

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 2001, the estimated value¹ of nonfuel mineral production for Washington was \$545 million, based upon preliminary U.S. Geological Survey (USGS) data. This was about a 10% decrease from that of 2000² and followed an 8.3% decrease from 1999 to 2000. The State ranked 25th (24th in 2000) among the 50 States in total nonfuel raw mineral production value, of which Washington accounted for more than 1% of the U.S. total.

In 2001, based on value, Washington's four leading nonfuel mineral commodities were construction sand and gravel, crushed stone, portland cement, and magnesium metal (in descending order of value), accounting for nearly 90% of the State's total nonfuel mineral value. These were followed by gold and diatomite (together a combined total of 6% of the State's value), lime, and industrial sand and gravel. In 2000, the decrease in value was mostly the result of a \$24 million drop in the value of crushed stone; decreases of \$13 million and \$11 million, respectively, in the values of lime and magnesium metal; and a \$6 million decrease in construction sand and gravel (table 1). Decreases of less than \$3 million each in gold and portland cement also were a portion of Washington's lowered total value for the year. The most significant increases were the nearly \$3 million increase in the value of gypsum and one-half that much in industrial sand and gravel. All other changes in both years were small and inconsequential to the net result.

Based upon USGS estimates of the quantities produced in the 50 States in 2001, Washington remained first of 2 magnesium-metal-producing States, second of 2 States that produce olivine, fourth in diatomite, seventh in construction sand and gravel, and eighth in gold. Additionally, the State was a significant producer of crushed stone. In 2000, Washington dropped to 11th from 1st in the Nation in the production of primary aluminum, the significant decrease resulting from the closing of most of the State's primary aluminum plants owing to highly escalated

¹The 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 2001 USGS mineral production data published in this chapter are preliminary estimates as of August 2002 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. Specialist contact information may be retrieved over the Internet at URL <http://minerals.usgs.gov/minerals/contacts/comdir.html>; alternatively, specialists' names and telephone numbers may be obtained by calling USGS information at (703) 648-4000 or by calling the USGS Earth Science Information Center at 1-888-ASK-USGS (275-8747). All Mineral Industry Surveys—mineral commodity, State, and country—also may be retrieved over the Internet at URL <http://minerals.usgs.gov/minerals>.

²Values, percentage calculations, and rankings for 2000 may differ from the Minerals Yearbook, Area Reports: Domestic 2000, Volume II, owing to the revision of preliminary 2000 to final 2000 data. Data for 2001 are preliminary and are expected to change; related rankings may also change.

energy costs. In 2000, Washington 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.

The Washington State Division of Geology and Earth Resources³ (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 operations in Washington in 2001 included gold mining at Republic and magnesium metal production at Addy. There was a dramatic decrease in metal mining by 2002 in part owing to the closing down of magnesium metal operations in October 2001. Battle Mountain Gold Co. became a wholly owned subsidiary of Newmont Mining Corp. and elected to drop its option for the Crown Jewel gold deposit.

Echo Bay Minerals Co. continued mining at the Kettle River Project, an epithermal vein-type deposit in Eocene volcanic rocks of the Republic graben north of Republic in Ferry County. The company mined 201,000 metric tons (t) of ore (1.4 t of contained gold) from the K-2 deposit. The company milled 241,000 t (1.5 t of contained gold) of K-2 ore (including stockpiled ore) and 68,000 t (0.4 t of contained gold) of stockpiled ore from the Lamefoot Mine. Mining had been completed in 2000 at the Lamefoot Mine; however, a small tonnage was removed during rehabilitation operations in 2001. Total gold recovered from K-2 and Lamefoot ores was 1.6 t from 308,000 t of ore; recovery was approximately 85%. Because haulage distances are greater and mining costs are higher, the company expected K-2 production to decrease to 1.1 t of gold in 2002. Echo Bay continued to explore for mineralization to maintain its reserves in the Republic area. Its focus was northeast of the K-2 Mine where the company completed approximately 4,600 meters of drilling from the surface, northeast of the mine. Drilling had not progressed sufficiently at the end of 2001 to allow the company to classify this resource as proven and probable reserves. It planned to continue drilling next year in order to prove this reserve. Echo Bay continued to explore for additional gold reserves in and adjacent to its K-2 gold deposit.

