VIRGINIA MINERALS

COMMONWEALTH OF VIRGINIA
DEPARTMENT OF CONSERVATION AND ECONOMIC DEVELOPMENT
Richmond, Virginia

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THE MINERAL INDUSTRY OF VIRGINIA IN 1964[1]

Value of mineral output in Virginia in 1964 was $237 million, 4 percent more than in 1963, and a new high. More than one-half of the mineral commodities produced gained in both output and value. Slight to substantial gains were made, or new records set, in output for commodities supplying the construction industries, with the exception of gypsum and masonry cement. Production and value of stone and kyanite rose to new highs. Records were also established in tonnage of coal and sand and gravel mined and in value of clay produced. Accelerated highway and other construction was a prime influence in increases in quantity of stone, sand and gravel, portland cement, and clays. Fifty-two percent of the total value of mineral production in Virginia was contributed by fuels (53 percent in 1963), 45 percent by nonmetals (44 percent in 1963) and 3 percent by metals, the same as in 1963.

Mineral Fuels

Coal (Bituminous).—Bituminous-coal output in 1964 set a new production record of 31.7 million tons, a 4-percent increase over the former record year of 1963. Production data includes coal produced from deposits within Virginia, whether the mine opening is or is not inside the State boundary, and excludes operations producing less than 1,000 tons per year. Consequently, production data in this volume published by the Federal Bureau of Mines may differ somewhat from that published by the State. The value of the output increased 2 percent over that of 1963 and was only 2 percent below the record high value ($126 million) of 1961. The average value per ton, however, continued to decline, and was $3.89 compared with $3.96 in 1963, $3.99 in 1962, and $4.16 in 1961, reflecting the continuous trend toward modernization and cost reduction in the bitmuinous coal industry.

A wide variety of coals were produced, including high- and low-volatile types for domestic and industrial heating, industrial power, coke feed-

Table 1 — Value of mineral production in constant 1957-59 dollars (millions).

Year	Value	Year	Value
1940	$114	1953	$155
1941	148	1954	138
1942	156	1955	175
1943	152	1956	210
1944	162	1957	223
1945	131	1958	205
1946	129	1959	231
1947	159	1960	214
1948	150	1961	234
1949	123	1962	234
1950	145	1963	244
1951	164	1964	252
1952	169		

[1] Data presented here are from a preprint of the 1964 Minerals Yearbook, Volume 3, Area Reports, prepared by the Bureau of Mines, U. S. Department of the Interior, under a cooperative agreement with the Virginia Division of Mineral Resources for collecting information on all minerals except fuels.

Table 2. — Mineral production in Virginia[1]

Mineral		1963 Quantity	1963 Value (thousands)	1964 Quantity	1964 Value (thousands)
Clays	thousand short tons	1,410	$1,558	1,440	$1,614
Coal (bituminous)	do	30,531	120,972	31,654	123,123
Gem stones		(2)	6	(2)	6
Lead (recoverable content of ores, etc.)	short tons	3,500	756	3,857	1,010
Lime	thousand short tons	639	8,058	780	9,781
Natural gas	million cubic feet	2,085	488	1,609	479
Petroleum (crude)	thousand 42-gallon barrels	3	(4)	6	(4)
Sand and gravel	thousand short tons	10,400	17,752	10,588	13,722
Soapstone	short tons	3,696	9	3,775	9
Stone	thousand short tons	27,653	45,529	30,407	52,153
Zinc (recoverable content of ores, etc.)[3]	short tons	23,988	5,725	21,004	5,700
Value of items that cannot be disclosed: Aplite, portland cement, masonry cement, feldspar, gypsum, iron ore (pigment material), kyanite, petroleum (crude), salt, titanium concentrate (ilmenite and rutile), and values indicated by footnote 4			28,211		29,818
Total			229,064		237,415

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Weight not recorded.
[3] Recoverable zinc valued at the yearly average price of prime western slab zinc, East St. Louis market. Value established after transportation, smelting, and manufacturing charges have been added to the value of ore at the mine.
[4] Figure withheld to avoid disclosing individual company confidential data.

stock, and a small quantity of semianthracite for domestic heating. Coal was also exported in sizable tonnage. Over two-fifths of the Virginia coal tonnage was produced by one county—Buchanan; four of the eight southwestern counties in which coal was mined—Buchanan, Dickenson, Wise, and Russell—accounted for 98 percent of the total output, compared with 97 percent in 1963. Underground production comprised 88.7 percent of the total; strip-mine output, 7.7 percent; and auger-mine production, 3.6 percent.

