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MINERAL INDUSTRY IN VIRGINIA - 1989

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INTRODUCTION

The total value of mineral production in Virginia in 1989 was 2.18- billion dollars (Table). About 1.62-billion dollars resulted from coal sales and about 40-million dollars was from the sale of petroleum and natural gas. The remaining 520-million dollars was from industrial rocks and minerals. The value of lime production increased more than 14 percent and the value of crushed stone production increased almost 6 percent over the 1988 production. Other commodities all increased slightly except for dimension stone and natural gas production, which declined.

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.

The exploration for heavy minerals was continued by several companies in the southern Piedmont and western Coastal Plain provinces of Virginia. Large acreages have been leased in Dinwiddie, Greensville, and Sussex Counties. Approximately eight-million tons of heavy minerals have been discovered. Ilmenite, leucoxene, rutile, and zircon comprise nearly 80 percent of the heavy-mineral concentrate; the value of these minerals will be several billion dollars.

CEMENT

Three companies, one each in Warren and Botetourt

Table. Mineral Resource Production in Virginia (Preliminary) - 1989[1].

Mineral Commodity	Quantity	Value (thousands)
Clays—thousand short tons	1,038	$ 6,031
Coal (bituminous)[2]($37/ton)—do	43,855	1,622,644
Gem stones (est.)	NA	20
Lime—thousand short tons	807	38,740
Natural gas[2]($2.19/Mcf)-million cubic feet	17,935	39,278
Petroleum (crude)[2]($18.17/bl.)—42-gal. bls.	21,271	386
Sand and gravel—thousand short tons	12,500	48,100
Stone:		
Crushed—do	66,300	344,800
Dimension—short tons	8,548	2,898
Combined value of cement, clay (fuller's earth), feldspar, gypsum, industrial sand and gravel, iron-oxide pigments (crude), kyanite, sulfur, and vermiculite	XX	79,494
Total	XX	$2,182,391

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

Counties and in the City of Chesapeake, produce cement in Virginia. Riverton Corporation in Warren County, just north of Front Royal, produces masonry cement. At this plant, 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 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 utilizes 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 six types of calcium aluminate cement. The advantages of this type of 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

More than one-million tons of residual and transported clay, weathered phyllites and schists, 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 producing at full capacity. The clay-material industry in the western part of the state mines Paleozoic-age shales, with the primary products being common and 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 schists, and residual and transported clays 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/ft^3 for particle sizes of 5/16 to 3/4 inches. Solite Corporation in northern Buckingham County uses the Arvonia Slate to produce lightweight aggregate. Triassic-age shale is used by Virginia Solite Company, southwest of Danville in 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 total of 43,855,231 short tons (Table) of coal were produced from the southwest Virginia coalfield in Buchanan, Dickenson, Lee, Russell, Scott, Tazewell, and Wise Counties from approximately 507 surface and underground mines. The majority of the bituminous coal from the southwest coalfield was produced from the Pocahontas No. 3 coal bed. Included in this production total are 5008 short tons of semi-anthracite coal produced from two additional surface mines in the Valley coalfield, 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 exported to overseas markets. The coal is exported through ports in the Hampton Roads area in Virginia and through the port in Wilmington, 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 processing, the "aplite" is stored in silos. Clay minerals are removed by gravity concentration. The heavy minerals (ilmenite, rutile, and sphene) that are present in the feldspar are removed by electrostatic and magnetic processing. 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.

The settling ponds have accumulated clay and silt with a high percentage of kaolinite and mica. 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 is 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. "Fines," resulting from the crushing of

feldspar used 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-thousand dollars of natural gem stones in 1989. The Morefield pegmatite in Amelia County is open to the public for collecting on a fee basis by Piedmont 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. Hopkins Enterprises, a collecting operation in Patrick County in southern Virginia, operates on a fee basis. Staurolite crystals (fairystone crosses) are the main interest of collectors at this site.

