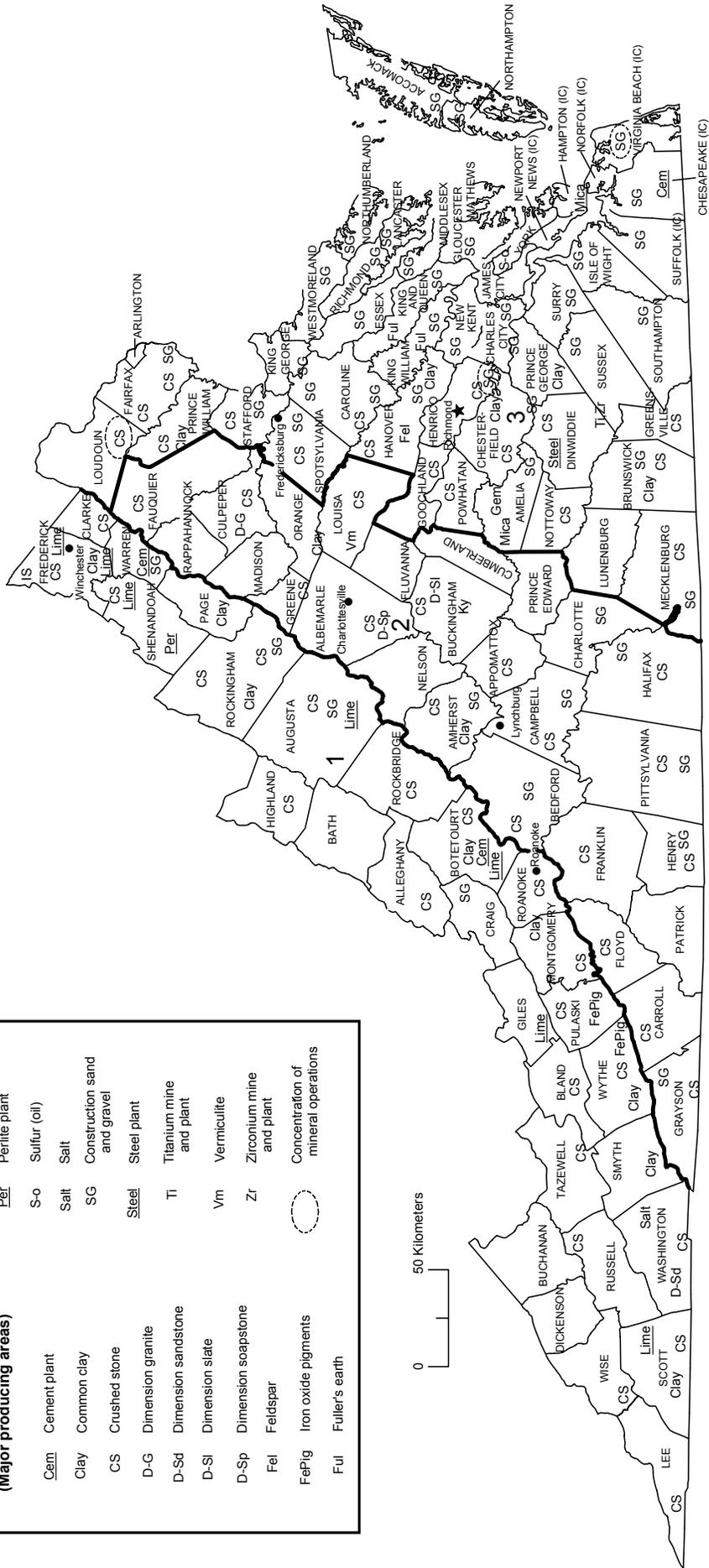


VIRGINIA

LEGEND

- County boundary
 - (IC) Independent City
 - ★ Capital
 - City
 - 1 — Crushed stone/sand and gravel districts
- ### MINERAL SYMBOLS (Major producing areas)
- Cem Cement plant
 - Clay Common clay
 - CS Crushed stone
 - D-G Dimension granite
 - D-Sd Dimension sandstone
 - D-Sl Dimension slate
 - D-Sp Dimension soapstone
 - Fel Feldspar
 - FePig Iron oxide pigments
 - Ful Fuller's earth
 - Gem Gemstones
 - IS Industrial sand
 - Ky Kyanite
 - Lime Lime plant
 - Mica Mica
 - Mica Mica plant
 - Per Perlite plant
 - S-o Sulfur (oil)
 - Salt Salt
 - SG Construction sand and gravel
 - Steel Steel plant
 - Ti Titanium mine and plant
 - Vm Vermiculite
 - Zr Zirconium mine and plant
 - Concentration of mineral operations



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 2003, the estimated value¹ of nonfuel raw mineral production for Virginia was \$727 million, based upon preliminary U.S. Geological Survey (USGS) data. This was about a 5% increase from that of 2002² and followed a 5.7% decrease from 2001 to 2002. Virginia continued to be 19th in rank among the 50 States in total nonfuel raw mineral production value, of which the State accounted for nearly 2% of the U.S. total.

