



COMMONWEALTH OF VIRGINIA

DEPARTMENT OF CONSERVATION  
AND ECONOMIC DEVELOPMENT

DIVISION OF MINERAL RESOURCES

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ANALYSES OF CLAY AND  
RELATED MATERIALS—  
EASTERN COUNTIES

**Stanley S. Johnson and Miles E. Tyrrell**

**In Cooperation with U. S. Bureau of Mines**

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MINERAL RESOURCES REPORT 8

**VIRGINIA DIVISION OF MINERAL RESOURCES**

**James L. Calver**

**Commissioner of Mineral Resources and State Geologist**

**CHARLOTTESVILLE, VIRGINIA**

**1967**



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COMMONWEALTH OF VIRGINIA  
DEPARTMENT OF PURCHASES AND SUPPLY  
RICHMOND  
1967

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ECONOMIC DEVELOPMENT

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# ANALYSES OF CLAY AND RELATED MATERIALS—EASTERN COUNTIES

By

STANLEY S. JOHNSON<sup>1</sup> and MILES E. TYRRELL<sup>2</sup>

## ABSTRACT

This report contains the results of tests and determinations of properties required to evaluate the potential ceramic and nonceramic uses of 132 samples of clay and related materials which were collected in 27 counties in eastern Virginia. Tests indicate that 82 samples are potentially suitable for use in one or more structural clay products or lightweight aggregate. Three samples were found to have possible nonceramic applications. The present report, which includes approximately 25 percent of the total land area in Virginia, is the fourth in a series related to a ceramic testing program in the State.

## INTRODUCTION

This report is the fourth in a series of Mineral Resources Reports that contain laboratory data derived from testing nonmetallic raw material for its potential ceramic and nonceramic uses. The report contains information on a total of 29 counties and 4 independent cities in eastern Virginia (Figure 1); these counties and cities include approximately 25 percent of the total land area in Virginia. The present report, combined with Mineral Resources Reports 2, 5, and 6, brings the area investigated for potential ceramic materials to approximately 73 percent of the State. A total of 132 samples of clay and related materials were collected from 27 counties in the Virginia Coastal Plain for this report. Eighty-five of the samples tested were found to be potentially suitable for various uses in brick, varieties of tile, flue lining, sewer pipe, lightweight aggregate, garden pottery, mineral fillers, stoneware, and absorbents.

<sup>1</sup> Geologist, Virginia Division of Mineral Resources.

<sup>2</sup> Physical Research Scientist, U. S. Bureau of Mines, Tuscaloosa, Alabama.

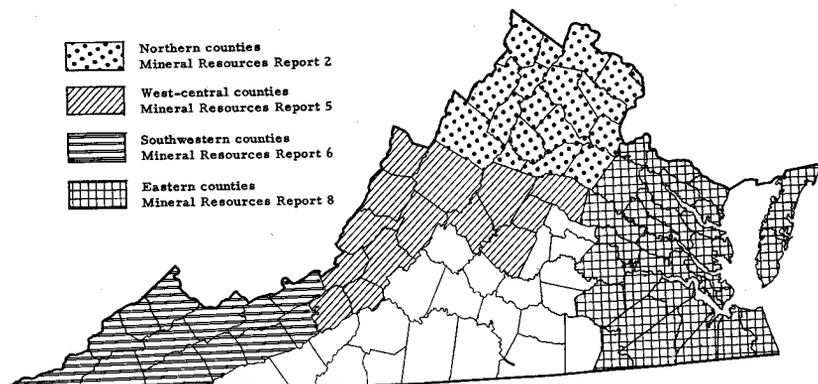


Figure 1. Areas of investigation.

Since November 1957 the Virginia Division of Mineral Resources and the U. S. Bureau of Mines have had a cooperative agreement to promote effective coordination of activities for exploration and evaluation of clays and similar materials for ceramic and nonceramic uses. The Virginia Division of Mineral Resources plans and conducts the field investigations, sampling, and correlation of field and laboratory data, and transmits the samples to the Tuscaloosa Metallurgy Research Center, U. S. Bureau of Mines, Tuscaloosa, Alabama. Under the agreement, the responsibility of the U. S. Bureau of Mines is to make the appropriate tests and determinations of properties required to evaluate the potential uses of the submitted materials.

Most of the clays sampled for this study are sedimentary in origin; a few samples of residual clay from weathered outcrops and a sample of clay from a company settling pond were obtained from the eastern part of the Piedmont province. The clays, which are stratified and lenticular, generally conform to the underlying sediments or rocks. The roadcuts in which most field observations were made do not provide sufficient exposures to determine total thickness or extent of the sampled clays. Descriptions of sample localities in the report indicate only the exposed thickness of material. Localities for which the test data indicate potential uses should be thoroughly investigated to determine whether adequate raw materials are available for commercial operations.

Although the counties of Accomack and Northampton, portions of Mathews and York counties, and the cities of Virginia Beach, Chesapeake, Hampton, and Newport News are underlain by clays and other sediments, the exposed surface clays in these areas were considered

too sandy or too thin to warrant sampling and ceramic tests. Information from drill holes, geologic logs, and test borings from these areas indicates that thin clay zones, sandy clays, sand, and gravel are present in the subsurface. Certain clays reported in deep borings were considered uneconomic because of the thickness of overburden.

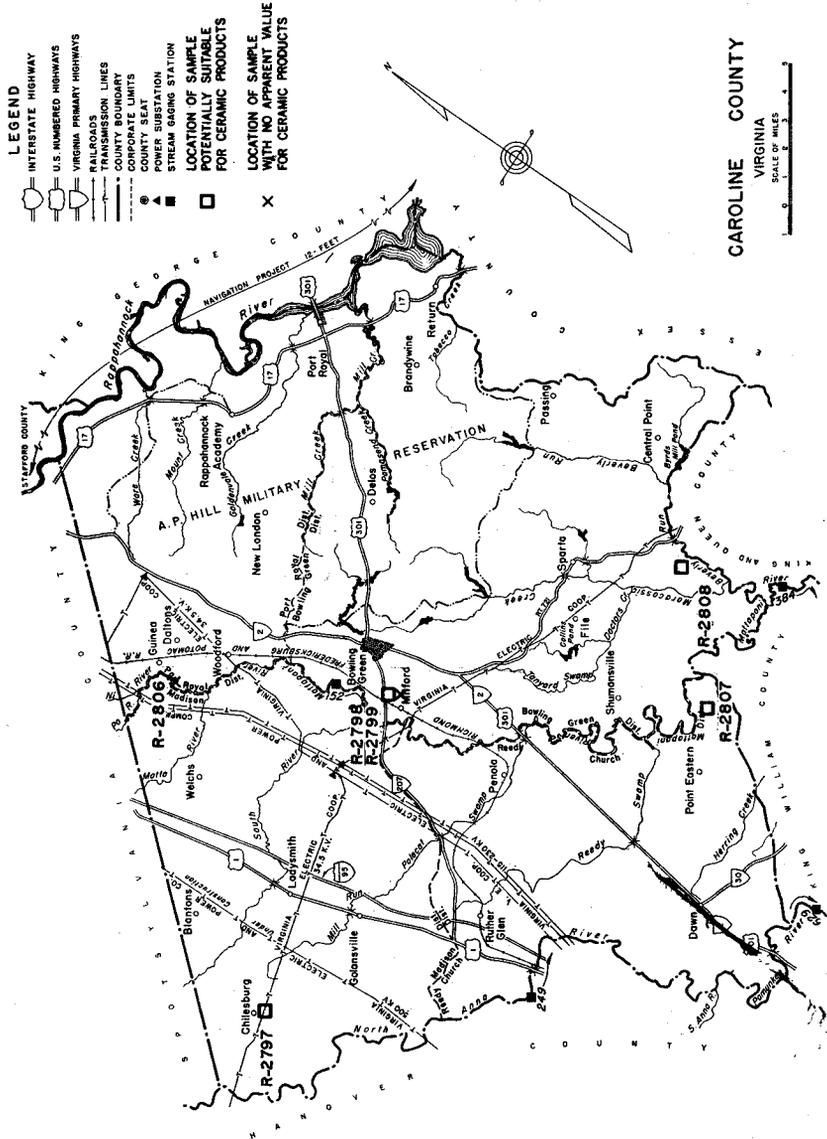
A word of caution: the data presented in this report are based on laboratory tests that are preliminary in nature and will not suffice for plant or process design. Evaluation remarks are based on test data determined on one or two samples from each locality. Detailed exploration, sampling, and tests should be carried out to prove any particular locality for commercial development. Likewise, test results of a single sample from an existing pit or stockpile may not be representative of all the material. Samples from other parts of the pit or stockpile, or from other locations of material of the same age, may not have the same physical characteristics as those determined for the sample that was tested.

