



# 2005 Minerals Yearbook

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## VIRGINIA

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# THE MINERAL INDUSTRY OF VIRGINIA

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Virginia Department of Mines, Minerals and Energy for collecting information on all nonfuel minerals.

In 2005, Virginia's nonfuel raw mineral production was valued<sup>1</sup> at \$1.16 billion, based upon annual U.S. Geological Survey (USGS) data. This was an increase of \$269 million, or more than 30%, from the State's total of \$891 million in 2004, which was up by 13.4% from that of 2003. Virginia rose to 18th from 19th in rank among the 50 States in total nonfuel raw mineral production value and accounted for more than 2% of the U.S. total.

Crushed stone was, by value, Virginia's leading raw nonfuel mineral, accounting for about 67% of the State's total nonfuel mineral value. From 1990 through 2005, the State produced nearly 981 million metric tons (Mt) of crushed stone, or an average of more than 61 million metric tons per year (Mt/yr) during that 16-year period. With a nearly 12.5-Mt increase in production in 2005 from that of 2004, Virginia's quarries during the past 5 years, on average, have produced nearly 71 Mt/yr of crushed stone. Cement (masonry and portland) was the second leading nonfuel mineral commodity, followed by construction sand and gravel, lime, and zirconium concentrates. These five mineral commodities represented about 93% of the State's total nonfuel mineral value.

In 2005, a \$238 million (44%) rise in the value of crushed stone led the State's increase in nonfuel mineral value for the year. This resulted from a 12.5-Mt (17%) production increase and a 23% rise in the average unit value. Substantial increases also took place in the values of cement (masonry and portland) and construction sand and gravel, which were up by about \$17 million and \$10 million, respectively. As was the case with crushed stone, the unit values of each increased also, construction sand and gravel rising by nearly 21%. Relatively small changes in value took place in zirconium concentrates and fuller's earth, increasing in the former commodity and decreasing in the latter (small decreases in production took place in each commodity). For all the State's other nonfuel mineral commodities, changes in value were significantly smaller and had minimal effect on the net change in total value (table 1).

In 2005, Virginia continued to be the only State to mine and produce kyanite. It also continued to rank 2nd in the production of zirconium in the two zirconium-producing States, and of ilmenite in the two ilmenite-producing States, and of crude vermiculite in the two crude vermiculite-producing States, as well as of feldspar produced. It ranked 4th in the production of iron oxide pigments and 10th in the production of common clays. The State rose in rank to 10th from 11th in the production

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<sup>1</sup>The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending upon the 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 2005 USGS mineral production data published in this chapter are those available as of December 2006. All USGS Mineral Industry Surveys and USGS Minerals Yearbook chapters—mineral commodity, State, and country—can be retrieved over the Internet at URL <http://minerals.usgs.gov/minerals>.

of lime and was 8th (5th in 2004) in crushed stone and 5th (4th in 2004) in fuller's earth (within rankings, commodities are listed in descending order of value). Additionally, the State was a producer of significant quantities of portland cement, construction sand and gravel, masonry cement, and industrial sand and gravel (in descending order of value). Although the only producing kyanite mine and calcined kyanite (mullite) facilities in the United States were in Virginia, synthetic mullite, which, in USGS terminology is a calcined bauxitic kaolin, was produced in one other State. About 90% of the U.S. kyanite and mullite output was used in refractories, mostly for the smelting and processing of a variety of metals (60% to 65% in ironmaking and steelmaking), as well as in the manufacture of chemicals, glass and high-temperature ceramics, and other materials.

The following narrative information was provided by the Virginia Division of Mineral Resources<sup>2</sup> (VDMR) of the Commonwealth of Virginia's Department of Mines, Minerals and Energy (DMME); much of the data are based on DMME's own estimates, surveys, and information gathered from company annual reports. Data or information as reported by the DMME are based on the Department's own estimates and information gathering processes and may differ from USGS estimates and production figures.

