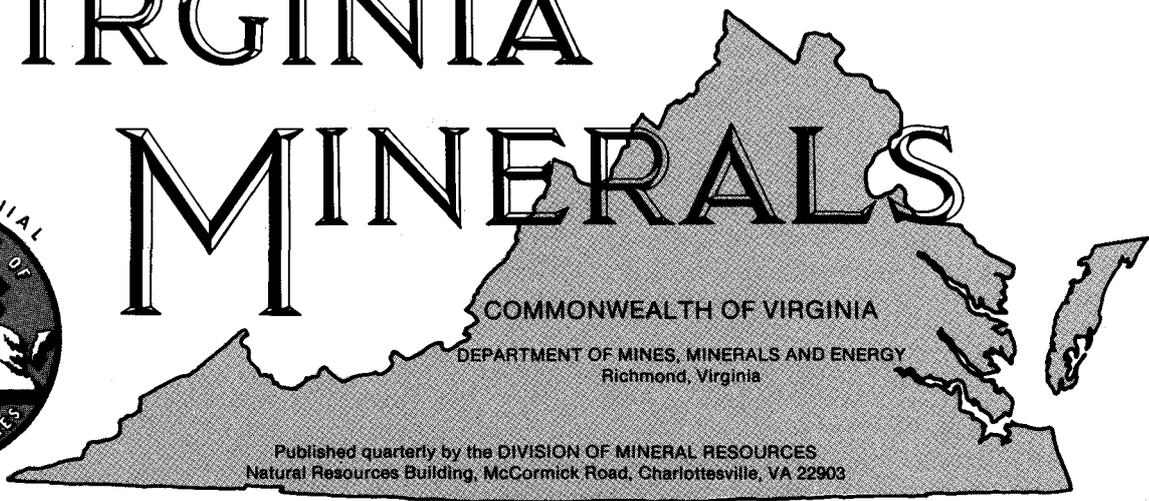
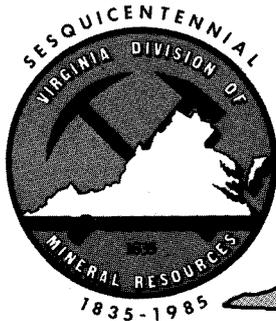


VIRGINIA

MINERALS



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MINERAL RESOURCE PRODUCTION IN VIRGINIA - 1988

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INTRODUCTION

The total value of mineral production in Virginia in 1988 was 2.12 billion dollars (Table). About 1.58 billion dollars resulted from coal sales and about 42 million dollars was from the sale of petroleum and natural gas. The remaining 498 million dollars was from nonfuel production, that is industrial rocks and minerals. That represents an increase of more than 111 million dollars for 1988, about 5.5 percent when compared with 1987 total mineral production. Production of lime increased almost 20 percent and petroleum production increased almost 46 percent over the 1987 statistics. Crushed stone production was up more than nine percent and coal production was up almost two percent. On the decline were natural gas, four-and-one-half percent, and clays, which were down more than ten percent from the previous year.

The number of producers, amount of production, and number of processing plants remained stable during the year for cement, feldspar, gem stones, gypsum, industrial sand, iron-oxide pigments, kyanite, lithium hydroxide, magnetite, manganese, mica, ornamental aggregate, perlite, phosphate rock, sand and gravel, sulfur, and vermiculite.

CEMENT

Three companies, one each in Warren and Botetourt counties and in the City of Chesapeake, produce cement in Virginia. Riverton Corporation in Warren County produces masonry cement at their plant north of Front Royal. There, crushed limestone (Edinburg Formation) is calcined, hydrated, and mixed with portland cement from out-of-state sources. Sales are made to building supply dealers in Virginia

Table. Mineral Resource Production in Virginia (Preliminary) - 1988¹

| Commodity | Quantity | Value (thousands) |
|--|----------|-------------------|
| Clays—thousand short tons | 1,049 | \$ 5,871 |
| Coal (bituminous) ² (\$34/ton)—do | 46,365 | 1,576,398 |
| Gem stones (est.) | NA | 20 |
| Lime—thousand short tons | 837 | 35,246 |
| Natural gas ² (\$2.23/1000 cu. ft.)—million cubic feet | 18,683 | 41,663 |
| Petroleum (crude) ² (\$13.95/bl.)—42-gallon barrels | 24,952 | 348 |
| Sand and gravel—thousand short tons | 11,500 | 46,400 |
| Stone: | | |
| Crushed—do | 66,000 | 326,700 |
| Dimension—do | 10 | 2,900 |
| Combined value of cement, clay (montmorillonite), feldspar, gypsum, industrial sand, iron-oxide pigments (crude), kyanite, sulfur, vermiculite | XX | 81,035 |
| Total | XX | \$2,116,581 |

NA Not available XX Not applicable

¹ Production as measured by mine shipments, sales, or marketable production (including consumption by producers) - from U.S. Bureau of Mines.