### ACKNOWLEDGEMENTS

The writers wish to thank the many persons who contributed information and assistance during the field investigation, the laboratory determinations, and the preparation of the manuscript. Several staff members of the Division collected samples in the course of their various field investigations. Acknowledgement is made to Marion V. Denny and Howard P. Hamlin (deceased) of the Bureau of Mines who provided technical interpretation and supervised the analysis of many samples at the U. S. Bureau of Mines station at Norris, Tennessee (closed in 1965). The samples were re-evaluated by the technical staff of the Tuscaloosa Metallurgy Research Center of the U. S. Bureau of Mines. Acknowledgement is made to the Department of Army, Corps of Engineers, for helpful subsurface information. Dr. James L. Calver, Commissioner of Mineral Resources and State Geologist, made many suggestions during the preparation of the manuscript.

Base maps used for plotting sample locations within individual counties were furnished by the Division of Planning.

SAMPLE DESCRIPTIONS  
CHARACTERISTICS  
AND EVALUATIONS



Location Map of Caroline County

## ANALYSES OF CLAY MATERIALS

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## CAROLINE COUNTY

Samples were collected from five localities in Caroline County. Laboratory testing indicates the following potential uses for the raw material:

<u>Sample</u>	<u>Formation or Age</u>	<u>Potential Use</u>
R-2797	Residual clay	Flue lining
R-2798	Calvert (?) Formation	Garden pottery
R-2799	Calvert (?) Formation	None
R-2806	Pleistocene (?)	None
R-2807	Pleistocene	Face brick, drain tile, and possible lightweight aggregate
R-2808	Pleistocene (?)	Face brick, structural tile, and flue lining

SAMPLE: R-2797

County: Caroline

*Locality:* Roadcut, 0.3 mile southeast of Chilesburg, on the west side of State Road 603 approximately 0.2 mile by road south of the intersection with State Road 658.

*Description:* An exposure of about 6 feet of clay is present in a long roadcut that has a maximum height of 7 feet. The exposure contains approximately 4 feet of mottled, micaceous, white, gray, yellow, and red clay that is overlain by 2 feet of brown clay. The clay, which was probably derived from a granite gneiss, is overlain by 1 foot of sandy soil overburden.

*Formation or Age:* Residual clay

*Sampled Interval:* Sample across approximately 6 feet of clay.

*Raw Properties:*

Water of plasticity: 29.8%	Plasticity: medium
Drying shrinkage: 5.0%	Dry strength: good
Drying defects: none	pH: 7.1

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	2	5.0	26.9	44.4	1.65
1900	Tan	2	5.0	26.2	43.5	1.66
2000	Lt. brown	3	5.0	23.4	40.7	1.74
2100	Lt. brown	4	5.0	18.5	35.0	1.89
2200	Brown	4	10.0	—	35.5	1.89
2300	Dk. brown	5	10.0	16.3	31.9	1.96

Remarks: Good color; high vitrification temperature.

*Bloating Test:* Negative

*Potential Use:* Flue lining

SAMPLES: R-2798 and R-2799

County: Caroline

*Locality:* Roadcut (Figure 2), 0.5 mile north of Milford, on the southwest side of State Road 722 just southeast of its intersection with State Highway 207.

*Description:* An exposure of about 12 feet of clay is present in a roadcut that has a maximum height of 13 feet. The clay is composed of two different zones based on color and visible composition. The lower zone (R-2798) consists of 5 feet of uniform gray-green to green, sandy, micaceous clay. The upper zone (R-2799) consists of about 7 feet of uniform light-tan and gray clay. Minor staining by iron oxide occurs throughout the exposure.

*Formation or Age:* Calvert (?) Formation

R-2798

*Sampled Interval:* Sample across 5 feet of gray-green to green, sandy clay.

*Raw Properties:*

Water of plasticity: 37.0%  
Drying shrinkage: 6.0%  
Drying defects: none

Plasticity: high  
Dry strength: good  
pH: 5.1

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Red-tan	3	9.0	22.5	35.3	1.57
1900	Red-tan	4	9.0	20.2	32.3	1.60
2000	Red-brown	4	9.0	18.0	29.9	1.66
2100	Dk. red-brown	6	11.0	10.1	18.4	1.82
2200	V. dk. brown	7	(Expanded)	—	—	—
2300	Gray-brown	7	(Expanded)	—	—	—

Remarks: Color marginal; abrupt vitrification.

*Bloating Test:* Positive

*Preliminary Bloating Test:*

Drying characteristics: good  
Particle size: —  $\frac{3}{4}$ " +  $\frac{1}{2}$ "

Crushing characteristics: good  
Retention time: 15 min.

Temp. ° F	Bulk Dens.	Lb/ft <sup>3</sup>	% Abs.	Remarks
2000	1.46	91	25.2	Very slight expansion
2100	1.44	90	22.1	Slight expansion
2200	1.04	65	21.2	Fair pore structure, semi-vitreous

Remarks: Bulk density rather high for lightweight aggregate.

*Potential Use:* Garden pottery

R-2799

*Sampled Interval:* Sample across about 7 feet of light-tan and gray clay.

*Raw Properties:*

Water of plasticity: 33.6%

Plasticity: high

Drying shrinkage: 10.0%

Dry strength: good

Drying defects: none

pH: 5.4

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	3	10.0	20.2	35.1	1.74
1900	Tan	3	10.0	19.4	34.1	1.76
2000	Lt. brown	5	12.0	15.6	29.2	1.87
2100	Brown	6	14.0	11.9	23.4	1.97
2200	Gray-brown	7	17.0	7.2	15.2	2.11
2300	Gray	7	17.0	4.7	10.0	2.13

Remarks: Good color; high shrinkage above 2100° F; not suitable for use as the principal component in vitreous clay products.

*Bloating Test:* Negative

*Potential Use:* None

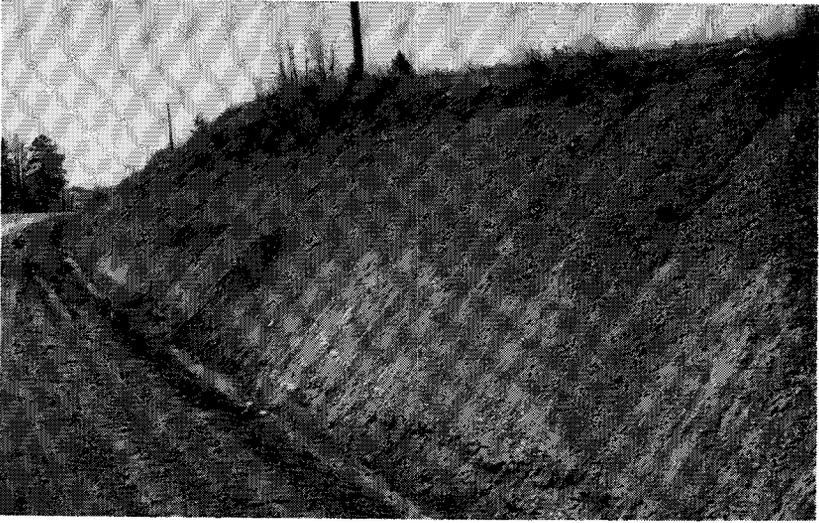


Figure 2. Exposure of the Calvert (?) Formation (Samples R-2798 and R-2799) on the southwest side of State Road 722 just southeast of its intersection with State Highway 207.



Figure 2. Exposure of the Calvert (?) Formation (Samples R-2798 and R-2799) on the southwest side of State Road 722 just southeast of its intersection with State Highway 207.

SAMPLE: R-2806

County: Caroline

*Locality:* Pit of Dillard's Sand and Gravel Company, 0.9 mile southwest of Guinea, off the northwest side of State Road 606 approximately 0.6 mile by road southwest of the intersection with State Road 607.

*Description:* A sample of blue-gray clay was collected from a pile of dredged material in the pit. According to company personnel, the clay is at least 4 feet thick and in places is overlain by a foot of yellow clay. Overburden varies from 5 to 14 feet and consists of sand and gravel.

*Formation or Age:* Pleistocene (?)

*Sampled Interval:* Representative sample of clay collected from pile of dredged material.

*Raw Properties:*

Water of plasticity: 37.0%

Plasticity: medium

Drying shrinkage: 4.0%

Dry strength: good

Drying defects: none

pH: 3.2

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Orange-tan	2	4.0	50.2	51.7	1.03
1900	Orange-tan	2	11.0	32.5	41.9	1.29
2000	Orange-tan	2	11.0	31.1	40.7	1.31
2100	Red-brown	3	15.0	25.9	36.3	1.40
2200	V. dk. brown	4	15.0	15.4	24.3	1.58
2300	V. dk. brown	6	20.0	7.1	12.0	1.69

Remarks: Poor color; high vitrification temperature; not suitable for use as the principal component in vitreous clay products.

*Bloating Test:* Negative

*Potential Use:* None

SAMPLE: R-2807

County: Caroline

*Locality:* Roadcut, 3.2 miles southeast of Shumansville, on the west side of the company access road of Mattaponi Sand and Gravel Co., Inc., approximately 0.8 mile by road north of its intersection with State Road 600.

