
**Mineral Production in Iowa in
1921 and 1922**

by

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Mineral production in Iowa in 1921 and 1922¹

<i>Products</i>	<i>Unit</i>	<i>Quantity</i>	<i>Value</i>
1920			
Cement	Bbl. of 376 lb.	4,421,783	\$ 8,742,854
Clay products .....	.....		10,489,232
Coal	short tons	7,774,916	30,793,847
Gypsum	short tons	571,895	4,422,965
Mineral waters	gallons	38,877	3,419
Natural gas	M cubic feet	827	290
Sand and gravel	short tons	2,467,644	1,993,441
Stone and lime	short tons	620,565	840,544
			57,250,317
1921			
Cement	Bbl. of 376 lb.	4,151,439	\$ 7,439,983
Clay products .....	.....		5,711,583
Coal	short tons	4,531,392	17,256,800
Gypsum	short tons	301,587	2,922,700
Mineral waters	gallons	21,100	2,105
Natural gas	M cubic feet	700	300
Sand and gravel	short tons	2,641,982	1,726,958
Stone and lime	short tons	423,279	563,427
			35,625,170
1922			
Cement	Bbl. of 376 lb.	4,475,074	\$ 7,709,313
Clay products .....	.....		5,739,449
Coal	short tons	4,335,161	16,119,000
Gypsum	short tons	452,451	4,146,182
Mineral waters	gallons	25,561	3,788
Natural gas	M cubic feet	460	230
Sand and gravel	short tons	2,690,798	1,752,233
Stone and lime	short tons	627,443	719,203
			36,189,398

The value of mineral production in Iowa in 1921, \$35,625,170, represents a decrease of \$21,437,147 from the peak production of the preceding year. In fact it dropped below the production of both 1918 and 1919, the years which represented war and immediately postwar conditions. This decrease from the 1920 figures is due chiefly to the great reduction in the output

¹ The statistics for these years were collected by the Iowa Geological Survey in cooperation with the United States Geological Survey, with the exception of data on clay products, which were compiled by the Bureau of the Census.

of coal, though a sharp restriction is evident in other lines also, notably clay products, gypsum and cement.

During 1922 the production of coal suffered a slight further decline, but clay products and cement sales increased slightly and the output of gypsum products was much larger than during 1921. There was a slight gain also in the minor products. These changes made an increase of \$564,228 in the output over that of 1921. Coal held the chief place in the list of producers and accounted for nearly half of the total value of the output. It is noteworthy, however, that whereas in previous years clay products have been second in the list, during both years here considered the output of cement exceeded that of clay wares and gave it rank as the second mineral product of the state.

The production of minerals in Iowa in the last decade is shown in the following table.

Production of minerals from 1913 to 1922

Year	Coal	Clay wares	Gypsum	Cement	Other (a)	Total
1913	\$13,496,710	\$ 5,575,581	\$1,157,930	\$3,972,876	\$1,409,239	\$25,612,345
1914	13,364,070	6,405,995	1,321,457	4,008,915	1,201,428	26,301,865
1915	13,577,608	6,749,088	1,278,128	4,119,952	1,338,174	27,062,950
1916	13,530,383	7,383,289	1,496,795	5,063,647	1,692,367	30,210,284
1917	21,096,408	7,540,213	2,041,997	6,870,863	1,663,206	39,336,372
1918	24,703,237	5,315,143	1,946,414	5,423,926	1,353,289	38,742,009
1919	17,352,620	8,125,324	2,634,444	7,798,347	1,977,048	37,882,183
1920	30,793,847	10,489,232	4,422,965	8,742,854	2,837,694	57,250,317
1921	17,256,800	5,711,583	2,922,700	7,439,983	2,294,104	35,625,170
1922	16,119,000	5,739,449	4,146,182	7,709,313	2,475,454	36,189,398

COAL

The production of coal in 1921 fell below that of 1920 by 3,282,524 tons, a decrease of 42 per cent from the banner production of the preceding year. The value of the output naturally decreased also, the drop being from the record figure of \$30,793,847 in 1920 to \$17,256,800 in 1921. The diminished value was due both to the smaller output and to the lower price per ton received—\$3.81 in 1921 as compared with \$3.94 in 1920. These figures represent a reaction from business and industrial conditions in 1920, when there was a temporary recovery from the relatively unfavorable situation of 1919.

The coal output of 1922, moreover, did not show the recovery

(*) Includes iron ore, lead and zinc, mineral waters, natural gas, potash, sand and gravel, stone and lime, ferroalloys.

that was in evidence in other lines of the mineral industry. The tonnage showed a slight decline—196,231 tons—and both the total value and the value per ton were lower—by \$1,137,800 and nine cents respectively. The tonnage produced in 1922 was the lowest since that of 1896. For some reason it took 1471 more men to get out the smaller output of 1922, as compared with that of 1921, although they worked only 131 days in 1922 as against 148 days in 1921. It is evident that some stabilizing element is needed to allow these men to work and the mines to produce coal more than about forty per cent of the total number of work days available.

The following table shows the production in Iowa during 1921 and 1922.

