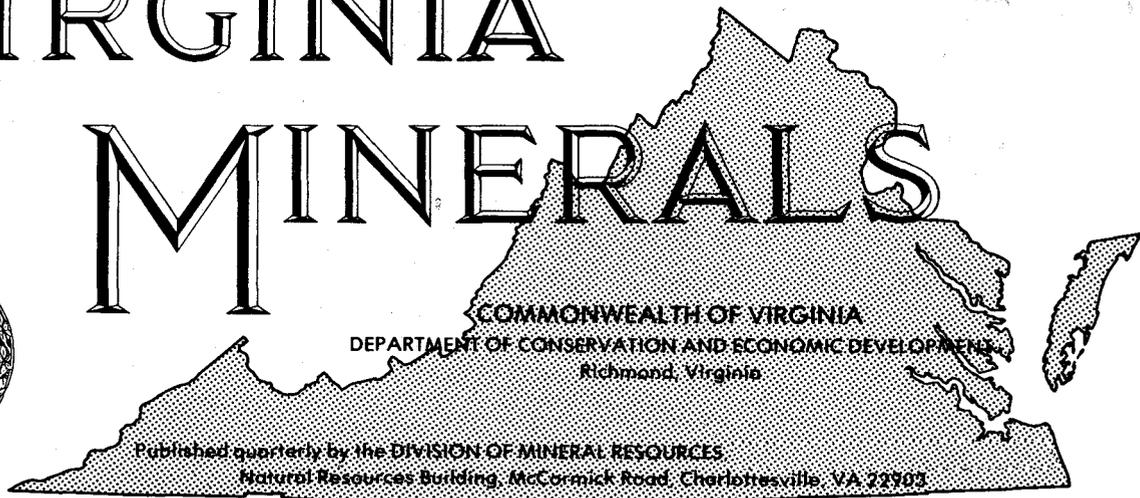


VIRGINIA

MINERALS



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VIRGINIA'S MINERAL INDUSTRY

by Palmer C. Sweet

Total mineral production in Virginia in 1982 was 1.71 billion dollars (Table); about 1.44 billion dollars consisted of coal and about 25 million dollars consisted of petroleum and natural gas. The remaining approximate 270 million dollars of noncoal production was from industrial rocks and minerals. The economic slowdown that developed during the later part of 1979 continues, creating a depressed market for a number of the State's commodities, especially those used by the construction industry.

Both residential and nonresidential construction, an important market for clay products, cement, sand and gravel, and stone have decreased significantly over the last several years. Highway construction, one of the largest markets for cement and crushed stone has fallen. Production of coal has kept the total percent of statewide mineral production highest in southwest Virginia.

In spite of the recessionary effects on the mineral industry, the State led the Nation in the production of kyanite; was the only producer of a feldspar marketed as "Virginia aplite;" and was one of three States mining vermiculite (White and Sweet, 1982). Several mineral commodities--iron oxide pigments, lithium carbonate, magnetite, manganese, mica, perlite, and vanadium pentoxide--were imported into the State and processed. Major mineral resources industries in Virginia include the following:

CEMENT

Virginia's cement industry consists of three companies, located in Warren and Botetourt counties and in the city of Chesapeake. The slowdown of Virginia Electric and Power Company's pumped storage project in Bath County in western Virginia and in building and highway construction has recently depressed the cement market in Virginia.

Riverton Corporation in Warren County produces masonry cement at their plant at Riverton. Crushed limestone (Athens Formation) is calcined, hydrated, and mixed with portland cement purchased from out-of-state sources. Sales are to building - supply dealers in Virginia and surrounding states. Lone Star Cement Inc. operates a plant west of Tinker Mountain in Botetourt County; this is the largest operation owned by Lone Star. The facility produces portland cement from locally mined limestone, shale, and sand and utilizes scrap iron from Roanoke Electric Steel Company. Clinker is manufactured in five coal-fired kilns and ground into cement. Three-quarters of the cement is sold to ready-mix companies and approximately 75 percent of the plant's production is shipped by rail. In January, 1982, 30 percent of the production employees were temporarily laid off; the majority were rehired by March, 1982.

Lone Star LaFarge, Inc., operates a cement manufacturing facility in the city of Chesapeake. The company purchases crushed quicklime (93-96 percent CaCO_3)

Table. Mineral Production in Virginia - 1982^{1/p}.

MINERAL MATERIAL	QUANTITY	VALUE (THOUSANDS)
Clays-----thousand short tons---	384	\$ 1,976
Coal(Bituminous) ^{3/} (\$35/ton)thousand short tons	40,481	1,416,845
Gem stones----- ^{3/} -----	NA	20
Lime-----thousand short tons---	675	31,721
Natural Gas ^{3/} (\$3.50/1000 cu. ft.)----- ----- ^{3/} -----million cubic feet---	6,880	24,084
Petroleum (crude) ^{3/} (\$30/bl.)----- ----- ^{3/} -----42-gallon barrels---	49,425	1,483
Sand and gravel ^{2/} -----thousand short tons---	6,700	31,600
Stone:		
Crushed-----thousand short tons---	36,660	151,700
Dimension-----thousand short tons---	4	1,130
Combined value of cement, feldspar, gypsum, iron oxide pigments (crude), kyanite, sand and gravel (industrial), talc (soap- stone), vermiculite-----	XX	53,830
Total-----	XX	\$1,714,389

p/ Preliminary. 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/ Excludes industrial sand; value included in "Combined value" figure.