*Description:* An exposure of about 6 feet of light-gray clay occurs in a roadcut through the crest of a small hill. The clay is locally stained light-yellow to yellow red-brown by iron oxide. Approximately 4 feet of sand and gravel overburden is present where the clay was sampled. According to company personnel, similar clay is present throughout the area and thicknesses of up to 18 feet have been revealed in company drill cores.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across approximately 6 feet of clay.

*Raw Properties:*

Water of plasticity: 41.4%

Plasticity: medium

Drying shrinkage: 6.0%

Dry strength: good

Drying defects: none

pH: 4.6

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Lt. tan	3	10.0	24.3	38.4	1.58
1900	Lt. brown	5	15.0	16.1	28.5	1.77
2000	Lt. brown	6	15.0	10.6	20.8	1.96
2100	Brown	6	15.0	9.1	18.3	2.01
2200	Dk. brown	7	15.0	4.6	9.8	2.13
2300	—	—	(Expanded)	—	—	—

Remarks: Good color; should fire to "SW" face-brick specifications at about 2100°F.

*Bloating Test:* Positive

*Preliminary Bloating Test:*

Drying characteristics: good  
 Particle size: —  $\frac{3}{4}$ " +  $\frac{1}{2}$ "

Crushing characteristics: fair  
 Retention time: 15 min.

Temp. ° F	Bulk Dens.	Lb/ft <sup>3</sup>	% Abs.	Remarks
2000	2.20	137	9.9	Very slight expansion
2100	0.80	50	7.8	Good pore structure, semivitreous
2200	0.87	55	6.0	Some large pores, vitreous
2300	—	—	—	Fused

Remarks: Very good possibility for lightweight aggregate.

*Potential Use:* Face brick, drain tile, and possible lightweight aggregate.

SAMPLE: R-2808

County: Caroline

*Locality:* Roadcut, 3.9 miles southeast of Sparta, on the west side of State Road 646 approximately 0.7 mile by road south of the intersection with State Road 645.

*Description:* An exposure of about 4 feet of light-gray clay occurs in a long roadcut that has a maximum height of 5 feet. The clay is slightly sandy and contains minor iron oxide staining.

*Formation or Age:* Pleistocene (?)

*Sampled Interval:* Sample across approximately 4 feet of clay.

*Raw Properties:*

Water of plasticity: 20.8%

Plasticity: medium

Drying shrinkage: 4.0%

Dry strength: good

Drying defects: none

pH: 5.0

*Slow Firing Test:*

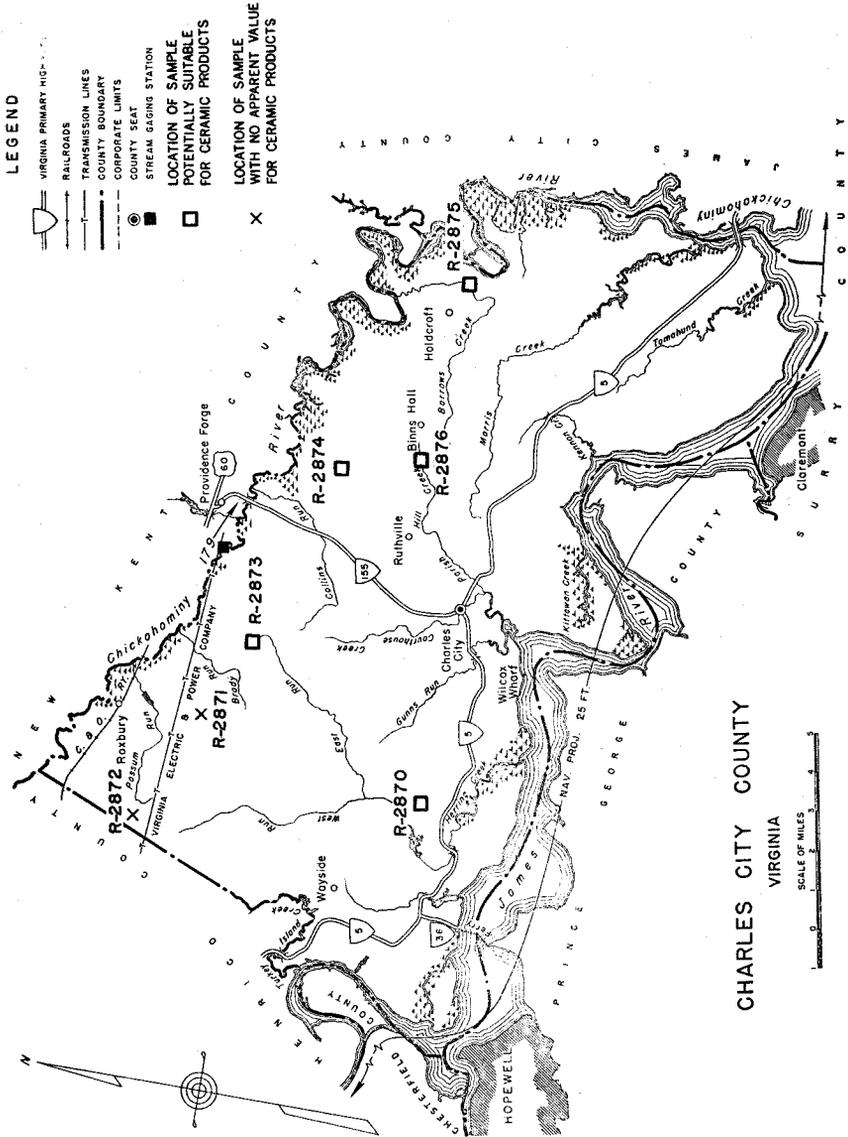
Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Pale tan	4	6.0	16.2	29.8	1.84
1900	Buff-tan	5	6.0	14.1	26.5	1.88
2000	Buff-tan	5	6.0	13.8	26.2	1.90
2100	Buff	5	6.0	13.1	25.0	1.91
2200	Cream	6	6.0	10.8	21.2	1.96
2300	Cream	7	9.0	11.1	21.5	1.94

Remarks: Good color; should fire to "MW" face-brick specifications at about 2150°F.

*Pyrometric Cone Equivalent:* 20-23

*Bloating Test:* Negative

*Potential Use:* Face brick, structural tile, and flue lining.



Location Map of Charles City County

## CHARLES CITY COUNTY

Samples were collected from seven localities in Charles City County. Laboratory testing indicates the following potential uses for the raw material:

<u>Sample</u>	<u>Formation or Age</u>	<u>Potential Use</u>
R-2870	Pleistocene	Quarry tile, sewer pipe, and possible face brick
R-2871	Pleistocene	None
R-2872	Pleistocene	None
R-2873	Pleistocene	Dark face brick
R-2874	Pleistocene	Face brick, quarry tile, and sewer pipe
R-2875	St. Marys Formation	Face brick and tile
R-2876	Pleistocene	Face brick, glazed structural tile, and stoneware

SAMPLE: R-2870

County: Charles City

*Locality:* Roadcut (Figure 3), 3.2 miles southeast of Wayside, on the east side of State Road 609 approximately 0.8 mile by road south of the intersection with State Road 625.

*Description:* A maximum of 12 feet of clay is present at this locality. Four feet of light- to medium-gray clay is exposed in the long roadcut that has a maximum height of about 4 feet; the clay is stained by iron oxide. A vertical auger hole 8 feet deep was drilled in the ditch at the base of the exposure. This hole penetrated 5 feet of light- to medium-gray clay and 3 feet of red-brown to purplish clay, with dark-brown carbonaceous material in the lower 0.5 foot. The clay is underlain by a gray, fine-grained quartz sand.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across 4 feet of clay exposed in the roadcut.

*Raw Properties:*

Water of plasticity: 30.5%  
Drying shrinkage: 5.0%  
Drying defects: none

Plasticity: medium  
Dry strength: good  
pH: 6.7

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	2+	5.0	22.4	37.9	1.69
1900	Tan	2+	6.0	19.2	33.8	1.76
2000	Buff	4	7.5	13.1	25.4	1.94
2100	Lt. brown	5	12.5	6.5	14.2	2.18
2200	Brown	7+	12.5	0.8	1.8	2.31
2300	Dk. brown	8	12.5	2.4	5.1	2.12

Remarks: Good buff color; dunting might be a problem; slightly overfired at 2300°F.

