



2018 Report on Ohio Mineral Industries: An Annual Summary of the State's Economic Geology

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DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGICAL SURVEY
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PREFACE

The *2018 Report on Ohio Mineral Industries* continues in the efforts of the ODNR Division of Geological Survey to present a clear and concise representation of mining production, sales, and employment for Ohio's mineral industry commodities. This report continues in the simplified and concise format, where a discussion of each geologic commodity is presented in a bulleted format to make viewing and obtaining the desired data easier for the user. This format parallels the digital commodity summaries that are available on the Division's website. Percent change comparisons of 2018 production and sales values for each commodity with those of the previous year are notated, with the 2017 data coming from the 2017 edition of this report (Wright and Stucker, 2018).

The *Map of Active Mineral Industry Operations in Ohio* is included at the end of the report and continues to act as a standalone product. The map includes a table with information about each labeled point, including the company name and total combined tonnage of material(s) mined at each operation location.

The appendices are not included within the report and are instead available as downloadable files at <http://geosurvey.ohiodnr.gov/economic-geology/mineral-industry-summaries>. These appendices include data for all commodities categorized by company, commodity, and county. Digital versions of these appendices allow users to view and organize data in a way that is convenient to them, which has been a feature widely requested by report users.

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2018 OHIO ECONOMIC GEOLOGY IN BRIEF

The total tonnage of coal and industrial minerals produced in Ohio during 2018 was 113,037,754 tons or approximately 9.7 tons per capita. The total value¹ of coal was \$379,576,872 in 2018; the value¹ of oil and gas was \$8,374,209,575; and the value¹ of all nonfuel industrial minerals was \$1,183,675,048 in 2018 (figs. 1, 2, 3; table 1). The combined value of fuel and nonfuel minerals produced in Ohio during 2018 was \$9,937,461,495 or approximately \$850 per capita.

Reported and estimated total direct employment in the extractive industries of Ohio in 2018 was more than

10,000 people. Industrial-mineral production decreased for all commodities except limestone and dolomite. The total value of nonfuel industrial minerals exceeded \$1 billion for the fifth straight year. In 2018, production for the leading commodity of limestone and dolomite was up 4.7%, while the second leading commodity of sand and gravel was down 2.1%, and the third leading commodity of coal was down 6.4% from 2017 values. In 2018, clay, shale, salt, and sandstone and conglomerate commodities production were all down by double digit percentages.

¹ Includes reported and estimated values. Some operations reporting sales did not report a value for those sales. A countywide- or statewide-average price per ton was calculated for each industrial-mineral commodity based on sales for which the value was reported. A countywide, average price per ton was calculated for coal based on sales for which the value was reported and method of production. These calculated averages were used to estimate the value of the sales for which the actual values were not reported.

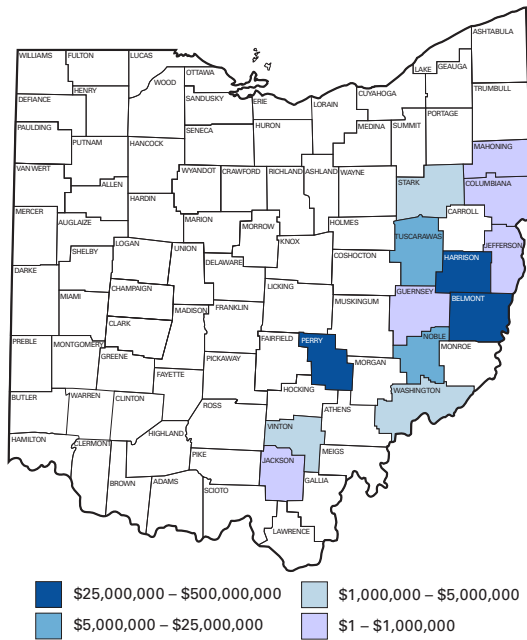


FIGURE 1. Total value of coal sold in Ohio in 2018, by county.

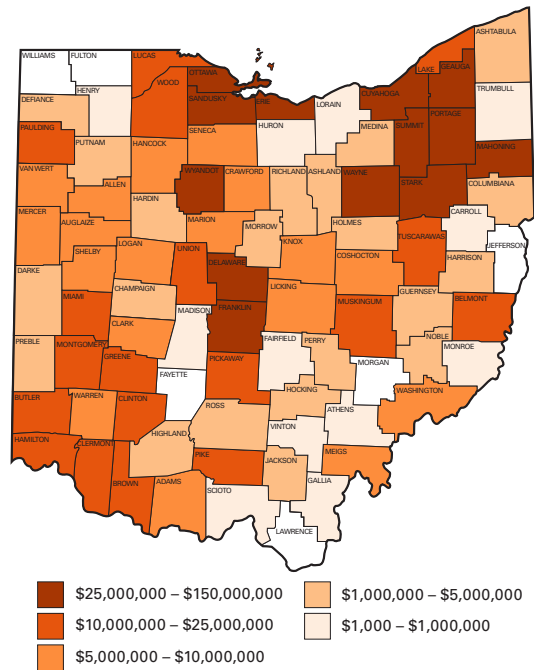


FIGURE 2. Total value of industrial minerals sold in Ohio in 2018, by county.

TABLE 1. Fuel and nonfuel mineral sales and production in Ohio in 2018

Commodity	Production ¹	Sales ²	Value ³	Change in value from 2017 (percent)
Limestone and dolomite	65,458,961 tons	64,821,047 tons	\$654,299,122	+ 6.6
Coal	9,613,912 tons	9,882,346 tons	\$379,576,872	- 0.8
Sand and gravel	31,700,708 tons	31,435,724 tons	\$245,606,387	+ 1.4
Salt	3,835,221 tons	3,909,206 tons	\$218,146,674	+ 11.7
Sandstone and conglomerate	1,243,043 tons	1,169,811 tons	\$48,203,968	- 5.9
Shale	443,552 tons	524,129 tons	\$11,506,384	- 17.2
Clay	742,357 tons	667,978 tons	\$5,912,513	- 33.7
Gas	2,398,386,763 thousand cubic feet	not available	\$7,003,289,348	+ 41.2
Oil	22,795,481 barrels	not available	\$1,370,920,227	+44.4

¹ The production figures for industrial minerals are estimates, as many operators do not know actual production. For those operators that do not report production, production is assumed equal to sales or estimated from ODNR Division of Mineral Resources Management records.

² Includes material for captive use.

³ The FOB value of industrial minerals sold was estimated for mines that failed to report this information and for those producing material for captive use. These estimates were calculated using a countywide- or statewide-average price per ton calculated using reported FOB values.

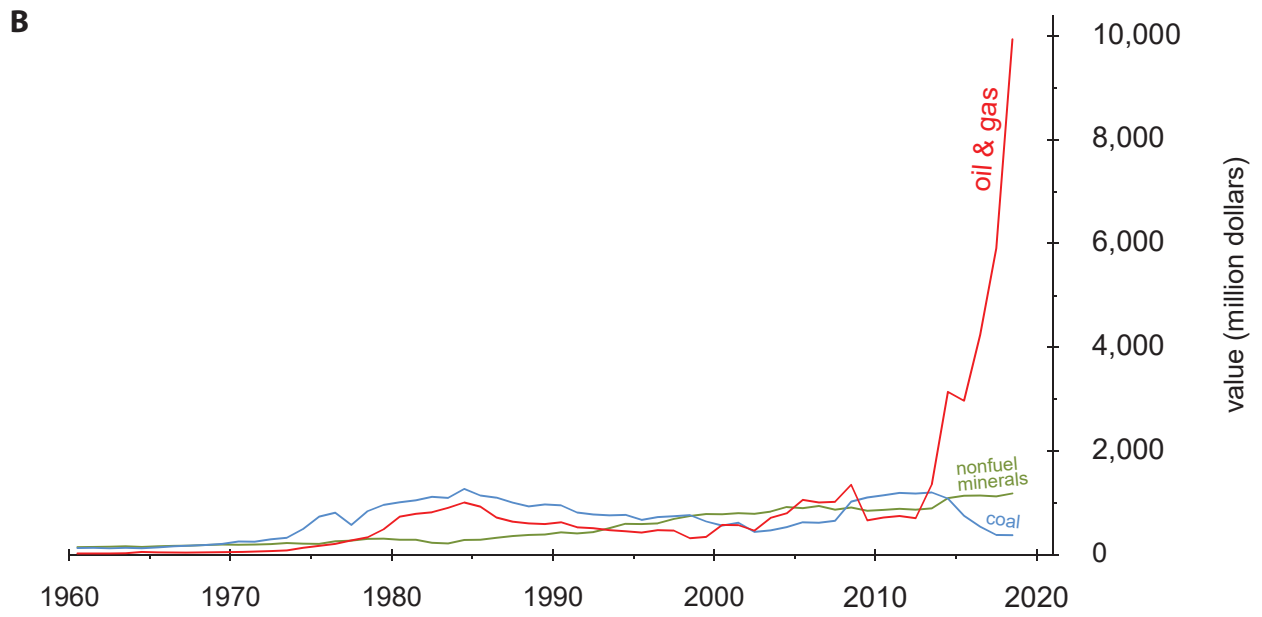
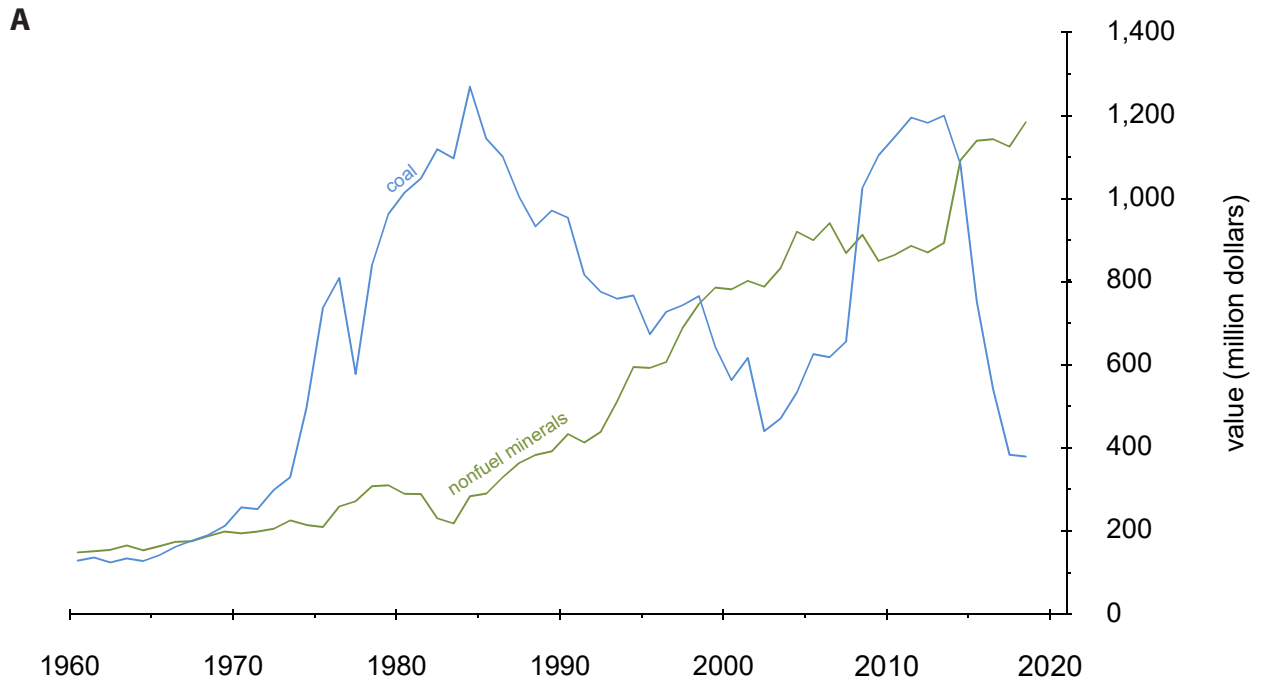


