

# THE MINERAL INDUSTRY OF WASHINGTON

**This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Washington State Department of Natural Resources, Division of Geology and Earth Resources, for collecting information on all nonfuel minerals.**

In 2000, the estimated value<sup>1</sup> of nonfuel mineral production for Washington was \$691 million, based upon preliminary U.S. Geological Survey (USGS) data. This was about a 4.4% increase from that of 1999<sup>2</sup> and followed an 8.7% increase from 1998 to 1999. The State ranked 23d (22d in 1999) among the 50 States in total nonfuel mineral production, of which Washington accounted for more than 1.5% of the U.S. total.

In 2000, four of Washington's mineral commodities, construction sand and gravel, crushed stone, portland cement, and gypsum (in descending order of value), accounted for more than 72% of the State's nonfuel mineral value. In 1999, the rise in value was mostly attributed to a \$35 million increase in the value of crushed stone, a \$13 million increase in construction sand and gravel, and sequentially smaller yet significant increases in the values of magnesium metal and gypsum. The largest decrease was that of gold, down \$4.2 million, while common clay, diatomite, and industrial sand and gravel each decreased by about \$1 million. All other changes in 1999 were small and inconsequential to the net result (table 1).

Based upon USGS estimates of the quantities produced in the 50 States in 2000, Washington remained fourth in diatomite and seventh in construction sand and gravel. While the State rose to first from second of two magnesium-metal-producing States and to eighth from ninth in gold, it decreased to second of two olivine-producing States and was a significant producer of crushed stone. In 2000, Washington continued to lead the Nation in the production of primary aluminum with an estimated 1.05 million metric tons (Mt). The State accounted for nearly 30% of the U.S. total primary aluminum production. Raw steel was also produced in Washington. Primary aluminum and raw steel were processed from materials received from other domestic and foreign sources.

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<sup>1</sup>The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending upon the minerals or mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 2000 USGS mineral production data published in this chapter are preliminary estimates as of July 2001 and are expected to change. For some mineral commodities, such as construction sand and gravel, crushed stone, and portland cement, estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. A telephone listing of the specialists may be retrieved over the Internet at URL <http://minerals.usgs.gov/minerals/contacts/comdir.html>, by using MINES FaxBack at (703) 648-4999 from a fax machine with a touch-tone handset (request Document #1000 for a telephone listing of all mineral commodity specialists), or by calling USGS information at (703) 648-4000 for the specialist's name and number. All Mineral Industry Surveys—mineral commodity, State, and country—also may be retrieved over the Internet at URL <http://minerals.usgs.gov/minerals>; facsimile copies may be obtained from MINES FaxBack.

<sup>2</sup>Values, percentage calculations, and rankings for 1999 may vary from the Minerals Yearbook, Area Reports: Domestic 1999, Volume II, owing to the revision of preliminary 1999 to final 1999 data. Data for 2000 are preliminary and are expected to change; related rankings may also change.

The Washington State Division of Geology and Earth Resources<sup>3</sup> (DGER) provided the following narrative information. Production data in the text that follows are those reported by the DGER and are based on the agency's own surveys and estimates. They may differ from some production figures reported to the USGS.

Major metal mining activities included gold mining at the Lamefoot and K-2 gold deposits, development work to reopen the Pend Oreille lead-zinc mine, continuation of the appeals process concerning water rights at the Crown Jewel gold deposit, and magnesium metal production from dolomite mined at the Addy quarry. Major exploration projects for metallic minerals in Washington in 2000 included exploration for additional reserves in and adjacent to the Lamefoot and K-2 gold deposits and at the Pend Oreille Mine.

The Kettle River Project of Echo Bay Minerals Co. continued gold production at two mines near Republic in Ferry County. The Lamefoot deposit, an exhalative/replacement-type deposit in Triassic rocks, produced approximately 1,870 kilograms (kg) of gold from 300,000 metric tons (t) of ore. Reserves at the Lamefoot deposit are depleted with the exception of a small amount, which the company planned to recover in the summer of 2001. The mine was closed in December 2000. The K-2 deposit, an epithermal vein-type deposit in Eocene volcanic rocks of the Republic graben, produced approximately 1,050 kg of gold from 233,000 t of ore. Echo Bay also milled 3,479 t of stockpiled, low-grade ore from the Overlook deposit and recovered approximately 6 kg of gold from that ore. Total production from the Kettle River Project was 2,926 kg of gold from 485,000 t of ore; recovery was 84%.

