher gravity, contains sufficient sulphur to classify it as a sour oil. The bulk of the Muskegon crude has been refined in the Chicago district.

Up to June 1, 1932, 462 wells had been completed in the Muskegon field, 248 of which produced 4,826,201 barrels of oil and over 5,000,000,000 cubic feet of natural gas. The peak of production was reached in August, 1929, when the average daily yield was 18,570 barrels. By 1932, however, production has declined to 1,160 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.

*Condensed from unpublished manuscript by R. B. Newcombe and publications of the Michigan Geological Survey,

Mount Pleasant Field

The Mount Pleasant field has developed into the most productive oil and gas field discovered to date in Michigan, and one of the most important fields in the eastern part of the United States. The structure of the rocks in this field was first determined by geologists of the Pure Oil Company from records of brine wells furnished by the Dow Chemical Company. The discovery well, located in Greendale township, Midland County, was completed February 8, 1928, with an initial production of 30 barrels of oil per day. This was later increased to 100 barrels by deeper drilling. As a result

of the successful completion of this test, drilling became active and by 1930 the Mount Pleasant district was the most productive area in the state. The field includes the Mount Pleasant pool, the East pool, Leaton pool, Vernon pool, Porter pool, and the Clare and Broomfield gas fields.

The Dundee limestone is the chief producing formation in all of the pools of the Mount Pleasant field, although there are several wells which found commercial amounts of oil in the Traverse limestone.

The Traverse oil is found at depths of about 3000 feet and the Dundee oil at about 3500 feet in depth. The gas fields near Clare and in Broomfield township obtain their gas from a sandstone bed in the lower part of the Michigan formation at depths of from 1300 to 1450 feet.

While the Dundee crude oil from the Mount Pleasant field is high gravity, paraffin base crude, there are certain properties requiring special refining processes, which have prevented Central Michigan crude from successfully competing with the crudes from the southwestern states.

Shipments of Mount Pleasant crude have been largely outside the State to refineries at Sarnia, Toronto, and Montreal, Canada; Trenton, Michigan; and Toledo and Cleveland, Ohio. Local refineries at Muskegon, Mount Pleasant, Midland, and Saginaw are, however, requiring increasing amounts.

The total production of the Central Michigan area to June 1, 1932, was 9,450,680 barrels, which is nearly two-thirds of the entire production in Michigan since the development of the Saginaw field in 1925. On this date there were 256 producing oil wells and 81 dry holes in the Mount Pleasant field. Initial production of individual wells varies from 10 to 3800 barrels per day. Several wells in the East pool came in at better than 3000 barrels per day.

Gas consumption, however, has kept pace with the available supply. About 530,000,000 cubic feet of gas have been taken from the Central Michigan area, against an original daily open flow from 30 wells estimated at 97,767,000 cubic feet and estimated reserves in excess of 20,000,000,000 cubic feet.

The Muskegon field has produced up to June 1, 1932, about 6,700,000,000 cubic feet of gas, which was piped to the city for industrial uses. Wasteful practices at the wells, however, hastened the decline of this field, which is now practically depleted of its natural gas reserves.

In addition to the commercial pools of oil and gas at Saginaw, Muskegon, and near Mount Pleasant, oil in small quantities has been found near Dundee, Monroe County; Howell, Livingston County; Owosso, Shiawassee County; Bannister, Gratiot County; Union, Cass County; Decatur, Van Buren County; Allegan, Allegan County; White Cloud, Newaygo County; Hart, Oceana County; Walhalla, Mason County; Manistee, Manistee County. Small quantities of gas have been found near Ashley, Gratiot County; St. Clair, St. Clair County; Barryton, Mecosta County; Evart, Osceola County; Walhalla and Freesoil, Mason County.