² Virginia Department of Mines, Minerals and Energy

and surrounding states. Roanoke Cement Company operates a plant in western Botetourt County. The facility manufactures portland cement from locally mined limestone and shale and iron scale from Roanoke Electric Steel Company. Burned calcium and iron aluminate clinker is manufactured in five

coal-fired kilns and ground into cement. Three-fourths of the cement is sold to ready-mix companies. LaFarge Calcium Aluminate, Inc. operates a cement manufacturing plant in the City of Chesapeake. Cement clinker is imported and ground into low- and medium-calcium aluminate cement. Six types of calcium aluminate cement are produced at the facility. The advantages of this cement include rapid hardening as well as resistance to wear and corrosion and the capacity to be used under a wide range of temperatures.

CLAY MATERIALS

Residual and transported clay, weathered phyllite and schist, and shale are used as raw material to produce almost one-half billion bricks in Virginia annually when all the plants in the State are working at full capacity. The clay-material industry in the western part of the State mines Paleozoic-age shale, with the primary end product being face brick. Face-brick producers in the central-to-eastern part of Virginia mine Triassic-age shale and clay residuum in Orange and Prince William counties and Precambrian-age schist, and residual and transported clay in Amherst, Brunswick, Chesterfield, Greensville, and Henrico counties.

Lightweight aggregate is produced in Botetourt, Buckingham, and Pittsylvania counties. Weblite Corporation in Botetourt County mines shale from the Rome Formation to produce lightweight aggregate by the sintering process, using semi-anthracite waste coal from Montgomery County to fire the kilns. They utilize about 100 tons of coal per day to yield a lightweight-product having a weight as low as 31 lb/ft³ for particle sizes of 5/16 to 3/4 inches. Solite Corporation in northern Buckingham County uses the Arvonite Slate of Ordovician age to produce lightweight aggregate. Triassic-age shale is used by Virginia Solite Company southwest of Danville, Pittsylvania County, to obtain a similar product.

Clay from the Cold Spring kaolin deposit in southeastern Augusta County is utilized intermittently by James River Limestone Company, Inc. to mix with crushed dolomite at their operation near Buchanan, Botetourt County to produce various grades of filler material and as an ingredient in white cement.

Bennett Mineral Company in the Walkerton area of King and Queen County in eastern Virginia mines and processes montmorillonite clay to produce an industrial and sanitary absorbent. The facility uses wood wastes as a plant fuel to dry the clay in a rotary kiln.

COAL

A record 46,364,647 short tons (Table) of coal were produced from the southwest Virginia coalfields in Buchanan, Dickenson, Lee, Russell, Scott, and Wise counties from approximately 543 surface and underground mines. The

majority of the bituminous coal from the southwest fields was produced from the Pocahontas No. 3, Jawbone, Splash Dam, Kennedy, and Blair coal beds. Included in this production total are 5553 short tons of semi-anthracite coal produced from two additional surface mines in the Valley Coal field, Montgomery County.

Coal from Virginia is used for metallurgical purposes, electrical power generation (steam coal), industrial purposes, and residential heating. A large percentage of Virginia coal is contracted for export to overseas markets. The coal is exported through the ports in the Hampton Roads area in Virginia and through the port at Wilmington in North Carolina.

FELDSPAR

The Feldspar Corporation operates a mine and plant near Montpelier in Hanover County in east-central Virginia and produces a material marketed as "Virginia aplite," which is sold to the glass industry. The "aplite" improves the workability of the molten glass and imparts a chemical stability to the finished glassware. Feldspar is mined from medium- to coarse-grained meta-anorthosite by open pit methods. The rock is trucked to the plant adjacent to the mine for crushing, grinding, classifying, and drying. After this processing, the "aplite" is stored in silos (Figure 1). Clay minerals are removed by gravity concentration. The heavy minerals (ilmenite, rutile, and sphene) that are present in the feldspar are removed by electrostatic processing and magnets. These minerals were stockpiled until the early 1980s and are currently being placed in settling ponds. Processed feldspar is shipped by truck and rail to markets in New Jersey, Pennsylvania, Ohio, and Indiana.

Clay and silt, with a high percentage of kaolinite and mica, has accumulated in settling ponds. This "tailings" waste material was evaluated in the mid-1960s and was found to be suitable for face brick and drain tile; the material fires dark brown to gray. Fines may have potential as a flux material for the brick industry. About 75,000 to 100,000 tons of this material are added to settling ponds per year.