FIGURE 3. (A) Value of coal and nonfuel minerals in Ohio since 1960. (B) Value of coal, nonfuel minerals, and oil and gas in Ohio since 1960.

COAL

Directory of operators available at:
<http://geosurvey.ohiodnr.gov/economic-geology/economic-geology-home>

Coal was first recognized in Ohio by pioneers during the 1740s, and the first map of Ohio coal deposits was made in 1752 (Crowell, 1995). Coal production first occurred in Jefferson County during 1800 and amounted to 100 tons. Columbiana County was the next to report coal production starting in 1803 (Crowell, 1995). Since that time, nearly 4 billion tons of coal have been mined from coal seams in the state (Crowell, 1995); this represents a value of more than \$200 billion in 2018 dollars.²

Throughout 2018, there were two surface mine and three underground mine expansion permits issued. There were three new permits issued with two new surface mines, and one new underground mine. Several coal operations ceased or curtailed production in 2018 because of less-expensive, competing natural gas and decreased demand.

²The following link will provide more information about the formation and uses of Ohio's coal resources:
<http://geosurvey.ohiodnr.gov/rocks-and-minerals/online-rock-and-mineral-kit>

Production

- Tons produced = 9,613,912 (-6.4% from 2017)
- U.S. ranking
 - 15th out of 23 producing states (USDOE, 2019)
- Leading counties (percentage of statewide production):
 - Belmont (55.0%)
 - Harrison (19.1%)
 - Perry (16.3%)
 - Noble (3.5%)
- Top producing seams (table 5):
 - Pittsburgh (No. 8)
 - Middle Kittanning (No. 6)
 - Meigs Creek (No. 9)

Sales

(see fig. 6 and tables 2, 6, 7)

- Tons sold = 9,882,346 (+1.2% from 2017)
- Value = \$379,576,872

Employment

(see table 8)

- Production employees reported = 676
- Nonproduction employees reported = 378
- Average employee wages:
 - Surface-mine production = \$52,855
 - Underground-mine production = \$89,409
- Total wages earned = \$101,156,928

SYSTEM	GROUP	LITHOSTRATIGRAPHIC UNITS
Permian	Dunkard	Washington (No. 12) coal
	Monongahela	Waynesburg (No. 11) coal Uniontown (No. 10) coal Meigs Creek (No. 9, Sewickley) coal Pomeroy (No. 8a, Redstone) coal Pittsburgh (No. 8) coal
Pennsylvanian	Conemaugh	Ames marine zone Harlem coal Anderson coal Wilgus coal Brush Creek marine zone Mahoning (No. 7a) coal
	Allegheny	Upper Freeport (No. 7) coal Lower Freeport (No. 6a) coal Middle Kittanning (No. 6) coal Lower Kittanning (No. 5) coal Vanport marine zone Clarion (No. 4a) coal Winters coal Newland (No. 4, Brookville) coal
	Pottsville	Tionesta (No. 3b) coal Upper Mercer (No. 3a) coal Lower Mercer (No. 3) coal Quakertown (No. 2) coal Sharon (No. 1) coal

FIGURE 4. Stratigraphic column of coals mined in Ohio during 2018 (black), other significant coal beds (red), and associated key beds (blue) used for stratigraphic correlation. Modified from Brant and Delong (1960, table 9), Collins (1979, fig. 3), and Larsen (1991, fig. 2).

TABLE 2. 2018 Ohio coal production and sales by county, in descending order of production

County	Production (short tons)	Sales (short tons)
Belmont	5,284,696	6,018,426
Harrison	1,832,411	1,895,944
Perry	1,563,560	1,080,252
Noble	336,439	336,439
Tuscarawas	243,911	245,234
Vinton	205,866	157,241
Stark	69,653	71,434
Washington	59,617	59,617
Jefferson	8,685	8,685
Mahoning	5,627	5,627
Jackson	3,257	3,257
Columbiana	187	187
Guernsey	3	3
TOTAL	9,613,912	9,882,346

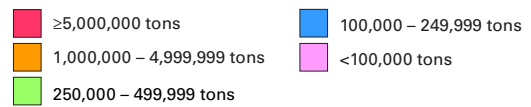
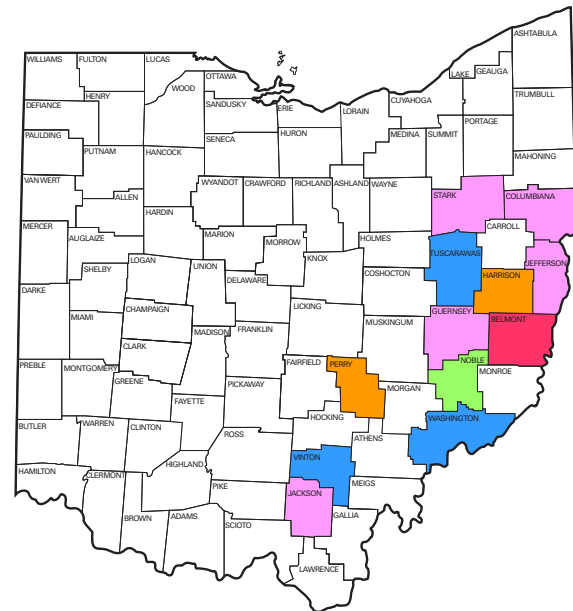


FIGURE 5. Coal production in Ohio in 2018, by county and quantity.

TABLE 3. 2018 Ohio coal production, by production size group and change from 2017

Production size group	2018		Change from 2017 (short tons)
	Number of mines reporting	Production (short tons)	
1,000,000 tons and over	2	6,178,671	502,031
500,000 to 999,999 tons	1	589,599	-1,375,020
250,000 to 499,999 tons	4	1,484,091	413,220
100,000 to 249,999 tons	5	714,886	-416,342
50,000 to 99,999 tons	7	499,221	233,156
25,000 to 49,999 tons	2	84,409	-21,552
Less than 25,000 tons	18	63,035	7,461
TOTAL	39	9,613,912	-657,046

TABLE 4. 2018 Ohio coal production, by county and mining method

County	All methods (short tons)	Total number of mines	Underground				Surface				
			Number of mines reporting	Production (short tons)			Number of mines reporting	Production (short tons)			
				Total	Longwall	Continuous miner		Total	Strip	Auger	Highwall
Belmont	5,284,696	5	1	4,785,568	4,354,126	431,442	4	499,128	305,216	3,641	190,271
Columbiana	187	1	1	187			1	187	187		
Guernsey	3	1	1	3			1	3	3		
Harrison	1,832,411	7	2	672,292		672,292	5	1,160,119	1,124,602	35,517	
Jackson	3,257	2	2	3,257			2	3,257	3,257		
Jefferson	8,685	1	1	8,685		8,685					
Mahoning	5,627	2	2	5,627			2	5,627	5,627		
Noble	336,439	4	4	336,439			4	336,439	336,439		
Perry	1,563,560	3	1	1,393,103		1,393,103	2	170,457	163,800	6,657	
Stark	69,653	2	2	69,653			2	69,653	51,165	6,610	11,878
Tuscarawas	243,911	8	1	162,874		162,874	7	81,037	81,037		
Vinton	205,866	2	2	205,866			2	205,866	154,282		51,584
Washington	59,617	1	1	59,617			1	59,617	59,617		
TOTAL¹	9,613,912	39	6	7,022,522	4,354,126	2,668,396	33	2,591,390	2,285,232	52,425	253,733

¹Any tally inconsistencies are because of rounding of production tonnages.