Crushed stone was, by value, Virginia's leading raw nonfuel mineral, accounting for about 59% of the State's total nonfuel mineral value. From 1990 through 2003, the State produced nearly 820 million metric tons of crushed stone, or an average of more than 58 million metric tons per year during that 14-year period. During the past 5 years, on average, Virginia's quarries have annually produced about 65 million metric tons of crushed stone per year. Cement (masonry and portland) was the second leading nonfuel mineral commodity, followed by construction sand and gravel and lime. These four mineral commodities represented about 86% of the State's total nonfuel mineral value.

In 2002, while production was down slightly, zirconium concentrates had the largest increase in value, about \$7 million, followed by common clays, feldspar, fuller's earth, and vermiculite, which showed increases of about \$2 million each. However, these increases were more than offset by decreases in the production and values of crushed stone, value down \$51 million, and those of construction sand and gravel, down about \$4 million, resulting in a net decrease for the year. All other changes in value in 2002 were significantly smaller and inconsequential to the net result (table 1).

Based upon USGS estimates of the quantities produced in the 50 States during 2003, Virginia remained the only State to mine kyanite; second in feldspar; second in both zirconium concentrates (zircon) and titanium (ilmenite) (listed in descending order of value), each being produced only

¹The 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 2003 USGS mineral production data published in this chapter are preliminary estimates as of July 2004 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 USGS Mineral Industry Surveys and USGS Minerals Yearbook chapters—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 2002 may differ from the Minerals Yearbook, Area Reports: Domestic 2002, Volume II, owing to the revision of preliminary 2002 to final 2002 data. Data for 2003 are preliminary and are expected to change; related rankings also may change.

in Virginia and Florida; second of 2 vermiculite-producing States; and fourth in iron oxide pigments. While the State increased to 8th from 10th in crushed stone and to 4th from 5th in fuller's earth, it decreased to 10th from 9th in lime. Additionally, significant quantities of cement, construction sand and gravel, industrial sand and gravel, and common clays (listed in descending order of value) were produced in the State. Although the only producing kyanite mine and calcined kyanite (mullite) facilities in the United States were in Virginia; synthetic mullite, which is a calcined bauxite, was produced in one other State. About 90% of the U.S. kyanite and mullite output was used in refractories for the smelting and processing of a variety of metals and in glass and high-temperature ceramics manufacturing.

The following narrative information was provided by the Virginia Division of Mineral Resources³ (VDMR) of the Commonwealth of Virginia's Department of Mines, Minerals and Energy (DMME). Employment of mine and quarry workers in the State's nonfuel minerals industry was up slightly in 2003 to 3,770. This represented a 2.3% increase from 2002 employment. Although no significant quantities of metals were mined in the State, recreational gold panners reported modest success in several Piedmont counties. Also, Gold Crown Mining Co. continued its active permit at its Kentuck Mine in Pittsylvania County, but no production was reported to the VDMR.

Commodity Review

Industrial Minerals

Clay.—Two companies, Bennett Mineral Co. and Nestle Purina Petcare, produced fuller's earth from clay deposits in the Coastal Plain northeast of Richmond. The material was processed to form cat box litter and industrial absorbents.

Gemstones.—The Morefield Mine in Amelia County in Virginia's eastern Piedmont continued operations as a recreational mineral collecting site. A single shaft has been driven into a quartz-feldspar pegmatite vein, from which material is periodically blasted and then dumped for collectors to sort through. The most commonly found collectable mineral is amazonite, a blue-green variety of microcline, but amethyst, beryl, garnet, and other minerals also are found.

Titanium and Zirconium.—Iluka Resources, Inc. continued heavy-mineral mining at its Old Hickory and Concord Mines and initial processing at the company's plant; all were in Dinwiddie County at the western edge of the Coastal Plain. Placer beach sands of Pliocene age here contain concentrations

³David B. Spears, Geologist Manager with the Virginia Division of Mineral Resources, authored the text of the State mineral industry information provided by that State agency.

of a number of heavy minerals from which Iluka Resources processes ilmenite and zirconium. Total production of ilmenite concentrate and zirconium concentrate showed a combined increase of 44% more than the 2002 levels.

Kyanite.—Kyanite Mining Co.'s kyanite mining and processing operations in Buckingham County (central Virginia) included two pits, separation facilities, and a calcining plant for the conversion of kyanite to mullite. In 2003, demand for the company's product was below its installed production capacity.