Feldspar in Amherst County is marketed as aggregate by the W. W. Boxley Company, Blue Ridge Stone Corporation, Piney River Quarry (Figure 2). Fines, resulting from the crushing of feldspar for use as road aggregate, are stockpiled at present. Feldspar has been mined from several pegmatite bodies in the Piedmont province in the past, including those in Amelia and Bedford counties.

GEM STONES

Mines and collectors in Virginia produced an estimated value of \$20,000 of natural gem stones in 1988. The Morefield pegmatite in Amelia County is open to the public for

collecting on a fee basis by Powhatan Mining Company; the company also mines and sells "hand picked" mica. Blue-green amazonstone, beryl, topaz, tantalite, tourmaline, and zircon are some of the minerals found in the pegmatite. Hopkins Enterprises opened a fee basis, collecting operation in Patrick County in southern Virginia. Staurolite crystals (fairystone crosses) are the main interest of collectors at this site.



Figure 1. Unloading of feldspar from storage silos, The Feldspar Corporation, Hanover County.



Figure 2. Loading of feldspar at Piney River Quarry, Blue Ridge Stone Corp., W. W. Boxley Company, Amherst County.

GYPSUM

United States Gypsum Company operates a mine and plant in the southwestern part of the State and a processing plant in Norfolk. The underground mine is located at Locust Cove, Smyth County. The Locust Cove mine is a slope-entry, multilevel operation. Isolated masses of gypsum in the Maccrady Formation are mined by a modified stoping system. The gypsum is trucked to their processing plant located at Plasterco, near Saltville, in adjacent Washington County. The Plasterco plant manufactures wallboard that is used in construction.

The Norfolk plant processes crude gypsum from Nova Scotia to produce wallboard and other gypsum-based products. The plant also produces a fertilizer (land plaster) for the peanut industry. The Norfolk facility receives a few shipments of anhydrite from Nova Scotia for sale to cement manufacturers. The anhydrite is used as a source of sulfur in producing cement clinker.

IRON-OXIDE PIGMENTS

Virginia is one of four states that produce natural iron-oxide pigments. Hoover Color Corporation in Pulaski County produces ocher, umber, and sienna. The company is the only operation in the United States producing sienna. Raw materials are mined by open pit methods from deposits near the contact of the Erwin Formation with the overlying Shady Dolomite. Deposits, which may be associated with Cambrian-age gossans, are concentrated in pockets with insoluble clay and iron oxide. Some iron is also concentrated by precipitation from groundwater. The raw material is trucked to the company plant at Hiwassee where it is pulverized, dried, ground, air separated, blended, and packaged prior to shipping. The finished product, used as a coloring agent in a variety of products, is shipped throughout the United States and to Canada and Mexico. Virginia Earth Pigments Company mines a small quantity of iron oxide from the Brubaker No. 1 mine in southeastern Wythe County. The majority of this material is sold to Hoover Color Corporation.

Blue Ridge Talc Company, Inc. imports crude iron-oxide pigments from a supplier near the Great Lakes. The pigments are ground and calcined for use in paints and fertilizers and for cement and mortar coloring. Their markets are both domestic and foreign.

KYANITE

Kyanite, an aluminum silicate, was first produced in Prince Edward County in the 1920s. In September, 1986, Virginia was the only state producing kyanite. The majority of the world's kyanite, is produced by Kyanite Mining Corporation from their deposit in Buckingham County. The

company produces a concentrate grade with a maximum of 61.8 percent alumina and a minimum iron content of 0.16 percent. Calcined kyanite is converted to mullite at temperatures greater than 3000 degrees Fahrenheit. The mullite is a super-duty refractory with a pyrometric cone equivalent of 36 to 37. Products, which are sold in 35, 48, 100, 200, and 325 mesh sizes, are used in the refractory, ceramic, glass, metallurgical, and foundry industries. Mullite aids ceramics and glass to resist cracking, warping, slagging, and deforming from high temperatures.

Kyanite Mining Corporation operates two surface mines and processing plants in central Buckingham County, one at Willis Mountain and one at East Ridge (Figure 3). Kyanite-bearing quartzite is quarried from open pits, run through primary crushers, through a log washer to remove clay, and onto the classifiers to remove some kyanite. The material then passes through a rod mill which reduces it to a minus 35-mesh size, and then through froth flotation cells so that the kyanite can be skimmed off. The kyanite is de-watered and then dried; the high temperature of the drier converts the sulfide minerals that are present in the quartzite to oxides. Pyrite is converted to ferrous iron oxide (Fe_3O_4) or magnetite, which is then removed by magnetic separators and stock-piled.