3/ Va. Dept. of Labor and Industry

from northern Virginia. Alumina is purchased on the open market from several aluminum companies. Three types of calcium aluminate cement are produced: low Al_2O_3 (Fondu), medium Al_2O_3 (50-55 percent) and high Al_2O_3 (70-80 percent), including SECAR 71, and SECAR 80. Advantages of this cement over portland cement include rapid hardening and resistance to wear, high and low temperatures, and corrosion.

CLAY MATERIALS

Residual and transported clay, shale, and weathered phyllites and schists are used as raw material to produce almost one half billion bricks annually when all the plants are working at full capacity in Virginia.

The clay material industry in the western part of the State mines Paleozoic shales as a raw material, with the primary end-products being common and face brick. Tazewell Clay Products Company in Tazewell County extrudes clay to produce clay dummies used by the coal industry to tamp shot holes.

Lightweight aggregate is produced by four different companies in Amherst, Botetourt, Buckingham, and Pittsylvania counties. Weblite Corporation in Botetourt utilizes

shale from the Rome Formation to produce lightweight aggregate by the sintering process using semi-anthracite coal waste from the Valley Coal Fields near McCoy, Montgomery County, to fire the kilns. They utilize about 100 tons of coal per day with the weight of their product as low as 31 lb./cu. ft. for 5/16" -- 3/4" size. In order to produce lightweight aggregate, the Triassic shale in the Danville basin is used by Virginia Solite Company near Cascade, Pittsylvania County. Solite Corporation near Arvonion in northern Buckingham County utilizes the Arvonion slate of Ordovician age, and Amlite Corporation near Snowden in Amherst County mines the Hampton Formation (slate) of Cambrian age. The old Cold Spring kaolin deposit, located near Big Levels in Augusta County, was last operated in 1951. The area was originally operated as the Bare Bank mine in 1906. Limonite (49 percent iron) in veins was mined for use at the nearby Cotopaxi furnace. In 1912 prospecting began in a 50 foot vein of white clay near the bottom of the weathered Shady (Tomstown) Dolomite, discovered in a tunnel from the old iron pit. In 1918, Cold Spring Mining Company, a subsidiary of

Georgia Kaolin Company took over the operation, producing a paper filler. The material was marketed as "white clay" instead of kaolin because of the advantage in freight rates. From the early 1920's for a ten year period, about 100,000 short tons of white clay (valued at almost \$850 thousand) were produced. An old chemical analysis of the material indicates 39 percent+ Al_2O_3 . Clay material was mined from a 500' by 800' by 90' pit area by power shovels and transported into mine cars and onto a 2.7 mile long aerial tramway to the preparation plant near the railroad; the material was ground, dried, sized, and bagged in fifty pound bags. Ten to thirty carloads per day were produced over the years. In the early 1930's several veins (6'-20' thick) of clay with some impurities were mined with markets more toward oil paints, etc. for camouflage paint for wartime use.

Production in 1949 and 1950 was about 6200 short tons per year valued at \$85,000 per year. During the late summer of 1951, when the preparation plant burned, one carload (40 tons) of clay per day was being produced. The plant was not rebuilt because of deteriorating material grade, expense of processing, and low demand for the product. About 3,300 short tons of material, valued at almost \$49,000 was produced in 1951. Today there are large spoil piles of kaolinitic material present on the site; small pieces of manganese and occasionally bits of bauxite can be found. The pit is also water-filled in part. A marketable use for the material would be important to help alleviate potential siltation problems in the future and to reduce its visibility from Interstate 81 in the Shenandoah Valley of Virginia. In July, 1982, James River Limestone Co., Inc. applied to Augusta County for a special use permit. Plans are to utilize the material for various grades of filler material and as an ingredient in white cement.

Eastern clay producers mine residual clays, shale, Precambrian schists, and transported clays in Brunswick, Chesterfield, Greenville, Henrico, and Prince William counties; product produced is face brick.

During early 1981, a large occurrence of clay material sediments was discovered in the Walkerton area of King and Queen County in eastern Virginia. Plans were announced by Bennett Mineral Company to mine and process the clays to produce an industrial absorbent. Construction of a \$2 million plant which would employ 40 to 50 people initially, was begun in 1981. The facility opened in 1982 and uses wood wastes, instead of oil, as a plant fuel to dry the clay in a rotary kiln.

COAL

More than 40.4 million tons of bituminous coal were produced from the Southwest coal fields from Buchanan, Wise, Dickenson, Tazewell, Russell, Lee, and Scott counties from approximately 850 mines (Figures 1 and 2). More than 30 million tons were

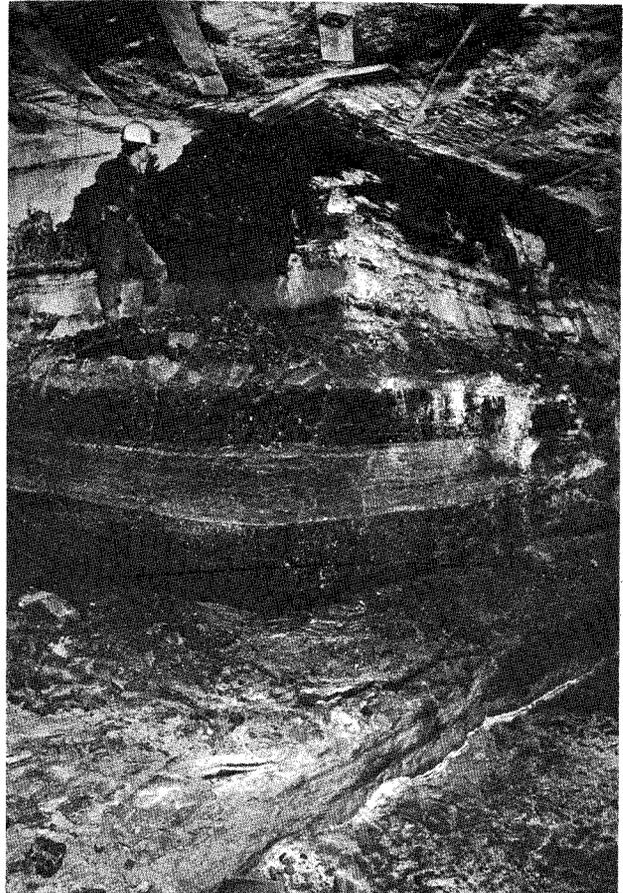


Figure 1. Underground coal mine (Wentz No. 1), Taggart coal seam - 3 splits, near Stonega, Wise County operated by Westmoreland Coal Company.