## Commodity Review

### *Industrial Minerals*

**Crushed Stone.**—Crushed stone production in 2005 increased by more than 5% from production reported in 2004 to about 76.4 Mt. Vulcan Construction Materials LP remained the leading producer of crushed stone in the State, reporting total production of 24.5 Mt in 2005. Luck Stone Corporation was a close second with 21.9 Mt produced statewide. Vulcan's Manassas Quarry in Prince William County was the leading operation, reporting production of about 4.6 Mt for 2005. As was the case in 2004, Loudoun County led the State in crushed stone production with a total of 9.6 Mt from five active operations.

**Iron Oxide Pigments.**—Production of natural iron oxide pigments continued during 2005 at three locations in Virginia. Hoover Color Corporation produced both crude and finished iron oxide pigments at the Hiwassee Mine and processing facility in Pulaski County and crude iron oxide pigments from an open pit in Wythe County. Total production of crude iron oxide pigments from both mine facilities for 2005 was about 270 metric tons (t). In Goochland County, Minerals and Chemicals Corporation mined ochreous oxides from soil

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<sup>2</sup>William L. Lassetter, Jr., Economic Geology Section Manager with the Virginia Division of Mineral Resources, authored the text of the State mineral industry information provided by that State agency.

developed over amphibolite gneiss bedrock and produced about 340 t of product.

**Kyanite.**—Kyanite Mining Corporation operated surface mines in Buckingham County and during 2005, remained the world's leading producer of kyanite. At the Willis Mountain–East Ridge complex, kyanite is mined from two pits. Ore processing and beneficiation includes comminution by crushing and grinding; froth flotation cells to separate pyrite, sand, and mica; drying and roasting in a reduced atmosphere; followed by magnetic separation to remove iron impurities. This process results in a 35-mesh product that is about 95% pure kyanite and ready for shipment. Refined kyanite is also transported to the company's kiln facility and railhead in Dillwyn, where it is calcined to produce synthetic mullite. During 2005, about 117,000 t of kyanite was produced, and out of that amount, approximately 15,000 t of mullite was produced. Plans are underway to increase the total capacity of calcined kyanite production to about 32,000 metric tons per year (t/yr). Products are shipped by truck and rail to a wide variety of domestic and international customers. Based on total kyanite production capacity of about 136,000 t/yr, the company estimates at least 50 years of minable reserves.

**Dimension Stone.**—Dimension stone, includes natural rock that is selected or quarried, cut and then shaped for specific building, construction, and other specialty applications, was produced at seven mining operations in Virginia during 2005. In Culpeper County, a total of about 11,000 t of stone blocks were produced from Jurassic-age diabase at the Aston Jet Mist and Virginia Mist quarries. Jet Mist is marketed by New England Stone LLC. Virginia Mist is marketed by the R.E.D. Graniti Group, which is headquartered in Massa, Italy. In Albemarle County, New World Stone Company processed about 700 t of soapstone from previously mined stockpiles. About 2,300 t of sandstone was mined in Washington County at the Boulder Look Stone operation. Starting in 2005, the Stonewall Division of Frazier Quarry in Rockingham County began producing natural stone slabs and split blocks of limestone “bluestone” for building and landscaping applications. Slate produced by Lesueur-Richmond Slate Corporation in Buckingham County is sold for use as roofing shingles and other architectural applications.

**Salt.**—According to information provided by the DMME, salt is being extracted from brines pumped from historic underground salt caverns that have been developed as a natural gas storage facility operated by the Saltville Gas Storage Company, LLC in Washington County. During 2005, the Saltville Gas Storage Company was acquired by the Spectra Energy Corporation. Salt is produced by evaporation at an onsite evaporator plant with a designed flow-through capacity of about 400 gallons per minute. Salt production in 2005 was reported to be about 35,000 t, which was down substantially from the approximately 62,000 t produced in 2004.

**Vermiculite.**—Virginia Vermiculite, LLC continued operations from an open pit mine located in Louisa County, which is one of three active mines in the United States that produce vermiculite concentrate. Production during 2005 was reported to be about 33,300 t, up slightly from the 32,000 t

reported in 2004. A new processing plant replaced the existing milling, washing, drying, and screening facility in the second half of 2005.