OIL AND GAS PRODUCTION IN MICHIGAN - 1927-1931*

Petroleum in Barrels of 42 Gallons

Field	1927	1928	1929	1930	1931	Total for State
Saginaw	433,328	231,000	113,559	89,387	61,676	1,027,822
Muskegon	1,928	334,601	3,157,668	1,297,962	531,147	5,323,306
Mount Pleasant	-------	27,019	1,369,784	2,539,861	3,192,610	7,118,094
Total for State	435,256	592,620	4,641,007	3,927,210	3,785,633	13,469,222

NATURAL GAS

Cubic Feet

	1928	1929	1930	1931
Muskegon	379,992,143	4,173,714,127	1,637,491,217	490,294,000
Mount Pleasant		161,100,000		255,226,000
TOTAL**		6,097,102,344		757,168,000

*Figures compiled by Michigan Geological Survey

**Includes other areas

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, Cheboygan, 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 and Rockport, Alpena County; Rogers City, Presque Isle County; Afton, Cheboygan County; Petoskey, Emmet County; Bayport, Huron County; Sibley, Wayne County; and Bellevue, Eaton County; in the Upper Peninsula at Fiborn, Ozark, and Hunt Spur, Mackinac County, and Groos, Delta County. First shipments were made from Port Inland, Schoolcraft County, in 1930, and from Thunder Bay Quarries at Alpena in 1931. A new quarry is under development near Presque Isle, Presque Isle County.

The high purity of many of the Michigan limestones especially adapts them for use as blast furnace flux and for various chemical purposes. Since approximately 60 per cent 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 alkalies and for various other chemical purposes to which the high purity of the stone especially adapts it.

Michigan ranked third among the states in total tons of limestone produced annually prior to 1930, but was generally fifth or sixth in value of the product owing to the necessarily low price for metallurgical and chemical limestone. In 1928 and 1929 Michigan production was very close to that of Pennsylvania and Ohio, the leading states in the production of stone. It is quite probable that

were it not for the depression Michigan would have passed both of these states in the near future, especially in view of the recent large developments in Mackinac and Alpena counties. As it was, however, Michigan dropped to fourth place in stone production for 1930, New York going into third place. Most of the crushed stone produced in Ohio and New York goes into road and building construction; hence those states were not affected by the depression to the extent that Michigan and Pennsylvania were, since these states produced large quantities of fluxing stone. The year 1929 was a record year in stone production for Michigan, 13,572,010 tons valued at $8,425,261 being produced.

The value of stone produced in 1929 was slightly greater than that for salt, it being the first and only time that any non-metallic mineral has out-ranked salt in value in Michigan.

PRODUCTION AND VALUE OF LIMESTONE IN MICHIGAN 1927-1931

	Road Metal and Concrete		Railroad Ballast		Flux	
Year	Tons	Value	Tons	Value	Tons	Value
1927	1,644,540	1,110,522	188,160	125,000	6,315,520	3,070,689
1928	1,445,600	1,079,734	271,190	199,879	7,289,490	4,156,903
1929	2,218,550	1,372,500	239,910	158,554	7,365,300	4,599,447
1930	1,242,210	902,282	202,310	80,316	5,161,490	3,237,042
1931	(a)729,740	490,828	(b)	(b)	2,708,380	1,629,346

	Alkali Works		Paper Mills		Fertilizer	
	Tons	Value	Tons	Value	Tons	Value
1927	2,397,630	1,081,529	153,680	180,393	202,220	195,868
1928	2,804,030	1,322,984	**	**	199,980	195,184
1929	3,042,260	1,500,760	**	**	182,660	187,500
1930	2,738,138	1,215,748	**	**	126,670	131,632
1931	2,002,140	946,891	**	**	89,900	67,876

(a) Includes Railroad Ballast. (b) Included in Road Metal and Concrete.
** Included in "Other Purposes."