GYPSUM

U. S. 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 the processing plant at Plasterco, near Saltville, in adjacent Washington County. The Plasterco plant manufactures wallboard 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, that may be associated with Cambrian-age gossans, are concentrated also in pockets with insoluble clay and iron oxide. Some iron is concentrated also 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. Since September, 1986, Virginia was the only state producing kyanite. The majority of the world's kyanite, is produced by Kyanite Mining Corporation from a deposit in Buckingham County. The company produces a concentrate grade of 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 melts 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. Kyanite-bearing quartzite is quarried from open pits, processed by primary crushers, passed through a log washer to remove clay, and moved onto the classifiers to remove some kyanite. The remaining material passes through a rod mill which reduces it to a minus 35-mesh size, and then moves 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 stockpiled.

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 their Dillwyn plant.

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

LIME

Virginia's lime industry is located in Frederick, Giles, Shenandoah, and Warren Counties. Production from six companies in 1989 was 807,000 short tons valued at more than 38-million dollars. In northwestern Virginia, two companies, W. S. Frey Company, Inc., and Chemstone Corporation quarry and calcine the high-calcium New Market Limestone (Figure 1). The Riverton Corporation in Warren County quarries and calcines limestone from the Edinburg Formation. Shenvalley Lime Corporation in Stephens City, Frederick County purchases quicklime and produces hydrated lime. Two companies in northwest 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 and for water purification, and during the last few years, in the neutralization of acid mine water. It is used also for mason's lime, sewage treatment, and agricultural purposes.

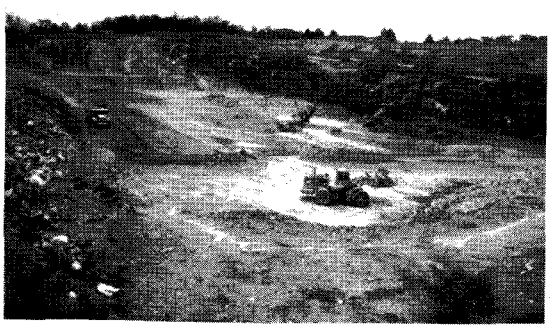

Figure 1. New quarry in New Market Limestone, Chemstone Corporation, Strasburg, Shenandoah County.

LITHIUM

Cyprus Foote Mineral Company purchases lithium carbonate produced from brines in Nevada using calcium hydroxide from various sources to produce lithium hydroxide at their Sunbright plant in Scott County. Lithium hydroxide is used in multipurpose grease applications. 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 cleaning coal. The magnetite is obtained from New York, with minor amounts being imported. The 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 magnetite is marketed in Virginia and Kentucky. 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 but 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 the City of 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 by Piedmont Mining Company.

NATURAL GAS

Natural gas production in 1989 was 17,935,376 Mcf (one Mcf equals 1000 cubic feet) from 752 wells in Buchanan, Dickenson, Russell, Scott, Tazewell, Washington, and Wise Counties. This reflects a decline of 4 percent from the 1988 production of 18,682,530 Mcf. The average price paid to Virginia's natural gas producers in 1989 was 2.19 dollars per Mcf.

In 1989, a total of 40 wells were drilled in Virginia. This represents a 11 percent decrease from the 45 wells drilled in 1988. The total footage drilled in 1989 was 178,993 feet. The

average depth for a development well was 4324 feet and the average depth for an exploratory well was 6337 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 use in 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 21,271 barrels in 1989, a 15 percent decrease from the 1988 production of 24,952 barrels. Production was by nine companies from 43 wells in three fields (Ben Hur, Rose Hill, and Roaring Fork). The average price paid by refineries for Virginia oil in 1989 was 18.17 dollars per barrel.

PHOSPHATE ROCK

TexasGulf, Inc., ships phosphate rock from its Lee Creek operation in North Carolina to Glade Spring, Washington County. The raw material 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 12.5-million short tons of material produced in 1989. Sand and gravel are extracted from river terraces and dredged from the rivers of the major drainages in central and eastern Virginia (Figure 2). Large tonnages of construction sand and gravel from an area 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.

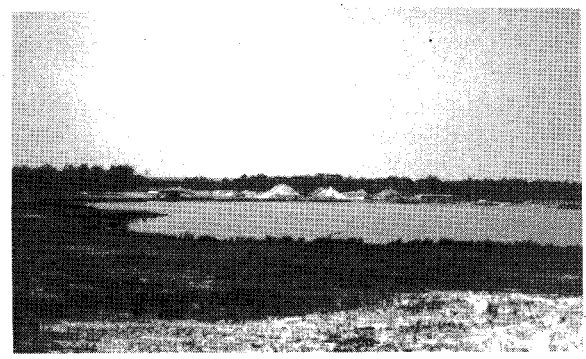

Figure 2. Sand and gravel operations along Chickahominy River, Custom Sand and Gravel, Charles City County.