The Willis Mountain plant processes the raw kyanite which is then trucked to the East Ridge facility for calcining. Mullite is ground and bagged at the Dillwyn Plant and raw kyanite is ground and bagged at Willis Mountain.

Approximately 40 percent of the production is shipped through the ports in the Hampton Roads area to worldwide customers. The company also markets a by-product sand obtained from the processing of kyanite. It is sold for golf course, masonry, and concrete sand and for other applications.

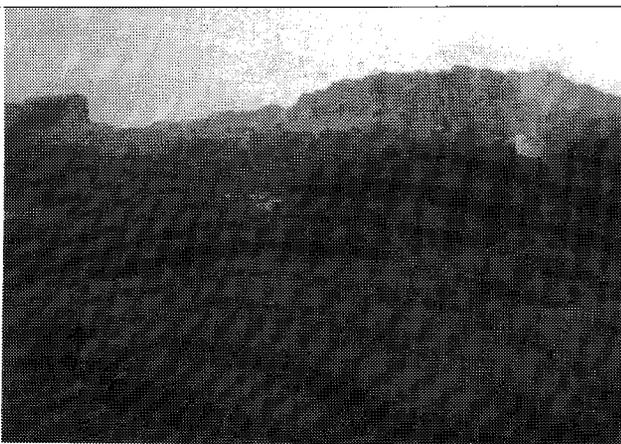


Figure 3. View of Willis Mountain looking northeast from U.S. Highway 15, Kyanite Mining Corporation, Buckingham County.

LIME

Virginia's lime industry is located in Frederick, Giles, Shenandoah, and Warren counties. Production in 1988 was 837,000 short tons valued at more than 35 million dollars. In northwestern Virginia, two companies, W. S. Frey Company, Inc. and Chemstone Corporation quarry and calcine the high-calcium New Market Limestone; and Riverton Corporation in Warren County quarries and calcines limestones from the Edinburg Formation. Two companies in western Giles County (APG Lime Corporation and Virginia Lime Company) operate underground mines in the Five Oaks Limestone. Both companies calcine the Five Oaks Limestone in rotary kilns. Principal sales are to the paper and steel industries.

The paper industry uses lime for regeneration of sodium hydroxide and for the neutralization of sulfate water. Lime is used in iron furnaces to remove impurities, to purify water, and, during the last few years, to neutralize acid mine water. It is used also for mason's lime, sewage treatment, and agricultural purposes.

LITHIUM

Cyprus Foote Mineral Company processes lithium carbonate from brines in Nevada with calcium hydroxide, from various sources. Lithium carbonate is used to produce lithium hydroxide at their Sunbright plant in Scott County. Lithium hydroxide is used in multipurpose grease. In the past, limestone from an underground mine at the Sunbright site was utilized in the manufacturing process and a calcium carbonate precipitate was formed as a waste product. This waste material remains on the site and may have a potential use. The approximate analysis of the material is 43 to 50 percent CaCO_3 , 3 to 6 percent Ca(OH)_2 , and 40 to 48 percent water.

MAGNETITE

Reiss Viking Corporation in Tazewell County processes out-of-state magnetite for use in coal preparation. The magnetite is obtained from New York, with minor amounts being imported. Magnetite is dried, ground in a ball mill, classified, and graded by percentage of material passing a 325 mesh sieve; grades produced are 40, 70, 90, 96.5, and 99. The product is marketed in Virginia and Kentucky for use in cleaning coal. In the coal cleaning process, magnetite is mixed with water to form a heavy-media slurry into which raw coal is fed. The heavier impurities sink with the magnetite whereas the lighter coal floats and is recovered. About two pounds of magnetite is used for every ton of coal cleaned.

MANGANESE

Eveready Battery Company, Inc. operates a manganese processing facility in the city of Newport News. Manganese ore, imported from Mexico and Africa, is dried, crushed, ground, and shipped to other company facilities for use in the manufacture of batteries.

MICA

Asheville Mica Company and an affiliate, Mica Company of Canada, process mica at facilities in Newport News. The crude mica is imported from Madagascar and India. Asheville Mica Company produces fabricated plate-mica; Mica Company of Canada uses splittings from the Asheville operations to produce reconstituted plate-mica. Mica has been produced in the past from pegmatite bodies in several counties in Virginia, including Amelia, Henry, and Powhatan. Mica is presently being "hand picked" in Amelia County.

NATURAL GAS

Natural gas production in 1988 was 18,682,530 Mcf (one Mcf equals 1000 cubic feet) from 728 wells in Buchanan, Dickenson, Russell, Scott, Tazewell, Washington, and Wise counties. This reflects a decline of four percent from the 1987 record production of 19,520,312 Mcf. The average price paid to Virginia's 18 natural gas producers in 1988 was \$2.23 per Mcf.

