

# 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 1999 the preliminary estimated value<sup>1</sup> of nonfuel mineral production for Washington was \$631 million, according to the U.S. Geological Survey (USGS). This was about a 4% increase from that of 1998,<sup>2</sup> and followed a 9.7% increase from 1997 to 1998. The State remained 23d in the Nation in total nonfuel mineral production, of which Washington accounted for about 2% of the U.S. total.

The following three mineral commodities, in descending order of value, accounted for about 68% of the State's nonfuel mineral value: construction sand and gravel, crushed stone, and portland cement. In 1999, the rise in value resulted mainly from a \$30 million increase in the value of crushed stone and a substantial increase in the value of magnesium metal. Smaller yet significant increases also occurred in portland cement and lime. These gains were offset, in part, by decreases of about \$21 million and about \$5 million in construction sand and gravel and gold, respectively, plus a smaller yet significant decrease in the value of diatomite (table 1). In 1998, most nonfuel minerals increased in value, led by construction sand and gravel, up \$34 million, and crushed stone, up about \$19 million. Smaller yet significant increases also occurred in magnesium metal, portland cement, olivine, lime, common clays, and diatomite (table 1). Only gold, down \$9.6 million, showed any significant decrease for the year. All other changes in 1998 and 1999 were small and inconsequential to the net result.

Based upon USGS estimates of the quantities produced in the 50 States in 1999, Washington remained first of 2 olivine-producing States; fourth of 4 diatomite-producing States; and ninth in gold. The State was second of two magnesium-metal-producing States, dropped from seventh to eighth in the production of construction sand and gravel, and was a significant producer of crushed stone. In 1999, Washington

<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 1999 USGS mineral production data published in this chapter are preliminary estimates as of May 2000, 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 for 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 1998 may vary from the Minerals Yearbook, Area Reports: Domestic 1998, Volume II, owing to the revision of preliminary 1998 to final 1998 data. Data for 1999 are preliminary and are expected to change; related rankings may also be subject to change.

continued to lead the Nation in the production of primary aluminum with an estimated 1.15 million metric tons (Mt). The State accounted for more than 30% of the U.S. total primary aluminum production. Raw steel was also produced in the State. Primary aluminum and raw steel were processed from materials received from other foreign and domestic sources.

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.

Significant highlights for 1999 included Washington's major metal mining operations at Echo Bay Minerals Co.'s K-2 and Lamefoot gold deposits and preparation of a draft environmental impact statement (EIS) to reestablish mining for zinc and lead at the Pend Oreille Mine. The only known major mineral exploration projects for metallic minerals in Washington in 1999 were for additional reserves in and adjacent to the K-2 and Lamefoot gold deposits and at the Pend Oreille Mine.

Echo Bay's Kettle River Project near Republic, Ferry County, mined and produced gold that contained a small amount of silver from the K-2 and the Lamefoot gold deposits. The majority of the silver came from the K-2 deposit. In 1999, the Lamefoot deposit produced 2,290 kilograms (kg) of gold from 346,185 metric tons (t) of ore. Reserves at the Lamefoot deposit will be depleted in January 2001. The K-2 deposit, which will become the major gold mine for the Kettle River Project, produced 1,748 kg of gold from 233,381 t of ore in 1999. Exploration for reserves to replace those being mined in 1999 was concentrated in and around the K-2 deposit. Combined production from the two deposits, which was processed at the Echo Bay mill near the Overlook deposit, was 4,040 kg of gold from 579,565 t of ore. The Lamefoot deposit is an exhalative/replacement-type deposit in Permian rocks, and the K-2 deposit is an epithermal vein-type deposit in Eocene volcanic rocks. Both deposits are in the same geologic formation (Derkey and Hamilton, 2000).

Cominco American Inc. announced an ore reserve of 5.5 Mt at the Pend Oreille Mine, a Mississippi-Valley type zinc-lead deposit in northern Pend Oreille County (accessed 2/7/2001 at URL <http://www.cominco.com/explore/Orereser.htm>). The company will ship zinc and lead concentrates to its smelter in Trail, British Columbia. Startup was anticipated to be in 2002, possibly sometime after closure of the parent company's Sullivan Mine in nearby British Columbia.

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

<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.

sedimentary rocks. Previously announced reserves for the deposit were 7.9 Mt of ore at a grade of 6.38 grams per metric ton of gold. These rocks contain more than 50 t of gold. Battle Mountain Gold Co., which was the operator, prepared an EIS that was released in February 1997. The company has been working to obtain permits to mine the deposit ever since.

Northwest Alloys Inc. mined dolomite near Addy, Stevens County, for magnesium metal production and road aggregate in 1999. A total of 500,000 t was sent to the smelter, and approximately 140,000 t of waste rock was used for road aggregate. Northwest Alloys also used some of the byproducts from smelting for fertilizer and soil conditioners.