Coal Production in 1921 by Counties

COUNTY	No. Producers	Loaded at mines for shipment		Sold to local trade and used by employees		Used at mines for steam and heat		Total		No. of employees			Average number of days worked	Average price per ton
		Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Under-ground	Surface	Total		
Appanoose	52	540,191	\$2,057,000	57,003	\$217,000	12,203	\$ 27,000	609,397	\$ 2,301,000	2,925	273	3,198	92	\$3.81
Boone	4	152,968	727,000	43,179	249,000	2,591	6,000	198,738	982,000	502	46	548	159	4.94
Dallas	3	299,324	1,150,000	6,618	30,000	3,946	15,000	309,888	1,195,000	600	55	655	179	3.86
Greene(2), Guthrie(1)	3	-----	-----	7,913	38,539	-----	-----	7,913	38,539	35	1	36	153	4.92
Jasper	3	Incl. in "Local trade"		101,401	407,000	8,009	24,000	108,410	431,000	276	41	317	124	3.98
Jefferson (1), Keokuk(1), Van Buren(2)	4	incl. in "Local trade"		11,590	39,100	-----	-----	11,590	39,100	22	4	26	120	3.37
Lucas	3	Incl. in "Local trade"		226,012	847,000	10,811	40,000	236,823	887,000	394	45	439	211	3.78
Mahaska	9	Incl. in "Local trade"		46,660	167,000	1,091	4,000	47,751	170,000	88	10	98	139	3.58
Marion	13	527,561	1,939,000	37,159	136,000	18,468	65,000	583,188	2,140,000	972	96	1,068	149	3.67
Monroe	10	1,447,902	5,302,000	31,546	118,000	39,843	81,000	1,519,291	5,501,000	2,702	217	2,919	172	3.62
Polk	16	519,549	2,001,000	213,044	1,017,000	17,758	52,000	750,351	3,970,000	1,514	141	1,655	179	4.09
Adams(2), Page(2), Taylor(1)	5	Incl. in "Local trade"		25,821	102,436	-----	-----	25,821	102,436	68	6	74	277	3.95
Wapello	8	2,700	4,000	47,799	131,000	Incl. in "Loaded at Mines"		50,499	135,000	85	10	95	175	2.67
Warren(1), Wayne(3)	4	56,183	202,158	15,549	62,179	Incl. in "Loaded at Mines"		71,732	264,337	229	29	258	143	3.84
	137	3,891,368	14,663,000	521,465	2,269,200	118,559	324,600	4,531,392	17,256,800	10,412	974	11,386	148	3.81

Coal Production in 1922 by Counties

COUNTY	Producers	Loaded at mine for Shipment	Sold to local trade and used by employees	Used at mine for steam and heat	Total		Average value per ton	Number of employees			Average number days worked
		Short tons	Short tons	Short tons	Short tons	Value		Under-ground	Surface	Total	
Adams(3), Page (2), Taylor(1)	6	7,809	30,512	-----	38,323	\$ 178,000	\$4.57, 4.46, 5.09	85	4	89	186, 199, 260
Appanoose	47	761,209	48,240	12,854	822,303	3,187,000	3.88	2,979	260	3,239	120
Boone	5	176,024	39,900	7,868	223,792	1,053,000	4.72	659	53	712	140
Dallas	4	299,640	11,289	1,842	312,771	1,137,000	3.64	646	62	708	154
Greene(2), Guthrie(2), Hardin(1)	5	Incl. in "Local trade"	8,049	Incl. in "Local trade"	8,049	39,000	5.44, 3.50, 5.00	41	7	48	143, 155, 60
Jasper	3	73,739	7,395	Incl. in "Shipped"	81,134	331,000	4.08	270	41	311	79
Jefferson(1), Keokuk (1) Van Buren(2)	4	Incl. in "Local trade"	14,477	Incl. in "Local trade"	14,477	44,000	3.00, 2.94, 3.78	21	2	23	198, 180, 257
Lucas(2), Warren(1)	3	454,424	5,616	14,120	474,160	1,449,000	3.02, 3.45	1,560	80	1,640	119, 170
Mahaska	10	29,288	Incl. in "Shipped"	Incl. in "Shipped"	29,288	98,000	3.36	95	9	104	111
Marion	14	483,125	36,935	13,847	533,907	1,930,000	3.62	1,154	111	1,265	135
Monroe	9	978,614	30,055	27,629	1,036,298	3,675,000	3.55	2,560	191	2,751	137
Polk	17	340,059	265,840	17,973	623,872	2,505,000	4.02	1,621	175	1,796	134
Wapello	8	1,263	23,939	Incl. in "Shipped"	25,202	81,000	3.23	70	7	77	128
Wayne(2), 48 small mines	50	52,273	59,312	-----	111,585	407,000	3.45, 4.00	85	9	94	155
	185	3,653,352	579,907	101,902	4,335,161	16,119,000	3.72	11,846	1,011	12,857	131

COAL PRODUCTION IN 1922

The production of coal in Iowa during the last ten years, which includes the war period, is shown in the subjoined table.

Production of Coal in Iowa, 1913 to 1922.

Year	Tons	Value
1913	7,525,936	\$13,496,710
1914	7,451,022	13,364,070
1915	7,614,143	13,577,608
1916	7,260,800	13,530,383
1917	8,965,830	21,096,408
1918	8,192,195	24,703,237
1919	5,624,692	17,352,620
1920	7,813,916	30,793,847
1921	4,531,392	17,256,800
1922	4,335,161	16,119,000

In the tables showing production by counties those in the southwestern field, mining the Nodaway coal, have been grouped together to avoid revealing individual production. This grouping also shows the output from this small but interesting field. The Nodaway coal averages only about sixteen inches in thickness and owes its value to its distance from other fields and the constancy of its occurrence. It is noteworthy that in number of days worked these counties stand among the highest in the state.

Monroe county was the leader in both tonnage and total value. Polk and Appanoose occupied second and third places in 1921 but reversed positions in 1922.

The statistics for 1921 show that during this year 71.2 per cent of the coal mined, or 3,227,867 tons, was shot off the solid; 12.7 per cent, or 572,754 tons, was mined by hand; and 15.4 per cent, or 698,443 tons, was mined by machine. The method of production of 0.7 per cent, 32,328 tons, was not specified. The corresponding percentages in 1920 were 62.7, 15.2, 20.7 and 1.4. It will be seen that the proportion mined by machine was 5.3 per cent less in 1921. There were 100 machines in use in 1920 and 98 in 1921. The number of machines in the bituminous mines of the country in 1921 was 16,618, and the amount of coal mined by their use was 272,702,389 tons.

The year 1921 was one of the quietest of recent years in the industry in Iowa so far as strikes and lockouts were concerned. There were only 897 men out on strike for a total of 1,840 man-days.

The table showing the leading coal producing states, which follows, shows that Iowa was not alone in the slight decline in 1922, but that several others experienced similar conditions. All of these states shown in the table as having a smaller output in 1922 are central and western states, and the same condition held true of most of the western producers, Washington and North Dakota being notable exceptions. This would seem to indicate that, in general, business conditions had not improved so much in the west as in the east. Estimates of production in 1923 indicate that most of these central and western states will have an increased output. Iowa's output is estimated at 6,500,000 tons.

Production of coal in the United States in 1921 and 1922.