In 1988, a total of 45 wells were drilled in Virginia. This represents a 12 percent decrease from the 51 wells drilled in 1987. The total footage drilled in 1988 was 213,527 feet. The average depth for a development well was 4963 feet and the average depth for an exploratory well was 4322 feet.

ORNAMENTAL AGGREGATE

Dolomite and quartzite from Botetourt and Rockbridge counties are marketed as exposed-aggregate materials. Rock materials, such as black limestone (Edinburg Formation) from the Valley and Ridge province and greenstone from the Piedmont province, have been used for terrazzo in the past. Exposaic Industries, Inc. in Spotsylvania County utilizes a variety of rock materials for exposed panels, including greenstone from Albemarle County and Triassic-age sandstone from Culpeper County.

Several rock types have been utilized for ornamental aggregate in past years. Vein quartz was quarried in Albemarle, Buckingham, Fauquier, Fluvanna, Greene, and Rappahannock counties, and quartz pebbles were extracted from the flood plain along the Mattaponi River in Caroline County.

PERLITE

Manville Sales Corporation operates a plant at Woodstock in Shenandoah County to expand perlite (volcanic glass with high water content and "onion-skin" appearance) obtained from Grants, New Mexico. Expanded perlite is used in the manufacture of roof insulation board, which is marketed throughout the eastern United States.

PETROLEUM

Crude oil production totaled 24,952 barrels in 1988, a 46 percent increase over the 1987 production of 17,141 barrels. Production was by 12 companies from 54 wells in three fields (Ben Hur, Rose Hill, and Roaring Fork). The average price paid by refineries for Virginia oil in 1988 was \$13.95 per barrel.

PHOSPHATE ROCK

TexasGulf, Inc. ships phosphate rock from its Lee Creek operation in North Carolina to Glade Spring, Washington County. It is then transported by truck to the TexasGulf plant in Saltville, Smyth County. A coal-fired rotary kiln is used to defluorinate the phosphate rock. The product is marketed as a poultry and animal feed supplement in the southern and midwestern states.

SAND AND GRAVEL**CONSTRUCTION**

Construction sand and gravel producers accounted for the majority of the 11.5 million short tons of material produced in 1988. Sand and gravel is extracted from river terraces and dredged from the rivers of the major drainages in central and eastern Virginia (Figure 4). Large tonnages of construction sand and gravel from southeast of Fredericksburg are shipped by rail into the northern Virginia-Washington, D.C., market area. A large portion of the production by Sadler Materials Corporation and Tarmac Virginia, Inc. near Richmond is barged down the James River to the Norfolk area. Shipments are also made by rail and truck to the western part of the state. Construction sand (concrete and masonry) is produced also from operations that crush and process sandstone. Sayers Sand Company in Smyth County produces construction sand from the Erwin Formation (Figure 5).

INDUSTRIAL SAND

J. C. Jones Sand Company mines industrial sand at Virginia Beach for use in foundry-casting applications and as a traction medium. Traction sand is produced also in Dickenson County by Howard L. Daniels Sand Company. Glass

sand is produced by Unimin Corporation near Gore, in Frederick County, from the Ridgeley Sandstone of Devonian age. CED Process Minerals Inc., Gore, recrystallizes sand purchased from U.S. Silica in a rotary kiln to produce cristobalite, which is marketed as a fine grit.

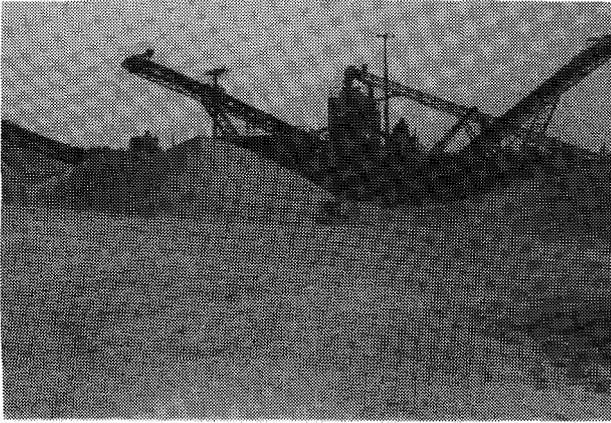


Figure 4. Stockpiles of sand and gravel at plant site of Aylett Sand and Gravel Corporation, along Mattaponi River, King and Queen County.