Teck Corp. completed the acquisition of Cominco American, Inc. during 2001. The company is now known as Teck Cominco American Inc. Work to reopen the Pend Oreille lead-zinc mine continued. Because of depressed zinc prices, Teck Cominco elected to delay startup of its mine until 2004. In 2001, the

³Robert E. Derkey, Geologist, authored the text of mineral industry formation submitted by the Washington State Division of Geology and Earth Resources.

company was preparing the tailings disposal site in preparation for resuming mining at the Pend Oreille Mine. It planned to rehabilitate/modernize the old mill on the property and to ship concentrates to its smelter in Trail, British Columbia, Canada, which is only about 64 kilometers from the mine. Teck Cominco has been working with local citizens to reduce the impact to Pend Oreille County, from the startup as well as for when the mine closes after reserves are depleted. Teck Cominco reported on its Web site reserves for Pend Oreille Mine of 5 million metric tons (Mt) containing 7.3% zinc and 1.3% lead. The company has projected a 10-year mine life at about 730,000 metric tons per year mined. Most of the approximately 13 Mt of previous production, grading 2.3% zinc and 1.1% lead, came from the Josephine horizon. The new reserve at the mine was from a deeper zone called the Yellowhead 1 zone. Teck Cominco has also identified a third ore horizon, which it refers to as the Yellowhead 2 zone.

Following its merger with Newmont Mining Corp., Battle Mountain Gold Co. dropped its option on the Crown Jewel gold deposit near Chesaw in Okanogan County. Crown Resources Corp. is now the sole owner of the deposit. It is a skarn-type gold deposit in a sequence of Pennsylvanian to Triassic age clastic and carbonate sedimentary rocks adjacent to the Buckhorn Mountain pluton. Previously announced reserves for the deposit were 8.2 Mt at a grade of 6.4 grams per metric ton (g/t) gold. Crown Resources Corp. proposed mining the deposit primarily as an underground operation and has recalculated the reserves, accordingly; it reported proven and probable reserves were 2.32 Mt grading 11.8 g/t gold (28 t of contained gold) and projected an additional 450,000 t of ore grading at about 13 g/t gold, or about 15 t of contained gold (Derkey and Hamilton, 2002).

Northwest Alloys Inc. ceased magnesium metal production in October at its plant near Addy in Stevens County. The company was no longer able to compete with lower priced foreign sources for magnesium metal. It, however, mined 608,000 t of dolomite in 2001 compared with 575,000 t in 2000 for magnesium metal production. In addition to using some of its reject material from the mine for road aggregate, the company processed some of its byproduct for fertilizer. It planned to continue that process until the byproduct material is expended. Research also continued to find ways to use some of its remaining waste materials.

Nonmetallic mineral commodities produced in Washington were used as bricks, casting sand, cement and fiber cement additives, feed lime, filter material, glass, landscape rock, paper filler, smelter flux, and soil conditioners.

Two companies mined limestone and dolomite for use as a soil conditioner and feed lime in 2001. 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 10,400 t of smelter slag from its magnesium metal operation at Addy in Stevens County; the slag was used for fertilizer and soil conditioner. Columbia River Carbonates continued to produce calcium carbonate from the Wauconda quarry and to ship it to its processing plant in Longview, Cowlitz County. Most of it is 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, Canada, 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 as they have for a number of years.

Celite Corp. mined and processed approximately 91,000 t of diatomite from its diatomite mine pits in Grant County. The company shipped approximately 59,000 t of finished diatomite; most is used for filtration purposes.

According to the DGER, Olivine Corp. mined 36,000 t of refractory-grade olivine from its Swen Larsen quarry in Whatcom County in 2001. Most of that production was shipped to Unimin Corp., a Belgian company that produces casting sands and other refractory products at Hamilton in Skagit County. The company also reported that initial investigations to produce ornamental olivine appeared successful; the olivine polished very well.

Mutual Materials Co. used about 93,000 t of clay for the manufacture of bricks and related products at its plants in Seattle and Spokane. The company produced from the Mica and Potratz pits in Spokane County and used clay-rich material from the Usk pit in Pend Oreille County. For its Seattle plant, the company obtained clay from the Elk and Section 31 pits in King County and from stockpiled clay from the Clay City pit in Pierce County.