STATE	1921			1922		
	Value	Av. per ton	Number employees	Value	Av. per ton	Number employees
Pennsylvania	\$ 322,538,300	\$2.78	190,643	\$ 351,777,000	\$3.11	188,838
West Virginia	206,661,500	2.84	101,850	236,162,000	2.93	110,014
Illinois	190,986,000	2.74	95,431	168,925,000	2.89	96,336
Kentucky	85,092,600	2.69	50,521	127,037,000	3.02	60,924
Ohio	84,686,500	2.65	51,785	87,056,000	3.23	54,194
Indiana	52,269,000	2.57	32,687	54,524,000	2.85	33,208
Alabama	38,713,000	3.08	25,809	42,856,000	2.34	28,169
Colorado	32,377,000	3.55	14,529	31,701,000	3.16	13,506
Wyoming	23,358,500	3.24	8,484	18,162,000	3.04	9,045
Virginia	22,947,700	3.06	11,922	27,083,000	2.58	13,399
Iowa	17,256,800	3.81	11,386	16,119,000	3.72	12,857
U. S.	1,199,983,600	2.89	663,754	1,274,820,000	3.02	687,958
Anthracite	452,305,000	5.00	159,499	273,700,000	5.01	156,849
Total	1,652,288,600	3.26	823,253	1,548,520,000	3.25	844,807

The average tonnage per man per day ranged in 1921 from 2.42 in Texas to 6.10 in Utah. Both of these figures, however, are somewhat abnormal and the average in most of the states is between three and four tons. Physical conditions in the mines have much to do with the tonnage average. For example the high average of Utah is due to the great thickness of the seams, some of which are sixteen feet or more in thickness. The average recovery by each Iowa worker was 2.69 tons.

CLAY PRODUCTS

The output of clay wares in 1921 and 1922 was much less than that of the two preceding years. The year 1920 had been

the record year in clay production as it was with coal, and the production during the next year fell from the value of \$10,489,232 reached in 1920 to that of \$5,711,583 in 1921. This was no doubt due to irregularity and depression in the building trades during 1921, conditions which continued, apparently, in large measure into 1922, as the output increased only very slightly during that year. The following table will show the amount and value of the various products during 1921 and 1922.

Production of clay wares by classes in 1921 and 1922

1921						
CLASS	Plants	Quantity	Value	Average price per unit	Per cent of total of U. S.	
Common brick	65	<i>Thous.</i> 48,844	\$ 680,689	\$13.94	1.2	
Face brick	14	10,196	189,568	18.59	1.0	
Hollow building tile or block	56	<i>tons</i> 161,136	1,209,180	7.50	8.1	
Drain tile	77	269,554	2,412,849	8.95	28.8	
Sewer pipe	5	49,564	783,429	15.81	3.6	
Other products(*)	10		435,868			
	103		5,711,583		2.1	

1922							
CLASS	Plants	Quantity	Value	Average price per unit	Per cent of total of U.S.	Per cent increase	
						Quantity	Value
Common brick	50	<i>Thous.</i> 56,030	\$ 728,508	\$13.00	1.0	14.7	7.0
Face brick	11	18,510	354,041	19.13	1.3	81.5	86.8
Hollow building tile or block	40	<i>tons</i> 308,366	2,170,368	7.04	11.0	91.4	79.5
Drain tile	52	176,894	1,495,116	8.45	29.0	—39.1	—38.5
Sewer pipe	4	38,359	681,233	17.76	2.9	—22.6	—13.0
Other products(*)	6		310,183				
	69		5,739,449		1.8		0.5

These tables when compared with those for the two preceding years show several facts of interest. One is the important drop in the quantity and value of common brick as compared with the production in 1920, which was 60,270,000 bricks valued at \$1,146,182. Another is the fluctuation in pro-

(*) Includes: fancy brick, vitrified brick, miscellaneous products.

duction of face brick. In 1919 this had risen to 20,603,000. In 1920 it declined to 13,678,000 and in 1921 it went still lower, but it witnessed a large rise in 1922. Probably the manufacture and sale of drain tile is a fairly accurate barometer of agricultural conditions. If this be true the following facts are worthy of note. In 1919 the sales of drain tile amounted to \$3,127,378, in 1920 to \$4,760,115, in 1921 to \$2,412,849, in 1922 to \$1,495,116. This last figure marks the lowest value of the drain tile output since 1904, when it was \$1,321,745. It must be remembered, too, that unit values were much lower then than now.

The production of clay wares in Iowa during the last ten years may be summarized as follows:

Production of clay wares in Iowa, 1913 to 1920.

CLASS	1913	1914	1915	1916
Common brick	\$1,052,036	\$1,067,746	\$ 898,851	\$ 947,247
Vitrified brick	222,105	211,905	300,785	393,038
Face brick	181,911	148,394	153,324	283,559
Drain tile	2,798,816	3,180,836	3,802,599	3,986,163
Sewer pipe	503,360	558,751	448,721	494,428
Fireproofing or hollow block	762,563	1,083,397	1,008,457	1,141,291
Other products	52,890	150,716	130,878	127,563
	5 575.581	6.405,995	6,749,088	7 375.716

CLASS	1917	1918	1919	1920
Common brick	\$ 947,247	\$ 749,325	\$ 941,489	\$ 1,146,182
Vitrified brick	83,310	116,522	179,969	176,430
Face brick	282,840	188,041	449,491	346,164
Drain tile	4,004,989	2,256,200	3,127,378	4,760,115
Sewer pipe	455,561	398,848	902,008	918,669
Fireproofing or hollow block	1,542,884	1,550,076	2,475,291	3,048,776
Other products	72,145	32,206	49,698	92,896
	7.543.225	5 318,848	8.125.324	10.489 232

The production of clay wares in the leading states of the Union during 1922 is shown by the following table.

Production of clay wares in the ten leading states of the United States in 1922

STATE	Rank	Brick, tile, etc.	Pottery	Total	Per cent of total
Ohio	1	\$ 38,128,927	\$ 33,218,387	\$ 71,347,314	22.2
Pennsylvania	2	35,760,030	5,923,014	41,683,044	13.0
New Jersey	3	17,243,445	20,881,443	38,124,888	11.8
Illinois	4	23,041,251	3,743,012	26,784,263	8.3
New York	5	14,862,925	5,685,884	20,548,809	6.4
California	6	12,680,942	2,008,888	14,689,830	4.6
Indiana	7	10,451,027	3,491,112	13,942,139	4.3
West Virginia	8	3,158,123	9,821,258	12,736,172	4.0
Missouri	9	11,649,495	96,513	11,746,008	3.7
Iowa	10	5,739,449	.....	5,739,449	1.8
United States		229,508,106	91,986,297	321,494,403	100.0

There were 1,797 plants producing brick, tile and other wares, and 301 pottery plants, a total of 2,098 for the nation.