### **Metals**

**Gold.**—The Gold Crown Mining Company's Kentuck Mine, a small open pit gold mine in Pittsylvania County, was reclaimed and closed in late 2005. Exploratory work and very minor production of gold was reported during the time period that the mine permit was active between 1995 and 2005.

**Titanium and Zirconium.**—Titanium-bearing minerals (ilmenite, rutile, leucoxene) and zircon concentrates are being produced by Iluka Resources Limited at the Old Hickory Mine located in Dinwiddie County. The mining permit covers 1,150 hectares (3,731 acres), and the primary facilities include two wet mineral concentrators and a dry mineral separation plant. In their annual report for 2005, Iluka reported production of 270,000 t of ilmenite and 69,000 t of zircon from the operation. Rutile and leucoxene are blended into the ilmenite concentrate. Remaining mineral resources (measured plus indicated) were reported to be 53 Mt at yearend 2005 (Iluka Resources Limited, 2005<sup>3</sup>). A priority during 2006 will be to complete feasibility studies for a new mining operation at Brink, which is located about 31 kilometers (km) (19 miles) to the south of the Old Hickory Mine area. During 2005, Iluka made plans to close mineral sand mining operations in Florida and Georgia, which will leave Virginia as the only State in the United States where titanium feedstocks and zircon are actively mined.

### **Government Programs and Activities**

The VDMR serves as the Commonwealth's geological survey. As part of DMME, the VDMR continued activities during 2005 to advance the department's mission of enhancing the development and conservation of energy and mineral resources in a safe and environmentally sound manner to support a more productive economy. These activities included geologic mapping programs, compilation and analysis of mineral production statistics, inventorying the locations and geologic characteristics of historic mining activities, and mineral resource quantitative assessments.

With cooperative funding from the USGS STATEMAP program, geologic mapping and digital map compilation were focused along the Interstate 81 (I-81) corridor, a nearly 500-km (300-statute mile) highway that is slated for expansion. STATEMAP is a component of the congressionally mandated National Cooperative Geologic Mapping Program (NCGMP), through which the USGS distributes Federal funds to support geologic mapping efforts through a competitive funding process. The NCGMP has three primary components: (1) FEDMAP, which funds Federal geologic mapping projects, (2) STATEMAP, which is a matching-funds grant program with State geological surveys, and (3) EDMAP, a matching-funds

<sup>3</sup>A reference that includes a section mark (§) is found in the Internet Reference Cited section.

grant program with universities that has a goal to train the next generation of geologic mappers.

The ongoing survey of active and abandoned mine sites in the State has provided new records for the Mineral Resources of Virginia database. This database serves as a critical resource for analyzing the spatial distribution of a wide variety of mineral resources and the implications for public safety and environmental concerns. With respect to the locations of active and abandoned underground coal mines, DMME continued to develop a Geographic Information System (GIS) containing scanned, catalogued, and georeferenced mine maps acquired from coal companies, State and Federal agencies, consultants, and the general public. Funding from the Federal Mine Safety and Health Administration and as the Federal Office of Surface Mining has supported this project.

During 2005, the VDMR participated in the USGS National Coal Resources Database System (NCRDS) State Cooperative Program. Working with USGS scientists from the Eastern Energy Resources Team, coal resource information in the

database has been recorrelated with the revised stratigraphic framework for the Virginia portion of the Appalachian Basin. The VDMR has also provided geospatial information for many of the most productive coal beds in the Southwest Virginia Coalfield to support ongoing coal bed assessment studies.

In 2005, the VDMR produced several reports including: Publication 172, Geology of the Damascus and Laurel Bloomery Quadrangles, Virginia; Open File Report 05-4, Mineral and Fossil Fuel Production in Virginia (1999-2003); and Open File Report 05-5, Preliminary Surficial Geologic Map of the Grottoes Quadrangle, Virginia. Information on these and other DVMR publications may be found on the VDMR Web site at <https://www.dmme.virginia.gov/commerce/PublicationCat.aspx>.

#### Internet Reference Cited

Iluca Resources Limited, 2005, Concise annual report 2005, accessed February 7, 2008, at URL <http://216.139.227.101/interactive/ilu2005/ilu2005/md/doc.php?n=20&even=1>.