Mine Reclamation

A significant reclamation project was completed at a site near Nassawadox on Virginia's Eastern Shore. The property (owned by the Nature Conservancy) included an abandoned sand pit and asphalt plant. Derelict tanks and railroad cars containing tar and other petroleum products were removed during the year along with contaminated soil. The reclaimed site is now part of a complex of Conservancy properties that preserve wildlife habitat along a critical migratory bird flyway.

In 2003, Kyanite Mining received the Kenes C. Bowling National Mine Reclamation Award in the noncoal category from the Interstate Mining Compact Commission. The award recognized the company for its reclamation of the Baker Mountain site, a depleted kyanite mine in Prince Edward County that had been active from the 1920s until 1979. The site now includes 8 hectares of wetlands and grasslands.

The Virginia DMME continued design work on the second phase of a major acid-drainage abatement program at the site of the Valzinco Mine, an abandoned (post-World War II) lead-zinc mine in Spotsylvania County (Phase I had been completed in 2002). Phase II, which was planned to begin in 2004, involves

the construction of additional wetland cells and geomorphic channels.

Government Activities and Programs

The VDMR serves as the State geological survey. During 2003, the VDMR continued cooperative programs with Federal agencies in geologic mapping, mineral resources, and mine safety. As part of an ongoing cooperative effort through the STATEMAP component of the National Cooperative Geologic Mapping Program, two digital geologic maps were published: the Geologic Map of Virginia (1:500,000 scale) and the Virginia Portion of the Winchester 30 x 60-minute quadrangle (1:100,000 scale). Further information regarding these two maps, which are to be issued in digital format as ESRI ArcView shapefiles on a CDROM, and other similar maps may be found on the Internet at URL <http://www.mme.state.va.us/Dmr/DOCS/Digit/dgm.html>. The geology of the Madison quadrangle, in the Blue Ridge physiographic province, was published as a 1:24,000-scale paper map. New geologic mapping and digital compilation of existing maps are being directed toward urban and interstate highway corridors. A major project was underway along Interstate Highway I-81 in the Shenandoah Valley, and another project has been proposed for the metropolitan Richmond area.

The VDMR Mineral Resources of Virginia database continued to be expanded to include active and abandoned mine and quarry sites in the western part of the State. This work is being carried out with state-of-the-art Global Positioning System (GPS) technology. More information about the Division and its activities can be found on its Web site at URL <http://www.geology.state.va.us>.

TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN VIRGINIA^{1,2}

(Thousand metric tons and thousand dollars)

Mineral	2001		2002		2003 ^P	
	Quantity	Value	Quantity	Value	Quantity	Value
Clays, common	937	1,840	827	3,320	827	3,320
Kyanite ^c	90	13,400	90	13,400	90	13,400
Sand and gravel, construction	11,800	64,400	10,500	60,000	11,100	63,800
Stone:						
Crushed	69,100	446,000	58,900	395,000	63,000	428,000
Dimension	6	626	6	651	6	642
Combine values of cement, clays (fuller's earth), feldspar, gemstones, iron oxide pigments (crude), lime, sand and gravel (industrial), titanium (ilmenite), vermiculite (crude), zirconium concentrates, and value indicated by symbol W	XX	206,000	XX	218,000	XX	218,000
Total	XX	732,000	XX	690,000	XX	727,000

^cEstimated. ^PPreliminary. XX Not applicable.

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

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

TABLE 2
VIRGINIA: CRUSHED STONE SOLD OR USED, BY KIND¹

Kind	2001				2002			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone ²	45 ^r	19,300 ^r	\$108,000 ^r	\$5.61 ^r	46	16,000	\$92,000	\$5.76
Dolomite	6 ^r	1,410 ^r	7,970 ^r	5.64 ^r	6	1,320	7,470	5.65
Granite	27 ^r	27,700 ^r	194,000 ^r	7.01 ^r	30	24,600	177,000	7.19
Sandstone and quartzite	5	1,540	6,680	4.35	5	970	3,750	3.87
Marble	1	W	W	5.95	1	W	W	8.30
Traprock	10 ^r	16,900 ^r	116,000 ^r	6.88 ^r	10	13,600	96,800	7.14
Slate	1	W	W	5.62	1	W	W	5.62
Miscellaneous stone	3	833 ^r	4,510 ^r	5.41 ^r	3	873	6,190	7.09
Total or average	XX	69,100	446,000	6.46	XX	58,900	395,000	6.70

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

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

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

TABLE 3
 VIRGINIA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 2002, BY USE¹