Echo Bay continued to explore for mineralization to maintain its reserves in the Republic area. It obtained a 75% interest in the Golden Eagle Project in the Republic Mining District just north of the Knob Hill shaft. The company also identified approximately 450,000 t of additional gold resources in the East vein, which is just east of the K-2 vein. Echo Bay was developing this resource at yearend from the K-2 adit. Because access to the East vein and the K-2 vein is limited to the K-2 portal, the company expected production for its Kettle River project to decrease to 1,870 kg gold in 2001.

Cominco American, Inc. conducted approximately 20,000 meters of core drilling in search of lead and zinc, both underground and on the surface, at its Pend Oreille Mine in northern Pend Oreille County. The company had not announced any additional reserves; however, an announcement of increased reserves was expected in its annual report. Cominco had announced an ore reserve of 5.9 Mt containing 7.2% zinc and 1.3% lead. The deposit is a Mississippi Valley Type zinc-lead deposit. Most of the earlier mining was on the Josephine

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<sup>3</sup>Robert E. Derkey, Geologist, authored the text of mineral industry information submitted by the Washington State Division of Geology and Earth Resources.

Horizon; however, this additional reserve is on a deeper ore zone referred to as the Yellowhead Horizon. A third horizon, referred to as the Yellowhead 2, was identified below the Yellowhead 1 Horizon. The company applied for permits to mine the deposit and planned to begin mining in 2003. It was rehabilitating the old mill on the property and was planning to ship concentrates to its smelter in Trail, British Columbia, which is about 60 kilometers from the mine.

The Crown Jewel gold deposit near Chesaw in Okanogan County is a skarn-type gold deposit in a sequence of Pennsylvanian to possibly Triassic clastic and carbonate sedimentary rocks. Previously announced reserves for the deposit are 7.9 Mt of ore at a grade of 6.38 grams per metric ton of gold. Since the environmental impact statement was released in 1997, the operator, Battle Mountain Gold Co., has been working to obtain permits to mine the deposit.

Northwest Alloys Inc. mined 575,000 t of dolomite near Addy in Stevens County for magnesium metal production and for road aggregate in 2000. It also studied ways to recycle its waste materials.

In the industrial minerals industry, two companies mined dolomite (calcium magnesium carbonate) and limestone (calcium carbonate) for use as a feed lime and soil conditioner, respectively. Pacific Calcium Inc. produced from the Tonasket and Brown quarries in Okanogan County, and Allied Minerals, Inc. produced from the Gehrke quarry in Stevens County. Northwest Alloys sold approximately 136,000 t of dolomite waste rock, which was used for road aggregate, from its magnesium metal operation at Addy in Stevens County. It also sold some of the byproducts from smelting for fertilizer and soil conditioner. Columbia River Carbonates continued to produce calcium carbonate from the Wauconda quarry and shipped it to its processing plant in Longview, Cowlitz County; most of the calcium carbonate was used as a coating agent to produce glossy paper. Northport Limestone Co. mined limestone from the Sherve quarry in Stevens County and shipped most of it to Trail, British Columbia, for use as a fluxing agent in smelting. Northwest Marble Products Inc. and the Whitestone Co., both in Stevens County, continued to produce terrazzo tile and building aggregates.

According to the DGER's surveys and estimates, Olivine Corp. mined 36,000 t of refractory-grade olivine from its Swen Larsen quarry in Whatcom County in 2000. Most of that production was shipped to Unimin Corp., a Belgian company that produces foundry sands and other refractory products at Hamilton in Skagit County.

Silica stockpiles at the Ash Grove Cement Co.'s Superior quarry in King County supplied 61,300 t of ore that was used for portland cement production in Seattle. Lafarge Corp., which formerly mined clay from the Twin River quarry in Clallam County, reported that the company was obtaining an alternate source for clay from Canada. Pacific Coast Coal Co. mined 900 t of clay interbeds from the John Henry No. 1 coal mine but shipped only 45 t to Ash Grove Cement Co.

Mutual Materials Co. mined about 124,000 t of clay for the manufacture of bricks and related products at its plants in Seattle and Spokane. The company produced from the Mica pit in Spokane County and used stockpiled material from the Usk pit in Pend Oreille County. For its Seattle plant, the company obtained clay from the Elk pit in King County and Section 31 pits and shipped stockpiled clay from the Clay City pit in Pierce County.

Celite Corp. mined and processed approximately 90,000 t of diatomite from its open pit quarries in Grant County. The company shipped approximately 59,000 t of finished diatomite, most of which was used as filter media.