Table 3. — Coal (bituminous) production and value, by counties (thousand short tons and thousand dollars).

County	1963 Quantity	1963 Value[1]	1964 Quantity	1964 Value[1]
Buchanan	13,141	$50,435	14,503	$57,379
Dickenson	8,257	32,741	7,728	28,510
Lee	502	2,065	471	1,826
Montgomery	13	45	8	29
Russell	1,904	8,807	1,899	7,317
Scott	3	11	4	17
Tazewell	469	1,530	237	787
Wise	6,242	25,338	6,804	27,258
Total	30,531	120,972	31,654	123,123

[1] Value received or charged for coal, f.o.b. mine, including selling cost. (Includes value for coal not sold but used by producers, such as mine fuel, and coal coked as estimated by producer at average prices that might have been received if such coal had been sold commercially.)

The number of mines in Virginia totaled 1,398, 6 percent fewer than in 1963. Underground mines declined 7 percent to 1,298, while the number of strip and auger mines rose to 44 and 56, respectively, compared with 38 and 51 in 1963. Mechanically loaded coal amounted to 45 percent of the total underground output; 73 percent of the mechanically loaded tonnage was by 127 mobile loading machines, 6 more than in 1963. Thirty-one continuous mining machines were also used. Of the total coal mined, 42 percent was mechanically cleaned in 28 cleaning plants. Wet washing other than with jigs was the principal method of cleaning, accounting for 79 percent of the cleaned coal. Thirty-six percent of the total coal mined was crushed. Seven percent of the total coal produced was treated with dust-allaying and antifreezing preparations, of which oil predominated (98 percent).

Coke.—Beehive-coke was produced in six plants in 1964, four in Wise County, one in Buchanan County, and one in the city of Norton. As in 1963, there were 877 beehive ovens operational, of which 390 were rectangular- or horizontal-bed internal-combustion ovens. Machine-drawn ovens

numbered 756, and the number of hand-drawn ovens was 121. There were no slot ovens operated and no byproduct recovery was made. Production of coke was about 25 percent greater than in 1963, and average value per ton increased $0.62 to $14.99.

Petroleum and Natural Gas.—Total gas production was 1,882 million cubic feet, including both marketed gas and that used for miscellaneous purposes. This is a decline of 23 percent from 1963. Buchanan County led in output, producing 1,285,626 thousand cubic feet of gas. Dickenson and Tazewell counties produced 584,030 and 12,124 thousand cubic feet of gas, respectively.

The output from Buchanan and Tazewell counties was delivered to the pipelines of Hope Natural Gas Co. and the Atlantic Seaboard Corp.; production from Dickenson County was delivered to the lines of the Kentucky-West Virginia Gas Co. There were no natural-gas-processing plants operating in Virginia as of January 1, 1964.

Natural-gas reserves were estimated by the American Gas Association to total 32,180 million cubic feet, an increase of 877 million cubic feet, or almost 3 percent more than the estimated reserve at the end of 1963. As of December 31, 1964, there were 103 producing gas wells in Virginia. Of interest was the drilling of seven successful gas wells in Tazewell County. The wells were drilled through Mississippian Berea sandstone to an average depth of 5,250 feet. The combined open flow after fracture was 41 million cubic feet.

Oil production in Lee County (Rose Hill and Ben Hur fields) increased from 3,466 barrels in 1963 to 5,828 barrels in 1964, a gain of 68 percent. Eight wells were oil productive at yearend.

A development oil well was drilled in Lee County, offsetting the well in which there had been a small amount of oil discovered in 1963. It has been reported that this well was shut down at 2,000 feet. The Shell Oil Co. drilled a wildcat test on the farm of L. S. Bales in Lee County, which was spudded December 7, 1964. The well was drilled to a total depth of 8,020 feet before being plugged and abandoned in January 1965. It has been reported that oil and gas leases on 575,000 acres were held by the major oil companies.