CEMENT

The production of Portland cement in 1921 dropped to five per cent below that of 1920 as compared with a drop of one per cent for the industry throughout the United States. At the same time the shipments dropped six per cent. The decrease in production continued in 1922 and brought it down to seven per cent under that of 1921. However, the shipments during 1922 were eight per cent greater than those of 1921 and the consumption in 1922 was greater than that in 1921 also. The following table will give the data for the state in detail.

Production of cement in Iowa, 1920 to 1922

	1920	1921	1922
Production, bbls.	4,849,228	4,590,920	4,272,432
Stock, Dec. 31, bbls.	553,607	993,090	790,447
Shipments, bbls.	4,421,783	4,151,439	4,475,074
Shipments, value	\$8,742,854	\$7,439,983	\$7,709,313
Average factory price per bbl.	\$1.98	\$1.79	\$1.72
Consumption, bbls.	3,360,089	3,118,469	3,246,436
Population, est.	2,422,485	2,440,948	2,459,411
Consumption per capita. bbl.	1.39	1.28	1.32

During both 1921 and 1922 the commercial district which includes eastern Missouri, Iowa and Minnesota, and which contains nine active plants, ranked third in production, with an output of 11,393,552 barrels in 1922. In value of shipments, however, this district ranked fourth, as California's shipments reached a higher value, though the amount was less. The following table will show the production in the leading states.

Cement production in the United States in 1921 and 1922

STATE	Active Plants		Production, barrels			Shipments	
			1921	1922	Inc. per cent 1922	1921	
	1921	1922				Barrels	Value
Pennsylvania	22	22	27,628,598	33,276,093	20	26,622,367	\$ 46,881,625
California	9	9	7,302,784	8,711,515	19	7,180,700	16,856,258
Michigan	11	12	5,777,533	6,243,805	8	5,680,156	10,300,289
Illinois	4	4	5,587,825	6,407,129	15	5,237,510	9,092,982
New York	8	9	5,294,188	5,922,706	12	4,993,341	9,403,015
Missouri	5	5	4,446,091	6,170,633	39	4,375,712	8,034,540
Iowa	4	4	4,590,920	4,272,432	-7	4,151,439	7,439,983
Kansas	7	7	3,781,494	4,634,287	23	3,643,583	7,253,944
Texas	5	5	2,668,741	3,628,756	36	2,514,045	5,902,863
Ohio	5	5	2,563,773	2,835,243	11	2,518,723	4,615,492
Total for U. S.	115	118	98,842,049	114,789,984	16	95,507,147	180,778,415

STATE	Shipments, Cont.			Consumption				
	1922			1921		1922		
	Barrels	Value	Average factory price per bbl.	Barrels	Per capita	Barrels	Per capita	
			1921					1922
Pennsylvania	34,023,695	\$ 55,528,002	\$1.76	\$1.63	9,268,804	1.04	10,457,809	1.16
California	9,041,788	20,478,577	2.35	2.26	6,173,132	1.69	8,356,362	2.23
Michigan	6,349,751	11,145,573	1.81	1.76	6,112,986	1.59	6,196,586	1.58
Illinois	6,554,945	10,584,171	1.74	1.61	6,366,563	0.96	9,667,741	1.43
New York	6,194,663	10,694,426	1.88	1.73	10,301,525	0.97	13,272,157	1.23
Missouri	6,239,144	10,457,557	1.84	1.68	2,236,368	0.65	3,017,859	0.83
Iowa	4,475,074	7,709,313	1.79	1.72	3,118,469	1.28	3,246,436	1.32
Kansas	4,556,517	8,138,268	1.99	1.79	2,292,363	1.28	2,692,345	1.50
Texas	3,730,477	7,515,932	2.35	2.01	2,303,573	0.48	2,892,922	0.59
Ohio	2,913,035	5,243,687	1.83	1.80	6,737,835	1.12	7,770,331	1.28
Total for U. S.*	117,701,216	207,170,430	1.89	1.76	94,286,002	0.87	116,306,907	1.06

* Other producing states are Alabama, Colorado, Georgia, Indiana, Kentucky, Maryland, Minnesota, Montana, Nebraska, New Jersey, Oklahoma, Oregon, Tennessee, Utah, Virginia, Washington and West Virginia.

A comparison of this table with that for the two years preceding will show that Indiana has dropped out of second place, which has been assumed by California, also that the latter state during both years here considered held first place in per capita consumption—perhaps due to California's aggressive road building program. Iowa may well take notice and climb out of fifth place. Mississippi consistently kept her position at the foot of the list of consumers.

An estimate of consumption of Portland cement in 1922 as

furnished to the United States Geological Survey by the Portland Cement Association is of interest as showing the distribution of this material.

	<i>Barrels</i>
Public and commercial buildings	29,000,000
Dwellings	11,000,000
Sidewalks and private driveways	8,000,000
Miscellaneous farm uses	24,000,000
Concrete pipe	5,000,000
Paving and highways	28,000,000
Railways	6,000,000
Bridges, river and harbor work, dams and water power projects, storage tanks, reservoirs	3,500,000
Miscellaneous uses	2,000,000
	116,500,000

The four plants in operation in Iowa are those of the Gilmore Portland Cement Company at Gilmore City, Pocahontas county; the Northwestern States Portland Cement Company and the Lehigh Portland Cement Company at Mason City, Cerro Gordo county; and the Hawkeye Portland Cement Company at Des Moines, Polk county. The figures show that the average factory price received by these plants decreased during both 1921 and 1922 until it was twenty-six cents per barrel less than the average price for 1920, \$1.98, which was the record price for recent years. Similar conditions prevailed throughout the producing districts of the United States.