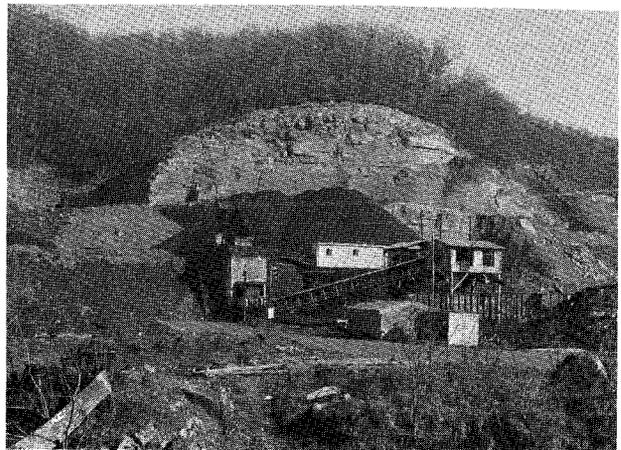


Figure 2. Coal tipple near Dorchester, Wise County, operated by Wise Coal Company.

produced from the Pocahontas No. 3, Jawbone, Splash Dam, and Blair coal seams. Coals from Virginia are used for metallurgical purposes, electric power generation, and residential heating. The majority of exported Virginia coal exits through the port of Hampton Roads.

FELDSPAR

In 1982, Virginia was the only state that produced a material marketed as "Virginia aplite", which has a chemical composition variation from true aplite (light-colored dike rock composed of quartz and orthoclase feldspar). It is sold to the glass industry to improve the workability of the molten material and impart a chemical stability to the finished glassware.

The Feldspar Corporation operates a mine and plant near Montpelier in Hanover County in east central Virginia. International Minerals and Chemicals (IMC) Corp. was operating at Piney River in Nelson County, mining in anorthosite (potassic feldspar as thin films and veinlets in albite (sodic) feldspar), until June 1980, when it closed because of a problem with a deteriorating grade of feldspar.

The Feldspar Corporation mines feldspar from pegmatites by open pit methods--ore is trucked to the plant adjacent to the mine for crushing, grinding, classifying, and drying. Processed feldspar is shipped by truck and rail to market, which includes the southern states, New Jersey, Pennsylvania, Ohio, and Indiana. Clay minerals are removed by gravity concentration and then electrostatic process and magnets remove the iron and other heavy minerals, which are stockpiled. In 1971, about six to eight thousand tons of heavy mineral sand were stockpiled, with equal amounts of apatite, rutile, ilmenite, and sphene. In 1973, heavy minerals were no longer separated, but were put into the tailings pond: in 1977, the heavy mineral sands were again being separated.

Clay and silt which should have a high percentage of kaolinite and mica have accumulated in these settling ponds. Material (accumulating at the rate of about 75-100,000 tons per year) was evaluated in the mid 1960's and found suitable for face brick and drain tile; material fires dark brown to gray. Fines may have the potential as a flux material for the brick industry.

Feldspar in Amherst County is marketed as aggregate by the Dominion Stone Plant, Inc. Fines, resulting from the crushing of anorthosite for use as road aggregate, are presently stockpiled. An attempt was made

to market this as roofing material, but transmission of light was too great and the material was unmarketable for this use.

Feldspar has been mined from several pegmatite bodies in the Piedmont province in the past, including those in Amelia and Bedford counties.

FERROVANADIUM

Chemstone Corporation, a subsidiary of Engelhard Corp., produces ferrovanadium (80 percent vanadium) at their Alloys Plant in Strasburg, Shenandoah County, in northern Virginia. Vanadium pentoxide, obtained from out-of-state is combined with aluminum scrap under high temperature to produce ferrovanadium, which is used as an alloying agent in the iron and steel industry to impart high strength. A residue from this process is an alumina concentrate (85-88 percent Al_2O_3 , several percent MgO and 1.5 percent vanadium).

GYPSUM

United States Gypsum Company operates a mine and plant in the southwestern part of the State and a plant in Norfolk on the Atlantic coast. The mine, an underground operation at Locust Cove, is in Smyth County and the plant at Plasterco is in adjacent Washington County.

The Locust Cove Mine is a slope entry, multilevel operation. Gypsum, occurring as isolated boulders in the Maccrady Shale, is mined by a modified underhand stoping system. Crude gypsum is trucked to the plant at Plasterco where it is made into wallboard.

The Norfolk operation located in the metropolitan area, receives crude gypsum from Nova Scotia in company-owned ships, and the gypsum is ground and calcined to produce wallboard and other gypsum-based products as well as a "land plaster" for the peanut industry. The Norfolk facility receives a few shipments of anhydrite from the Nova Scotia operations for sale to local cement manufacturers.