The American Oil Co. operated a skimming, cracking, and coking plant at Goodwin Neck, York County. The plant had a crude-oil capacity of 38,000 barrels, a catalytic-cracking capacity of 22,800 barrels, a thermal-cracking capacity of 13,700 barrels, and a reforming capacity of 6,800 barrels, all per day.

Nonmetals

Aplite.—Output and value of aplite for glass manufacture increased in 1964. Aplite was also quarried and crushed for highway use. Production was from Hanover and Nelson counties.

Cement.—Shipments of portland cement increased moderately in 1964 (9 percent), and total value increased 6 percent, but unit value decreased slightly. Masonry-cement shipments decreased slightly (1 percent) in both quantity and total value; unit value increased slightly. Plant capacity for producing portland cement remained essentially unchanged during the year. Two plants used the dry process of manufacturing portland cement, and one used the wet process. Three plants made both portland and masonry cement, and one plant produced only masonry cement. Cement was manufactured in Augusta, Botetourt, and Warren counties and the city of Chesapeake.

The cement producers mined limestone, shale, clay, and calcareous marl for their own use. Materials purchased for use in cement manufacture included sand, gypsum, oyster shells, mill scale, various air-entraining compounds, and various grinding aids.

Types I—II (general-use and moderate-heat cements) comprised the bulk of portland cement marketed; both air-entrained and nonair-entrained types were produced. High-early-strength cement was also produced and shipped. Most of the shipments were in bulk and were made by railroad, but sizable bulk shipments were also made by truck. Shipments of cement in paper bags were also sizable and were made by railroad and truck.

Portland cement was distributed for various consumer uses as follows: 59 percent to ready-mixed concrete companies (60 percent in 1963); 19 percent to concrete-products manufacturers (19 percent in 1963); 15 percent to contractors, including highway contractors (12 percent in 1963); 6 percent to building-material dealers (8 percent in 1963) and the remaining 1 percent (1 percent in 1963) to Federal, State, and local government agencies and miscellaneous customers. Marketing areas for portland cement were chief-

ly Virginia, North Carolina, West Virginia, Kentucky, and Maryland. The bulk of masonry cement was shipped to Virginia, North Carolina, the District of Columbia, and Maryland.

Clays.—Production of clay was 2 percent higher than in 1963, and only 2 percent lower than 1962, the record year for clay output. Value however, rose to $1,613,523, a new record, exceeding by 4 percent the previous record of 1963. Miscellaneous clay or shale was the only type of clay produced, and a little over half the output was consumed in brick manufacture. The principal uses for the balance were lightweight aggregate and the manufacture of portland cement; some was consumed in the making of vitrified sewer pipe, flue linings, and other heavy clay products. Clay production was reported from 22 operations in 16 counties. The chief clay-producing counties in order of tonnage mined were Botetourt, Nansemond, Russell, and Orange; in order of output value they were Botetourt, Orange, Prince William, and Nansemond.

Table 4. — Clays sold or used by producers.

Year	Short tons	Value
1955-59 (average)	1,065,616	$1,086,382
1960	1,347,766	1,394,665
1961	1,406,201	1,332,165
1962	1,464,417	1,443,927
1963	1,410,098	1,558,327
1964	1,440,385	1,613,523

Feldspar.—One company mined feldspar in one county (Bedford). Combined output from three mines increased 26 percent compared with that of 1963, while the average value per ton remained the same. Potash feldspar and mixed feldspar were mined. Ground feldspar, produced at the company mill in Bedford, was marketed chiefly in Maryland, Ohio, New Jersey, and New York, principally for pottery and enamel manufacture, although smaller quantities were used in the manufacture of soaps, abrasives, and welding-rod coatings.

Gem Stones.—Gems and mineral specimens gathered by mineral collectors and hobbyists included agate, amazonite, blue corundum, lepidolite, olivine, staurolite, and unakite.

Gypsum.—Crude gypsum, mined at Plasterco, Washington County, and near Chatham Hill, Smyth County, was calcined and manufactured into plasterboard and other gypsum products by United States Gypsum Co. at their Plasterco plant. Production of crude gypsum was less than in 1963. The company also calcined domestic and imported gypsum at a mill near Norfolk. Crude gypsum imported from Nova Scotia was ground by several firms in the Norfolk area for use as a land dressing.