Production and Value of Limestone in Michigan (Continued)

Year	Other Purposes*		Total	Total	Rank of State	
	Tons	Value	Tons	Value	Quantity	Value
1927	433,850	479,747	11,335,780	6,243,751	3	6
1928	370,942	452,460	12,381,240	7,407,149	3	6
1929	523,330	606,500	13,572,010	8,425,261	3	5
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	-	-

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

PRODUCTION AND VALUE OF LIMESTONE IN MICHIGAN 1899-1931

Year	Rank of State Value	Total Tons	Total Value	Year	Rank of State Value	Total Tons	Total Value
1899	--	--	$ 281,769	1915	7	--	$1,828,766
1900	12	--	330,847	1916	6	--	2,389,763
1901	12	--	429,771	1917	5	--	3,320,895
1902	13	--	413,148	1918	3	--	5,186,867
1903	14	--	390,473	1919	5	7,186,760	3,797,522
1904	10	--	501,708	1920	5	9,766,550	5,943,229
1905	12	--	544,754	1921	6	5,395,780	3,387,722
1906	10	--	656,269	1922	6	7,646,550	4,533,998
1907	11	--	760,333	1923	6	10,589,070	5,948,649
1908	9	--	669,017	1924	6	9,901,910	5,573,642
1909	11	--	750,589	1925	6	11,460,000	6,327,634
1910	9	--	842,126	1926	7	10,788,740	6,411,828
1911	8	--	1,005,751	1927	6	11,335,780	6,243,751
1912	8	--	1,139,560	1928	6	12,381,240	7,407,149
1913	7	--	1,408,703	1929	5	13,572,010	8,425,261
1914	8	--	1,457,961	1930	5	10,432,950	6,596,713
				1931	-	6,059,770	3,805,607

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 country 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 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 of “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. This stone is variegated in color, ranging from pure white to pink, green, gray, and purple, the color depending largely upon the metamorphic minerals present. Tremolite is a characteristic mineral of this type, which is a common constituent of the Randville-Felch dolomites. The stone so far as 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 to the uses to which it is put; namely, as cast stone for art and ornamental purposes.

The Vertique Marble Company carried on development work near Ishpeming in 1930 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 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 will be cut and polished, while the shattered material is to be utilized for terrazzo.

Slate

It is reported that the old slate quarries near Arvon in Baraga County, abandoned since 1899, will be reopened

by the Ford Motor Company. This slate is said to compare favorably with that from eastern quarries.

The Ford Motor Company recently shipped 125,000 slate shingles from this quarry 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.

Trap Rock, Production Table

PRODUCTION AND VALUE OF TRAP ROCK OR BASALT IN MICHIGAN
1911-1931

Year	No.of Producers	Total Tons	Total Value	Rank Value
1911	3	--	$51,000	8
1912	5	--	36,206	8
1913	5	--	92,201	10
1914	5	--	34,406	12
1915	6	--	105,855	12
1916	8	--	83,072	12
1917	4	--	70,197	11
1918	4	--	53,269	11
1919	1	--	36,186	11
1920	4	--	84,273	10
1921	6	--	173,620	12
1922	-	94,560	376,788	--
1923	12	109,810	420,524	10
1924	6	103,860	331,302	11
1925	6	110,400	323,991	10
1926	6	96,990	303,601	--
1927	6	107,000	317,195	11
1928	5	91,360	181,331	12
1929	5	96,429	187,580	---
1930	8	118,491	202,335	13
1931	7	116,500	128,960	---

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 marked 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 per cent 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 was exceeded by only 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 chief market. Prices naturally suffered and many plants had to close down.

Among the more notable developments in recent years is the installation of a strictly modern plant near Grand Haven by the Construction Materials Company of Chicago. This plant is reported to have a capacity of 5,000,000 tons annually, which would rate it as probably the largest sand and gravel plant in the world. Most of the production of this plant is shipped into the Chicago market. Four hundred additional acres of gravel land were also acquired by the company.

The American Aggregates Corporation acquired several plants at Oxford, Oakland County; thus extending their operations in Michigan to four counties. The Koenig Coal Company built a new plant at Oxford to produce 2,500 tons per day, and the Champion Gravel Company built a plant at Beechwood, Iron County, giving them a total of three plants in the Upper Peninsula.

An important merger which involved plants at Port Austin, Huron County, Manistee, Ludington, and Muskegon was consummated, the resultant organization being known as the Sand Products Company, having offices at Detroit. This company specializes in the production of core sand, the Michigan production of which was the largest in the country in 1929.