IRON OXIDE PIGMENTS

Virginia is one of four States producing iron oxide pigments. Hoover Color Corporation in Pulaski County in the southwestern part of the State, produces ocher, umber, and sienna. The company is the only operation in the United States producing sienna. Raw pigments are mined by open pit methods and trucked to the company plant at Hiwassee where the pigments are pulverized, dried, ground, graded, 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.

Blue Ridge Talc Company Inc., imports crude iron oxide pigments from a midwest supplier. The pigments are ground and calcined for use in paints, fertilizers, and cement and mortar coloring. Markets are domestic and foreign.

KYANITE

Kyanite, an aluminum silicate, has a maximum of 61.8 percent alumina and a minimum iron content of 0.16 percent; the first recorded production of kyanite, worldwide, was in Prince Edward County, Virginia, in the 1920's. Currently, the State produces approximately 45 percent of the world's kyanite. Calcined kyanite (mullite) is converted at 3,000+ degrees Fahrenheit; it expands depending on the grain size and the temperature. This may offset other raw materials that it is combined with and will not expand on further firings. The material is a super-duty refractory as it is, with a pyrometric cone equivalent of 36 to 37. Products, which are sold in 35, 48, 100, 200 and 325 mesh sizes, resist cracking, warping, slagging, and deformation from high temperature. Uses include products in the refractory, ceramic, glass, metallurgical, and foundry industries.

Kyanite Mining Corporation operates two surface mines and processing plants at Willis Mountain and East Ridge in Buckingham County in central Virginia. After mining, the ore is crushed, ground, screened, classified, and washed. Flotation is used to separate pyrite and silica impurities; magnetic separators remove remaining iron contaminants. The Willis Mountain plant processes raw kyanite; kyanite from the Willis Mountain mine used for mullite synthesis is 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 the plant in Pamplin, which is on the main line of the Norfolk and Western Railway.

Kyanite-bearing quartzite is quarried from an open pit, run through primary crushers, through a log washer to remove clay and on to classifiers to remove some kyanite. Material then passes through a rod mill and to a minus 35-mesh size, through froth flotation cells so that kyanite can be skimmed off. Resulting kyanite is de-watered and then dried; temperature of drier converts sulfides to oxides. Through a cooler with an atmosphere deficient in air, ferric oxide

(Fe_2O_3) is converted to ferrous iron (Fe_3O_4) or magnetite, which is then removed by separators. Material is stockpiled; potential uses are always being investigated.

Approximately 40 percent of the output is shipped through the port of Hampton Roads to worldwide customers. The company produces approximately 90,000 tons per year (Dixon, 1980). The company closed their mine at the Baker Mountain in Prince Edward County because of the transportation costs and the mine has been reclaimed. The company also produces a by-product sand from kyanite processing. Sales are for golf courses, masonry, concrete, and other applications.

LIME

Lime sales ranked behind stone in Virginia in 1982. Over the past 10 years, lime production has added over \$200 million to the State's economy, although lime sales have slumped recently due to the slowdown in the steel industry.

Virginia's lime industry is situated in Frederick, Giles, Shenandoah, and Warren counties. In northern Virginia, three companies, Genstar Stone Products Company, W. S. Frey Company, Inc., and Chemstone Corporation (Figure 3) quarry and calcine the high-calcium, New Market Limestone, and one company, Riverton Corporation, quarries the Athens Formation. Two companies in Giles County (Gold Bond Building Products and Virginia Lime Company) on the West Virginia border operate underground mines in the Five Oaks Limestone. Principal sales are to the paper and steel industries. The paper industry uses lime for regeneration of sodium hydroxide and



Figure 3. High-calcium lime plant of Chemstone Corporation, a Subsidiary of Engelhard Corp., near Strasburg in Shenandoah County.

the neutralization of sulfate water, a byproduct of paper manufacture. Lime is used by the steel industry to control slagging, for water purification, and in neutralization of acid mine water (over the last couple of years). It is also used for mason's lime, sewage treatment, and for agriculture.

LITHIUM

Foote Mineral Company processes lithium carbonate from Spruce Pine, North Carolina along with calcium hydroxide from various sources to produce lithium hydroxide at their Sunbright plant in Scott County in southwestern Virginia. Lithium hydroxide is used in multipurpose grease applications. In the past, limestone from an underground mine at the site was utilized and a calcium carbonate precipitate remained. The material remains on the site and may be a valuable waste resource; approximate analysis is 43-50 percent CaCO_3 , 3-6 percent Ca(OH)_2 , and 40-48 percent water.

MAGNETITE

Reiss Viking Corporation in Tazewell County in southwestern Virginia processes out-of-state magnetite for use in coal preparation. The material is marketed in New York and Pennsylvania.

MANGANESE

Union Carbide Corporation, Battery Products Division, operates a manganese processing facility in the city of Newport News on the Atlantic coast. Manganese ore, imported from South Africa and Gabon, is dried, crushed, and 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 on the coast. Crude mica is purchased through New York brokerages, from Madagascar and India. Asheville Mica Co. utilizes the imported mica to produce fabricated plate-mica; Mica Company of Canada uses splittings from Asheville to produce reconstituted plate-mica. Mica has been produced in the past from pegmatite bodies in several counties, including Amelia, Henry, and Powhatan.

NATURAL GAS

Natural gas production in 1982 was 6,880,116 Mcf from 294 wells in Buchanan,

Dickenson, Rockingham, Russell, Tazewell, and Wise counties. Seventy new wells (44 development and 26 exploratory) were drilled in 1982; these wells were drilled in nine counties, with the deepest, a dry hole, being drilled by ARCO Oil and Gas Company in Lee County, with a total depth of 13,252 feet.