Kyanite.—Although production of crude kyanite ore decreased 2 percent, recovery of the refined material improved 10 percent over comparable figures reported for 1963. Sales of refined kyanite increased moderately. Two mines and two flotation plants were operated by the Kyanite Mining Corp. in Buckingham and Prince Edward counties and the company also operated a pulverizing plant in the latter county.

Lime.—Lime output and value exceeded those of 1963 by more than one-fifth. The gains were attributed chiefly to sharply increased demand for lime in chemical and other industrial uses. Sales of building lime were greater than in 1963, while sales of agricultural lime declined. Quicklime comprised 92 percent of the total production and hydrated lime the balance. All but 5 percent of the lime sold or used, including both quicklime and hydrated lime, was consumed in chemical and industrial uses. Nine companies produced lime in seven counties; one company, active in 1963, was idle. Giles, Smyth, and Shenandoah counties were the chief limestone calcining counties. Fuels used in calcination included natural gas, bituminous coal, and coke. Processing equipment used in lime manufacturing included pot, shaft, and rotary kilns and batch and continuous hydrators. Uses for quicklime included the manufacture of calcium carbide, paper, whiting, flux in steel manufacture, alkalies, and agricultural lime. Hydrated lime was marketed principally for use in the purification and treatment of water, leather tanning, sewage and trade waste treatment, construction, and agriculture.

Mica.—As in 1963, no sales of crude mica were reported. Domestic and foreign scrap mica were wet-ground by Richmond Mica Corp., Newport News, for use in paint, rubber, wallpaper, plastics, and other products.

Nitrogen Compounds.—Allied Chemical Corp., Nitrogen Division, Hopewell, Prince George County, manufactured nitrogen compounds for use chiefly as fertilizer ingredients. Included among products manufactured were ammonia, urea solution, and ammonium sulfate.

Perlite.—Perlite, obtained from a western source, was expanded by a firm at Hopewell, Prince George County, chiefly for use in concrete aggregate, soil conditioning, and building plaster.

Salt.—Olin-Mathieson Chemical Corp., Saltville, Smyth County, produced soda ash, chlorine, and other chemicals from brine recovered from nearby salt wells. Production was slightly higher than in 1963.

Sand and Gravel.—Production of sand and gravel reached a new high in 1964, exceeding 1963, the former year of record output, by 2 percent. Value declined considerably, however, mainly because more of the output had lower priced uses than in 1963. Paving and building uses comprised 85.4 percent of the commercial production (49.9 percent paving, 35.5 percent building). Other types of sand and gravel uses included glass sand, engine sand, filtration sand, railroad ballast, fill material, and sand and gravel for miscellaneous uses. Gravel comprised 48 percent of the total commercial output and 54 percent of the commercial value. Commercial output comprised 98 percent of the total production and value. The small remainder of the total output (2 percent) was State and local government production, of which 46 percent was processed material. Eighty-four percent of the commercial production was washed, screened, or otherwise prepared, as compared with 91 percent in 1963.

Sand and gravel production was reported from 35 counties and 2 independent cities. Nearly three-quarters of the commercial tonnage was shipped by truck, and the remainder by railroad and waterway.

In order of decreasing contribution, the principal sand and gravel producing areas were Fairfax, Henrico, City of Virginia Beach, Chesterfield, and Prince George. The output of these five producing areas alone comprised over three-quarters of the total tonnage value of Virginia sand and gravel. Five mines with an output range of from 500,000 to 1,000,000 tons accounted for 35 percent of the output; 26 mines with an output range of from 50,000 to 500,000 tons accounted for 46 percent; and 37 mines with an output range of up to 50,000 tons accounted for 19 percent.

Soapstone.—Crushed and ground soapstone was produced by one firm in Franklin County. The principal uses of the product were insecticides and foundry facings. Soapstone used as a dimension stone is included with miscellaneous stone in the stone section of this chapter.