*Bloating Test:* Negative

*Extrusion Test:*

Body composition: 80% by weight raw clay thru 8 mesh; 20% by weight clay calcined to 2000°F

Water added for extrusion: 30% of dry batch weight

Shapes extruded: 1-inch x 1-inch bars, cut to 3-inch lengths

0.5-inch x 1-inch bars, cut to 7-inch lengths

Vacuum on machine: 27 inches of mercury

Drying: 24 hours in air; 24 hours at 140°F

Drying shrinkage: 5.2%

*Firing:*

Time: 24 hours

Temperature: 2140°F

Cone: 5 over

Total shrinkage: 12.5%

Absorption: 4.6%

Appar. porosity: 10.8%

Bulk density: 2.24 gm/cc

Hardness: 7

Color: dark red

Glaze: Single fire, lead

*Remarks:*

Develops good color at cone 5 (2140°F). Although the absorption is probably too low for face brick, the clay looks fairly promising for use in sewer pipe or quarry tile. Laminations were not evident. No crazing or shivering was noted in the glazed pieces.

*Potential Use:* Quarry tile, sewer pipe, and possible face brick.

SAMPLE: R-2871

County: Charles City

*Locality:* Roadcut, 2.2 miles south of Roxbury, on the east side of State Road 609 approximately 0.2 mile by road south of the intersection with State Road 603.

*Description:* An exposure of 3 feet of brown, silty clay occurs in a long roadcut that has a maximum height of 4 feet. The clay is overlain by 1 foot of sandy soil.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across 3 feet of silty clay.

*Raw Properties:*

Water of plasticity: 26.2%

Plasticity: low

Drying shrinkage: 2.5%

Dry strength: low

Drying defects: none

pH: 6.5

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Buff	2+	2.5	17.0	31.8	1.87
1900	Buff	2+	5.0	16.8	30.9	1.84
2000	Buff	2+	5.0	17.2	31.6	1.84
2100	Buff	2+	7.0	16.9	31.1	1.84
2200	Lt. brown	2+	7.0	17.0	31.1	1.83
2300	Brown	2+	7.5	15.9	29.6	1.86

Remarks: Poor color; high vitrification temperature.

*Bloating Test:* Negative

*Potential Use:* None

SAMPLE: R-2872

County: Charles City

*Locality:* Roadcut, 2.8 miles west of Roxbury, on the north side of State Road 600 approximately 0.1 mile by road east of the intersection with State Road 603.

*Description:* An exposure of 7 feet of mottled gray, red, and brown silty clay occurs in a roadcut that has a maximum height of 8 feet and a length of 150 feet.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across 7 feet of silty clay.

*Raw Properties:*

Water of plasticity: 31.8%

Plasticity: medium

Drying shrinkage: 5.0%

Dry strength: low

Drying defects: none

pH: 6.4

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Salmon	(Poor bond)	6.5	—	—	—
1900	Salmon	2+	6.5	24.0	40.6	1.69
2000	Salmon	2+	7.5	22.4	39.0	1.74
2100	Lt. brown	2+	9.0	20.0	35.8	1.79
2200	Brown	2+	10.0	19.7	35.3	1.79
2300	Dk. brown	2+	10.0	17.6	32.4	1.84

Remarks: Poor color; high vitrification temperature.

*Bloating Test:* Negative

*Potential Use:* None

SAMPLE: R-2873

County: Charles City

*Locality:* Roadcut, 4.9 miles northwest of Ruthville, on the southwest side of State Road 631 approximately 0.2 mile by road southeast of the intersection with State Road 630.

*Description:* An exposure of about 3 feet of mottled red, gray, and brown, slightly silty clay occurs in a long roadcut that has a maximum height of 4 feet.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across approximately 3 feet of clay.

*Raw Properties:*

Water of plasticity: 36.2%

Plasticity: medium

Drying shrinkage: 7.5%

Dry strength: good

Drying defects: none

pH: 6.9

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Salmon	(Poor bond)	7.5	—	—	—
1900	Salmon	2+	8.5	24.1	40.2	1.67
2000	Salmon	3	12.5	20.2	36.2	1.79
2100	Lt. brown	3	13.5	17.0	32.3	1.90
2200	Brown	4	13.5	15.9	30.5	1.92
2300	Dk. brown	4	13.5	14.2	27.7	1.95

Remarks: Color marginal

*Bloating Test:* Negative

*Potential Use:* Dark face brick.

SAMPLE: R-2874

County: Charles City

*Locality:* Roadcut (Figure 4), 2.5 miles northeast of Ruthville, on the east side of State Road 614 approximately 1.5 miles by road northwest of the intersection with State Road 615.

*Description:* A minimum of 17 feet of clay is present at this locality. Seven feet of mottled and layered gray, red, yellow, and brown, slightly silty clay is exposed in this long roadcut that has a maximum height of 8 feet. A vertical auger hole 10 feet deep was drilled in a ditch at the base of the exposure. This hole penetrated 10 feet of the same type of clay and was still in the clay at the bottom of the hole.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across 7 feet of clay exposed in the roadcut.

*Raw Properties:*

Water of plasticity: 36.7%

Plasticity: medium

Drying shrinkage: 7.5%

Dry strength: good

Drying defects: none

pH: 6.6

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Salmon	2+	7.5	21.6	36.9	1.71
1900	Salmon	2+	7.5	19.6	34.9	1.78
2000	Buff	6+	12.5	13.4	26.3	1.96
2100	Lt. brown	6+	14.5	9.1	19.7	2.16
2200	Brown	7	15.0	4.5	10.5	2.33
2300	Dk. brown	7	15.0	2.7	6.6	2.43

Remarks: Colors marginal at low temperatures; good brown color at 2200°F.

*Bloating Test:* Negative

*Extrusion Test:*

Body composition: 80% by weight raw clay thru 8 mesh; 20% by weight clay calcined to 2000°F

Water added for extrusion: 30% of dry batch weight

Shapes extruded: 1-inch x 1-inch bars, cut to 3-inch lengths  
2-inch-diameter tubes, cut to 8-inch lengths

Vacuum on machine: 27 inches of mercury

Drying: 24 hours in air; 24 hours at 140°F

Drying shrinkage: 6.25%

Firing:

Time: 24 hours

Temperature: 2140°F

Cone: 5 over

Total shrinkage: 12.5%

Absorption: 7.8%

Appar. porosity: 17.0%

Bulk density: 2.16 gm/cc

Hardness: 7

Color: dark red

Glaze: Single fire, lead

Remarks:

Develops good color at cone 5 (2140°F). The shrinkage might be excessive at higher temperatures but the clay looks fairly promising for use in face brick, sewer pipe, or quarry tile. There are some laminations in the 1-inch x 1-inch bars. Generally, this fault can be corrected by minor adjustments in the mix or the machine. No crazing or shivering was noted in the glazed pieces.

*Potential Use:* Face brick, quarry tile, and sewer pipe.

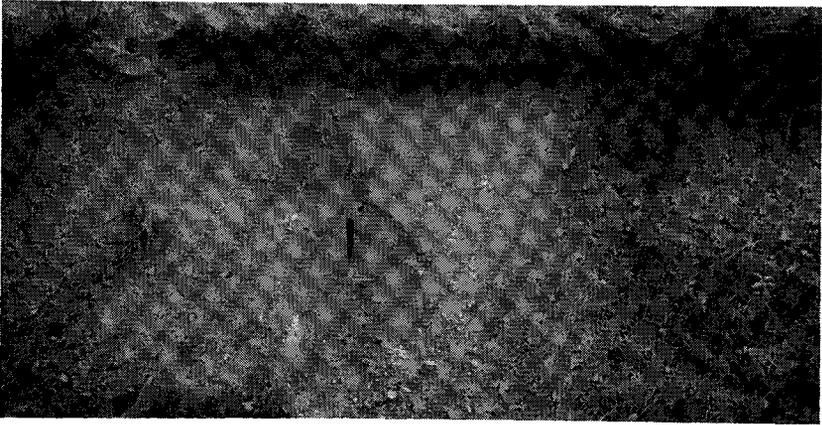


Figure 3. Exposure of clay of Pleistocene age (Sample R-2870) on the east side of State Road 609 approximately 0.8 mile by road south of the intersection with State Road 625.

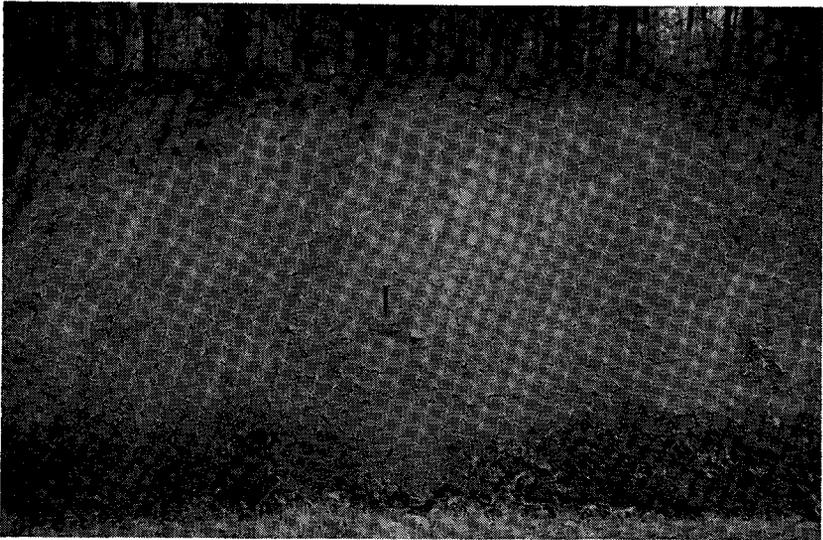


Figure 4. Exposure of clay of Pleistocene age (Sample R-2874) on the east side of State Road 614 approximately 1.5 miles by road north-west of the intersection with State Road 615.