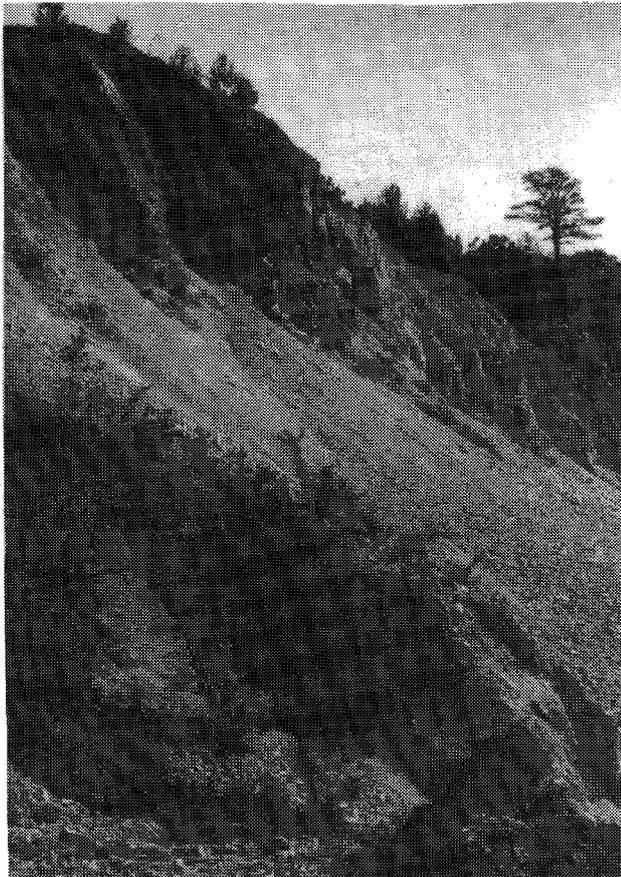


Figure 5. Sandstone quarry in the Erwin Formation of Sayers Sand Company, Smyth County.

STONE

CRUSHED

Crushed limestone, dolomite, sandstone, quartzite, granite, gneiss, diabase, basalt, greenstone, amphibolite, slate, "Virginia aplite," and marble, valued at more than 326 million dollars were produced in Virginia in 1988. Virginia was the fourth leading producer of crushed stone in 1988, behind Pennsylvania, Florida, and Texas.

Stone production has increased over the last two years due to legislation which took effect in January 1986, when additional taxes were initiated in Virginia to increase funding for mass transit, ports, airports, and highways. Additional tax dollars are being raised by increasing the state tax on gasoline by 2.5 percent, increasing the automobile titling tax by 1.0 percent, increasing state sales tax by 0.5 percent and increasing the state tax on aviation fuel by one cent per gallon. Eighty-five percent of the increased revenue (400+ million dollars per year) will be utilized in upgrading and building new roads in the state. Approximately 200 million dollars per year of additional federal funds will be utilized in this increased road building effort in the 1990s.

Limestone, dolomite, shale, and sandstone and quartzite producers are located in the Valley and Ridge and Plateau provinces in the western part of the State (Figure 6). Principal end uses of these products are for roadstone, concrete aggregate, asphalt stone, and agricultural applications. Mine safety dust (335,000 short tons in 1980) is produced in southwest Virginia from limestone. The more recent figures on safety dust have been combined with those for acid-water treatment material in the stone production total. Safety dust is used in

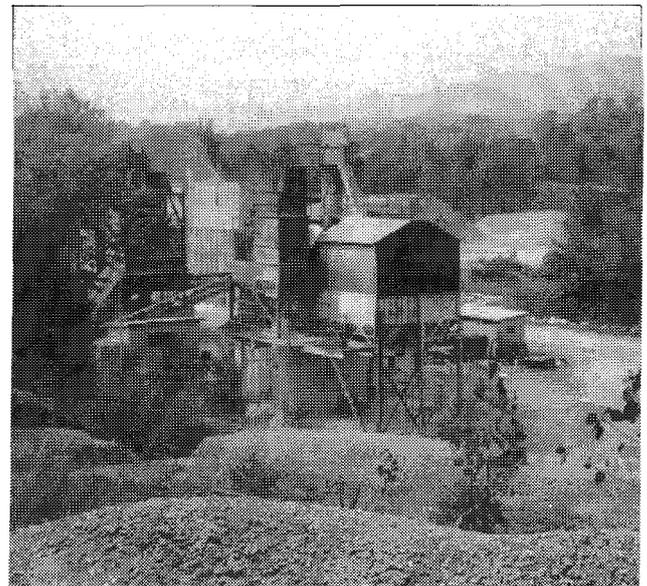


Figure 6. Looking south at limestone crushing equipment at the Broadway Plant of C. S. Mundy Quarries, Inc., Rockingham County.

coal mines to prevent explosions. The dust should contain less than 5 percent SiO_2 and 100 percent should pass through 20 mesh, with 70 percent passing through minus 200 mesh. Finely-ground dolomite and limestone is marketed also by several operations for use as a filler material.