TABLE 5. 2018 Ohio coal production, by county and seam

County ¹	Production (short tons)											
	Total	Upper Mercer (No. 3a)	Newland (No. 4, Brookville)	Clarion (No. 4a)	Lower Kittanning (No. 5)	Middle Kittanning (No. 6)	Lower Freeport (No. 6a)	Upper Freeport (No. 7)	Pittsburgh (No. 8)	Pomeroy (No. 8a, Redstone)	Meigs Creek (No. 9, Sewickley)	Waynesburg (No. 11)
Belmont	5,284,696							187	5,189,493		54,778	40,425
Columbiana	187											
Guernsey	3										3	
Harrison	1,832,411						361,457	310,835	811,926	229,645	118,548	
Jackson	3,257		2,026		1,231							
Jefferson	8,685						8,685					
Mahoning	5,627				5,627							
Noble	336,439										336,439	
Perry	1,563,560				2,577	1,560,983						
Stark	69,653				4,709	62,217	2,727					
Tuscarawas	243,911	551	15,792		43,336	184,232						
Vinton	205,866			144,261	31,545	13,141	16,919					
Washington	59,617										59,617	
TOTAL²	9,613,912	551	17,818	144,261	89,025	1,820,573	389,788	311,022	6,001,419	229,645	569,385	40,425

¹Production from mines operating in more than one county was evenly split between the counties involved unless a county-specific breakdown was provided by the operator.
²Any tally inconsistencies are because of rounding of production tonnages.

TABLE 6. 2018 Disposition of Ohio coal, by county

County ¹	Number of mines	Disposition ¹ (short tons)					Stored
		Total ²	Rail	Water	Truck	Conveyor	
Belmont	5	6,018,426	4,399,228		1,619,198		92,165
Columbiana	1	187			187		
Guernsey	1	3			3		
Harrison	7	1,895,944	423,581		1,472,363		14,070
Jackson	2	3,257			3,257		
Jefferson	1	8,685			8,685		
Mahoning	2	5,627			5,627		
Noble	4	336,439			336,439		
Perry	3	1,080,252	900,121		180,131		
Stark	2	71,434			71,434		
Tuscarawas	8	245,234	32,535		212,699		
Vinton	2	157,241			157,241		40
Washington	1	59,617			59,617		
TOTAL³	39	9,882,346	5,755,465	0	4,126,881	0	106,275

¹Tonnage of coal shipped from mines operating in more than one county was evenly split between the counties involved and type(s) of disposition reported unless county-specific information was provided by the operator.
²Does not reflect tonnage stored. Reflects tonnage sold and shipped from mine.
³Any tally inconsistencies are because of rounding.

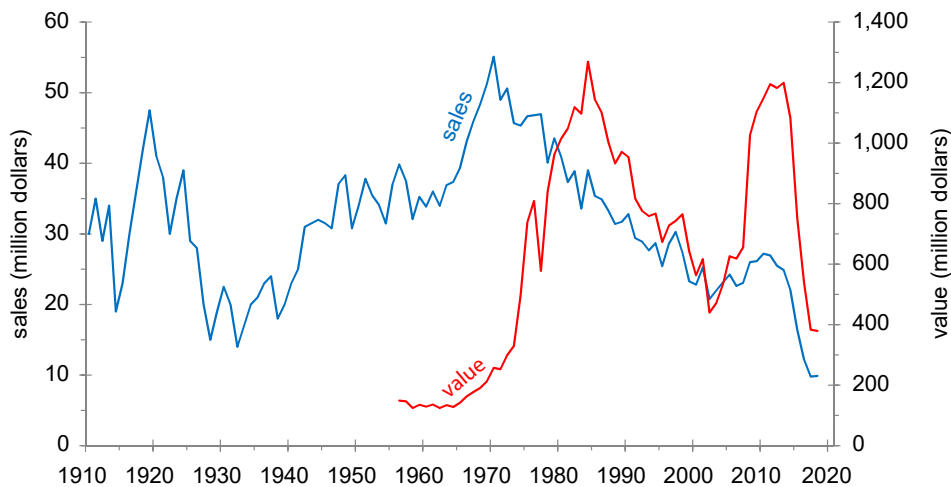


FIGURE 6. Sales and value of coal in Ohio since 1910.

TABLE 7. 2018 Dollar value of coal at mine, by county and mining method

County ¹	Total				Underground				Surface			
	No. of mines	Tonnage sold (short tons)	Value at mine ² (dollars)	Per ton average (dollars)	No. of mines	Tonnage sold (short tons)	Value at mine ¹ (dollars)	Per ton average (dollars)	No. of mines	Tonnage sold (short tons)	Value at mine ¹ (dollars)	Per ton average (dollars)
Belmont	5	6,018,426	\$210,354,738	\$34.95	1	5,508,178	\$193,324,741	\$35.10	4	510,248	\$17,029,997	\$33.38
Columbiana	1	187	\$5,797	\$31.00					1	187	\$5,797	\$31.00
Guernsey	1	3	\$84	\$28.00					1	3	\$84	\$28.00
Harrison	7	1,895,944	\$76,733,963	\$40.47	2	686,362	\$31,020,321	\$45.20	5	1,209,582	\$45,713,642	\$37.79
Jackson	2	3,257	\$62,477	\$19.18					2	3,257	\$62,477	\$19.18
Jefferson	1	8,685	\$484,430	\$55.78	1	8,685	\$484,430	\$55.78				
Mahoning	2	5,627	\$182,008	\$32.35					2	5,627	\$182,008	\$32.35
Noble	4	336,439	\$11,102,487	\$33.00					4	336,439	\$11,102,487	\$33.00
Perry	3	1,080,252	\$62,026,849	\$57.42	1	900,121	\$54,344,816	\$60.38	2	180,131	\$7,682,033	\$42.65
Stark	2	71,434	\$3,518,175	\$49.25					2	71,434	\$3,518,175	\$49.25
Tuscarawas	8	245,234	\$9,575,688	\$39.05	1	162,874	\$7,980,826	\$49.00	7	82,360	\$1,594,862	\$19.36
Vinton	2	157,241	\$3,562,815	\$22.66					2	157,241	\$3,562,815	\$22.66
Washington	1	59,617	\$1,967,361	\$33.00					1	59,617	\$1,967,361	\$33.00
TOTAL	39	9,882,346	\$379,576,872	\$38.41	6	7,266,220	\$287,155,134	\$39.52	33	2,616,126	\$92,421,738	\$35.33

¹Sales reported from mines operating in more than one county were evenly split between the counties involved unless county-specific information was provided by the operator.

²The FOB value of coal sold was estimated for those mines that failed to report this information. These estimates were calculated using a statewide-average price per ton by mining method, based on reported FOB values deemed to be reliable.

TABLE 8. 2018 Wage and salary payments to Ohio coal mine employees, by county and occupational group

County ¹	Wage and salary payments (nearest whole dollar) ²			
	All occupations	Underground production employees	Surface production employees	Other
Belmont	\$87,581,862	\$28,732,719	\$3,713,359	\$55,135,784
Guernsey	\$995,333		\$557,424	\$437,909
Harrison	\$15,209,517	\$7,388,467	\$4,610,623	\$3,210,427
Jefferson	\$419,713			\$419,713
Mahoning	\$113,016		\$113,016	
Noble	\$2,825,181		\$2,825,181	
Perry	\$1,420,861		\$758,809	\$662,052
Stark	\$683,993		\$451,869	\$232,124
Tuscarawas	\$804,278		\$355,171	\$449,107
Vinton	\$1,340,712		\$638,774	\$701,938
Washington	\$352,437		\$352,437	
TOTAL³	\$111,746,903	\$36,121,186	\$14,376,663	\$61,249,054

¹For those operations reporting activity in more than one county, wage and salary payments were evenly split between the counties involved unless county-specific information was provided by the operator.

²For those operations reporting only a total wage and salary payment for all workers, an equal pay rate was assumed for all employees. In cases where quarterly employment was reported but wage and salary payments were not, wage and salary payments for that quarter were estimated from reported payments in the other quarters to arrive at the annual figure.

³Any tally inconsistencies are because of rounding.

INDUSTRIAL MINERALS

Directory of operators available at: <http://geosurvey.ohiodnr.gov/economic-geology/economic-geology-home>

Industrial minerals are nonmetallic, nonfuel rocks or minerals that have economic value and are essential to modern society. Industrial minerals have been mined or quarried in Ohio since the establishment of early settlements and include limestone, dolomite, sand, gravel, sandstone, conglomerate, clay, shale, salt, gypsum, and peat. Hundreds of construction projects and industrial products rely on the availability of industrial minerals.