TABLE 1  
NONFUEL RAW MINERAL PRODUCTION IN VIRGINIA<sup>1,2</sup>

(Thousand metric tons and thousand dollars)

Mineral	2003		2004		2005	
	Quantity	Value	Quantity	Value	Quantity	Value
Clays:						
Bentonite	--	--	5	W	--	--
Common	958	2,530	994	4,640	983	4,690
Kyanite <sup>c</sup>	90	13,400	90	13,400	90	13,400
Sand and gravel, construction	11,300	65,500	12,800	75,800	12,000	85,800
Stone:						
Crushed	66,500	481,000	73,700 <sup>r,3</sup>	540,000 <sup>r,3</sup>	86,200	778,000
Dimension	6	651	5	594	6	631
Talc, crude	--	--	--	--	1	15
Combined values of cement, clays (fuller's earth), feldspar, gemstones, iron oxide pigments (crude), lime, sand and gravel (industrial), titanium concentrates (ilmenite), vermiculite (crude), zirconium concentrates (zircon), and value indicated by symbol W	XX	223,000	XX	256,000 <sup>f</sup>	XX	272,000
Total	XX	786,000	XX	891,000 <sup>f</sup>	XX	1,160,000

<sup>c</sup> Estimated. <sup>r</sup> Revised. W Withheld to avoid disclosing company proprietary data. Withheld value included in "Combined values" data. XX not applicable. -- Zero.

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

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

<sup>3</sup> Excludes certain stones; kind and value included with "Combined values" data.

TABLE 2  
 VIRGINIA: CRUSHED STONE SOLD OR USED, BY KIND<sup>1</sup>

Kind	2004			2005		
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Number of quarries	Quantity (thousand metric tons)	Value (thousands)
Limestone <sup>2</sup>	44	20,500 <sup>r</sup>	\$141,000 <sup>r</sup>	45	29,000	\$260,000
Dolomite	6	3,460 <sup>r</sup>	16,100 <sup>r</sup>	7	3,400	27,900
Marble	-- <sup>r</sup>	-- <sup>r</sup>	-- <sup>r</sup>	--	--	--
Granite	27	30,300 <sup>r</sup>	233,000 <sup>r</sup>	26	31,200	291,000
Sandstone and quartzite	5	2,040	14,300	5	2,180	19,900
Traprock	10	16,700	128,000	10	18,600	164,000
Slate	1	192 <sup>r</sup>	4,370 <sup>r</sup>	1	136	1,240
Miscellaneous stone	2	441 <sup>r</sup>	3,050 <sup>r</sup>	3	1,640	13,500
Total	XX	73,700 <sup>r</sup>	540,000 <sup>r</sup>	XX	86,200	778,000

<sup>r</sup>Revised. XX Not applicable. -- Zero.

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

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

TABLE 3  
VIRGINIA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 2005, BY USE<sup>1</sup>

(Thousand metric tons and thousand dollars)

Use	Quantity	Value
<b>Construction:</b>		
<b>Coarse aggregate (+1½ inch):</b>		
Macadam	W	W
Riprap and jetty stone	629	9,070
Filter stone	944	9,950
Other coarse aggregate	1,250	11,000
Total	2,820	30,100
<b>Coarse aggregate, graded:</b>		
Concrete aggregate, coarse	6,920	67,000
Bituminous aggregate, coarse	3,980	34,900
Bituminous surface-treatment aggregate	1,760	16,200
Railroad ballast	501	4,710
Other graded coarse aggregate	3,100	30,100
Total	16,200	153,000
<b>Fine aggregate (-¾ inch):</b>		
Stone sand, concrete	584	4,520
Stone sand, bituminous mix or seal	813	5,890
Screening, undesignated	1,620	11,400
Other fine aggregate	996	8,440
Total	4,010	30,200
<b>Coarse and fine aggregates:</b>		
Graded road base or subbase	7,940	69,000
Unpaved road surfacing	378	2,840
Crusher run or fill or waste	2,460	18,500
Other coarse and fine aggregates	3,010	24,100
Total	13,800	114,000
Other construction materials	56	379
<b>Agricultural:</b>		
Agricultural limestone	356	3,250
Other agricultural uses	30	247
Total	386	3,500
<b>Chemical and metallurgical:</b>		
Lime manufacture	(2)	(2)
Chemical stone	(2)	(2)
Special, mine dusting or acid water treatment	(2)	(2)
Other miscellaneous uses and other specified uses not listed	210	2,120
<b>Unspecified:<sup>3</sup></b>		
Reported	29,600	261,000
Estimated	19,000	170,000
Total	48,200	431,000
Grand total	86,200	778,000

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

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

<sup>2</sup>Withheld to avoid disclosing company proprietary data; included in "Grand total."