Stone.—For the seventh consecutive year the production of stone in Virginia in 1964 broke all records in both quantity and value. Stone, the second most important mineral commodity produced in Virginia, is exceeded only by coal in output and value. Production totaled 30.4 million tons valued at $52.2 million, a gain of 10 percent in output and 14 percent in value over that of 1963. Most contributary to the gain in output were increases in the production of limestone (15 percent over that of 1963) and granite (8 percent over that of 1963); limestone and granite, the leading stone types, accounted for more than five-sixths of the total stone tonnage and more than three-quarters of the value. The substantially greater demand for concrete aggregate and roadstone was the major reason for the rise in output of granite, and in considerable measure for the rise in limestone production, reflecting an accelerated rate of building and local and interstate highway construction in 1964. In addition, greater demand by lime and cement industries contributed to the increase in limestone output. Mainly crushed or broken material was produced; no dimension limestone and only a limited amount of dimension granite production was reported in Virginia in 1964. Increases in output and value were also reported for slate and marble, while basalt, the third-leading stone produced in Virginia, declined moderately in output and slightly in value. Overall production of miscellaneous stone, including soapstone and "Virginia Greenstone," decreased sharply, but average value per ton increased moderately, mainly because of increased output of the relatively higher priced dimension product. Sandstone output decreased slightly, but average value per ton also rose moderately because of increased demand for the crushed product.

Many types of stone were quarried in Virginia, including limestone, granite, basalt, slate, sandstone, calcareous marl, miscellaneous stone (including soapstone and "Virginia Greenstone"), and marble, in order of decreasing output. Seventy-one percent of the total stone production was used as concrete aggregate and roadstone; 6 percent and 5 percent in the manufacture of cement and lime, respectively; 4 percent as metallurgical fluxstone; and the balance for uses such as stone sand, riprap, railroad ballast, and agricultural dressings. Limestone, either as such or as lime, had additional application in the chemical and

glass industry. Marine shell, a product of oyster and other mollusk processing, was used chiefly as an agricultural liming material similar to agricultural stone (agstone), and in the manufacture of lime. Roofing granules were produced from crushed slate by a firm in Buckingham County. Limestone output accounted for 63 percent of the total stone production, granite output for 24 percent, and basalt output for 8 percent. Of the total Virginia stone output, almost all the tonnage was crushed or broken stone (99.8 percent); dimension stone—miscellaneous, sandstone, slate, and granite—accounted for the balance.

In terms of tonnage, the principal stone-producing counties were Frederick, Botetourt, Loudoun, Wythe, and Roanoke. In terms of product value, the most important counties were Frederick, Botetourt, Nelson, Loudoun, and Giles. Ten counties produced more than 1 million tons of output, compared with 8 in 1963, and there were 22 counties with production valued at more than $1 million each (18 in 1963).

Commercial stone was produced by 127 quarrying operations in 48 counties, and 9 quarries were operated in 9 counties by State or municipal agencies producing Government and contractor stone. Commercial production of limestone was reported from 69 quarries in 24 counties; granite, from 24 quarries in 19 counties; basalt, from 9 quarries in 5 counties; slate, from 4 quarries in 2 counties; sandstone, from 14 quarries in 8 counties; calcareous marl, from 2 quarries in 2 counties; miscellaneous stone, from 4 quarries in 3 counties; and marble from 1 quarry in 1 county. The number of counties listed in the preceding sentence exceeds the number of counties in which all types of commercial stone was produced because of duplication of counties when considering each stone type quarried.

Sulfur.—Hydrogen sulfide was recovered from fuel gas and converted to sulfur by the American Oil Co. at its Yorktown Refinery in York County. Both production and shipments increased 4 percent over those of 1963, and the value of shipments also increased.

Metals

Ferroalloys.—Reopening of the ferromanganese plant of E. J. Lavino & Co. near Lynchburg, Campbell County, was announced in August 1964. The Lynchburg plant had discontinued production of ferromanganese about mid-1962, selling small quantities from stock during 1963. A strong demand for ferromanganese was chiefly responsible for the resumption of production by the company.

Iron Ore (Pigment Material).—Natural and manufactured iron-oxide pigments were produced by one firm near Henry, Franklin County. Crude brown and yellow oxide pigments were produced and marketed by another firm near Hiwassee, Pulaski County. This company also produced sienna, umber, and ocher, natural red and yellow iron-oxide pigments, and a variety of finished natural and manufactured pigments. In contrast to the decline of sales in 1963, total sales of iron-oxide pigments increased substantially in 1964.