GYPSUM

Following the great increase in the production and sales of gypsum in 1920 the industry experienced the slump which seemed to be common to the mineral industry in general. The sales of gypsum and gypsum products in 1920 amounted to 432,239 tons with a value of \$4,422,965. Then in the succeeding year the production dropped to 301,587 tons valued at \$2,922,700. There was a slight decline in the production of the country at large although only in Kansas and Wyoming was this decline comparable with that in Iowa. Several states experienced an advance in 1921, as a result of which Ohio passed Iowa and took second place, next to New York, both in tonnage mined, in tonnage and value of calcined products and in total value of material sold. In the value of the crude gypsum sold

for agricultural uses Iowa was the leader in both 1921 and 1922, although the value in both years was less than the corresponding figure for 1920, which was the highest thus far reached for sales of this commodity. Iowa ranked fourth in the amount and value of crude gypsum sold for Portland cement and other purposes in 1921 and third in 1922.

In 1922 Iowa regained very nearly the ground she lost in 1921. The tonnage mined was somewhat less than that of 1920—536,905 tons as compared with 571,895 in 1920, the largest figure so far attained in the history of the industry—but the tonnages sold for agriculture, for cement and as calcined products were all larger than during 1920. Owing, however, to somewhat lower prices per unit the values of all these items were somewhat lower than during the banner year 1920. Iowa also regained second place in total production as Ohio made but slight gain while as stated above Iowa made a gain which brought her back nearly to normal production.

The Iowana Gypsum Company began the construction of a mill near Fort Dodge in 1920 and put it in operation during the next year. This mill uses the method of making plastic gypsum which is described in Doctor Wilder's report on Gypsum in volume XXVIII of the reports of this Survey.

The Universal Gypsum Company was organized in Chicago in 1922 and has taken over the properties of the Iowana and the Plymouth Gypsum companies, both at Fort Dodge.

The following table gives the details regarding gypsum production in Iowa in 1921 and 1922.

MINERAL PRODUCTION IN IOWA

Production of Gypsum in Iowa in 1921 and 1922.

	1921		1922	
	Tons	Value	Tons	Value
Crude gypsum mined.....	350,247		536,905	
Sold crude—				
to Portland cement mills.....	58,293	\$135,727	80,452	\$ 223,187
agricultural gypsum.....	26,364	98,311	45,062	136,451
Total sold crude.....	84,657	234,038	125,514	359,638
Sold calcined—				
as stucco.....	37,383	387,528	11,691	98,608
as mixed wall plaster.....	133,717	1,346,452	260,167	2,272,290
as paster of Paris, molding, casting, etc.....	1,369	15,041	3,263	33,341
as Keenes cement, dental plaster, etc.....	582	13,363	3,927	75,635
as plaster board and wall board.....	20,610	598,700	23,720	862,061
as tile and block.....	23,269	327,578	24,169	444,509
Total sold calcined.....	216,930	2,688,662	326,937	3,786,544
Total sold.....	301,587	2,922,700	452,451	4,146,182

The production of gypsum in different states is shown below.

Gypsum production by states.

STATE	1920			1921		
	Sold crude	Sold calcined	Total Value	Sold crude	Sold calcined	Total value
Iowa	\$ 414,431	\$ 4,008,534	\$ 4,422,965	\$ 234,038	\$ 2,688,662	\$ 2,922,700
Kansas	103,964	864,334	968,298	89,792	574,601	665,164
Michigan	268,968	3,252,060	3,521,028	369,185	2,942,911	3,312,096
Nevada	32,123	1,036,158	1,100,261	45,477	1,471,960	1,533,037
New York	987,503	5,451,426	6,438,929	694,518	5,715,703	6,410,221
Ohio	35,707	2,122,223	2,161,038	28,672	3,163,265	3,191,937
Oklahoma	64,019	772,749	816,768	242,382	1,046,844	1,289,226
Texas	47,961	1,391,382	1,439,491	33,068	1,732,463	1,765,600
Wyoming	125	410,599	410,724	1,298	222,960	224,258
Other states ^(*)	778,502	2,658,405	3,253,563	531,496	1,874,910	2,386,051
	2,565,195	21,967,870	24,533,065	2,265,011	21,434,279	23,700,290

STATE	1922		
	Sold crude	Sold calcined	Total value
Iowa	\$ 359,638	\$ 3,786,544	\$ 4,146,182
Kansas	86,612	604,093	690,740
Michigan	291,295	2,551,822	2,843,117
Nevada	57,187	1,971,709	2,043,974
New York	851,385	7,955,981	8,807,366
Ohio	37,331	3,938,769	3,976,100
Oklahoma	118,997	1,532,825	1,651,837
Texas	50,791	2,030,688	2,081,479
Wyoming	14,016	290,546	304,562
Other states ^(*)	640,901	1,994,009	2,546,220
	2,443,346	26,917,805	29,361,151

^(*) 1920 and 1921: Alaska, Arizona, California, Colorado, Montana, New Mexico, Oregon, South Dakota, Utah and Virginia. 1922: same states with Arkansas in addition.

The total quantity of gypsum mined in the United States in 1921 was 2,890,784 tons and that mined in 1922 was 3,779,949 tons. Sixty-two plants were reported as operating in 1921 and sixty-four in 1922. The amount sold without calcining for agricultural uses decreased from 104,966 tons, valued at \$490,902, in 1921 to 101,904 tons, valued at \$387,203, in 1922. During the same time the amount sold for cement and other purposes increased from 537,978 tons, valued at \$1,775,109, to 668,821 tons, valued at \$2,056,143. In both years New York was the chief contributor to the supply for cement mills and furnished nearly a third of the total.

SAND AND GRAVEL

The sand and gravel industry suffered a decline in 1921, although this decline was not so serious as was that in some other lines of the mineral industry. The greatest drop was in the amount and value of the sand used for building and in fact the amounts and values of paving sand and of gravel were larger in 1921 than in 1920. Lower prices prevailing in 1921 tended to reduce the increase in the values of these commodities below what it would have been otherwise. Most of Iowa's sand and gravel deposits occur as beds in the glacial drift or in the valleys of the larger streams. Such materials are by nature better fitted for the coarser uses than for finer ones such as glass making, molding, polishing and filter sands. However, some of these finer purposes are served by carefully selecting and preparing some of the finer and better grades of sand. Some sand and gravel is prepared by crushing and sizing, though most of that which is prepared is simply washed and sized.