Figure 3. Exposure of clay of Pleistocene age (Sample R-2870) on the east side of State Road 609 approximately 0.8 mile by road south of the intersection with State Road 625.

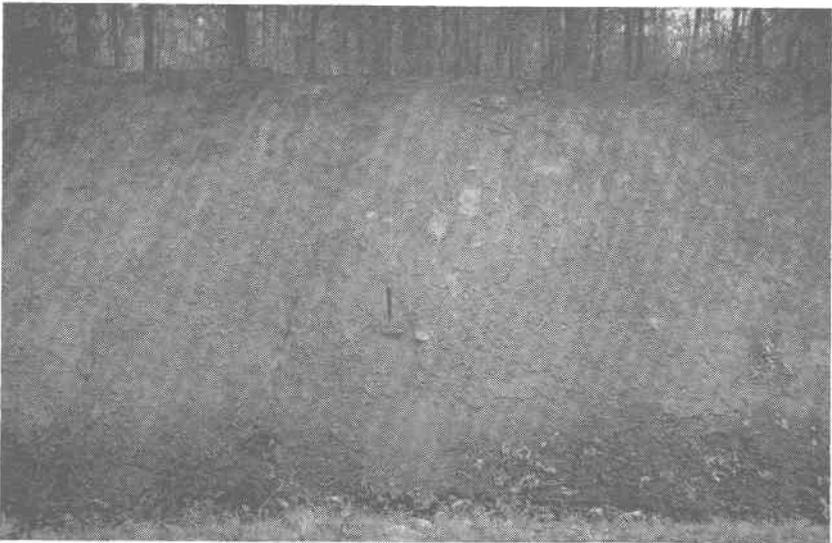


Figure 4. Exposure of clay of Pleistocene age (Sample R-2874) on the east side of State Road 614 approximately 1.5 miles by road north-west of the intersection with State Road 615.

SAMPLE: R-2875

County: Charles City

*Locality:* Roadcut, 0.9 mile southeast of Holdcroft, on the north side of State Road 615 approximately 0.2 mile by road west of the intersection with State Road 623.

*Description:* An exposure of 3 feet of very uniform, light-gray clay occurs in a long roadcut that has a maximum height of 8 feet. A zone of indurated, ferruginous sandstone 4 inches thick directly overlies the clay. Overburden is composed of clayey sand and sandy clay.

*Formation or Age:* St. Marys Formation

*Sampled Interval:* Sample across 3 feet of clay.

*Raw Properties:*

Water of plasticity: 30.3%

Plasticity: medium

Drying shrinkage: 7.5%

Dry strength: good

Drying defects: none

pH: 6.5

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	2+	7.5	16.9	31.3	1.85
1900	Tan	2+	7.5	16.3	30.3	1.86
2000	Buff	3	9.5	13.1	25.4	1.94
2100	Lt. brown	4	11.0	9.8	19.6	2.00
2200	Brown	5+	13.0	5.7	12.2	2.14
2300	Gray-brown	6+	12.5	3.2	7.2	2.25

Remarks: Good buff color below 2100°F; should fire to "MW" face-brick specifications at about 2050°F.

*Bloating Test:* Negative

*Potential Use:* Face brick and tile.

SAMPLE: R-2876

County: Charles City

*Locality:* Roadcut, 2.0 miles east of Ruthville, on the west side of State Road 614 approximately 0.3 mile by road south of the intersection with State Road 615.

*Description:* An exposure of 4 feet of clay is present in a long roadcut that has a maximum height of 5 feet. The clay is composed of two zones; the lower zone, about 3 feet thick, is a uniform, light- to medium-gray clay; the upper zone, about 1 foot thick, is a mottled gray, red, and brown clay that contains silt-size particles of quartz. A vertical auger hole drilled 40 feet north of and approximately 3 feet lower than the sampled portion of the cut penetrated only 1 foot of clay and then went into at least 9 feet of gray, sandy clay and iron oxide stained sand.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across 4 feet of clay exposed in the roadcut.

*Raw Properties:*

Water of plasticity: 31.1%

Plasticity: medium

Drying shrinkage: 5.0%

Dry strength: good

Drying defects: none

pH: 6.3

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Cream	2+	5.0	18.4	32.9	1.79
1900	Cream	2+	5.0	17.6	31.9	1.81
2000	Ivory	2+	7.5	14.9	28.6	1.92
2100	Ivory	5+	10.0	10.7	21.7	2.03
2200	Lt. gray	6	12.5	5.0	11.1	2.22
2300	Gray	6+	12.5	2.4	5.6	2.32

Remarks: This is a good clay for light-colored ware.

*Bloating Test:* Negative

*Extrusion Test:*

Body composition: 80% by weight raw clay thru 8 mesh; 20% by weight clay calcined to 2000°F

Water added for extrusion: 25% of dry batch weight

Shapes extruded: 1-inch x 1-inch bars, cut to 3-inch lengths

Vacuum on machine: 27 inches of mercury

Drying: 24 hours in air; 24 hours at 140°F

Drying shrinkage: 3.2%

Firing:

Time: 24 hours

Temperature: 2140°F

Cone: 5 over

Total shrinkage: 7.8%

Absorption: 9.6%

Appar. porosity: 21.0%

Bulk density: 2.02 gm/cc

Hardness: 6

Color: buff

Glaze: Single fire, lead

Remarks:

This is an excellent buff-firing clay. It should be suitable for use in face brick, glazed structural tile, and stoneware. The glaze did not craze or shiver. It should be noted, however, that the glaze used on this set of trials is softer than the glazes generally used for structural tile.

*Potential Use:* Face brick, glazed structural tile, and stoneware.



## CHESTERFIELD COUNTY

Samples were collected from eight localities in Chesterfield County. Laboratory testing indicates the following potential uses for the raw material:

<u>Sample</u>	<u>Formation or Age</u>	<u>Potential Use</u>
R-2709	Vinita Formation	Face brick
R-2710	Vinita Formation	None
R-2866	Pleistocene	Buff face brick and tile
R-2867	Pleistocene	None
R-2868	Quaternary (?)	None
R-2869	Pleistocene	Face brick and sewer pipe
R-2890	Paleozoic (?)	Nonplastic component
R-2891	Pleistocene	Face brick, quarry tile, and sewer pipe

SAMPLE: R-2709

County: Chesterfield

*Locality:* Pit of Daniels Brick and Tile Co., Inc., 1.5 miles southeast of Hallsboro, 0.7 mile off the west side of State Road 667 approximately 1.7 miles by road north of the intersection with State Road 604.

*Description:* At least 18 feet of red-brown, gray-brown, and tan siltstone is exposed in the pit. The siltstone is argillaceous and moderately micaceous, with thin zones of coarse-grained, clayey sandstone. Overburden consists of approximately 3 feet of Otterdale Sandstone of Triassic age.

*Formation or Age:* Vinita Formation

*Sampled Interval:* Sample across 18 feet of siltstone.

*Raw Properties:*

Water of plasticity: 15.4%

Plasticity: low

Drying shrinkage: 2.5%

Dry strength: low

Drying defects: none

pH: 6.0

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Lt. brown	3	2.5	17.3	30.7	1.77
1900	Lt. brown	3	2.5	16.9	30.1	1.78
2000	Dk. brown	4	5.0	10.5	21.1	2.01
2100	Dk. brown	5	10.0	3.3	7.6	2.30
2200	—	—	(Expanded)	—	—	—

Remarks: Poor color (borderline); should fire to "SW" face-brick specifications at about 2050°F.

*Bloating Test:* Negative

*Potential Use:* Face brick

SAMPLE: R-2710

County: Chesterfield

*Locality:* Roadcut, 4.5 miles south of Hallsboro, on the southeast side of State Road 667 approximately 0.3 mile by road north of the intersection with State Road 604.

*Description:* An exposure of at least 20 feet of red-brown, soft, friable, silty to sandy shale is present in a roadcut that has a maximum height of approximately 26 feet. The shale is predominantly red-brown, but contains thin zones of light-green and gray-green clay. Directly overlying the shale is 1 foot of sand and gravel, and above that is 5 feet of tan to gray-green clay.

*Formation or Age:* Vinita Formation

*Sampled Interval:* Sample across 20 feet of shale.