A Canadian company expressed interest in clays derived from weathering of pre-Miocene igneous and metamorphic rocks and deposited in Miocene lake basins around the northeastern margin of Columbia River Basalt. In Spokane County, these clays are known as the Latah Formation. The Canadian company has been evaluating these clays in Idaho as a potential source of kaolinite. Kaolin clay is used to make glossy paper, fine china, paint, and Kaopectate. Should markets be established, these deposits in Spokane and Stevens Counties could become a viable resource. Pacific Coast Coal Co. did not mine any clay from the John Henry #1 coal mine in 2001.

Ash Grove Cement Co. mined 100,000 t of silica ore at the Superior quarry in King County and 14,000 t of clay ore at the Castle Rock quarry in Cowlitz County; the ore was used for portland cement production in Seattle. Ash Grove was exploring for additional silica reserves at Bridge Camp near Enumclaw.

Lane Mountain Silica Co. mined 243,000 t of Addy quartzite from the Lane Mountain quarry in Stevens County. Following processing, the company shipped 96,000 t of high-purity quartz for making glass bottles and jars; 20,000 t, for making fiberglass; and 31,000 t, for sand blasting and filtering and 62,000 t of clay/silica byproduct recovered during processing to make cement at a plant in Richmond, British Columbia, Canada.

Reserve Silica Corp. mined 109,000 t of quartz-rich Puget Group sands from the Ravensdale pit in King County. Following washing the sand, the company shipped 71,000 t; most is used for the manufacture of bottle glass, and some is used for sand traps at golf courses.

The James Hardy Building Products Co. mined 109,000 t of silica in 2001 from its Scatter Creek Mine in King County, most of which it used for the manufacture of fiber cement for Hardy Board products. It also shipped 18,000 t to the LaFarge Corp. cement plant in Seattle for cement manufacture.

Reference Cited

Derkey, R.E., and Hamilton, M.M., 2002, Washington, in Annual review 2001:
Mining Engineering, v. 54, no. 5, May, p. 88-89.

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

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	1999		2000		2001 p/	
	Quantity	Value	Quantity	Value	Quantity	Value
Cement, masonry	--	--	--	--	W	W
Clays, common	110	W	116	425	116	425
Gemstones	NA	34	NA	37	NA	25
Gold 3/ kilograms	3,250	29,200	2,930	26,400	W	W
Sand and gravel, construction	43,800	227,000	41,800	221,000	41,100	221,000
Silver 3/ metric tons	W	W	2	250	W	W
Stone, crushed	19,300 r/	146,000	18,900	122,000	18,100	120,000
Combined values of cement [masonry (2001), portland], diatomite, gypsum (crude), lime, magnesium metal, olivine, peat, sand and gravel (industrial), stone (dimension miscellaneous), and values indicated by symbol W	XX	260,000	XX	237,000	XX	204,000
Total	XX	662,000 r/	XX	607,000	XX	545,000

p/ Preliminary. r/ Revised. 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	1999				2000			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone 2/	11	2,120 r/	\$47,900 r/	\$22.56 r/	11	2,040	\$29,300	\$14.37
Dolomite	8 r/	531 r/	2,470 r/	4.66 r/	15	687	3,430	4.99
Granite	7	2,120 r/	12,700 r/	6.01 r/	11	2,000	10,900	5.46
Sandstone	5	297	4,340	14.62	3	W	W	13.51
Slate	5	W	W	W	5	W	W	6.56
Traprock	99 r/	13,200 r/	72,100 r/	5.47 r/	107	13,200	71,000	5.38
Volcanic cinder and scoria	2	W	W	W	1	W	W	5.94
Miscellaneous stone	7 r/	864 r/	5,340 r/	6.18 r/	11	544	2,310	4.24
Total or average	XX	19,300 r/	146,000	7.55 r/	XX	18,900	122,000	6.43

r/ Revised. 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.

2/ Includes limestone-dolomite reported with no distinction between the two.