The year 1922 witnessed a slight upward trend in some lines of the industry, notably those using gravel. There was a slight decline in the tonnage of both sand and gravel used in building but a large increase in the amount and value of gravel used for paving.

The following table will show the tonnage and value of the different kinds of sand and gravel produced during the past three years.

MINERAL PRODUCTION IN IOWA

Production of sand and gravel in Iowa by uses.

CLASS	1920		1921		1922	
	Tons	Value	Tons	Value	Tons	Value
<i>Sand</i>						
Molding	10,566	\$ 13,254	13,132	\$ 10,401	29,809	\$ 32,613
Building	1,058,990	788,184	887,470	524,627	842,254	466,326
Grinding and polishing	-----	3,248	3,403	2,454	6,225	6,961
Engine	27,334	16,366	37,042	24,443	59,778	27,568
Paving	205,893	152,337	288,163	160,478	286,303	146,030
Filter	41,084	28,130	16,465	9,339	12,255	4,682
Other	159,514	106,116	64,763	40,172	76,700	36,835
Total	1,503,381	1,108,635	1,310,438	770,914	1,313,324	721,015
<i>Gravel</i>						
Building	256,600	291,758	333,097	282,771	328,207	314,541
Roofing	16,677	26,202	10,390	13,893	-----	-----
Paving	499,072	521,360	595,229	548,576	757,329	629,549
Railroad	191,914	46,486	392,828	110,804	291,848	87,128
Total	964,263	885,806	1,331,544	956,044	1,377,474	1,031,218
Sand and gravel	2,467,644	1,993,441	2,641,982	1,726,958	2,690,798	1,752,233

No separate figures are given for roofing gravel in 1922 as these are included with those for building gravel. The production by counties so far as these figures can be made public, is given in the following table.

Production of sand and gravel in 1921.

COUNTY	Producers	Building sand	Paving sand	Other sand (a)	Gravel	Total	
						Tons	Value
Black Hawk	4	\$ 17,916	.....	(3)	*	55,833	31,416
Boone(1), Bremer(1), Butler(2)	4	2,470	.....	(3)	*	25,002	11,465
Carroll(1), Cerro Gordo(1), Cherokee(2), Clay(2)	6	45,334	*	.....	\$ 184,511	469,757	232,497
Clayton(2), Clinton(4)	6	*	*	\$12,587(1)(5)	19,523	37,779	33,436
Des Moines(2), Dickinson(1), Dubuque(2)	5	7,580	*	.....	44,026	78,147	64,662
Emmet(1), Fayette(2), Floyd(2), Frank- lin(4)	9	7,703	*	(1)(5)	21,122	50,138	41,942
Fremont(1), Hardin(1), Harrison(1), Humboldt(1), Jackson(3)	7	29,098	\$51,274	(4)(5)	120,888	209,057	201,936
Johnson(3), Kossuth(1), Lee(2)	6	22,590	*	.....	*	52,167	26,005
Linn(3), Lyon(2), Mahaska(1)	6	58,276	*	(2)(4)	13,121	141,436	82,208
Marion(1), Marshall(2), Monroe(1)	4	10,726	*	(1)(3)	*	41,626	27,434
Muscatine	6	49,111	*	(2)(3)(4)(5)	102,739	204,299	177,107
O'Brien(2), Osceola(2), Palo Alto(2), Plymouth(3)	9	12,432	*	.....	55,954	198,137	68,506
Polk	13	95,804	39,780	15,783(3)(4)(5)	145,429	423,300	296,796
Sac(2), Scott(2)	4	50,603	.....	.....	88,708	198,330	139,311
Sioux	6	47,827	Incl. in Grav.	.....	64,676	173,716	112,503
Story(2), Wapello(3)	5	36,461	*	(1)(4)(5)	49,470	133,344	103,421
Webster(4), Winneshiek(1)	5	23,185	.....	.....	5,791	33,765	28,976
Woodbury(2), Wright(2)	4	*	*	(5)	20,503	116,157	52,337
Counties with less than 3 producers	.....	6,000	69,424	57,439	28,583	.....	.....
	109	524,627	160,478	85,809	956,046	2,641,982	1,726,958

* Included in: Counties with less than 3 producers.

(*) Includes: (1) molding, \$10,401; (2) grinding and polishing, \$2,454; (3) engine, \$23,443; (4) filter, \$9,339; (5) not specified, \$40,172.

SAND AND GRAVEL IN 1921

Production of sand and gravel in 1922.

COUNTY	Producers	Building sand	Paving sand	Other sand (a)	Gravel	Total	
						Tons	Value
Black Hawk(2), Boone(2)	4	\$ 24,288	-----	(3)	\$ 81,140	172,501	\$ 109,428
Butler (2), Cerro Gordo(1), Cherokee(2)	5	8,730	*	(3)(4)	176,643	437,899	207,950
Clay(1), Clayton(2), Clinton(5)	8	*	-----	(1)(2)	21,125	61,128	57,749
Dallas(1), Des Moines(2), Dubuque(2)	5	8,280	\$ 5,599	(5)	52,426	118,589	84,305
Emmet(2), Fayette(2), Floyd(1), Frank- lin(2)	7	18,250	*	(1)(5)	13,481	43,292	34,832
Fremont(1), Hardin(2), Harrison(1), Humboldt(1)	5	21,228	*	(3)(5)	42,126	105,010	70,945
Ida(1), Jackson(2), Johnson(3)	6	14,541	*	(3)(5)	25,778	81,027	56,414
Leo(2), Linn(5)	7	51,254	*	-----	8,580	116,003	67,964
Lyon(2), Mahaska(1), Marion(1), Marshall(2)	6	29,058	*	(3)	30,007	105,003	68,640
Muscatine	5	52,529	*	(2)(3)(4)(5)	171,008	291,313	264,192
O'Brien(1), Osceola(2), Palo Alto(2), Plymouth(2)	7	5,610	*	-----	19,884	53,695	26,286
Polk	15	66,215	41,405	\$20,634(1)(3)(4)(5)	181,554	446,469	315,009
Sac(1), Scott(2), Sioux(6)	9	67,298	*	-----	96,934	277,283	174,232
Story(2), Webster(2), Winneshiek(1)	5	12,750	-----	-----	11,767	86,157	24,517
Wapello	3	*	22,457	(1)(5)	35,477	116,917	87,590
Woodbury(2), Wright(3)	5	54,092	-----	-----	48,087	168,512	102,179
Counties with less than 3 producers		32,198	72,569	88,025			
	102	466,326	146,030	108,659	1,031,218	2,690,798	1,752,233

* Included in: Counties with less than 3 producers.
 (*) Includes: (1)molding, \$32,613; (2) grinding and polishing, \$6,961;
 (3) engine, \$27,568; (4) filter, \$4,682; (5) not specified, \$36,835.