Lead and Zinc.—Output of zinc decreased moderately but the value declined only slightly because of the higher unit price prevailing in 1964. While lead output rose only moderately, value increased substantially, due partly to the increase in production and partly to a rise in the average value per ton over 1963. Production of lead and zinc was limited to two mines in Wythe County.

Titanium Concentrates.—Continuing an increasing trend, marketed production of titanium concentrates (ilmenite and rutile) rose moderately in output and gained substantially in value. Production of both ilmenite and rutile increased, with rutile having the greatest rate of increase compared with 1963 output. Ilmenite was produced near Piney River, Amherst County, by American Cyanamid Co., and both ilmenite and rutile were produced by M&T Chemicals, Inc., near Montpelier, Hanover County.

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Deepest Well in Virginia

The deepest oil and gas test well in Virginia, and one of the deeper wells in the Eastern United States, was drilled near Bergton in northern Rockingham County during 1965. The Shell Oil Company *et al.* R. J. Whetzel No. 1 was plugged and abandoned as a dry hole at a total depth of 14,176 feet, almost a mile deeper than the previous record for Virginia set in 1949 by The California Company's 9340-foot dry hole in Montgomery County. The test is located approximately 25,000 feet south of 38°50′N. and 11,000 feet west of 78°55′W. on the Bergton anticline and has a ground elevation of 1464.8 feet. Drilling was commenced on July 8, 1965, in shale of Devonian age and was completed on November 4 in carbonate rocks of probable Cambrian age. The top of the Oriskany was encountered at 3244 feet.

Fourteen tests have been drilled near Bergton by other companies since 1935, five of which were completed between 1941 and 1956 as potentially productive gas wells in the Oriskany Sandstone at depths ranging from 2985 to 3759 feet. These successful wells were shut in and have not been produced commercially. The deepest well previously drilled on the structure in Virginia went to a depth of 4058 feet.

Logs and other data for the well have been placed on file at the Division's office in Charlottesville under repository number W-1432. A set of 1379 rock samples representing 10-foot intervals between 201 and 14,176 feet is also on file.

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News Notes

The Salem Stone Corporation commenced production of sand and gravel near McGaheysville, Rockingham County, during October 1965. The company also operates quarries in limestone and dolomite near Woodstock and Mount Jackson, Shenandoah County, for the production of crushed stone. Materials from the three operations are being used in highway construction.

The Shanks Construction Company has commenced production of gravel from Little River nears Woods Store, Floyd County. The gravel is crushed for road construction and other building purposes.

The Superior Stone Company, Division of Martin-Marietta Corporation, began production during September 1965 of crushed granite from a quarry near Charlottesville, Albemarle County. The stone is being used primarily for highway construction.

The Virginia Granite Corporation opened a second quarry for the production of dimension stone from diabase near Buena, Culpeper County. The company, which has operated a quarry near Buena since November 1961, is shipping quarried blocks to their finishing plant in Eberton, Georgia, for preparation as architectural and monumental stone.

Shenandoah Sand and Gravel, Inc. is producing sand and gravel near Shenandoah, Page County. The material is removed by dragline and processed in a stationary plant.

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New Publication

Report of Investigations 8. GEOLOGY OF THE MILLBORO QUADRANGLE, VIRGINIA by Samuel J. Kozak. Geologic map in color, 19 p.
Price: $1.75

Within the Millboro quadrangle of west-central Virginia, Upper Cambrian through Upper Devonian sedimentary rocks have an aggregate thickness of approximately 15,000 feet. Cambrian and Ordovician dolomites, limestones, and shales are restricted in outcrop to the southeast part of the quadrangle; Silurian and Devonian rocks are mainly restricted to that part of the quadrangle northwest of North Mountains.

Deformation of rocks in the Millboro quadrangle can be dated only as post-Chemung. Rock strata are more intensely deformed in the southeast part of the quadrangle and faults and folds are common. To the northwest faults are absent, and folds are more open and less overturned than those to the southeast.