In the industrial minerals industry, limestone (calcium carbonate) and dolomite (calcium magnesium carbonate) were used in soil conditioners and in animal feeds. 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. Columbia River Carbonates continued to produce calcium carbonate from the Wauconda quarry. The company was looking for an alternate source of high-brightness limestone closer to its processing plant in Longview, Cowlitz County. Northport Limestone Co. mined carbonate 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 continued to produce color- and site-specific carbonate products for terrazzo tile and related uses.

Olivine Corp. mined 43,500 t of refractory-grade olivine from its Swen Larsen Quarry in Whatcom County in 1999. Of that total, Olivine Corp. shipped 43,000 t to Unimin Corp., a Belgian company that produced casting sands and other refractory products at Hamilton, in Skagit County (Derkey and Hamilton, 2000).

Much of the clay produced in western Washington was mined by or for Ash Grove Cement Co. and LaFarge Corp. for use in cement. Ash Grove Cement Co. mined 5,500 t of clay from its Castle Rock quarry, LaFarge Corp. mined 28,880 t of clay from the Twin River quarry, and Pacific Coast Coal Co. mined a clay

interbed from the John Henry #1 coal mine and shipped almost 6,400 t to Ash Grove Cement Co.

Mutual Materials Co. continued to mine clay for the manufacture of bricks and related products. It mined at the Mica pit in Spokane County, at the Usk pit in Pend Oreille County, and at the Elk and Section 31 pits in King County. Mutual Materials also shipped stockpiled clay from the Clay City pit in Pierce County.

Celite Corp. mined and processed 84,404 t from diatomite pits in Grant County. The company shipped 55,662 t of finished diatomite.

Lane Mountain Silica Co. mined 250,373 t of Addy Quartzite from the Lane Mountain quarry in Stevens County. Following processing, the company shipped 197,484 t of high-purity quartz, most of which was used to manufacture clear glass bottles and jars. Approximately 20% of the ore was removed during processing. This waste material, which had accumulated over a number of years, was being shipped to Richmond, British Columbia, and was used to manufacture cement. Lane Mountain agglomerated the fine-grained siliceous waste material into small lumps by mixing a small amount of cement with it prior to shipping to avoid massive solidification during rail transport.

Reserve Silica Corp. mined 63,000 t of quartz-rich Puget Group sands from the Ravensdale pit in King County. Most of Reserve Silica's production was used for the manufacture of colored bottle glass. Ash Grove Cement Co. mined nearly 118,000 t of silica from its Superior quarry in King County. The company used the silica for making cement. The James Hardy Building Products Co. mined 91,000 t of silica from its Scatter Creek Mine in King County, which it used to manufacture Hardy Board products (Derkey and Hamilton, 2000).

## Reference Cited

Derkey, R.E. and Hamilton, M.M., 2000, Annual review 1999: Mining Engineering, v. 52, no. 5, May, p. 101-102.

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

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1997		1998		1999 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Cement: Portland	1,210	92,400 e/	1,200	95,500 e/	1,230	98,000 e/
Clays: Common	165	715	178	W	180	W
Gemstones	NA	23	NA	24	NA	30
Gold 3/ kilograms	4,040	43,200	3,540	33,600	3,190	28,700
Gypsum, crude	12	549	--	--	--	--
Sand and gravel: Construction	40,500	180,000	45,700	214,000	40,500	193,000
Silver 3/ metric tons	2	285	1	102	W	W
Stone: Crushed	14,700	92,200	19,400	111,000	24,000	141,000
Combined values of cement (masonry), diatomite, lime, magnesium metal, olivine, peat, sand and gravel (industrial), stone (dimension miscellaneous), and values indicated by symbol W	XX	146,000	XX	156,000	XX	170,000
Total	XX	555,000	XX	609,000	XX	631,000

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

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	1997				1998			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone	7 r/	1,460 r/	\$19,200 r/	\$13.15 r/	14	997	\$6,080	\$6.11
Dolomite	3	463	2,010	4.35	3	569	2,580	4.53
Limestone-dolomite	2	W	W	32.10	2	W	W	6.29
Granite	3	417	2,330	5.60	3	399	2,350	5.90
Marble	--	--	--	--	1	W	W	5.52
Sandstone	4	604	5,660	9.37	6	788	8,220	10.44
Shell	1	W	W	6.25	3	W	W	2.74
Traprock	87	11,000 r/	57,900 r/	5.28 r/	101	15,000	83,000	5.54
Volcanic cinder and scoria	2	W	W	6.95	2	200	1,120	5.61
Miscellaneous stone	8	571	2,810	4.93	9	820	4,460	5.44
Total or average	XX	14,700	92,200	6.25	XX	19,400	111,000	5.74

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable. -- Zero.