The production of multiple commodities is important to the economic success of mine operations in many areas of Ohio. The production of sand and gravel along with clay is often located in glaciated portions of northern and western Ohio, where deposits of sand and gravel can occur with clay-rich glacial tills. The Pennsylvanian-age cyclic sedimentation in eastern Ohio includes coals, clays, shales, and limestones

in close proximity, allowing for economic recovery of multiple commodities.³

Industrial minerals were reported as produced or sold at 345 operations, in 80 Ohio counties during 2018. The combined value of all industrial minerals sold in 2018 was \$1,183,675,048 (table 9). This is the fifth consecutive year that the combined value of all nonfuel minerals has exceeded one billion dollars. The statewide combined employment for all nonfuel industrial mineral extraction was 4,211 employees (table 10).

³The following links will provide more information on the general bedrock and glacial geology of Ohio:

http://geosurvey.ohiodnr.gov/portals/geosurvey/PDFs/BedrockGeology/BG-1_8.5x11.pdf

<http://geosurvey.ohiodnr.gov/portals/geosurvey/PDFs/Glacial/glacial.pdf>

TABLE 9. 2018 Value of Ohio industrial minerals

Commodity	Sales (tons)	Change from 2017 (tons/percent)	Value ¹	Percent of total value
Limestone and dolomite	64,821,047	+2,617,510/+4.2	\$654,299,122	55.3
Sand and gravel	31,435,724	-404,592/-1.3	\$245,606,387	20.7
Salt	3,909,206	-526,291/-11.9	\$218,146,674	18.4
Sandstone and conglomerate	1,169,811	-465,065/-28.4	\$48,203,968	4.1
Shale	524,129	-108,011/-17.1	\$11,506,384	1.0
Clay	667,978	-105,957/-13.7	\$5,912,513	0.5
Total	102,527,895	+1,007,594/+1.0	\$1,183,675,048	100.0

¹The FOB value of industrial minerals sold was estimated for those mines that failed to report this information and for those producing material for captive use. These estimates were calculated using a countywide- or statewide-average price per ton based on reported FOB values.

TABLE 10. 2018 Employment at Ohio industrial-mineral operations, by county

County	Total Employees ²	Production Employees	Nonproduction Employees
Adams	19	8	11
Allen	17	8	9
Ashland	17	11	6
Ashtabula	7	5	2
Athens	9	5	4
Auglaize	8	5	3
Belmont	92	37	55
Brown	30	16	14
Butler	145	51	94
Carroll	1	1	0
Champaign	10	5	5
Clark	8	5	3
Clermont	42	35	7
Columbiana	16	11	5
Coshocton	27	19	8
Crawford	14	14	0
Cuyahoga	224	164	60
Darke	10	7	3
Defiance	25	19	6
Delaware	26	26	0
Erie	112	90	22
Fairfield ¹	0	0	0
Franklin	151	95	56
Gallia	1	1	0
Geauga	76	58	18
Greene	56	40	16
Guernsey	64	44	20
Hamilton	101	50	51
Hancock	7	7	0
Hardin	17	7	10
Harrison	2	2	0
Henry ¹	0	0	0
Highland	28	23	5
Hocking	23	19	4
Holmes	34	19	15
Huron	1	1	0
Jackson	27	13	14
Knox	66	44	22
Lake	103	67	36
Licking	35	22	13

TABLE 10. 2018 Employment at Ohio industrial-mineral operations, by county (cont.)

County	Total Employees ²	Production Employees	Nonproduction Employees
Logan	60	36	24
Lorain	4	3	1
Lucas	56	43	13
Madison	6	3	3
Mahoning	103	65	38
Marion	14	11	3
Meigs	22	16	6
Mercer	34	21	13
Miami	55	38	17
Monroe	8	8	0
Montgomery	49	35	14
Morrow	5	5	0
Muskingum	61	49	12
Noble	17	15	2
Ottawa	109	86	23
Paulding	42	38	4
Perry	10	7	3
Pickaway	589	15	574
Pike	30	29	1
Portage	138	94	44
Preble	28	17	11
Putnam	5	5	0
Richland	26	21	5
Ross	24	15	9
Sandusky	214	192	22
Scioto	1	1	0
Seneca	67	14	53
Shelby	18	14	4
Stark	112	85	27
Summit	91	1	90
Trumbull	8	6	2
Tuscarawas	115	60	55
Union	57	42	15
Van Wert	25	21	4
Warren	28	20	8
Washington	60	17	43
Wayne	53	41	12
Williams ¹	0	0	0
Wood	90	64	26
Wyandot	126	96	30
TOTAL 80 counties	4,211	2,403	1,808

¹ Counties where commodities were extracted, but no employment information was provided are represented with zeros in the employment fields.

² Any tally inconsistencies are because of computer rounding produced by partial-year employment.

LIMESTONE AND DOLOMITE

Directory of operators available at:
<http://geosurvey.ohiodnr.gov/economic-geology/economic-geology-home>

Limestone and dolomite are Ohio's most versatile industrial minerals. Both are used by the construction industry as aggregate, as an essential ingredient in the cement industry, to produce lime, as a flux in the steel and glass industries, as filler in a multitude of products, as an agricultural supplement, in water purification, and as a building stone. Ohio has long been a national leader in the production of lime and construction aggregates.

Devonian and Silurian-age carbonates located in the western half of Ohio are the primary geologic units producing crushed stone. Pennsylvanian and Mississippian-age limestones are important sources of aggregate in local markets of eastern Ohio (Stout, 1941; Lamborn, 1951).

Production

- Tons produced = 65,458,961 (+4.7% from 2017)
- U.S. ranking
 - 5th out of 50 producing states for crushed stone (USGS, 2019a)
 - 4th out of 28 producing states for lime (USGS, 2019b)
- Top Producing Geologic Units (fig. 7):
 - Columbus/Delaware Limestones (Devonian)
 - Lockport Dolomite (Silurian)
 - Greenfield/Tymochtee Dolomites (Silurian)
 - Brassfield Formation (Silurian)

Sales

(See figs. 8, 9)

- Tons sold = 62,821,047 (+4.2% from 2017; table 11, 12)
- Value⁴ = \$654,299,122 (table 9)
- Leading counties (percentage of statewide sales):
 - Wyandot (11.7%)
 - Franklin (11.7%)
 - Ottawa (7.1%)
 - Erie (7.1%)

Employment

(See table 10)

- Production employees reported = 1,320
- Nonproduction employees reported = 577
- Average employee annual wage = \$51,651
- Total wages earned = \$75,965,352
- Average days worked per operation = 196

⁴Includes reported and estimated values. See footnote 1, p. 1.

SYSTEM	GROUP	LITHOSTRATIGRAPHIC UNITS
Pleistocene		Glacial clay Glacial sand and gravel
Permian	Dunkard	
Pennsylvanian	Monongahela	Fishpot limestone Redstone limestone
	Cone-maugh	Bellaire sandstone Ames limestone Buffalo sandstone Brush Creek limestone
	Allegheny	Upper Freeport sandstone Lower Kittanning clay Vanport limestone Clarion shale Putnam Hill limestone
	Pottsville	Newland-Brookville clay Tionesta clay Middle Mercer clay Massillon sandstone Sharon conglomerate
Mississippian		Maxville Limestone Logan Formation
Devonian		Black Hand Sandstone Buena Vista Sandstone
	Detroit River	Berea Sandstone Bedford Shale Ohio Shale Chagrin Member Ten Mile Creek Dolomite Dundee Limestone Delaware Limestone Columbus Limestone
Silurian	Salina	Salina Dolomite "Salt beds" Tymochtee Dolomite Greenfield Dolomite Peebles Dolomite Cedarville Dolomite Lockport Dolomite Laurel Limestone Dayton Limestone Brassfield Formation
	Black River	Black River Limestone

FIGURE 7. Stratigraphic column of nonfuel industrial minerals mined in Ohio during 2018. Modified from Brant and Delong (1960, table 9), Ohio Division of Geological Survey (1990), and Slucher and others (2006).

TABLE 11. 2018 Ohio limestone and dolomite sales, by county and use (cont'd.)

County	Tons sold																
	Total all types	Crushed and broken stone										Dimension stone	Stone for portland cement manufacture	Agricultural stone (aglime)	Raw stone for burning		
		Total	Riprap	Flux stone	Stone for portland cement concrete	Stone for asphaltic concrete	Road construction/resurfacing	Commercial building	Railroad ballast	Extenders/fillers	Unspecified/other						
Montgomery	880,153	880,153				263,015								487,817			
Muskingum	1,110,697	1,110,697	134,733			110,962								975,964			
Noble	272,281	272,281	648			2,131,493								160,671			
Ottawa	4,624,097	4,400,144	125,405	435,323	167,417									1,448,506			223,953
Paulding	1,166,415	609,450												609,450	556,965		
Perry	203,208	203,208												203,208			
Pickaway	207,744	207,744	6,000	60,000	100,000	15,000								6,744			
Pike	1,054,314	1,035,314	96,000	300,000	300,000	200,000								34,314			19,000
Portage	650	650				300								350			
Putnam	481,000	481,000	3,000	88,000	40,000									350,000			
Ross	260,125	260,125				150,000								30,125			
Sandusky	3,215,626	1,151,942	4,101	276,006	82,605	206,808								391,343			2,050,151
Seneca	1,197,519	383,956	5,006	84,182		24,279								269,766	723		788,775
Shelby	666,000	666,000												666,000			
Tuscarawas	248,997	248,997	21,171			214,810								13,016			
Union	2,145,406	2,145,406												2,145,406			
Van Wert	615,642	615,642		27,000										588,642			
Wayne	2,689	2,665				2,665											24
Wood	1,789,512	1,781,265	37,384	53,965	438,903	546,945								350,692			8,247
Wyandot	7,596,316	7,557,316	60,000	1,384,826	596,878	74,613								229,000			39,000
TOTAL	64,821,047	60,830,119	868,175	5,909,505	4,444,294	8,413,246								35,000,985	8,109	556,965	3,062,879

TABLE 12. 2018 Production of lime from Ohio, by county and use

County	Total tons ¹	Building (tons)	Chemical and industrial (tons)	Refractory (tons)
Ottawa	101,797	64,760	37,037	
Sandusky	891,370		891,370	
Seneca	352,742		352,742	
TOTAL	1,345,909	64,760	1,281,149	0

¹Burning produced a 43.9% weight loss.