Lane Mountain Silica Co. mined 198,000 t of Addy Quartzite from the Lane Mountain quarry in Stevens County. Following processing, the company shipped 155,000 t of high-purity quartz, most of which was used to manufacture glass bottles and jars. Lane Mountain also shipped 46,600 t of clay/silica byproduct, recovered during processing, to make cement at a plant in Richmond, British Columbia.

Reserve Silica Corp. mined 119,800 t of quartz-rich Puget Group sands from the Ravensdale pit in King County. Most of Reserve's production was used for the manufacture of bottle glass; some was used for sand traps at golf courses. The James Hardy Building Products Co. mined 91,000 t of silica in 2000, as in 1999, from its Scatter Creek Mine in King County, which it used to manufacture fiber cement for Hardy Board products.

TABLE 1  
NONFUEL RAW MINERAL PRODUCTION IN WASHINGTON 1/ 2/

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1998		1999		2000 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Cement, portland	1,200	95,500 e/	W	W	W	W
Clays, common	178	W	110	W	110	W
Gemstones	NA	24	NA	34	NA	34
Gold 3/ kilograms	3,540	33,600	3,250	29,200	W	W
Sand and gravel, construction	45,700	214,000	43,800	227,000	47,900	250,000
Silver 3/ metric tons	1	102	W	W	W	W
Stone, crushed	19,400	111,000	19,500	146,000	19,000	146,000
Combined values of cement [masonry (1998)], diatomite, gypsum (1999-2000), lime, magnesium metal, olivine, peat, sand and gravel (industrial), stone (dimension miscellaneous), and values indicated by symbol W	XX	156,000	XX	260,000	XX	295,000
Total	XX	609,000	XX	662,000	XX	691,000

e/ Estimated. p/ Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined values" data. XX Not applicable.

1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

2/ Data are rounded to no more than three significant digits; may not add to totals shown.

3/ Recoverable content of ores, etc.

TABLE 2  
WASHINGTON: CRUSHED STONE SOLD OR USED, BY KIND 1/

Kind	1998				1999			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone	14	1,520	\$8,820	\$5.80	9	2,090	\$47,700	\$22.82
Dolomite	3	569	2,580	4.53	7	503	2,350	4.68
Limestone-dolomite	2	W	W	W	2	W	W	W
Granite	7	2,210	13,300	6.03	7	2,260	13,500	5.98
Sandstone	5	521	6,540	12.55	5	297	4,340	14.62
Slate	3	W	W	W	5	W	W	W
Traprock	99	10,900	57,800	5.28	100	11,300	65,500	5.79
Volcanic cinder and scoria	2	200	1,120	5.61	2	W	W	W
Miscellaneous stone	10	3,360	20,800	6.18	9	2,780	11,900	4.28
Total or average	XX	19,400	111,000	5.74	XX	19,500	146,000	7.52

W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.

1/ Data are rounded to no more than three significant digits, except unit value; may not add to totals shown.

TABLE 3  
WASHINGTON: CRUSHED STONE SOLD OR USED BY PRODUCERS  
IN 1999, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
<b>Construction:</b>			
<b>Coarse aggregate (+1 1/2 inch):</b>			
Macadam	W	W	W
Riprap and jetty stone	575	\$3,460	\$6.02
Filter stone	87	592	6.80
Other coarse aggregate	539	2,570	4.77
<b>Coarse aggregate, graded:</b>			
Concrete aggregate, coarse	448	3,270	7.29
Bituminous aggregate, coarse	503	2,390	4.75
Bituminous surface-treatment aggregate	237	886	3.74
Railroad ballast	924	3,760	4.07
Other graded coarse aggregate	2	19	9.50
<b>Fine aggregate (-3/8 inch):</b>			
Stone sand, concrete	W	W	W
Stone sand, bituminous mix or seal	W	W	W
Screening, undesignated	22	152	6.91
Other fine aggregate	201	1,120	5.58
<b>Coarse and fine aggregates:</b>			
Graded road base or subbase	3,220	12,900	4.00
Unpaved road surfacing	897	4,970	5.54
Terrazzo and exposed aggregate	238	1,140	4.79
Crusher run or fill or waste	69	376	5.45
Other coarse and fine aggregates	381	1,840	4.84
Other construction materials	258	1,780	6.90
<b>Agricultural:</b>			
Agricultural limestone	W	W	W
Other agricultural uses	17	81	4.76
<b>Chemical and metallurgical:</b>			
Lime manufacture	W	W	W
Flux stone	W	W	W
Glass manufacture	W	W	W
Other chemical and metallurgical	413	4,600	11.15
<b>Special:</b>			
Asphalt fillers or extenders	(3/)	(3/)	(3/)
Other fillers or extenders	(3/)	(3/)	(3/)
Other miscellaneous uses and specified uses not listed	(3/)	(3/)	(3/)
<b>Unspecified: 4/</b>			
Reported	4,670	37,400	8.01
Estimated	5,400	28,000	5.09
Total or average	19,500	146,000	7.52

W Withheld to avoid disclosing company proprietary data; included with "Other."