ORNAMENTAL AGGREGATE

Several materials have been utilized for ornamental aggregate in past years. Vein quartz has been produced in Albemarle, Buckingham, Fluvanna, Greene, and Rappahannock counties; quartz pebbles have been produced from Caroline County. Dolomite and quartzite from Botetourt and Rockbridge counties are presently produced and marketed as exposed aggregate materials. Rock materials to be used in terrazzo include black limestone (Edinburg Formation) in the Valley and Ridge province and greenstone in the Piedmont province.

PERLITE

The Manville Corporation operates a plant at Woodstock, Shenandoah County in Northern Virginia to expand perlite (volcanic glass with high water content and "onionskin" appearance) shipped by rail from Grants, New Mexico. Expanded perlite is used in the manufacture of roof insulation board marketed throughout the eastern United States. Although sales were off slightly, as compared to the previous year, product demand in 1982 for roofing installation and maintenance was strong.

PETROLEUM

Crude oil production, from the Rose Hill and Ben Hur fields in Lee County totaled 49,425 barrels of petroleum in 1982. More than 45,300 barrels were produced from the Ben Hur field with more than 24,000 barrels from three wells of APACO Petroleum, Incorporated. Thirty new wells (twenty-six development and four exploratory) were drilled in 1982, all in Lee County. Refineries paid an average of \$30/barrel for Virginia crude oil in 1982.

POTASH

Potash is used mainly in the agriculture industry; the mineral sylvite contains approximately 63 percent K_2O and the mineral kainite contains almost 19 percent K_2O . Potash silicates (orthoclase feldspar) common in igneous and metamorphic rocks release potash minerals upon weathering. Fines from crushing operations in these types of rocks may provide low grade potassium. Some granite fines near

the North Carolina border have been trucked to central Virginia for low-grade fertilizer (D. Via, personal communications). Chemical analyses for granitic materials from Brunswick and Nottoway counties in the southern Piedmont province indicate K_2O percentages higher than 10 percent.

Greensand (glaucconitic marls) materials are located in the Coastal Plain province of Virginia, and are exposed along the Potomac, Rappahannock, Pamunkey, and James rivers. The glauconite (hydrous silicate of iron and potash) makes the material potentially valuable for fertilizer from the amount of potash contained which is to up 10 percent in the purer greensands. Material may also be important in ion exchange with toxic materials around landfills, waste dumps, etc.

SAND AND GRAVEL

Historical cost data for sand and gravel in Virginia were compiled in a report by the Division of Mineral Resources (Sweet, 1978). Construction sand and gravel producers probably produced the majority of the material in 1982. Large tonnages of construction sand and gravel, produced east of Fredericksburg, are shipped by rail into the northern Virginia-Washington, D. C., market area. A large portion of the production by Sadler Materials and Lone Star Cement, Inc., is barged along the James River below Richmond to the Norfolk area and shipments are also made by rail and truck to the western part of the State.

Industrial Sand

J. C. Jones Sand Company mines industrial sand at Virginia Beach, for use in foundry-casting applications and as a traction medium. Glass sand is produced by Unimin Corporation near Gore in Frederick County, from the Ridgeley Sandstone of Devonian age. CED Process Minerals Inc. near Gore, Virginia in Frederick County recrystallized purchased sand in a rotary kiln to produce cristobalite, which is marketed as a fine grit. The Tuscarora sandstone is quarried near Saltville in Smyth County; Saltville Silica Inc. produces the material which is marketed to the glass industry in Tennessee.

STONE Crushed

Stone operators mine and process about \$152 million worth of limestone, dolomite, sandstone, quartzite, granite, gneiss, diabase, basalt, amphibolite, slate,

"Virginia aplite," marble, and marl. Limestone, dolomite, and sandstone producers are located in the Valley and Ridge, and Plateau provinces in the western portion of the State. Principal end uses were for road construction, concrete aggregate, asphalt stone, and agricultural application. Glass grade dolomite which is low in iron, sulfur, phosphorus, and carbon is produced from the Honaker Dolomite of Cambrian age. It is produced by Piedmont Mining Corporation, located on the site of Tri State Lime Company, Scott County on State Road 694 just north of the Virginia - Tennessee state line. Mine safety dust (335,000 short tons in 1980) is produced at six quarries in southwest Virginia. Dust is spread in coal mines to prevent explosions; material should contain less than 5 percent SiO_2 and 100 percent should pass 20 mesh with 70 percent minus 200 mesh. Finely ground dolomite - limestone is also marketed by several operations for use as a filler material.

Tailings from the processing plant of New Jersey Zinc Company at Austinville, Wythe County consist of five to six million tons of approximately 20 percent $MgCO_3$ (minus 180 mesh) material that is in a wet to dry condition. Lead and zinc have been mined from the Shady Dolomite of Cambrian age since 1756 in this area. Possible uses may be to remove the material in its slurry form and to market it as dolomitic limestone, or dry for use as mine safety dust. Approximately 5 percent iron content from pyrite in the original rock would be a problem for pure material use.

Sandstone production was for roadstone, concrete aggregate, asphalt stone, and manufactured fine aggregate. Quartzite from the Antietam Formation is produced by Locher Silica Company in Wythe County and marketed as metallurgical flux. Similar material has been produced in Rockbridge County in the past.

Granite and gneiss, diabase, basalt, amphibolite, slate, and marble are produced in the Piedmont/Blue Ridge provinces which include much of the central portion of Virginia. Granite and gneiss output totaled 18.2 million tons in 1980 (Figure 4). Major end uses were for roadstone, asphalt stone, and concrete aggregate. Diabase, basalt, and amphibolite production (non-polishing aggregate) totaled about 6 million tons from four counties.