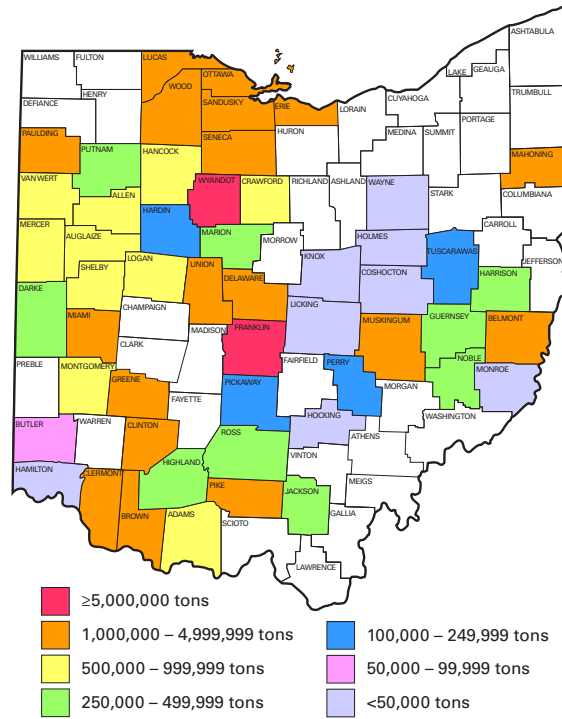


FIGURE 8. Sales of limestone and dolomite in Ohio in 2018, by county and quantity.

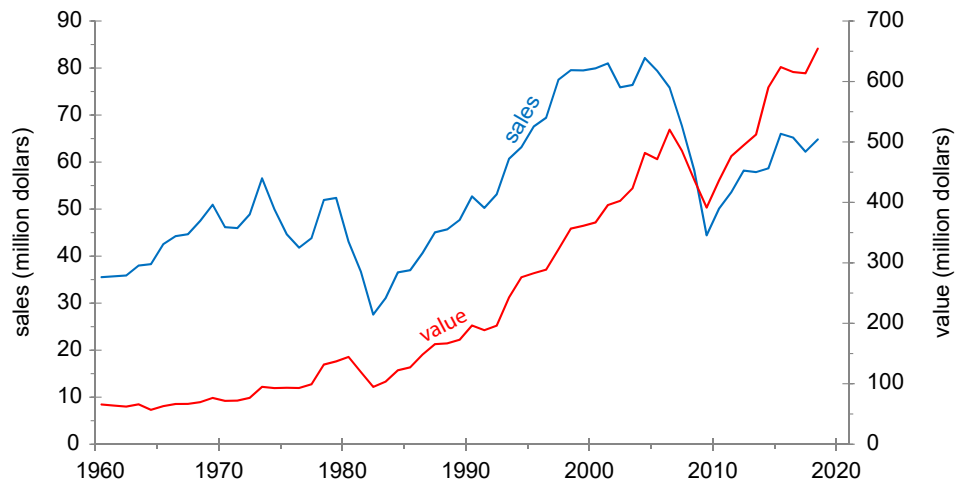


FIGURE 9. Sales and value of limestone and dolomite in Ohio.

SAND AND GRAVEL

Directory of operators available at: <http://geosurvey.ohiodnr.gov/economic-geology/economic-geology-home>

Sand and gravel are common raw materials that are major constituents of asphalt, concrete, mortar, landscaping, roofing shingles, soil additives, and many other products. Sand-and-gravel production increased rapidly in Ohio beginning in the 1950s with the development of improved mining and processing machinery and increased demand from road building (Ohio Division of Geological Survey, 1959). Many depleted sand-and-gravel operations have been redeveloped as parks, residential spaces, or commercial facilities because of their proximity to urban areas.

Sand-and-gravel deposits in Ohio primarily are associated with Wisconsinan-age glacial outwash and kame terraces in the valleys and tributaries of the Great Miami, Scioto, and Muskingum Rivers located in the southwestern, central, and eastern portions of the state, respectively. Important sand-and-gravel deposits also are found in glacial kames in northeastern Ohio, beach ridges associated with ancestral Lake Erie, and alluvium of modern floodplains of the Ohio River and its tributaries.

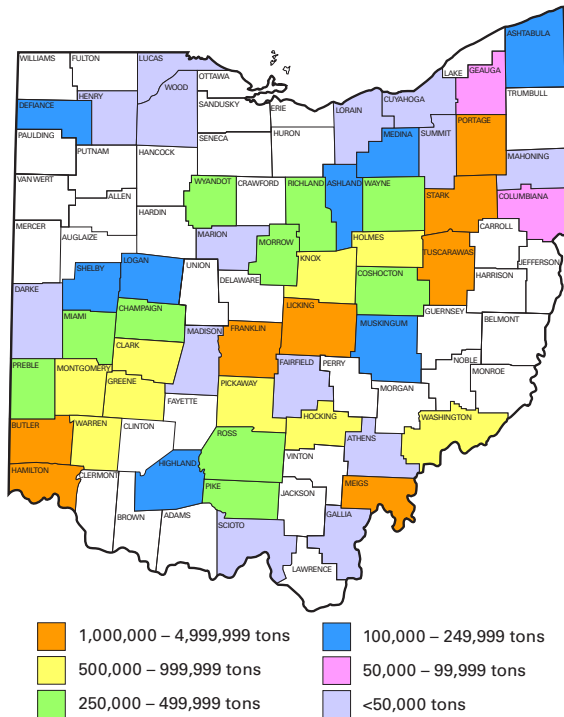


FIGURE 10. Sales of sand and gravel in Ohio in 2018, by county and quantity.

Production

- Tons produced = 31,700,708 (-2.1% from 2017)
- U.S. ranking
 - 8th out of 50 producing states (USGS, 2019c)

Sales

(See figs. 10, 11)

- Tons sold = 31,435,724 (-1.3% from 2017; table 13)
- Value⁵ = \$245,606,387 (table 9)
- Leading counties (percentage of statewide sales):
 - Stark (12.8%)
 - Butler (10.6%)
 - Portage (10.1%)
 - Hamilton (9.0%)
 - Franklin (5.2%)

Employment

(See table 10)

- Production employees reported = 1,036
- Nonproduction employees reported = 1,147
- Average employee annual wage = \$53,872
- Total wages earned = \$77,134,254
- Average days worked per operation = 158

⁵ Includes reported and estimated values. See footnote 1, p. 1

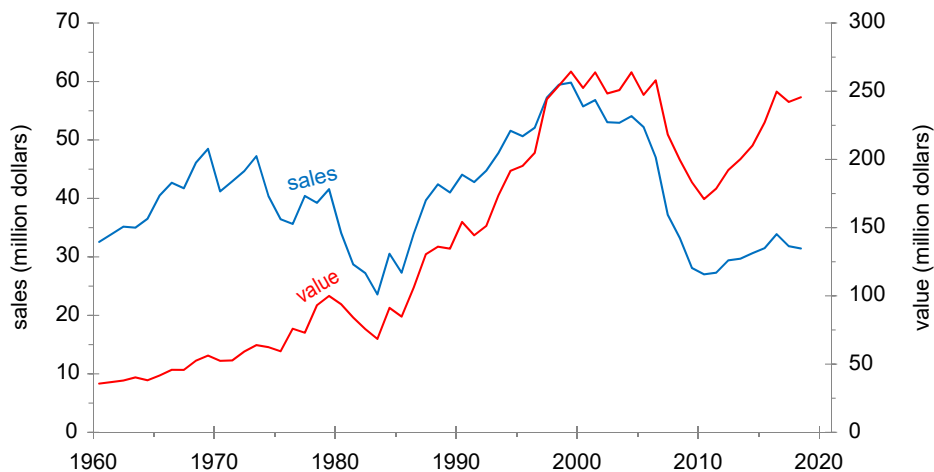


FIGURE 11. Sales and value of sand and gravel in Ohio.