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. CED Process Minerals, Inc., Gore, in Frederick County, recrystallizes sand purchased from U.S. Silica in a rotary kiln to produce cristobalite, which is marketed as fine grit.

STONE

CRUSHED

Crushed limestone, dolomite, sandstone, quartzite, granite, gneiss, diabase, basalt, greenstone, amphibolite, slate, "Virginia aplite," and marble, valued at more than 344-million dollars were produced in Virginia in 1989. The previous year, Virginia was the fourth leading producer of crushed stone behind Pennsylvania, Florida, and Texas.

Limestone, dolomite, shale, sandstone, and quartzite mineral producers are located in the Valley and Ridge and Plateau provinces in the western part of the state. Principal 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 are combined with those for acid-water treatment material in the stone production total. Safety dust is used in coal mines to cover the coal dust on ribs, floor, and roof and thus keep it from entering the atmosphere after a methane gas explosion. The dust should contain less than 5 percent SiO_2 and 100 percent must pass 20 mesh, with 70 percent passing minus 200 mesh. Finely ground dolomite and limestone are 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 (Figure 3). Major uses of these materials are for roadstone, asphalt stone, and concrete aggregate. Waste slate is crushed near Arvonia in Buckingham County by Solite Corporation. Solite uses the crushed 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 that K_2O (potash) percentages are greater than 10 percent. Potash silicates (orthoclase feldspar) common in igneous and metamorphic rocks release potassium minerals upon weathering.

Figure 3. Loading of diabase at Manassas Quarry, Vulcan Materials Company, Prince William County.

DIMENSION

Dimension stone production was valued at 2.898-million dollars in 1989. Slate, diabase, quartzite, and soapstone were quarried in the Piedmont province; slate was the leading stone type quarried, in terms of cubic feet and value. LeSueur-Richmond Slate Corporation mines slate from two quarries in the Arvonia area of Buckingham County. Arvonia 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 flagging, 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. The New Alberene Stone Company, Inc., quarries soapstone from a quarry at Alberene and expects to open a new quarry in late 1989. Their products include soapstone fireplaces, woodstoves, cooking ware, and other products of solid soapstone.

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 marketed 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. Material mined with a backhoe and front-end loader is trucked to the adjacent plant where material greater than four inches across is removed. It is washed and run through a rod mill to shear the vermiculite thin. Biotite, feldspar, and other minor minerals 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. Most of the crude vermiculite is shipped by rail in unexfoliated form to North Carolina, West Virginia, Ohio, and to other eastern states. Uses for the exfoliated material include packing, insulation, lightweight aggregate, and potting material.

SOME RECENT PUBLICATIONS ON THE GEOLOGY OF VIRGINIA

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QUOTE FOR THE QUARTER*

"Most geologists consider themselves environmentalists.

We have spent a good portion of our lives studying the Earth. Through our interest, education, training and experience we have acquired knowledge about the Earth and its processes. We feel a special protective relationship to it. In that sense we are all environmentalists."

* James A. Gibbs, President, American Association of Petroleum Geologists. Quote from AAPG Explorer.

SE-GSA ANNUAL MEETING

The Southeastern and Northeastern Sections of the Geological Society of America will hold a joint meeting at the Omni Inner Harbor Hotel in Baltimore, Maryland from March 14-16, 1991. Contact Juergen Reinhardt, U.S. Geological Survey, Reston, Virginia.

Virginia Minerals, Vol. 36, No. 4, November 1990

NEW PUBLICATION

Publication 101. Travertine-marl: stream deposits in Virginia edited by Janet S. Herman and David A. Hubbard, Jr., 184 p., 1990. **Price:** $7.00

NOTICE

Your cooperation is solicited in up-dating the *Virginia Minerals* mailing list. If you want to receive *Virginia Minerals* send your name and current address to Virginia Minerals, Division of Mineral Resources, P.O. Box 3667, Charlottesville, Virginia 22903 by January 15, 1991.