Shale is excavated in Frederick and Rockingham counties for use as local roadstone and fill material. Sandstone and quartzite are quarried in Carroll, Culpeper, Pittsylvania, Rockbridge, and Wythe counties for the production of roadstone, concrete aggregate, asphalt stone, and manufactured fine aggregate.

Granite, gneiss, diabase, basalt, amphibolite, slate, and marble are quarried in the central part of Virginia. Major end uses of these materials are for roadstone, asphalt stone, and concrete aggregate. Waste slate is crushed near Arvonnia in Buckingham County by Solite Corporation. Solite uses the slate primarily for the production of lightweight aggregate. Production of crushed slate, as a by-product of dimension slate operations, increased as a result of local highway construction. Appomattox Lime Company, Inc. mines marble (Mt. Athos Formation) near Oakville in Appomattox County for agricultural lime.

Fines produced at granite quarries in the southern part of Virginia have been trucked to central Virginia for use as a low-grade fertilizer (D. Via, personal communication). Chemical analyses of granitic materials from Brunswick and Nottoway counties in the southern Piedmont province indicate K_2O (potash) percentages are greater than 10 percent. Potash silicates (orthoclase feldspar) common in igneous and metamorphic rocks release potash minerals upon weathering.

DIMENSION

Dimension stone production was valued at 2.9 million dollars in 1988. Slate, diabase, quartzite, and soapstone were quarried in the Piedmont province; slate was the leading stone type quarried, in terms of volume (cubic feet) and value. LeSueur-Richmond Slate Corporation mines slate from two quarries in the Arvonnia area of Buckingham County. Arvonnia slate production dates from the late 1700s when slate was quarried for use as roofing tile for the State Capitol in Richmond. Slate producers supply the building trade with a variety of products ranging from material for exterior applications, such as roofing tile and flooring, to interior uses such as flooring, hearths, and sills. Diabase for use as monument stone is produced by Virginia Granite Company in southern Culpeper County. Quartzite used as flagging material was extracted from two quarries, by Carter Stone Company in Campbell County, south of Lynchburg, and by Mower Quarries in Fauquier County, north of Warrenton (Figure 7). The New Alberene Stone Company, Inc. is quarrying soapstone from a quarry at Alberene and expects to open a new quarry site in late 1989. Their products include soapstone fireplaces, woodstoves, cooking ware, and other products of solid soapstone

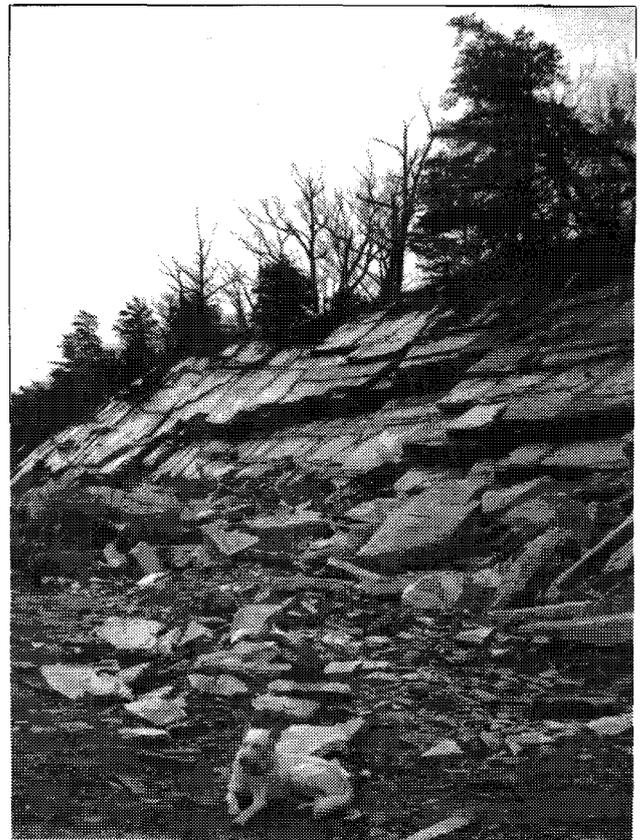


Figure 7. Quarry in quartzite of the Weverton Formation, operated in the Bull Run Mountains by Mower Quarries, Fauquier County.