Iowa occupied twelfth place among the states in production of sand and gravel in 1921 and tenth place in 1922. This speaks well for the development of the industry, especially in view of the fact that this is essentially an agricultural state with no very large cities. The following table may be presented as showing the comparative production in the leading states in 1921.

Leading states in the production of sand and gravel in 1921.

STATE	Total sand		Total gravel		Sand and gravel	
	Tons	Value	Tons	Value	Tons	Value
Pennsylvania	4,596,982	\$ 5,674,633	2,043,352	\$ 1,926,078	6,640,334	\$7,600,711
Ohio	2,665,436	2,394,013	2,472,840	1,666,473	5,138,276	4,060,486
Illinois	3,343,996	2,346,236	3,115,696	1,670,570	6,459,692	4,016,806
New York	4,521,619	2,649,120	1,499,610	1,024,007	6,021,229	3,673,127
California	1,876,714	1,376,822	2,827,500	1,872,257	4,704,214	3,249,079
Michigan	1,848,784	995,894	3,666,469	2,019,402	5,515,253	3,015,296
Indiana	1,723,703	850,920	3,553,801	1,930,379	5,277,504	2,781,299
New Jersey	2,553,291	1,734,491	1,015,489	701,807	3,568,780	2,436,298
West Virginia	908,768	1,487,888	465,911	551,154	1,374,679	2,039,042
Texas	591,700	432,088	2,378,868	1,415,653	2,970,568	1,847,741
Wisconsin	1,308,967	743,746	1,590,842	1,039,432	2,899,809	1,783,178
Iowa	1,310,438	770,914	1,331,544	956,044	2,641,982	1,726,958
Total U. S.	38,294,954	29,148,329	41,550,054	27,434,295	79,845,008	56,582,624

The total production, including both sand and gravel, of these states in 1922 was as follows:

Leading states in production of sand and gravel in 1922.

STATE	Tons	Value
Pennsylvania	7,352,988	\$ 7,413,686
Ohio	6,999,962	5,503,374
Illinois	8,840,293	5,411,821
New York	8,303,392	5,085,312
California	5,946,892	4,033,856
New Jersey	4,854,433	3,425,013
Michigan	5,962,916	3,222,043
Indiana	5,824,330	2,977,008
West Virginia	1,553,929	2,063,781
Wisconsin	3,433,996	1,957,624
Iowa	2,690,798	1,752,233
United States	94,867,046	64,617,664

It will be noticed that there is a wide range in the value per ton in different states. This is due in part at least to the different uses for which the material is intended. Pennsylvania's

output in 1922, for example, is valued at over a dollar a ton. Over two million dollars worth of this output was used for glass making, molding, polishing and grinding. The glass sand sold for \$1.86 per ton and the other grades here mentioned sold for over a dollar and a half per ton. Most of Iowa's output of both sand and gravel, on the other hand, was used for building and paving and these grades do not command nearly such high prices, only sixty-five cents per ton in this case. The average value per ton in the United States was sixty-eight cents.

STONE AND LIME

The production of stone and lime in Iowa amounted in 1921 to 423,279 tons with a value of \$563,427. This was a decrease from the previous year's output of 207,386 tons and of \$277,117. During 1922, however, the industry regained much of this lost ground, as the tonnage rose to 627,443 and the value to \$719,203, a gain of 204,164 in tonnage and of \$155,776 in value. The tonnages of various classes of material produced during the two years were as follows:

Tonnages of stone and lime produced in Iowa.

USE	1921	1922
Building	2,470	5,560
Rubble and riprap	63,070	117,950
Concrete and road metal	299,890	417,550
Agriculture	31,090	59,720
Sugar factories	11,500	8,100
Lime, R.R. ballast, flux	15,259	18,563
	423,279	627,443

Building stone is also computed in cubic feet, and in 1922 these amounted to 64,500, an average of 11.6 feet per ton.

The following table will show the production of stone and lime by counties in 1921 and 1922, so far as these may be given without revealing individual outputs.

Production of stone and lime in 1921.

COUNTY	Producers	Build- ing	Rubble and riprap	Concrete and road metal	Agri- culture	Other uses ^a	Total value
Allamakee(1), Black Hawk(1), Clayton(2), Clinton(2)	6	\$2,880	*	\$ 39,746	*	-----	\$ 48,696
Cerro Gordo	3	-----	*	*	*	\$17,400	18,860
Des Moines(1), Hardin(1), Henry(1)							
Jackson(2)	5	*	\$21,400	33,454	*	*	77,472
Dubuque	4	*	7,017	*	*	*	62,855
Johnson(1) Linn(2)	3	-----	-----	45,000	*	*	48,175
Jones	4	-----	20,520	6,547	\$ 602	-----	27,669
Lec	3	-----	*	60,160	*	-----	62,561
Madison (1), Marshall(1), Mitchell(1)							
Pocahontas(1)	4	*	-----	45,708	*	*	51,051
Scott	4	-----	17,273	120,774	18,641	9,400	166,088
Counties with less than three producers		2,246	5,816	28,524	6,822	54,497	
	36	4,126	72,026	379,913	26,065	81,297	563,427

* Included with: Counties less than 3 producers.

^a Includes: stone sold to sugar factories, \$22,400; lime, railroad ballast and flux, \$58,897.

Stone and lime production in 1922.