TABLE 3
WASHINGTON: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 2000, BY USE 1/ 2/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Construction:			
Coarse aggregate (+1 1/2 inch):			
Macadam	W	W	\$6.49
Riprap and jetty stone	332	\$2,050	6.17
Filter stone	134	868	6.48
Other coarse aggregate	295	1,640	5.55
Coarse aggregate, graded:			
Concrete aggregate, coarse	W	W	5.47
Bituminous aggregate, coarse	70	456	6.51
Bituminous surface-treatment aggregate	43	171	3.98
Railroad ballast	477	2,030	4.25
Other graded coarse aggregate	90	414	4.60
Fine aggregate (-3/8 inch):			
Stone sand, concrete	W	W	7.50
Stone sand, bituminous mix or seal	172	1,080	6.29
Screening, undesignated	118	559	4.74
Other fine aggregate	71	363	5.11
Coarse and fine aggregates:			
Graded road base or subbase	1,640	8,220	5.01
Unpaved road surfacing	786	3,910	4.97
Crusher run or fill or waste	328	1,240	3.77
Other coarse and fine aggregates	786	3,760	4.78
Other construction materials	197	3,045	15.46
Agricultural limestone	(3/)	(3/)	7.20
Chemical and metallurgical:			
Cement manufacture	(3/)	(3/)	5.95
Lime manufacture	(3/)	(3/)	3.42
Flux stone	(3/)	(3/)	12.58
Special:			
Asphalt fillers or extenders	(4/)	(4/)	(4/)
Other fillers or extenders	(3/)	(3/)	129.53
Unspecified: 5/			
Reported	3,600	26,000	7.23
Estimated	8,600	41,000	4.78
Total or average	18,900	122,000	6.43

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/ Less than 1/2 unit.

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

TABLE 4
WASHINGTON: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 2000, 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/	712	4,260	W	W	W	W	33	233
Coarse aggregate, graded 3/	272	1,420	47	188	362	1,460	--	--
Fine aggregate (-3/8 inch) 4/	W	W	W	W	W	W	--	--
Coarse and fine aggregate 5/	2,760	13,700	445	1,960	336	1,470	--	--
Other construction materials	20	122	--	--	177	2,920	--	--
Agricultural 6/	--	--	W	W	W	W	--	--
Chemical and metallurgical 7/	W	W	--	--	W	W	--	--
Special 8/	--	--	W	W	W	W	--	--
Other miscellaneous uses 9/	--	--	W	W	--	--	--	--
Unspecified: 10/								
Reported	79	514	1,880	14,000	1,410	10,400	230	1,150
Estimated	6,500	32,000	180	990	1,400	6,100	540	2,000
Total	11,500	58,700	2,770	35,900	3,860	23,800	807	3,420

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, unpaved road surfacing, and other coarse and fine aggregates.

6/ Includes agricultural limestone.

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

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

9/ Includes other specified uses not listed.

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

TABLE 5
WASHINGTON: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2000,
BY MAJOR USE CATEGORY 1/

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Concrete aggregate (including concrete sand)	3,470	\$27,400	\$7.89
Plaster and gunite sands	15	112	7.47
Concrete products (blocks, bricks, pipe, decorative, etc.)	89	1,050	11.78
Asphaltic concrete aggregates and other bituminous mixtures	2,630	18,600	7.06
Road base and coverings	6,560	39,100	5.96
Road stabilization (cement)	478	4,950	10.36
Fill	5,340	19,600	3.68
Snow and ice control	128	541	4.23
Railroad ballast	108	674	6.24
Other miscellaneous uses 2/	537	3,810	7.09
Unspecified: 3/			
Reported	11,800	54,300	4.61
Estimated	11,000	51,000	4.79
Total or average	41,800	221,000	5.29

1/ Data are rounded to no more than three significant digits, except unit value; 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 2000,
 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 (including concrete sand) 2/	3,270	26,100	W	W	W	W	--	--
Concrete products (blocks, bricks, pipe, decorative, etc.)	89	1,050	--	--	--	--	--	--
Asphaltic concrete aggregates and other bituminous mixtures	W	W	W	W	434	2,760	--	--
Road base and coverings 3/	5,190	36,900	524	2,380	1,320	4,790	--	--
Fill	5,190	19,000	112	473	31	103	1	1
Snow and ice control	W	W	W	W	98	386	--	--
Other miscellaneous uses 4/	2,600	19,000	415	2,380	79	495	--	--
Unspecified: 5/								
Reported	8,940	42,600	730	4,690	2,110	7,040	--	--
Estimated	7,800	38,000	2,400	11,000	440	2,100	--	--
Total	33,100	183,000	4,170	20,600	4,520	17,700	1	1

W Withheld to avoid disclosing company proprietary data; included with "Other miscellaneous uses." -- Zero.

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

2/ Includes plaster and gunite sands.

3/ Includes road and other stabilization (cement).

4/ Includes filtration and railroad ballast.

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