*Raw Properties:*

Water of plasticity: 17.4%

Plasticity: low

Drying shrinkage: 2.5%

Dry strength: low

Drying defects: none

pH: 5.9

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	(Poor bond)	2.5	—	—	—
1900	Tan	(Poor bond)	2.5	—	—	—
2000	Lt. brown	3	5.0	15.6	28.4	1.82
2100	Dk. brown	4	10.0	10.5	21.0	2.00
2200	Dk. brown	5	10.0	6.9	14.7	2.13
2300	Dk. gray	6	12.5	2.3	5.2	2.25

Remarks: Poor color; poor ceramic bond; not suitable for use in vitreous clay products.

*Bloating Test:* Negative

*Potential Use:* None

SAMPLE: R-2866

County: Chesterfield

*Locality:* Clay pit of Daniels Brick and Tile Co., Inc., 3.0 miles north of Hopewell, off the west side of State Road 827 approximately 0.3 mile by road south of the intersection with State Road 618.

*Description:* The clay is light-gray and slightly sandy. One to 2 feet of sandy overburden is present. The clay is mixed with a quartz-mica schist (R-2917) from Dinwiddie County and extruded into tile products.

*Formation or Age:* Pleistocene

*Sampled Interval:* Representative of sandy clay in pit.

*Raw Properties:*

Water of plasticity: 31.8%

Dry strength: good

Drying shrinkage: 7.5%

pH: 6.9

Drying defects: none

Other: some grit

Plasticity: medium

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Cream	2+	7.8	17.9	31.9	1.78
1900	Cream	2+	10.0	15.7	28.4	1.81
2000	Ivory	3	12.5	12.5	23.8	1.90
2100	Buff	6+	15.0	6.9	14.6	2.11
2200	Lt. brown	7	15.0	1.7	3.8	2.26
2300	Gray-brown	7+	15.0	3.4	7.1	2.09

Remarks: Good color; should fire to "MW" face-brick specifications at about 2000°F.

*Bloating Test:* Negative

*Potential Use:* Buff face brick and tile.

SAMPLE: R-2867

County: Chesterfield

*Locality:* Roadcut, 2.4 miles east of Walthall, on the northwest side of State Road 619 approximately 0.3 mile by road south of the intersection with State Road 617.

*Description:* An exposure of 6 feet of light-gray, clayey sand is present in a long roadcut that has a maximum height of 10 feet. The clay content of the material is greater in the lower 3 feet of the exposure. A zone of rounded quartz gravel 2 inches thick is present about 3 feet above the base of the exposure; 3 to 4 feet of sandy overburden is present.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across 6 feet of clayey sand.

*Raw Properties:*

Water of plasticity: 17.3%

Dry strength: low

Drying shrinkage: 2.5%

pH: 7.3

Drying defects: none

Other: sandy

Plasticity: low

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Salmon	2	2.5	19.8	35.6	1.80
1900	Salmon	2	2.5	16.4	30.0	1.83
2000	Salmon	2	2.5	16.7	30.7	1.84
2100	Buff	2	2.5	15.9	29.6	1.86
2200	Lt. brown	2	2.5	16.3	30.0	1.84
2300	Gray-brown	2	5.0	15.3	28.3	1.85

Remarks: Fair color; lacks plasticity.

*Bloating Test:* Negative

*Potential Use:* None

SAMPLE: R-2868

County: Chesterfield

*Locality:* Roadcut, 0.5 mile north of Winterpock, on the east side of State Road 621 approximately 0.5 mile by road north of the intersection with State Road 655.

*Description:* An exposure of 2 feet of light-gray, clayey sand is present in a long roadcut that has a maximum height of 5 feet. Overburden consists of 3 feet of sand that is stained by iron oxide.

*Formation or Age:* Quaternary (?)

*Sampled Interval:* Sample across 2 feet of clayey sand.

*Raw Properties:*

Water of plasticity: 20.5%

Dry strength: low

Drying shrinkage: 2.5%

pH: 7.0

Drying defects: none

Other: short working,  
some grit

Plasticity: low

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	2	2.5	—	—	—
1900	Tan	2	2.5	19.6	34.1	1.74
2000	Buff	2	3.5	—	—	—
2100	Lt. brown	2	5.0	19.3	34.2	1.77
2200	Brown	2	5.0	13.1	25.0	1.91
2300	Dk. brown	5	7.5	8.8	17.1	2.06

Remarks: Fair color; high vitrification temperature.

*Bloating Test:* Negative

*Potential Use:* None

SAMPLE: R-2869

County: Chesterfield

*Locality:* Bed of Swift Creek, 3.7 miles southeast of Hallsboro, just north of State Road 604 at the bridge across Swift Creek, and 1.1 miles by road east of the intersection with State Road 667.

*Description:* Medium-gray clay is exposed in the bed of Swift Creek. The clay contains small lenses of fine-grained sand. Some minor iron oxide staining is present.

*Formation or Age:* Pleistocene

*Sampled Interval:* Representative of clay in bed of Swift Creek.

*Raw Properties:*

Water of plasticity: 24.3%

Plasticity: low

Drying shrinkage: 5.0%

Dry strength: fair

Drying defects: none

pH: 7.1

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	2+	5.0	16.1	29.0	1.80
1900	Tan	2+	5.0	15.4	27.9	1.81
2000	Buff	2+	7.5	12.6	24.3	1.93
2100	Lt. brown	3	7.5	10.6	21.2	2.00
2200	Brown	4	10.0	6.7	14.0	2.09
2300	Dk. brown	5	10.0	2.3	5.1	2.20

Remarks: Good buff color at 2000°F; should fire to "MW" face-brick specifications at about 2000°F.

*Bloating Test:* Negative

*Potential Use:* Face brick and sewer pipe.

SAMPLE: R-2890

County: Chesterfield

*Locality:* Pit of Daniels Brick and Tile Co., Inc., 1.7 miles southeast of Winterpock, on the south side of State Road 602 approximately 1.5 miles by road east of the intersection with State Road 621.

*Description:* Gray-green to blue-green schist that weathers to pale gray-green and gray is present in the pit. The material is inter-layered with zones of deeply weathered brown-yellow mica schist. The exposed schist in the pit is stained by iron oxide, and brown-black to black manganese (?) stains are present on joint and foliation planes. The foliation of the schist has a strike of N.31° W. and a dip of 52°NE.; joint planes have strikes of N.59°W. and N.47°E. and dips of 45°SW. and 69°NW. respectively. Minor folding is present. This material has been used as a component in the manufacture of structural clay products.

*Formation or Age:* Paleozoic (?)

*Sampled Interval:* Representative of schist in pit.

*Raw Properties:*

Water of plasticity: 16.4%

Dry strength: low

Drying shrinkage: none

pH: 6.2

Drying defects: none

Other: short working, mealy

Plasticity: low

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Lt. brown	(Poor bond)	0.0	—	—	—
1900	Lt. brown	(Poor bond)	0.0	27.0	40.5	1.50
2000	Brown	(Poor bond)	0.0	23.1	39.2	1.56
2100	Dk. brown	5	2.5	15.6	28.9	1.85
2200	(Clinker)	7+	12.5	1.1	2.7	2.47
2300	(Clinker)	7+	12.5	0.0	0.0	2.60

*Bloating Test:* Negative

*Potential Use:* Nonplastic component in structural clay products.

SAMPLE: R-2891

County: Chesterfield

*Locality:* Clay pit of Redford Brick Company, 0.9 mile northeast of Ampthill, approximately 0.2 mile off the west side of Commerce Road and approximately 0.4 mile by road south of the intersection with Bells Road.

*Description:* Redford Brick Company is utilizing the clay from this pit in the manufacture of brick. General Shale Products Corporation and Southern Pottery use similar clay obtained from an adjacent pit for manufacture of brick and pottery respectively. Ten feet of light- to medium-gray and yellow-orange clay is exposed in the pit. Dull-black manganese (?) stain occurs on surfaces exposed along shrinkage cracks.

*Formation or Age:* Pleistocene

*Sampled Interval:* Representative of clay in pit.

*Raw Properties:*

Water of plasticity: 22.1%

Dry strength: good

Drying shrinkage: none

pH: 5.2

Drying defects: none

Other: smooth

Plasticity: medium

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	2	0.0	18.4	32.4	1.76
1900	Tan	3	0.0	16.3	29.8	1.83
2000	Dk. tan	6	5.0	11.0	21.6	1.96
2100	Red	7	7.5	4.3	9.4	2.19
2200	Dk. red	7+	7.5	2.7	6.0	2.23
2300	Dk. red	7+	7.5	1.9	4.3	2.27

Remarks: Good color; good firing range; should fire to "SW" face-brick specifications at about 2050°F.