Slate is mined and crushed by three companies in Buckingham County and one in Amherst County. Two of the companies, Amlite Corporation and Solite Corporation also expand slate for lightweight aggregate

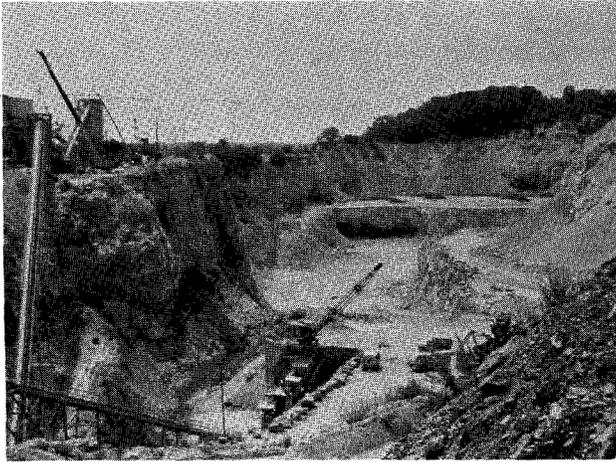


Figure 4. Quarry of Luck Stone Corporation, Boscobel Plant in Petersburg Granite at Manakin, Goochland County.



Figure 5. Dimension stone quarry in quartzite of Weverton Formation in Bull Run Mountains, Fauquier County (circa. mid-1960's).

production. Crushed slate production, a by product of past dimension slate operations, increased as a result of local highway construction.

One company, Appomattox Lime Company, Inc., mines a Precambrian marble (Mt. Athos Formation) near Oakville in Appomattox County for agricultural lime. Sales, principally to the eastern coastal areas of Virginia and North Carolina, were severely curtailed because of drought conditions.

One company in Frederick County near Winchester mines marl for agricultural applications. The material is mined with a frontend loader, disked, and dried before it is sold.

Dimension

Dimension stone production (\$1.1 million in 1982) of diabase, slate, granite, quartzite, and soapstone was reported from quarries in the Valley and Ridge and Piedmont provinces. Slate was the leading stone type produced, in terms of cubic feet and value. Two companies, Arvonja-Buckingham Slate Corporation, Inc., and LeSueur-Richmond Slate Corporation, quarried slate in the Arvonja area of Buckingham County. Arvonja slate production dates from the late 1700's when slate was quarried for 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 hearths and sills. Diabase is produced for use as monument stone at Virginia Granite Company in southern Culpeper County.

Granite is presently produced from one quarry in Hanover County, while quartzite is produced as flagging material at three quarries, one in Campbell County, south of Lynchburg and two in the Bull Run Mountains in Fauquier County from the Weverton Formation of Cambrian age (Figure 5).

SOAPSTONE

Alberene Stone Company produces soapstone for speciality laboratory materials and also as panels for the woodstove industry; a by-product is material for flagstone (Figure 6).

SULFUR

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

TALC

Blue Ridge Talc Company, Inc., in Franklin and Henry counties in southcentral Virginia, produces talc for foundry applications. Talc, in a talc-chlorite-dolomite schist is mined by open pit methods, trucked to the company's mill on the Franklin-Henry county border and ground for foundry use as a releasing agent in

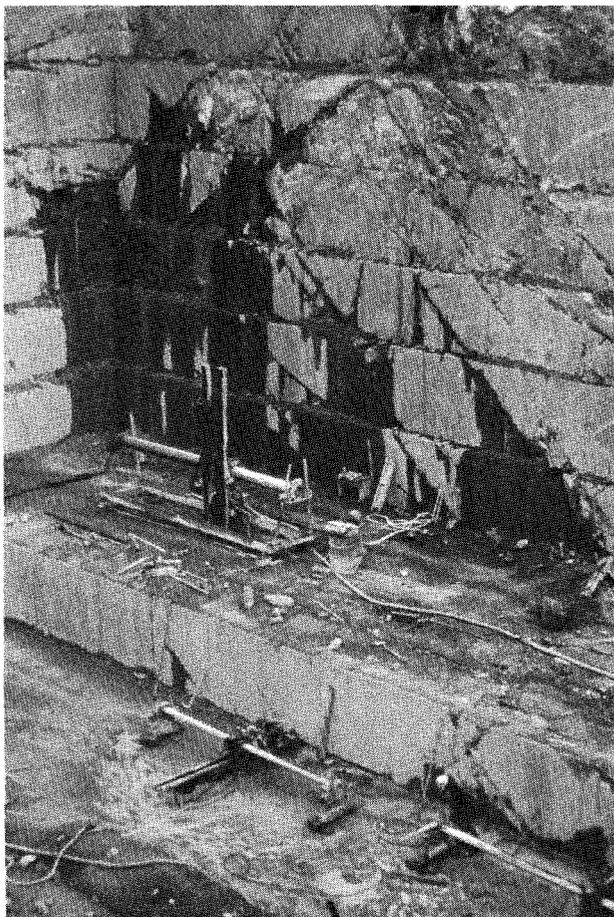


Figure 6. Soapstone quarry near Schuyler, Nelson County (circa. mid-1960's).

mold coatings. Much of the ground talc is shipped to foundries in the western Pennsylvania area. Material was formerly used in insecticides. Sales have recently been down because of the depressed state of the steel industry.