SULFUR

Elemental sulfur is recovered from hydrogen sulfide gas by the Claus process during crude-oil refining by Amoco Oil Company. The refinery is adjacent to the York River, near Yorktown. Crude oil is heated in a furnace and fed under pressure into a cylinder where it vaporizes, expands, and condenses into liquid. Hydrogen sulfide is produced and is converted into elemental sulfur. About 50 short tons of sulfur is produced per day and is marketed to a buyer for use in fertilizer.

VERMICULITE

Virginia is one of three states in which vermiculite, a hydrated magnesium-iron-aluminum silicate, is mined. Virginia Vermiculite, Ltd. operates an open-pit mine and processing facility near Boswells Tavern in Louisa County. Vermiculite mined with a backhoe and front-end loader is trucked to the adjacent plant where pieces greater than four inches across are removed. They are washed and run through a rod mill to shear the vermiculite thin. Biotite, feldspar, and other impurities are removed by washing over a riffle table. The vermiculite is further concentrated by flotation cells, dewatered, dried in a rotary kiln, and screened to produce four basic sized products (Figure 8). Most of the crude vermicu-

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lite is shipped by rail in unexfoliated form to North Carolina, West Virginia, Ohio, and other eastern states. Uses for the exfoliated material include packing, insulation, lightweight aggregate, and potting material.

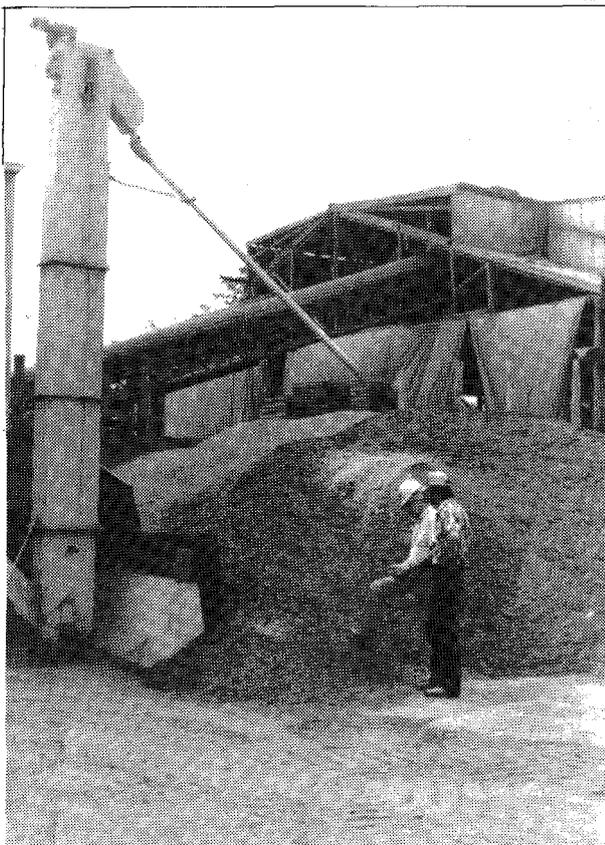


Figure 8. Stockpiles of sized vermiculite at Virginia Vermiculite, Ltd., Louisa County.

NEW GEOLOGIC MAP OF VIRGINIA'S COASTAL PLAIN RELEASED

A geologic map of the coastal plain of Virginia was released November 20, 1989 by the U.S. Geological Survey. Entitled "Geologic Map of the Coastal Plain and Adjacent Parts of the Piedmont, Virginia," the map was prepared cooperatively by the USGS and the Virginia Department of Mines, Minerals and Energy's Division of Mineral Resources, under the joint state-federal Cooperative Geologic Mapping Program (COGEOMAP). The program is part of an ongoing effort to map the rock formations and mineral deposits of Virginia at a scale of 1:250,000, or one inch equaling approximately four miles.

The new coastal plain map includes the area from the fall line on the west to the Atlantic Ocean on the east, and extends from North Carolina to Maryland. The area covered by the map contains major heavy mineral, quartz sand and gravel, and clay deposits, and the aquifers which supply much of the groundwater to Tidewater Virginia residents. Produced in full-color, the map will be useful for mineral exploration, hydrogeologic studies, and environmental assessments. The map will aid governmental bodies and public interest groups in their studies of changing socio-economic conditions such as land use, economic development, the environmental effects of development, and changing mineral markets. Data from this map and similar maps aid in mineral resource identification and development, urban/suburban development, and highway and engineering applications.

The map may be purchased from: Division of Mineral Resources, Box 3667, Charlottesville, VA 22903 for \$6.75 plus 4.5% sales tax for Virginia residents and \$1.00 postage or from U.S. Geological Survey, Map Sales, Box 25286, Denver, CO 80225 for \$6.75 plus \$1.00 postage.