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Construction:			
Coarse aggregate (+1 1/2 inch):			
Macadam	W	W	\$10.90
Riprap and jetty stone	859	\$8,650	10.07
Filter stone	795	6,500	8.18
Other coarse aggregates	450	3,330	7.40
Total or average	2,100	18,500	8.79
Coarse aggregate, graded:			
Concrete aggregate, coarse	8,190	64,400	7.87
Bituminous aggregate, coarse	2,260	17,400	7.69
Bituminous surface-treatment aggregate	2,220	18,200	8.18
Railroad ballast	797	5,060	6.35
Other graded coarse aggregates	1,640	13,500	8.21
Total or average	15,100	119,000	7.85
Fine aggregate (-3/8 inch):			
Stone sand, concrete	634	5,160	8.14
Stone sand, bituminous mix or seal	364	2,880	7.90
Screening, undesignated	2,210	14,200	6.43
Other fine aggregate	1,100	7,080	6.47
Total or average	4,310	29,300	6.82
Coarse and fine aggregates:			
Graded road base or subbase	11,700	79,500	6.80
Unpaved road surfacing	1,050	8,070	7.71
Terrazzo and exposed aggregate	W	W	21.82
Crusher run or fill or waste	2,770	15,900	5.74
Other coarse and fine aggregates	1,500	7,950	5.31
Total or average	17,000	111,000	6.55
Other construction materials	903	5,860	6.49
Agricultural:			
Agricultural limestone	433	3,620	8.36
Poultry grit and mineral food	W	W	4.74
Other agricultural uses	157	943	6.01
Total or average	590	4,560	7.74
Chemical and metallurgical:			
Cement manufacture	(2)	(2)	3.31
Chemical stone for alkali works	(2)	(2)	9.84
Total or average	1,830	7,550	4.12
Special:			
Asphalt fillers or extenders	(2)	(2)	4.94
Whiting or whiting substitute	(2)	(2)	12.07
Other fillers and extenders	(2)	(2)	10.38
Total or average	72	663	9.21
Other miscellaneous uses and other specified uses not listed	1	4	4.00
Unspecified:³			
Reported	6,950	42,100	6.06
Estimated	10,000	57,000	5.61
Total or average	17,000	98,600	5.79
Grand total or average	58,900	395,000	6.70

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

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

²Withheld to avoid disclosing company proprietary data; included in "Total."

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

TABLE 4
 VIRGINIA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 2002, BY USE AND DISTRICT¹

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction:						
Coarse aggregate (+1 1/2 inch) ²	364	2,390	353	3,280	1,390	12,900
Coarse aggregate, graded ³	W	W	W	W	12,200	96,500
Fine aggregate (-3/8 inch) ⁴	759	4,870	W	W	W	W
Coarse and fine aggregate ⁵	2,170	10,500	4,490	30,600	10,500	71,500
Other construction materials	169	910	214	1,210	520	3,750
Agricultural ⁶	421	2,730	W	W	W	W
Chemical and metallurgical ⁷	W	W	--	--	--	--
Special ⁸	W	W	--	--	W	W
Other miscellaneous uses ⁹	--	--	1	4	--	--
Unspecified: ¹⁰						
Reported	730	5,460	820	5,050	5,190	29,300
Estimated	8,600	48,000	1,500	8,600	--	--
Total	16,400	91,100	10,100	71,500	32,500	232,000

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

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

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

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

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

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

⁶Includes agricultural limestone, poultry grit and mineral food, and other agricultural uses.

⁷Includes cement manufacture and chemical stone for alkali works.

⁸Includes asphalt fillers or extenders, whiting or whiting substitute, and other fillers or extenders.

⁹Includes other uses not listed.

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

TABLE 5
 VIRGINIA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2002,
 BY MAJOR USE CATEGORY¹

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Concrete aggregate (including concrete sand)	3,810	\$29,400	\$7.71
Concrete products (blocks, bricks, pipe, decorative, etc.) ²	170	1,530	8.98
Asphaltic concrete aggregates and other bituminous mixtures	1,220	6,600	5.41
Road base and coverings	319	1,420	4.45
Fill	862	2,630	3.05
Snow and ice control	38	216	5.68
Other miscellaneous uses ³	68	601	8.84
Unspecified: ⁴			
Reported	2,120	9,850	4.65
Estimated	1,900	7,800	4.12
Total or average	10,500	60,000	5.71

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

²Includes plaster and gunite sands.

³Includes roofing granules.

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

TABLE 6
 VIRGINIA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2002,
 BY USE AND DISTRICT¹

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate (including concrete sand) ²	W	W	W	W	3,680	28,200
Concrete products (blocks, bricks, pipe, decorative, etc.)	--	--	--	--	106	921
Asphaltic concrete aggregates and road base materials	W	W	W	W	1,170	5,150
Fill	6	12	(3)	1	856	2,610
Other miscellaneous uses ⁴	506	4,230	72	545	91	704
Unspecified: ⁵						
Reported	28	194	42	228	2,050	9,430
Estimated	90	470	460	2,400	1,300	4,900
Total	630	4,900	571	3,150	9,290	51,900

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

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

²Includes plaster and gunite sands.

³Less than 1/2 unit.

⁴Includes roofing granules and snow and ice control.

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