VERMICULITE

Virginia is one of three States that mines vermiculite, a hydrated magnesium - iron - aluminum silicate. Virginia Vermiculite, Ltd., operates an open pit mine and processing facility near Boswells Tavern, in Louisa County northwest of Richmond. Material, mined with a backhoe and frontend loader, is trucked to the adjacent plant where desliming, flotation, drying, and screening are used to produce four basic size products. Most of the crude vermiculite 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 concrete, and cement aggregate, and for use as potting material.

REFERENCES

- Dixon, G. B., Jr., 1980, Kyanite mining in Virginia: Virginia Division of Mineral Resources, Virginia Minerals, vol. 29, no. 1, p. 12.
- Edmundson, R. S., 1938, Barite deposits of Virginia: Virginia Division of Mineral Resources Bull. 53, 85 p.
- Pharr, R. F., 1965, Diatomaceous sediments: Virginia Division of Mineral Resources Virginia Minerals, vol. 11, no. 3, p. 25-31.
- Roberts, J. K., 1942, Annotated geological bibliography of Virginia: Richmond, Virginia, 726 p.
- Sweet, P. C., 1978, Sand and gravel resources in Virginia, in Contributions to Virginia geology: Virginia Division of Mineral Resources Publication 7, pp. 67-74.
- Watson, T. L., 1907, The mineral resources of Virginia: Lynchburg, Virginia, J. P. Bell Co., 618 p.
- White, D. H., Jr. and Sweet, P. C., 1982, The mineral industry of Virginia: Washington, D. C., U. S. Bureau of Mines, preprint.

NEW PUBLICATIONS

Publication 43

Relationship of Stratigraphy to Occurrences of Oil and Gas in Western Virginia by D. C. Le Van and E. K. Rader is a multicolor sheet showing six geologic columns with formational units and associated oil and gas production or showings (\$6.00).

Directory of the Mineral Industry of Virginia

Directory of the Mineral Industry of Virginia by Palmer C. Sweet has listings of active companies and processing plants (exclusive of coal mines) 28 pages and map (\$4.00).

Mineral Industries and Resources of Virginia

Mineral Industries and Resources of Virginia by Palmer C. Sweet indicates active producers and describes their raw materials and products on a 1:500,000 (30 x 60 inches) colored map (\$8.00).

GEOLOGICAL DISPLAYS

IN VIRGINIA*

Mark P. Phillips and Sharon R. Brennan

<u>Location</u>	<u>Admission Hours</u>	
<u>Blacksburg</u>		
Virginia Polytechnic Institute & State Univ. Dept. of Geological Sciences Derring Hall, Room 2062 rocks, minerals, gems, meteorites, fossils, fluorescent minerals, seis- mograph, dinosaur model, artifacts (703) 961-6521	Monday - Friday 9 a.m.-5 p.m.	
<u>Charlottesville</u>		
University of Virginia Environmental Sciences Department Clark Hall (first and second floor halls) rocks, minerals, fossils, fluo- rescent minerals, radioactive minerals (804) 924-7761	Everyday 8 a.m.-10 p.m.	
Virginia Division of Mineral Resources McCormick Road, Univ. of Virginia grounds Natural Resources Building rocks, minerals, maps, and Division geological publications for sale (804) 293-5121	Monday - Friday 8 a.m.-4:45 p.m.	
<u>Emory</u>		
Emory and Henry College Miller Hall rocks, minerals, gems, arti- facts, fluorescent minerals (703) 944-3121	Everyday 8 a.m.-10 p.m.	
<u>Farmville</u>		
Longwood College Department of Natural Sciences Science Museum rocks, minerals (804) 392-9351	Monday - Friday 8 a.m.-5 p.m.	
<u>Fredericksburg</u>		
Mary Washington College Department of Chemistry and Geology Combs Science Hall rocks, minerals, fossils, soils, sands (804) 899-4064	Monday - Friday 8 a.m.-5 p.m.	
<u>Harrisonburg</u>		
Eastern Mennonite College Dr. Ralph Hostetter Museum of Natural History Science Center Building rocks, minerals, gems, fossils, artifacts, fluorescent minerals (804) 433-2771		Open by appointment
<u>Lexington</u>		
Washington and Lee University Department of Geology Howe Hall rocks, minerals, fossils (703) 463-9111		Monday - Friday 9 a.m.-6 p.m.
<u>Millboro</u>		
Douthat State Park Visitor Center rocks, minerals, fossils of the park (703) 862-7200		June - Labor Day 8 a.m.-10 p.m.
<u>Montross</u>		
Westmoreland State Park Visitor Center fossils of the park (804) 493-8821		Memorial Day - Labor Day 9 a.m. - 5 p.m.
<u>New Market</u>		
George Washington National Forest Massanutten Visitor Center Geology Interpretive Trail (703) 740-8310		April - October 8 a.m.-4:30 p.m.
<u>Newport News</u>		
Peninsula Nature and Science Center 524 J. Clyde Morris Blvd. rocks, minerals, fossils (804) 595-1900		Monday - Saturday 9 a.m.-5 p.m. Sunday: 1 p.m.-5 p.m. Thursday: 7 p.m.-9 p.m. also
<u>Norfolk</u>		
Old Dominion University Department of Geophysical Sciences Technology Building, 47 47th Street and Hampton Blvd. rocks, minerals, fossils, crystal structure, weather		Monday - Thursday 8 a.m.- 10 p.m. Friday: 8 a.m.-6 p.m.
<u>Radford</u>		
Radford University Department of Geology Curie Hall (first floor) rocks, minerals, gems (703) 731-5000		Monday - Friday 9 a.m.-5 p.m.
<u>Richmond</u>		
Science Museum of Virginia 2500 West Broad Street Discovery Room rock, minerals, fossils, artifacts (804) 257-0000		Monday - Saturday 10 a.m.-5 p.m. Sunday: 1 p.m.-5 p.m. \$1.50 admission

University of Richmond
Lora Robins Gallery of
Design from Nature
Boatwright Library (Level B-2)
rocks, minerals, gems, fossils,
fluorescent minerals,
meteorites, artifacts, shells,
corals, radioactive minerals,
mine suites
(804) 285-6215

Monday - Friday
8 a.m.-4:30 p.m.
(All Day)
Saturday: 9-4:30
Sunday: 12-4:30

Roanoke

Roanoke Valley Science Museum
2323 Overlook Road NE
minerals
(703) 563-2891

Monday - Friday
9 a.m.-5 p.m.
Saturday: 10a.m.-5p.m.
Sunday: 2p.m.-5p.m.