*Bloating Test:* Negative

*Extrusion Test:*

Body composition: 100% by weight raw clay thru 8 mesh  
 Water added for extrusion: 22% of dry batch weight  
 Shapes extruded: 1-inch x 1-inch bars, cut to 8-inch lengths  
 Vacuum on machine: 27 inches of mercury  
 Drying: 24 hours in air; 24 hours at 140°F.  
 Drying shrinkage: 6.25%

**Firing:**

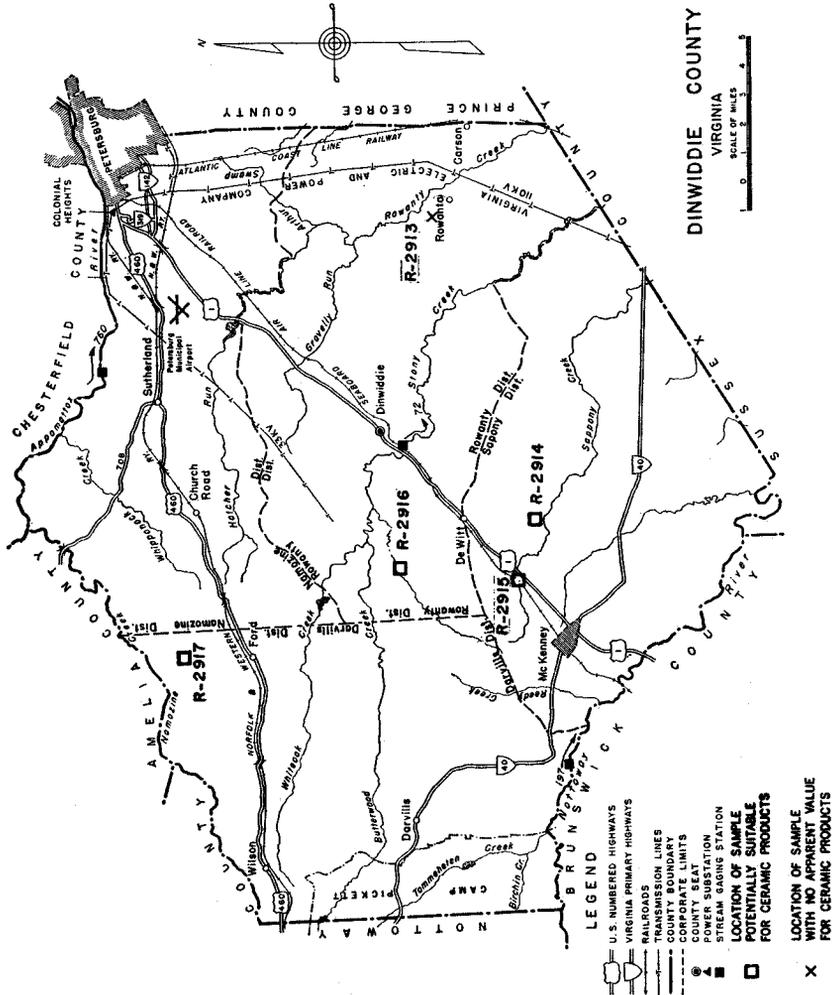
Time: 24 hours	Appar. porosity: 1.48%
Temperature: 2140°F	Bulk density: 2.35 gm/cc
Cone: 5 over	Hardness: 6
Total shrinkage: 12.5%	Color: dark red
Absorption: 0.5%	

Glaze: Single fire, lead (clear).

**Remarks:**

Handles well in extrusion; has good firing range and develops good color. When fired to the temperature necessary to provide specified absorption this clay should be suitable for face brick, sewer pipe, and quarry tile. No crazing or shivering was noted in the glazed pieces.

*Potential Use:* Face brick (current use), quarry tile, and sewer pipe.



Location Map of Dinwiddie County

## DINWIDDIE COUNTY

Samples were collected from five localities in Dinwiddie County. Laboratory testing indicates the following potential uses for the raw material:

<u>Sample</u>	<u>Formation or Age</u>	<u>Potential Use</u>
R-2913	Pleistocene (?)	None
R-2914	Tertiary	Garden pottery
R-2915	Paleozoic (?)	Face brick, and possible sewer pipe
R-2916	Paleozoic (?)	Used as a nonplastic component
R-2917	Paleozoic (?)	Used as a nonplastic component

SAMPLE: R-2913

County: Dinwiddie

*Locality:* Roadcut, 0.8 mile northwest of Rowanta, on the north side of State Road 703 approximately 0.7 mile by road west of the intersection with State Road 667.

*Description:* An exposure of about 5 feet of sandy, micaceous clay that is mottled gray, yellow, and red occurs in a roadcut having a length of 130 feet and a maximum height of 7 feet. Localized concentrations of quartz sand that is stained by iron oxide are scattered throughout the exposure. Overburden consists of approximately 3 feet of clayey sand and sand.

*Formation or Age:* Pleistocene (?)

*Sampled Interval:* Sample across approximately 5 feet of sandy clay.

*Raw Properties:*

Water of plasticity: 17.5%

Dry strength: low

Drying shrinkage: none

pH: 3.8

Drying defects: none

Other: gritty

Plasticity: low

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	2	0.0	20.0	35.2	1.76
1900	Tan	3	0.0	19.8	35.0	1.77
2000	Tan	4	0.0	—	—	—
2100	Lt. brown	4	0.0	18.4	32.9	1.79
2200	Brown	4	0.0	—	—	—
2300	Dk. brown	4	0.0	18.2	31.5	1.73

Remarks: High vitrification temperature; very low mechanical strength.

*Bloating Test:* Negative

*Potential Use:* None

SAMPLE: R-2914

County: Dinwiddie

*Locality:* Roadcut, 2.5 miles south of DeWitt, on the east side of State Road 646 approximately 2.0 miles by road north of the intersection with State Roads 655 and 692.

*Description:* An exposure of about 9 feet of brown-red, red, and yellow-brown clay occurs in a roadcut that has a maximum height of 10 feet. The clay in the exposure can be divided into 3 zones based on color and composition. The lower 4 feet is yellow-brown to orange-brown clay, with light-gray and red mottling; the intermediate zone is composed of about 2 feet of consolidated, slightly indurated ferruginous silty clay that contains a black, sooty coating on fracture surfaces; the upper 3 feet is a uniform, brown-red clay. Overburden consists of gravel, sand, and soil. Small fragments of weathered granitic rock are scattered over the surface of the exposure and surrounding area.

*Formation or Age:* Tertiary

*Sampled Interval:* Sample across approximately 9 feet of clay.

*Raw Properties:*

Water of plasticity: 28.2%

Dry strength: good

Drying shrinkage: 5.0%

pH: 3.9

Drying defects: none

Other: smooth

Plasticity: medium

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	2	5.0	32.7	48.4	1.48
1900	Tan	2	5.0	32.9	49.7	1.51
2000	Lt. brown	3	7.5	31.5	47.3	1.50
2100	Lt. brown	4	10.0	25.0	42.3	1.69
2200	Brown	4	12.5	20.9	37.6	1.80
2300	Dk. brown	4	12.5	20.3	37.1	1.83

Remarks: Color marginal; high vitrification temperature.

*Bloating Test:* Negative

*Potential Use:* Garden pottery

SAMPLE: R-2915

County: Dinwiddie

*Locality:* Pit, 2.9 miles southwest of DeWitt, off the northwest side of U. S. Highway 1 approximately 1.5 miles by road southwest of the intersection with State Road 649.

*Description:* The quartz-mica schist that crops out in the pit is light-gray, cream, and white. Many zones within the schist have been deeply weathered. Zones of predominantly quartz and mica are present. Black manganese (?) stains occur on joint and foliation planes.

*Formation or Age:* Paleozoic (?)

*Sampled Interval:* Representative sample of schist in pit.

*Raw Properties:*

Water of plasticity: 19.0%

Dry strength: low

Drying shrinkage: none

pH: 4.5

Drying defects: none

Other: very short working,

Plasticity: low

gritty

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Lt. tan	2	0.0	19.6	32.9	1.68
1900	Lt. tan	2	0.0	19.0	32.3	1.70
2000	Lt. tan	3	0.0	15.3	26.5	1.73
2100	Sand	5	0.0	13.9	25.9	1.86
2200	Gray	7	2.5	7.1	14.6	2.05
2300	Gray	7+	5.0	6.3	12.6	2.00

Remarks: Good light-tan color; friable until a ceramic bond develops.

*Bloating Test:* Negative

*Extrusion Test:*

Body composition: 100% by weight raw clay thru 8 mesh

Water added for extrusion: 18% of dry batch weight

Shapes extruded: 1-inch x 1-inch bars, cut to 8-inch lengths

Vacuum on machine: 27 inches of mercury

Drying: 24 hours in air; 24 hours at 140°F

Drying shrinkage: none

**Firing:**

Time: 24 hours

Temperature: 1970°F

Cone: 03 flat

Total shrinkage: 4.3%

Absorption: 7.5%

Appar. porosity: 13.9%

Bulk density: 2.10 gm/cc

Hardness: 7

Color: light red

**Glaze:** Single fire, lead (clear).**Remarks:**

Clay is very low in green strength. It develops good color and would probably be satisfactory for face brick, but marginal for sewer pipe. No crazing or shivering was noted in the glazed pieces.