Lower to Middle Ordovician dolomite and limestone, and Upper Silurian and Lower Devonian limestone are potential sources for commercial use; and Lower to Middle Silurian sandstone and Lower Devonian sandstone, sources of silica sand. Ordovician and Devonian shales, as well as residual and Quaternary clays, are potential sources of commmercially valuable clay deposits.

Note: Report of Investigations 7 is currently in preparation.

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Addition to Staff

Mr. William W. Winters was employed by the Division on November 1, 1965, to assist in groundwater studies. He received a B.S. degree in geology from the University of North Carolina in 1965. From 1957 to 1960 Mr. Winters served in the U. S. Army, Security Agency and was stationed at Frankfurt, Germany, during 1958-60. He is married and has one child.

Division of Mineral Resources
Box 3667
Charlottesville, VA 22903

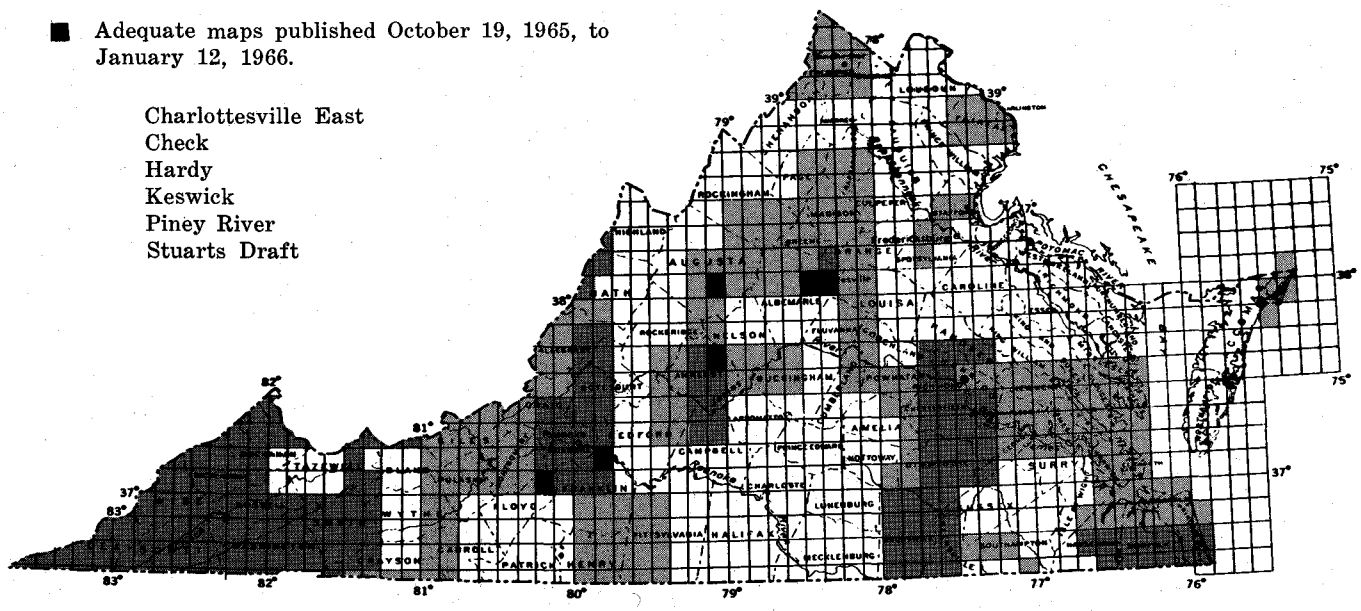
Form 3547 Requested

TOPOGRAPHIC MAPS

7.5 minute quadrangle topographic maps

- Advance prints and revision compilations
- Adequate maps published prior to October 19, 1965
- Adequate maps published October 19, 1965, to January 12, 1966.

Charlottesville East
Check
Hardy
Keswick
Piney River
Stuarts Draft



ADVANCE PRINTS AND REVISION COMPILATIONS

Advance prints and copies of revision compilations are available at 50 cents each from the U. S. Geological Survey, Topographic Division, 1109 N. Highland St., Arlington, VA 22210.

PUBLISHED MAPS

State index is available free. Published maps are available at 30 cents each from the Virginia Division of Mineral Resources, Box 3667, Charlottesville, VA 22903.