1/ Data are rounded to no more than three significant digits, except unit value; may not add to totals shown.

2/ Includes dolomite, granite, limestone, limestone-dolomite, miscellaneous stone, sandstone, slate, traprock, and volcanic cinder and scoria.

3/ Withheld to avoid disclosing company proprietary data; included in "Total."

4/ Reported and estimated production without a breakdown by end use.

TABLE 4  
WASHINGTON: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1999, BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3		Unspecified districts	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Construction:								
Coarse aggregate (+1 1/2 inch) 2/	1,160	6,350	--	--	W	W	W	W
Coarse aggregate, graded 3/	556	3,000	W	W	1,250	6,060	W	W
Fine aggregate (-3/8 inch) 4/	W	W	--	--	W	W	--	--
Coarse and fine aggregate 5/	3,940	17,800	W	W	342	1,340	W	W
Other construction materials	W	W	--	--	W	W	--	--
Agricultural 6/	W	W	W	W	W	W	--	--
Chemical and metallurgical 7/	W	W	--	--	W	W	--	--
Special 8/	W	W	W	W	W	W	--	--
Other miscellaneous uses	W	W	--	--	--	--	--	--
Unspecified: 9/								
Reported	W	W	W	W	1,440	11,200	403	3,220
Estimated	4,500	23,000	180	940	760	3,300	--	--
Total	11,800	78,000	2,600	36,400	4,130	26,700	962	5,270

W Withheld to avoid disclosing company proprietary data; included in "Total." -- Zero.

1/ Data are rounded to no more than three significant digits; may not add to totals shown.

2/ Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregate.

3/ Includes bituminous aggregate (coarse), bituminous surface-treatment aggregate, concrete aggregate (coarse), railroad ballast, and other graded coarse aggregate.

4/ Includes screening (undesignated), stone sand (bituminous mix or seal), stone sand (concrete), and other fine aggregate.

5/ Includes crusher run (select material or fill), graded road base or subbase, terrazzo and exposed aggregate, unpaved road surfacing, and other coarse and fine aggregates.

6/ Includes agricultural limestone and other agricultural uses.

7/ Includes flux stone, glass manufacture, and lime manufacture.

8/ Includes asphalt fillers or extenders and other fillers or extenders.

9/ Reported and estimated production without a breakdown by end use.

TABLE 5  
WASHINGTON: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1999,  
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Concrete aggregate (including concrete sand)	11,200	\$71,100	\$6.33
Plaster and gunit sands	63	489	7.76
Concrete products (blocks, bricks, pipe, decorative, etc.)	401	2,650	6.62
Asphaltic concrete aggregates and other bituminous mixtures	2,750	20,000	7.28
Road base and coverings 2/	8,430	43,500	5.16
Fill	6,220	22,600	3.63
Snow and ice control	118	483	4.09
Railroad ballast	138	753	5.46
Other miscellaneous uses	87	538	6.18
Unspecified: 3/			
Reported	3,570	13,700	3.85
Estimated	11,000	51,000	4.64
Total or average	43,800	227,000	5.18

1/ Data are rounded to no more than three significant digits; may not add to totals shown.

2/ Includes road and other stabilization (cement).

3/ Reported and estimated production without a breakdown by end use.

TABLE 6  
WASHINGTON: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1999,  
BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3		Unspecified districts	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 2/	9,940	65,100	1,300	6,800	455	2,360	--	--
Asphaltic concrete aggregates and road base materials 3/	8,510	53,200	845	4,740	1,820	5,580	--	--
Fill	6,010	22,100	139	270	79	219	--	--
Other miscellaneous uses 4/	253	1,350	23	132	67	293	--	--
Unspecified: 5/								
Reported	811	4,030	--	--	2,630	9,320	127	396
Estimated	8,900	44,000	1,800	6,600	100	500	--	--
Total	34,400	190,000	4,080	18,600	5,160	18,300	127	396

-- Zero.

1/ Data are rounded to no more than three significant digits; may not add to totals shown.

2/ Includes gunite sands and plaster.

3/ Includes road and other stabilization (cement).

4/ Includes railroad ballast and ice and snow control.

5/ Reported and estimated production without a breakdown by end use.