The plant of the Alpena Gravel Company was destroyed by fire in June 1931. It is reported that this plant will not be rebuilt.

Tentative plans call for the erection of a plant at Munising for the production of silica sand from the east shore of Munising Bay. This sand is said to be adapted to a variety of uses, such as for abrasive purposes and for foundries. Considerable sand and gravel is produced from the Great Lakes and connecting waters under lease from the State Conservation Department. Lake St. Clair and the St. Clair River are the most important producing areas.

Production of sand and gravel in Michigan in 1930 fell off about one-third from the record of 1929. Producers in 1930 reported 11,389,119 tons valued at $5,161,176. The 1931 total was about 50 per cent of that of 1929.

The following counties are the most important producers in the State: Oakland, Livingston, Kent, Kalamazoo, Ottawa, Genesee, Lenawee, Huron, Hillsdale, Washtenaw, St. Clair, Ingham, Wayne, Osceola, Mason, Muskegon, Calhoun, Tuscola, and Berrien; in the Upper Peninsula Delta, Dickinson, Iron, and Marquette.

PRODUCTION AND VALUE OF SAND AND GRAVEL IN MICHIGAN
1927-1931 By Uses
SAND

Year	Molding Sand		Building Sand		Paving and road-making sand	
	Tons	Value	Tons	Value	Tons	Value
1927	514,616	$218,625	1,690,481	$630,690	3,295,012	$1,234,837
1928	740,428	323,416	2,258,031	660,986	3,200,533	1,121,334
1929	1,150,807	305,447	1,941,452	800,116	3,152,125	1,239,397
1930	521,452	158,561	1,219,592	452,431	1,890,094	726,899
1931	421,635	146,420	996,580	356,418	1,164,563	384,141

Year	Railroad Ballast		Other Sand*		Total Sand	
	Tons	Value	Tons	Value	Tons	Value
1927	744,002	$152,737	315,949	$218,038	6,560,060	$2,454,947
1928	258,450	74,000	640,611	212,481	6,098,053	2,392,197
1929	297,236	101,826	451,643	226,004	6,993,263	2,672,790
1930	85,650	20,039	426,739	196,591	4,143,727	1,554,571
1931	101,259	26,037	345,105	229,430	5,038,968	1,145,370

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

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	GRAVEL					
	Building Gravel		Paving and road-making Gravel		Railroad Ballast	
Year	Tons	Value	Tons	Value	Tons	Value
1927	2,755,945	$1,836,424	4,971,393	$3,083,211	1,127,131	$425,330
1928	1,959,106	1,248,623	4,870,352	2,582,543	1,862,663	564,240
1929	2,533,588	1,425,565	5,139,278	2,969,864	2,112,729	847,444
1930	1,573,059	845,959	4,812,224	2,484,826	800,588	269,873
1931	1,112,013	502,848	3,405,843	1,448,008	578,519	259,974

	Other Gravel*		Total Gravel	
Year	Tons	Value	Tons	Value
1927	4,920	$ 629	8,859,439	$5,345,594
1928	102,916	40,828	8,795,037	4,436,234
1929	65,241	13,081	9,850,836	5,255,954
1930	59,221	5,947	7,245,392	3,606,605
1931	29,228	5,531	5,125,603	2,216,359

*Mostly fill

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PRODUCTION AND VALUE OF SAND AND GRAVEL IN MICHIGAN 1905-1931

	Total Sand and Gravel		Rank	
Year	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
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	-	-
1931	8,164,571	3,361,729	-	-

MISCELLANEOUS MINERALS AND MINERAL PRODUCTS

Miscellaneous minerals and mineral products regularly or intermitently produced in Michigan are amorphous graphite, iron ore sold 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.

ERRATA

Page 26 - Paragraph 4. Read: which formerly prevented Central Michigan crude, etc.

Page 26 - Paragraph 7. Read: Gas consumption, however, has not kept pace, etc.