COUNTY	Producers	Build- ing stone	Rubble and riprap	Concrete and road metal	Agri- culture	Other uses ^a	Total value
Allamakee(2), Cerro Gordo(2) ..	4	*	*	*	----- Incl. in Concrete	*	\$ 39,635
Black Hawk	3	-----	-----	\$ 50,854	-----	-----	50,854
Clayton(2), Clinton(1), Des Moines(1)	4	*	*	*	*	*	34,190
Dubuque	6	*	\$19,341	34,978	*	*	89,168
Hardin(1), Jackson(1), Linn(2)	4	-----	*	26,645	*	*	63,556
Johnson(1), Jones(2), Keokuk(1)	4	-----	18,033	38,420	*	*	58,080
Madison(1), Marshall(1), Mitchell(2)							
Pocahontas(1)	5	-----	-----	39,744	*	*	42,624
Scott	4	-----	43,324	184,301	\$36,742	\$12,271	276,638
Counties with less than three producers		\$9,470	32,991	77,001	12,484	74,361	
	34	9,470	121,932	451,943	49,226	86,632	719,203

* Included under: Counties with less than 3 producers.

^a Includes: Sandstone and lime sold, \$62,047; stone sold to sugar factories, \$11,670; rail-
road ballast and flux, \$12,885.

Iowa's output of limestone does not place the state in a very high position among the producers of this material. In 1921 her rank was sixteenth in tonnage and eighteenth in value of output. The reasons for this situation are chiefly the very small amount of building stone produced and the further fact that Iowa is not so active in those lines of industry which make heavy demands on the limestone resources of some other states, especially ore smelting and certain manufacturies. Perhaps a comparison of the following table with those above which show production of stone in Iowa will make this clear.

Limestone sold in the United States, by uses.

USES	1921	1922
Building	\$ 7,920,390	\$12,418,873
Rubble	280,067	470,264
Riprap	1,003,399	925,760
Crushed	32,233,438	33,224,879
Flux	9,428,767	14,208,457
Sugar factories	1,019,288	634,511
Glass works	232,715	291,854
Paper mills	223,601	264,130
Agriculture	2,355,339	2,150,435
Other	3,053,590	3,808,764
Total	57,749,594	68,397,927

Crushed stone was used in 1922 as follows: for concrete and road metal \$28,966,511; for railroad ballast \$4,258,368. When we compare Iowa's output of \$452,000 worth of stone used for concrete and road metal with the total used in the country it seems as if Iowa were scarcely contributing her share. The tonnage of limestone used in the United States for all purposes in 1921 and 1922 is shown below.

Limestone used for all purposes in the United States.

USE	Tons 1921	Tons 1922
Limestone as given in table above	45,621,000	58,928,660
Portland cement	24,400,000	30,070,000
Natural cement	90,000	148,000
Lime	5,060,000	7,280,000
	75,171,000	96,426,660

The amounts given above under cement and lime are included under those topics, hence they are not included in the total production of limestone.

The output of a few of the leading states in order of their importance is shown in the following table.

Leading states in production of limestone in 1922.

STATE	Building	Crushed	Flux	Agriculture	Total
Indiana	\$11,352,690	\$ 1,626,631	\$ 53,095	\$ 67,176	\$13,203,146
Pennsylvania	50,709	3,506,610	5,569,056	339,761	9,848,290
Ohio	41,642	4,708,567	2,061,629	82,136	7,473,525
New York	101,663	5,277,871	162,570	211,292	6,512,291
Illinois	31,405	4,947,104	682,525	293,894	6,423,573
Michigan .....	.....	695,805	2,390,692	211,192	4,533,998
Missouri	172,897	1,490,512	41,319	36,122	2,409,202
West Virginia .....	.....	653,752	1,407,170	65,298	2,126,265
Kentucky	159,107	1,418,341	13,932	25,341	1,653,506
Virginia .....	.....	1,169,987	36,688	53,485	1,527,430
Iowa	9,470	451,943	.....	49,266	719,203
United States ..	12,418,873	33,224,879	14,208,457	2,150,435	68,397,927

As is suggested by this table, the leading states in production of limestone for building are Indiana, Missouri, Minnesota and Kentucky, in the order named. Minnesota's product was valued at \$274,525. Other materials, chiefly crushed stone, brought the state's total production up to \$583,467. Indiana owes her great preëminence to the deposits near Bedford and Bloomington, in Lawrence and Monroe counties.

There were only two operators producing lime in Iowa and these kept Iowa in twenty-ninth place by quantity and thirty-first by value. The lime sold at an average of \$9.35 per ton. When all classes of stone are considered Iowa held thirty-second place among the states of the Union in 1922.

MINERAL WATERS

Three mineral springs were reported as being in use in 1921. The total sales from these amounted to 21,100 gallons valued at \$2,105. In addition 122,632 gallons were used for making soft drinks.

In 1922 the sales were somewhat larger, amounting to 25,561 gallons, with a value of \$3,788. The quantity used for soft drinks was 168,000 gallons. The average price for table and medicinal water was ten cents per gallon in 1921 and fifteen cents in 1922. The springs operating in 1921 were Fry's well at Colfax, Hawkeye Hygeia at Sioux City and Lime Rock at Dubuque. In addition to these the Grand Hotel of Colfax re-

ported sales in 1922 and also stated that it operated a bathing establishment.

The mineral water industry is of considerable importance, taking the country over. In 1922 the value of water sold for medicinal and table use was \$5,498,269. Wisconsin was the leading state, with a production valued at \$2,120,669. The next state was New York, far in the rear with sales of \$800,831. Forty-three states reported sales during the year. The waters used for soft drinks amounted to 5,831,635 gallons. This is additional to the 38,492,881 gallons sold for medicinal and table use as discussed above.

NATURAL GAS

The production and use of natural gas from pockets in the glacial drift continued on a small scale as in previous years. The production reported in 1921 amounted to 700,000 cubic feet, with a value of \$300. Six wells were productive.

During 1922 there was an estimated production of 460,000 feet with a value of \$230. The active wells are in Louisa and Guthrie counties. Pockets of gas are frequently encountered in the course of well drilling. In some cases this gas is inflammable while in others it is not. In many cases the pockets are soon exhausted, but in a few instances the supply is continuous, as in the case of the wells here listed, which have been producing for many years. The wells are shallow, not much over a hundred feet deep; and some of them are being abandoned.

Attempts are continually being made to find petroleum in Iowa, but so far these have met with uniform failure. The chances are strongly against commercial production of oil in this state.