Stuart

Fairy Stone State Park
Visitor Center
rocks, minerals, history
of Park's
iron mine
(703) 930-2424

Memorial Day - Labor Day
9 a.m. - 5 p.m.

Troutdale

Mount Rogers National
Recreational Area
Visitor Center
rocks of area, relief map
(703) 783-5196

Memorial Day - Labor Day
8 a.m.-6 p.m.
Off Season
8 a.m.-4:30 p.m.

Volney

Grayson Highlands State Park
Visitor Center
rocks of area
(840) 579-7142

June - October
10 a.m.-6 p.m.

Waterlick

George Washington National
Forest
Elizabeth Furnace Recreation
Area
Geology Interpretive Trail
(703) 740-8310

April - October

Waynesboro

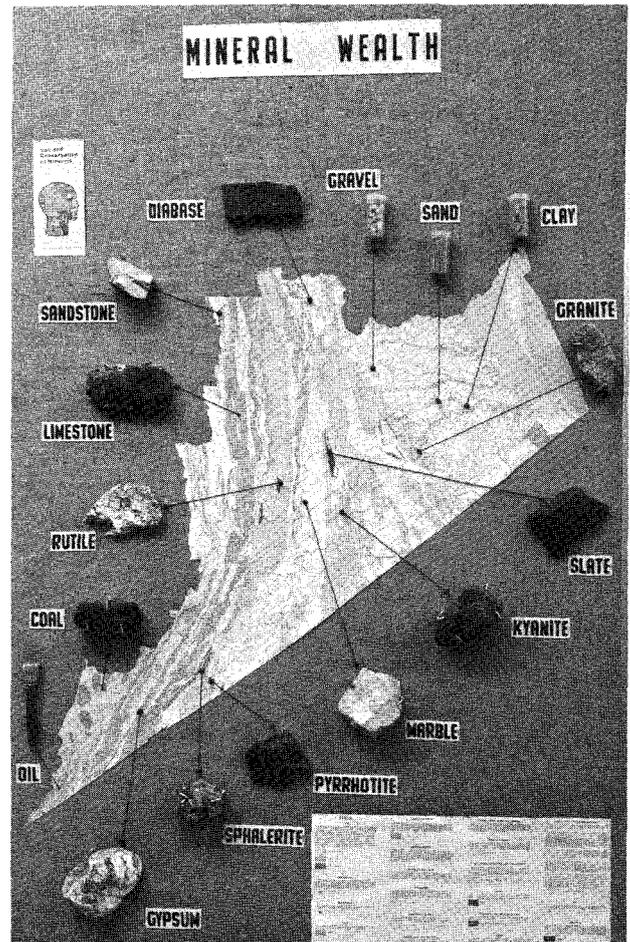
Blue Ridge Parkway
Greenstone overlook between
mile posts 8 & 9
Geology interpretive trail

All year except
when drive closed
by snow or ice

Williamsburg

College of William and Mary
Department of Geology
Small Hall (second floor)
rocks, minerals, fossils,
fluorescent minerals, mine
suites, radioactive minerals
(804) 253-4204

Monday - Friday
8 a.m.-5 p.m.



Typical examples of the geological displays which are located in the Division of Mineral Resources, Charlottesville, Virginia.

*When colleges are not in session display rooms may be closed.

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OIL AND GAS NEWS

Drilling for oil and gas in Virginia continues to increase despite a worldwide gas and oil surplus. Drilling in 1981 totaled 30 new wells. The total number of wells completed in 1982 was 100, representing an increase of 233 percent over the previous year. Seventy-five of these 100 wells were completed as producers. Twenty-five wells were dry. Development drilling achieved a 90 percent success ratio while exploratory drilling was 28 percent.

The number of wells drilled in each county for 1982 are as follows:

<u>County</u>	<u>Number of Wells</u>
Lee	32
Dickenson	17
Buchanan	15
Wise	14
Chesterfield	10
Scott	4
Washington	4
Rockingham	3
Botetourt	1

Funds for exploratory drilling by companies in 1983 are allocated primarily to areas where there is a chance of high success, and less in unproven areas where drilling is speculative involving high risks.

There are three major interstate natural gas transmission companies in Virginia. These are as follows:

1. Columbia Gas Transmission Corporation delivers gas to distribution companies in northern and western parts of the state.
2. Transcontinental Gas Pipeline Corporation crosses the central portion of Virginia and supplies gas to several distribution companies.
3. East Tennessee Natural Gas Company delivers gas to distribution companies in close proximity to its main line system from Bristol to Roanoke.

Liquified natural gas plants have been built at Chesapeake, Roanoke, and Lynchburg. Liquified petroleum gas is available from a major oil refinery at Yorktown, the Dixie Pipeline Terminal at Apex, North Carolina, and from a deep water, LP-gas terminal located at Chesapeake.