TABLE 13. 2018 Ohio sand and gravel sales, by county and use

County	Tons sold																
	Total sand and gravel	Total sand	Total gravel	Building		Portland cement concrete		Asphaltic concrete		Road construction/resurfacing		Filtration		Foundry sand	Industrial sand	Other/unspecified	
				Sand	Gravel	Sand	Gravel	Sand	Gravel	Sand	Gravel	Sand	Gravel			Sand	Gravel
Ashland	243,671	80,746	162,925	24,224	48,878					48,447	97,755					8,075	16,292
Ashtabula	133,335	71,247	62,088	56,698	62,075	8,856		5,680								13	13
Athens	16,076	10,513	5,563	10,513	5,563												
Butler	3,339,881	1,540,595	1,799,286	351,321	603,048	377,983	240,950			403	158,189					811,291	797,099
Champaign	274,134	107,792	166,342	10,494	50,873	49,971	22,984				20,274					46,924	72,211
Clark	862,230	468,842	483,766	8,401	45,805	97,400	92,631			43,540	26,380					247,845	247,846
Columbiana	77,005	40,457	36,548							1,859						34,074	36,548
Coshocton	419,121	285,957	133,164	11,804	18,532					558	47,937			1,409		273,595	66,345
Cuyahoga	28,487	14,244	14,243													14,244	14,243
Darke	30,000	25,000	5,000	25,000	5,000												
Defiance	193,572	173,396	20,176	13,168	15,993	160,228											4,183
Fairfield	3,238	2,317	921													2,317	921
Franklin	1,643,500	961,697	681,803	45,400	285,201	626,923	57,047			35,284	16,926					254,090	256,373
Gallia	2,010	2,010														2,010	
Geauga	81,406	40,702	40,704													40,702	40,704
Greene	839,502	368,782	581,564	11,200	9,700	21,780	24,200			59,170	4,000					223,672	520,564
Hamilton	2,841,685	1,623,297	1,218,388	641,056	664,122	331,045	192,787				64,955					651,196	296,524
Henry	4,135	4,135										500				2,435	
Highland	136,068	70,583	65,485		19,931	64,803											18,109
Hocking	530,041	363,020	167,021		10,200	18,968	18,544			24,341	17,509					278,920	89,004
Holmes	627,334	324,618	302,716	29,029	109,560	131,222	28,178			30,465	88,814					3,139	1,100
Knox	971,077	458,008	513,069	104,592	245,669	46,018	46,018				78,614					124,241	144,797
Licking	1,111,654	594,997	516,657	54,625	357,249	237,798	7,074				1,898					267,349	124,098
Logan	190,003	112,485	77,518	489	488	1,838	1,838					461				109,697	74,730
Lorain	3,378	1,689	1,689	1,689	1,689												
Lucas	3,000	1,500	1,500													1,500	1,500
Madison	10,792	1,966	8,826	1,966	8,826												
Mahoning	36,241	16,665	19,576	6,581	3,959					7,422							3,058
Marion	16,227	11,902	4,325	567													1,555
Medina	161,000	80,500	80,500													80,500	80,500
Meigs	1,255,929	934,735	321,194			586,078	125,421									348,657	195,773
Miami	403,756	237,872	165,884		50,000	38,514										199,358	115,884
Montgomery	751,905	348,850	403,055	36,297	119,511	48,250	54,500			21,000	6,750			20,000		223,303	222,294
Morrow	285,000	78,000	207,000	1,000		36,000				19,000						22,000	207,000
Muskingum	217,704	185,096	32,608	7,678	1,684					85,463	1,666					90,289	24,083

TABLE 13. 2018 Ohio sand and gravel sales, by county and use (cont'd.)

County	Tons sold																
	Total sand and gravel	Total sand	Total gravel	Building		Portland cement concrete		Asphaltic concrete		Road construction/resurfacing		Filtration		Foundry sand	Industrial sand	Other/unspecified	
				Sand	Gravel	Sand	Gravel	Sand	Gravel	Sand	Gravel	Sand	Gravel			Sand	Gravel
Pickaway	917,613	476,226	441,387		309	339,000	105,000	80,000	50,000	10,580	10,161					46,646	275,917
Pike	342,197	282,230	59,967													282,230	59,967
Portage	3,178,025	2,207,295	970,730	226,090	234,319	770,163	113,621	391,293	257,528	135,221	126,461	1,440	57,865	13,700	669,388	180,936	
Preble	347,329	158,940	188,389	49,461	76,700	20,429	69,350	8,461	1,476	65,081	427				15,508	40,863	
Richland	392,500	265,227	127,273	44,051	56,745			65,604	38,476						155,572	31,625	
Ross	283,794	160,963	122,831	4,473	27,376	14,822	80	33,990	32,485	1,848	6,338				105,830	56,552	
Sandusky	259	130	129					130	129								
Scioto	24,400	11,312	13,088	100	2,093	237	20								10,975	10,975	
Shelby	194,230	97,115	97,115												97,115	97,115	
Stark	4,065,589	2,325,736	1,765,492	47,371	368,546	555,455	27,429	569,005	608,477	496,670	344,132				657,235	416,908	
Summit	13,835	13,156	679	13,056	679										100		
Tuscarawas	1,524,171	997,090	527,081	279,784	202,292	131,106	48,253	343,167	110,426	123,277	164,692	28,000		62,638	29,118	1,418	
Warren	657,862	284,989	372,873	237,957	297,345	4,334	14,810	12,584	26,659						30,114	34,059	
Washington	768,696	524,225	244,471	29,350	7,962	258,086	15,925	47,782	47,782						236,789	158,743	
Wayne	417,294	266,528	150,766	18,904	119,225	162,721	4,064	60,996	12,360	20,171	12,679	3,736	2,438				
Williams	305	153	152												153	152	
Wood	8,715	4,357	4,358	4,357	4,358												
Wyandot	327,952	230,278	97,674	38,094	51,179	54,935	5,935	131,000				554	36,865		5,695	3,695	
TOTAL ¹	31,435,724	17,950,165	13,485,559	2,342,248	4,051,607	5,405,949	1,318,777	2,246,392	1,553,691	1,070,719	1,352,118	76,229	167,090	1,409	103,315	6,703,904	5,042,276

¹Any tally inconsistencies are because of rounding.

SANDSTONE AND CONGLOMERATE

Directory of operators available at: <http://geosurvey.ohiodnr.gov/economic-geology/economic-geology-home>

Extensive high-quality sandstone and conglomerate deposits are located in central and eastern Ohio, from near Lake Erie to the Ohio River. During the mid-1800s, these geologic resources were developed into large building-stone and glass production industries, and to support the steel and associated industries. Many prominent buildings in the state use local building stones, including the Ohio Statehouse, Cleveland's Old Stone Church, The Ohio State University's Orton Hall, Cincinnati's City Hall, and numerous other churches, monuments, and historic structures.

Ohio led the nation in sandstone production for many decades; this natural resource continues to support the state's industries today. Historically, the Pennsylvanian-age Massillon sandstone and the Devonian-age Berea Sandstone of northern Ohio, as well as the Mississippian-age Buena Vista Sandstone in southern Ohio, have been the primary geologic units quarried for building stone (Bownocker, 1915; see also fig. 7).

Production

- Tons produced = 1,243,043 (-28.0% from 2017)
- U.S. ranking
 - 5th out of 50 producing states for crushed stone (USGS, 2019a)
 - Detailed 2018 U.S. rankings for the 34 dimension-stone producing states were unavailable (USGS, 2019d); in 2017, Ohio ranked in the top 20
- Top Producing Geologic Units (fig. 7):
 - Sharon conglomerate (Pennsylvanian)
 - Berea Sandstone (Devonian)
 - Logan Formation (Mississippian)
 - Cuyahoga Formation (Mississippian)

Sales

(See figs. 12, 13)

- Tons sold = 1,169,811 (-28.5% from 2017; table 14, 15)
- Value⁶ = \$48,203,968 (table 9)
- Leading counties (percentage of statewide sales):
 - Geauga (64.6%)
 - Wayne (8.3%)
 - Lake (5.8%)
 - Pike (5.4%)
 - Knox (5.1%)

Employment

(See table 10)

- Production employees reported = 263
- Nonproduction employees reported = 115
- Average employee annual wage = \$51,812
- Total wages earned = \$16,935,892
- Average days worked per operation = 162

⁶Includes reported and estimated values. See footnote 1, p. 1.

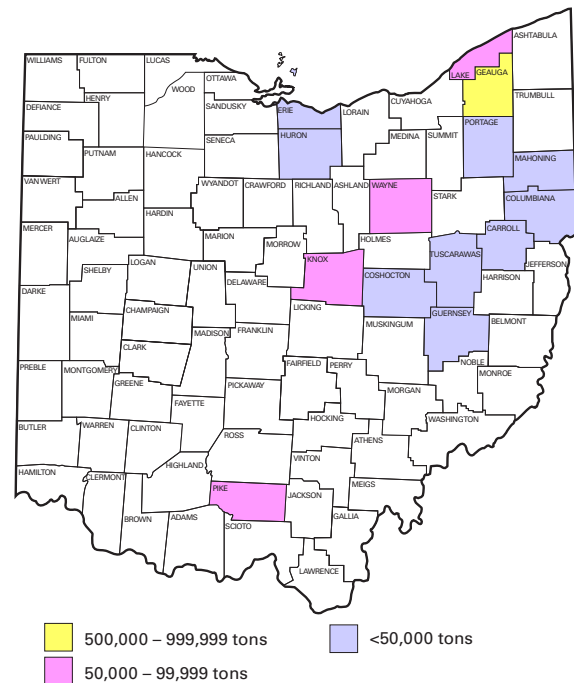


FIGURE 12. Sales of sandstone and conglomerate in Ohio in 2018, by county and quantity.