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 1998, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
<b>Coarse aggregate (+1 1/2 inch):</b>			
Macadam	W	W	\$5.89
Riprap and jetty stone	1,050	\$6,690	6.35
Filter stone	75	310	4.13
Other coarse aggregate	568	4,320	7.60
<b>Coarse aggregate, graded:</b>			
Concrete aggregate, coarse	W	W	7.39
Bituminous aggregate, coarse	72	299	4.15
Bituminous surface-treatment aggregate	30	138	4.60
Railroad ballast	733	3,000	4.09
Other graded coarse aggregate	1,120	7,910	7.07
<b>Fine aggregate (-3/8 inch):</b>			
Stone sand, concrete	2	8	4.18
Stone sand, bituminous mix or seal	W	W	2.99
Screening, undesignated	73	287	3.94
Other fine aggregate	82	619	7.55
<b>Coarse and fine aggregates:</b>			
Graded road base or subbase	3,530	20,500	5.81
Unpaved road surfacing	1,570	7,030	4.47
Terrazzo and exposed aggregate	219	1,310	5.98
Crusher run or fill or waste	983	3,960	4.03
Other construction materials	51	602	11.80
<b>Agricultural:</b>			
Agricultural limestone	W	W	4.07
Other agricultural uses	32	113	3.53
<b>Chemical and metallurgical:</b>			
Cement manufacture	119	196	1.65
Lime manufacture	W	W	5.52
Flux stone	W	W	14.08
Glass manufacture	W	W	20.48
Other chemical and metallurgical	399	5,250	13.16
<b>Special:</b>			
Mine dusting or acid water treatment	(3/)	2	W
Asphalt fillers or extenders	(3/)	1	W
Whiting or whiting substitute	(3/)	1	W
Other fillers or extenders	W	W	13.88
Roofing granules	W	W	3.68
Other special uses	115	1,590	13.79
Other miscellaneous uses: Other specified uses not listed	14	62	4.43
<b>Unspecified: 4/</b>			
Actual	4,240	25,300	5.96
Estimated	4,290	21,700	5.06
Total or average	19,400	111,000	5.79

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

1/ Data are rounded to three significant digits, except unit value; may not add to totals shown.

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

3/ Less than 1/2 unit.

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

TABLE 4  
WASHINGTON: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 1998, 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 aggregates:								
Coarse aggregate (+1 1/2 inch) 2/	1,500	10,400	--	--	131	587	65	284
Coarse aggregate, graded 3/	1,260	8,740	10	41	636	2,400	45	175
Fine aggregate (-3/8 inch) 4/	80	614	69	269	7	31	--	--
Coarse and fine aggregate 5/	4,670	26,600	160	962	201	1,010	1,270	4,200
Other construction materials	W	W	--	--	W	W	--	--
Agricultural 6/	--	--	W	W	W	W	--	--
Chemical and metallurgical 7/	W	W	--	--	W	W	--	--
Special 8/	--	--	W	W	W	W	--	--
Other miscellaneous uses	W	W	1	6	W	W	--	--
Unspecified: 9/								
Actual	1,260	7,380	930	5,640	1,710	10,400	339	1,870
Estimated	3,560	18,300	172	902	560	2,470	--	--
Total	12,700	73,400	1,480	9,470	3,520	21,700	1,720	6,530

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

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

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

6/ Includes agricultural limestone and other agricultural uses.

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

8/ Includes asphalt fillers or extenders, mine dusting or acid water treatment, whitening or whitening substitute, other fillers or extenders, and roofing granules.

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

TABLE 5  
WASHINGTON: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1998,  
BY MAJOR USE CATEGORY 1/

Use	Quantity	Value (thousands)	Unit value
	(thousand metric tons)		
Concrete aggregate	10,100	\$63,400	\$6.31
Plaster and gunite sands	69	482	6.99
Concrete products (blocks, bricks, pipe, decorative, etc.)	175	1,170	6.66
Asphaltic concrete aggregates and other bituminous mixtures	2,770	13,100	4.71
Road base and coverings	7,160	34,500	4.82
Fill	5,260	18,500	3.53
Snow and ice control	216	768	3.56
Railroad ballast	198	1,110	5.61
Other miscellaneous uses 2/	246	736	2.99
Unspecified: 3/			
Actual	6,310	20,600	3.25
Estimated	13,200	59,200	4.48
Total or average	45,700	214,000	4.68

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

2/ Includes filtration.

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

TABLE 6  
 WASHINGTON: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 1998,  
 BY USE AND DISTRICT 1/

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3		Unspecified districts 2/	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products 3/	9,570	61,800	657	2,830	71	408	--	--
Asphaltic concrete aggregates and other bituminous mixtures	2,330	11,300	380	1,570	66	192	--	--
Road base and coverings	5,700	29,400	533	2,250	929	2,830	--	--
Fill	4,990	17,700	235	760	33	86	--	--
Snow and ice control	126	463	24	133	66	172	--	--
Other miscellaneous uses 4/	285	1,280	149	512	9	61	--	--
Unspecified: 5/								
Actual	1,390	6,290	880	3,100	3,580	10,400	475	785
Estimated	9,960	46,700	2,680	10,20	578	2,390	--	--
Total	34,300	175,000	5,540	21,30	5,330	16,500	475	785

-- Zero.

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

2/ Includes production within the State with no district reported.

3/ Includes plaster and gunite sands.

4/ Includes filtration and railroad ballast.

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