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

TABLE 4  
VIRGINIA : CRUSHED STONE SOLD OR USED BY PRODUCERS IN 2005, BY USE AND DISTRICT<sup>1</sup>

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
<b>Construction:</b>						
Coarse aggregate (+1½ inch) <sup>2</sup>	919	8,050	W	W	W	W
Coarse aggregate, graded <sup>3</sup>	2,760	23,200	W	W	W	W
Fine aggregate (-¾ inch) <sup>4</sup>	1,490	12,500	W	W	W	W
Coarse and fine aggregates <sup>5</sup>	3,470	29,500	W	W	W	W
Other construction materials	33	162	23	217	--	--
Agricultural <sup>6</sup>	W	W	W	W	W	W
Chemical and metallurgical <sup>7</sup>	W	W	--	--	--	--
Special <sup>8</sup>	W	W	--	--	--	--
Other miscellaneous uses	--	--	--	--	210	2,120
<b>Unspecified:<sup>9</sup></b>						
Reported	2,780	25,400	6,530	56,500	20,300	179,000
Estimated	18,000	161,000	939	8,600	--	--
<b>Total</b>	<b>29,800</b>	<b>275,000</b>	<b>14,100</b>	<b>114,000</b>	<b>42,300</b>	<b>389,000</b>

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

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

<sup>2</sup>Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregates.

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

<sup>4</sup>Includes screening (undesignated), stone sand (bituminous mix or seal), stone sand (concrete), and other fine aggregates.

<sup>5</sup>Includes crusher run or fill or waste, graded road base or subbase, unpaved road surfacing, and other coarse and fine aggregates.

<sup>6</sup>Includes agricultural limestone and other agricultural uses.

<sup>7</sup>Includes chemical stone and lime manufacture.

<sup>8</sup>Includes mine dusting or acid water treatment.

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

TABLE 5  
VIRGINIA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2005,  
BY MAJOR USE CATEGORY<sup>1</sup>

Use	Quantity	Value (thousands)	Unit value
	(thousand metric tons)		
Concrete aggregate and concrete products <sup>2</sup>	5,600	\$47,500	\$8.49
Asphaltic concrete aggregates and other bituminous mixtures	1,150	7,370	6.42
Road base and coverings	224	1,120	5.01
Fill	633	2,980	4.71
Other miscellaneous uses <sup>3</sup>	182	1,430	7.85
<b>Unspecified:<sup>4</sup></b>			
Reported	2,770	15,900	5.76
Estimated	1,490	9,410	6.34
<b>Total or average</b>	<b>12,000</b>	<b>85,800</b>	<b>7.13</b>

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

<sup>2</sup>Includes plaster and gunite sands.

<sup>3</sup>Includes roofing granules and snow and ice control.

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

TABLE 6  
 VIRGINIA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2005,  
 BY USE AND DISTRICT<sup>1</sup>

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregates and concrete products <sup>2</sup>	W	W	W	W	5,350	45,100
Asphaltic concrete aggregates and other bituminous mixtures	W	W	W	W	809	4,760
Road base and coverings	W	W	W	W	171	829
Fill	9	11	--	--	624	2,970
Other miscellaneous uses <sup>3</sup>	553	4,770	141	963	124	1,010
Unspecified: <sup>4</sup>						
Reported	19	161	--	--	2,750	15,800
Estimated	310	1,970	690	4,370	485	3,080
Total	891	6,910	830	5,330	10,300	73,500

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

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

<sup>2</sup>Includes plaster and guniting sands.

<sup>3</sup>Includes roofing granules and snow and ice control.

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