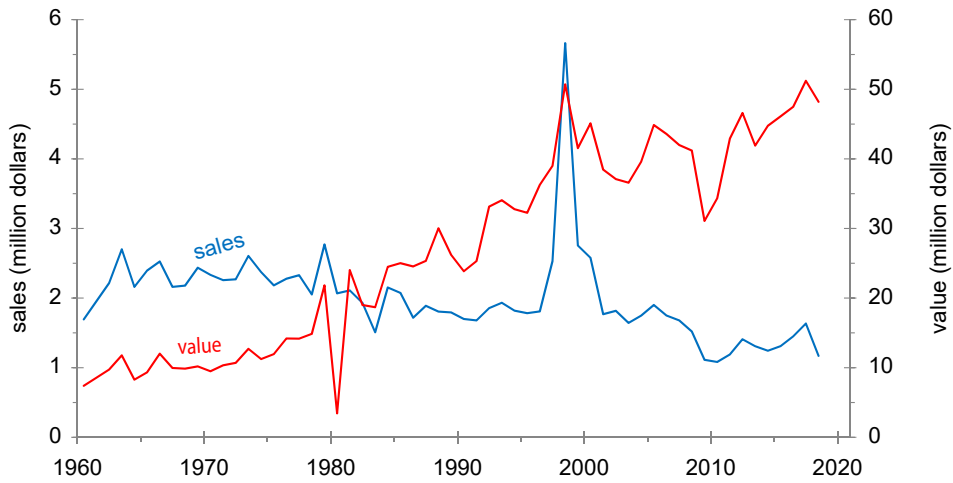


FIGURE 13. Sales and value of sandstone and conglomerate.

TABLE 14. 2018 Ohio sales of crushed sandstone and conglomerate, by county and use

County	Tons sold														
	Total	Foundry sand	Glass sand	Metallurgical pebble	Refractory	Riprap	Aggregate	Silica flour	Polishing/ grinding sand	Fire and furnace sand	Engine sand	Frac sand	Construction	Industrial sand	Other/ unspecified
Carroll	2,656														2,656
Columbiana	21,255				8,465									4,053	8,737
Geauga	755,418	86,092	185,347	1,807	5,785		19,496					280	222,093	27,573	206,945
Guernsey	9,600					2,600									7,000
Knox	58,474	11,810	15,267								7,714	5,662	5,417	7,215	5,389
Lake	67,701						56,144						11,557		
Mahoning	42,573												42,573		
Pike	62,748												28,805		33,943
Portage	15,884														15,884
Tuscarawas	11,504					3,052							7,998		454
Wayne	95,144					9,339	82,447						3,358		
TOTAL	1,142,957	97,902	200,614	1,807	14,250	14,991	158,087				7,714	5,942	321,801	38,841	281,008

TABLE 15. 2018 Ohio sales of dimension sandstone, by county and use

County	Tons sold									
	Total	Refractory	Rough construction	Rubble	Grindstones	Rough architectural	Finished	Curbing	Flagging	Other/ unspecified
Columbiana	177									177
Coshocton	5,960									5,960
Erie	8,078		3,626	94		1,731	2,617		10	
Guernsey	5,451		5,451							
Huron	2,701		2,701							
Knox	833		242				81			510
Lorain	1,406			1,275			131			
Scioto	582									582
Wayne	1,666									1,666
TOTAL	26,854		12,020	1,369		1,731	2,829		10	8,895

CLAY AND SHALE

Directory of operators available at: <http://geosurvey.ohiodnr.gov/economic-geology/economic-geology-home>

The ceramics industry in Ohio has a long and dynamic history. Potteries were established by the early 1800s to supply dinnerware, and by the early 1900s, Ohio was producing tremendous amounts of building bricks, sewer pipes, roof and floor tiles, paving bricks, art pottery, and refractory products. Edward Orton, Jr., established the first ceramics engineering program in the nation at Ohio State University in 1894. Ohio clay and shale still are being used to produce important ceramic products, though production tonnages are much less than 100 years ago. Ohio ceramic products are shipped throughout the eastern United States and Canada. Nearly all clay and shale produced in Ohio is

used to produce value-added products (e.g., building bricks, industrial ceramics, pottery, expanded aggregate, quarry tile), thus the economic impact is much greater than the combined mined value.

Pennsylvanian-age shales and clays of eastern Ohio are the primary sources of raw materials for the ceramics industry; Mississippian and Devonian-age shales of northern and central Ohio and Pleistocene-age glacial clays of western Ohio are important secondary sources. General discussions of clay and shale geology in Ohio can be found in Lamborn and others (1938) and Stout and others (1923).

Production

- Tons produced (clay) = 742,357 (–18.7% from 2017)
- Tons produced (shale) = 443,552 (–34.3% from 2017)
- Detailed 2018 U.S. rankings for the 40 producing states were unavailable (USGS, 2019e); in 2016, Ohio was ranked 6th.

Sales

(See figs. 14, 15, 16, 17)

- Clay:
 - Tons sold = 667,978 (–13.7% from 2017; table 16)
 - Value⁷ = \$5,912,513 (table 9)
- Leading counties for clay (percentage of statewide sales):
 - Tuscarawas (28.0%)
 - Paulding (19.7%)
 - Defiance (8.2%)
 - Mahoning (6.6%)
 - Washington (6.1%)

Shale:

- Tons sold = 524,129 (–17.1% from 2017; table 17)
- Value⁸ = \$11,506,384 (table 9)
- Leading counties for shale (percentage of statewide sales):
 - Tuscarawas (35.6%)
 - Cuyahoga (32.2%)
 - Harrison (5.4%)
 - Marion (5.2%)
 - Coshocton (4.8%)

Employment

(See also table 10)

- Production employees reported = 252
- Nonproduction employees reported = 172
- Average employee annual wage = \$42,478
- Total wages earned = \$15,653,457
- Average days worked per operation = 135

⁷Includes reported and estimated values. See footnote 1, p. 1

⁸Includes reported and estimated values. See footnote 1, p. 1

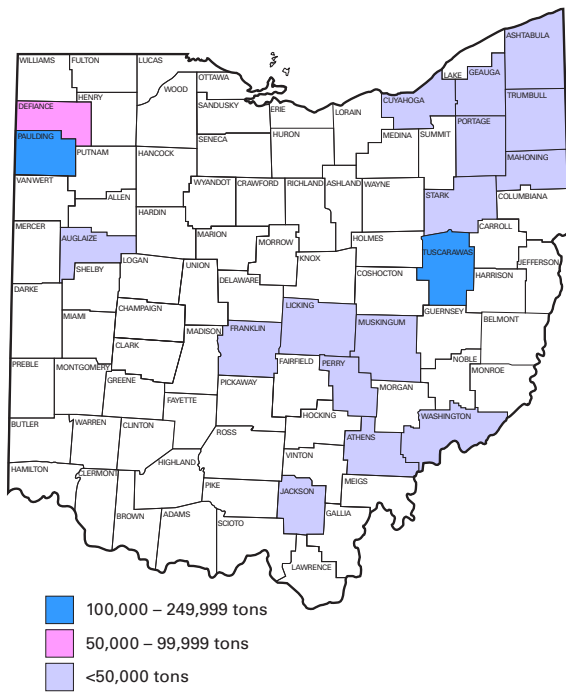


FIGURE 14. Clay sales in Ohio in 2018, by county and quantity.

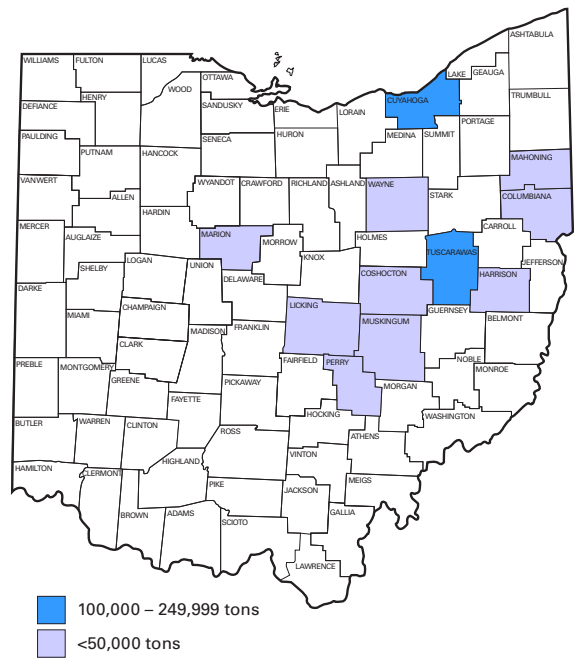


FIGURE 15. Shale sales in Ohio in 2018, by county and quantity.

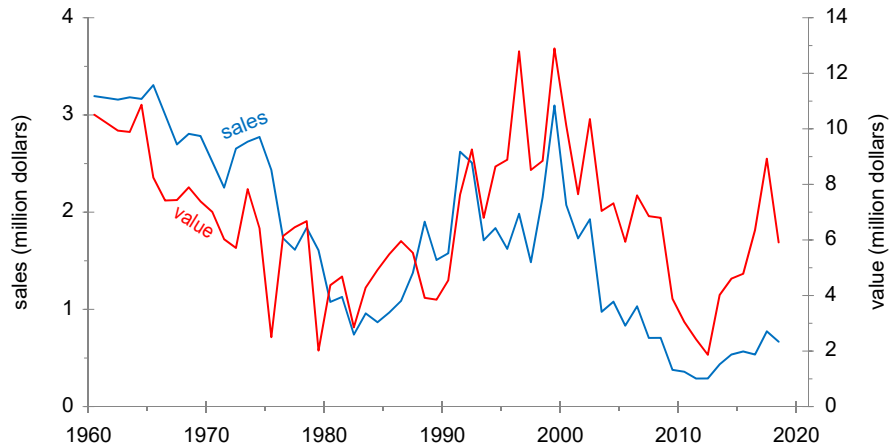


FIGURE 16. Sales and value of clay in Ohio.

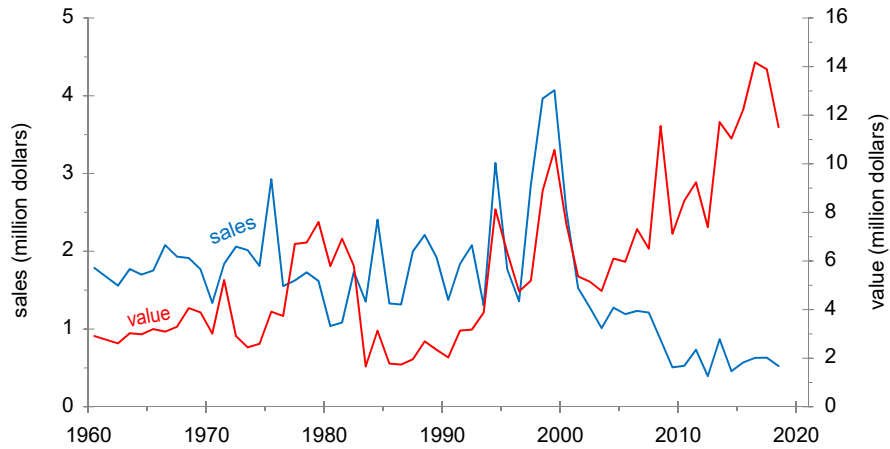


FIGURE 17. Sales and value of shale in Ohio.

TABLE 16. 2018 Ohio clay sales, by county and use

County	Tons sold								
	Total	Common clay products	Stoneware	Vitrified products	Cement manufacture	Refractories	Construction	Landfill use	Other/ unspecified
Ashtabula	3,452						3,452		
Athens	22,000							22,000	
Auglaize	1,798	1,798							
Cuyahoga	6,291	1,304							4,987
Defiance	55,000							55,000	
Franklin	10,920							10,920	
Geauga	8,860								8,860
Jackson	33,514					5,627			27,887
Licking	40,485						40,485		
Mahoning	43,789								43,789
Muskingum	26,825	11,825	1,000			7,000	7,000		
Paulding	131,624				131,624				
Perry	11,505	11,505							
Portage	7,078	68					7,000		10
Stark	2,920								2,920
Trumbull	33,923							33,923	
Tuscarawas	187,260	164,189			22,659				412
Washington	40,734						40,734		
TOTAL	667,978	190,689	1,000	0	154,283	12,627	98,671	121,843	88,865

TABLE 17. 2018 Ohio shale sales, by county and use

County	Tons sold							
	Total	Common clay products	Vitrified products	Cement manufacture	Lightweight aggregate	Construction	Landfill use	Other/ unspecified
Columbiana	9,795	9,795						
Coshocton	25,196						25,196	
Cuyahoga	168,597				168,597			
Harrison	28,202	28,202						
Knox	1,148							1,148
Licking	20,268	20,268						
Mahoning	17,517							17,517
Marion	27,242							27,242
Muskingum	10,000					10,000		
Perry	22,674	22,674						
Tuscarawas	186,363	186,363						
Wayne	7,127							7,127
TOTAL	524,129	267,302	0	0	168,597	10,000	25,196	53,034

SALT

Directory of operators available at: <http://geosurvey.ohiodnr.gov/economic-geology/economic-geology-home>

Salt was one of the first industrial minerals produced in Ohio and was a valuable commodity to early pioneers who obtained it from natural springs. The first State Legislature enacted laws concerning salt springs in 1803–1804, and wells were drilled in Jackson and Muskingum Counties, leading to the first commercial salt production in the state. The most important area for early salt production was in Meigs County, beginning in 1850. By 1903, Ohio was producing 14.7 percent of all salt in the United States (Bownocker, 1906).

The modern salt industry in Ohio began in 1956 with the construction of the underground salt mine at Fairport Harbor in Lake County. A second large underground operation was constructed in Cleveland, beginning in 1957. The primary use for Ohio salt in 2018 was ice control. Salt also was used as an additive in animal feed, for cattle blocks, and as a commercial and residential water-softening agent.

Salt production in 2018 decreased slightly from 2017, and sales decreased for the third straight year. Decreased sales are likely a result of the unusually warm winter with lower-than-average precipitation.

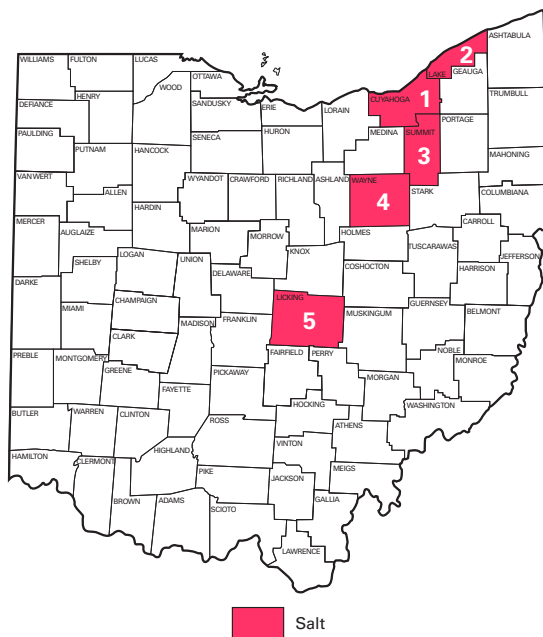


FIGURE 18. Counties producing salt in Ohio in 2018 and their rankings in sales.

Production

- Tons produced = 3,835,221 (-16.7% from 2017)
- U.S. ranking
 - 5th out of 16 producing states (USGS, 2019f)
- Top producing geologic units (fig. 7):
 - Salina Group (Silurian)

Sales

(See figs. 18, 19)

- Tons sold = 3,909,206 (-11.9% from 2017)
- Value⁹ = \$218,146,674 (table 9)

Employment

(See table 10)

- Production employees reported = 238
- Nonproduction employees reported = 184
- Average employee annual wage = \$73,918
- Total wages earned = \$31,045,473
- Average days worked per operation = 292

⁹Includes reported and estimated values. See footnote 1, p. 1.

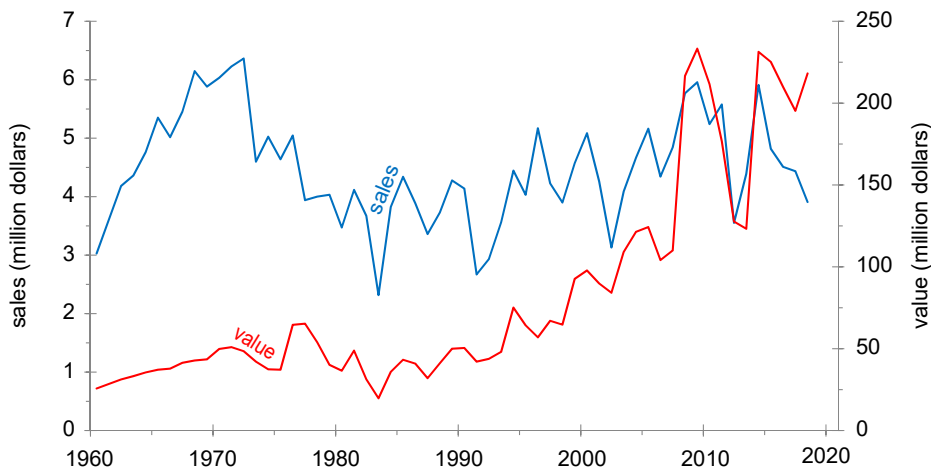


FIGURE 19. Sales and value of salt in Ohio.

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LIST OF DOWNLOADABLE APPENDICES

Mineral commodity summaries as well as the following appendices can be found on the Ohio Department of Natural Resources, Division of Geological Survey website at <http://geosurvey.ohiodnr.gov/economic-geology/mineral-industry-summaries>

2018 Coal companies reporting sales and/or production, by company and county
<http://geosurvey.ohiodnr.gov/economic-geology/mineral-industry-summaries/post/2018-coal>

2018 Limestone and dolomite companies reporting sales and/or production, by company and county
<http://geosurvey.ohiodnr.gov/economic-geology/mineral-industry-summaries/post/2018-limestone-dolomite>

2018 Sand and gravel companies reporting sales and/or production, by company and county
<http://geosurvey.ohiodnr.gov/economic-geology/mineral-industry-summaries/post/2018-sand-gravel>

2018 Sandstone and conglomerate companies reporting sales and/or production, by company and county
<http://geosurvey.ohiodnr.gov/economic-geology/mineral-industry-summaries/post/2018-sandstone-conglomerate>

2018 Clay and Shale companies reporting sales and/or production, by company and county
<http://geosurvey.ohiodnr.gov/economic-geology/mineral-industry-summaries/post/2018-clay-shale>

2018 Salt companies reporting sales and/or production, by company and county
<http://geosurvey.ohiodnr.gov/economic-geology/mineral-industry-summaries/post/2018-salt>