*Potential Use:* Face brick and possible sewer pipe.

SAMPLE: R-2916

County: Dinwiddie

*Locality:* Pit of General Shale Products Corporation, 3.0 miles northwest of DeWitt, off the northeast side of State Road 646 approximately 0.3 mile by road northwest of the intersection with State Road 647.

*Description:* Gray and gray-green schist that weathers to light gray, light gray-green, and pale green is present in the pit. Blue-black to black stains occur on foliation and joint planes. The foliation of the schist has a strike of N.23°W. and a dip of 84°SW.; well-developed joint planes have a strike of N.85°E. and a dip of 81°NW. Minor folding is present.

*Formation or Age:* Paleozoic (?)

*Sampled Interval:* Representative sample of schist in pit.

*Raw Properties:*

Water of plasticity: 16.0%

Dry strength: low

Drying shrinkage: none

pH: 6.7

Drying defects: none

Other: very short working

Plasticity: low

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	2	0.0	23.0	38.0	1.65
1900	Tan	2	0.0	—	—	—
2000	Lt. brown	3	0.0	21.4	36.4	1.70
2100	Brown	5	2.5	13.2	25.7	1.95
2200	(Clinker)	8	2.5	12.7	25.0	1.97
2300	(Clinker)	8	2.5	4.6	9.4	2.04

Remarks: Color marginal; short firing range.

*Bloating Test:* Negative

*Potential Use:* Used as a nonplastic component in structural clay products.

SAMPLE: R-2917

County: Dinwiddie

*Locality:* Pit of Daniels Brick and Tile Co., Inc., 2.3 miles north of Ford, off the west side of State Road 621 approximately 2.0 miles by road north of the intersection with U. S. Highway 460.

*Description:* Medium-gray schist that weathers light gray, gray-green, pale green, and white is present in the pit. The foliation of the schist has an east-west strike and a dip of 37°N.; well-developed joint planes have a strike of N.80°E. and a dip of 55°NW. The foliation and joint surfaces are stained brown, yellow-orange, rust-brown, and blue-black by iron oxide.

*Formation or Age:* Paleozoic (?)

*Sampled Interval:* Representative sample of schist in pit.

*Raw Properties:*

Water of plasticity: 17.5%

Dry strength: low

Drying shrinkage: none

pH: 6.9

Drying defects: none

Other: short working

Plasticity: low

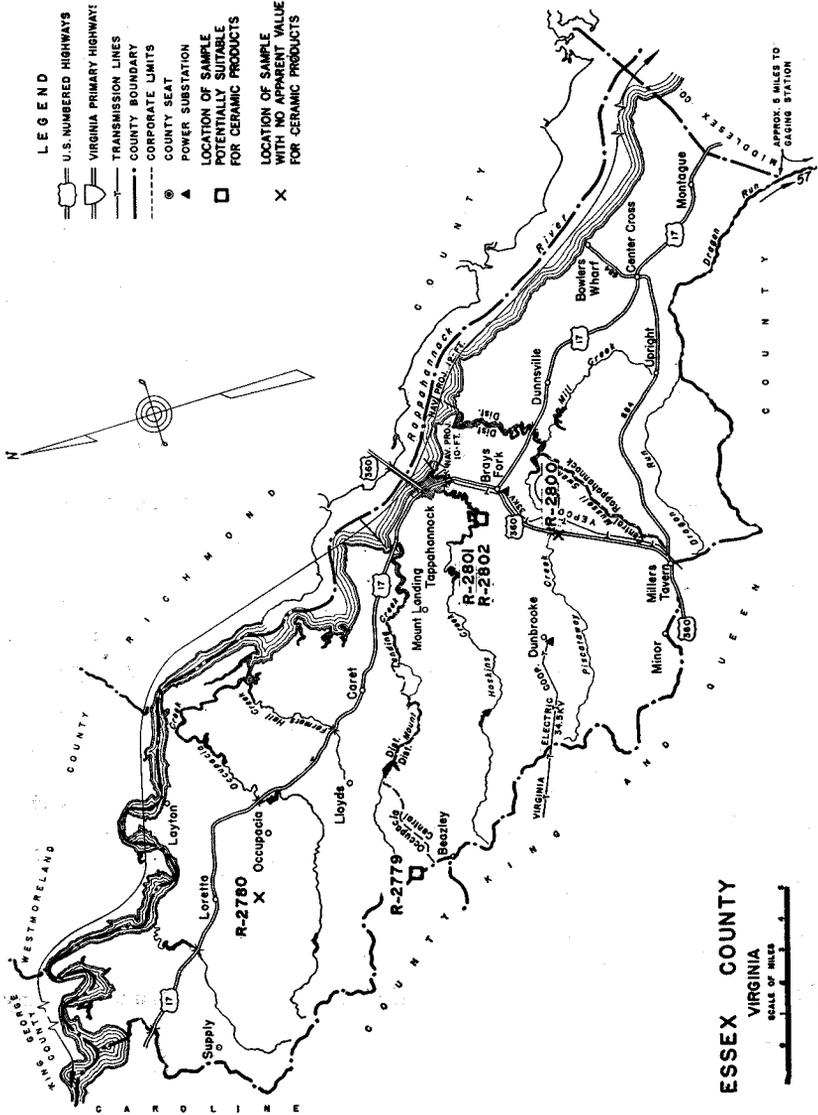
*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	2	0.0	22.1	36.9	1.67
1900	Tan	2	0.0	20.6	35.2	1.71
2000	Lt. brown	3	0.0	18.0	32.2	1.79
2100	Brown	7	5.0	9.8	20.0	2.04
2200	Dk. brown	8	7.5	1.7	3.8	2.26
2300	(Clinker)	8	5.0	8.6	14.8	1.72

Remarks: Overfired at 2300°F.

*Bloating Test:* Negative

*Potential Use:* Used as a nonplastic component in structural clay products.



Location Map of Essex County

## ESSEX COUNTY

Samples were collected from four localities in Essex County. Laboratory testing indicates the following potential uses for the raw material:

<u>Sample</u>	<u>Formation or Age</u>	<u>Potential Use</u>
R-2779	Pleistocene	Flue lining
R-2780	Pleistocene	None
R-2800	Pleistocene (?)	None
R-2801	Pleistocene (?)	Flue lining
R-2802	Pleistocene (?)	Face brick

SAMPLE: R-2779

County: Essex

*Locality:* Roadcut, 1.3 miles north of Beazley, on the east side of State Road 635 (Figure 5) approximately 0.7 mile by road north of the intersection with State Road 630.

*Description:* An exposure of about 9 feet of mottled gray, red, and yellow sandy clay occurs in a long roadcut that has a maximum height of 10 feet. Less than a foot of soil overburden is present.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across approximately 9 feet of sandy clay.

*Raw Properties:*

Water of plasticity: 20.2%

Plasticity: medium

Drying shrinkage: 5.0%

Dry strength: good

Drying defects: none

pH: 7.3

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Pale tan	3	5.0	17.9	33.1	1.85
1900	Pale tan	3	5.0	17.1	32.8	1.92
2000	Pale tan	4	5.0	16.6	31.0	—
2100	Buff-tan	5	5.0	15.4	29.4	1.91
2200	Buff	6	5.0	14.1	27.2	1.93
2300	Buff	6	5.0	14.1	26.8	1.90

Remarks: Good color; high vitrification temperature.

*Pyrometric Cone Equivalent:* 20-23

*Bloating Test:* Negative

*Potential Use:* Flue lining

SAMPLE: R-2780

County: Essex

*Locality:* Roadcut, 1.5 miles south of Loretto, on the west side of State Road 635 approximately 0.2 mile by road south of the intersection with State Road 639.

*Description:* An exposure of about 3 feet of mottled gray, red, and pink-gray clay occurs in a long roadcut that has a maximum height of 12 feet. The clay is overlain by about 3 feet of sand and sandy soil, and underlain by approximately 5 feet of light-gray, slightly mottled sandy clay, that contains quartz gravel.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across approximately 3 feet of clay.

*Raw Properties:*

Water of plasticity: 21.8%

Plasticity: medium

Drying shrinkage: 5.0%

Dry strength: good

Drying defects: none

pH: 6.6

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Red-brown	3	5.0	21.3	37.9	1.78
1900	Red-brown	4	5.0	20.6	37.1	1.80
2000	Red-brown	4	5.0	20.6	36.9	1.79
2100	Dk. red-brown	4	5.0	19.6	35.5	1.81
2200	Dk. red-brown	5	5.0	18.1	33.3	1.84
2300	V. dk. brown	5	5.0	18.3	33.7	1.84

Remarks: Weak ceramic bond; high vitrification temperature; not suitable for use as the principal component in vitreous clay products.

*Bloating Test:* Negative

*Potential Use:* None

SAMPLE: R-2800

County: Essex

*Locality:* Roadcut, 3.8 miles northeast of Millers Tavern, on the west side of U. S. Highway 360 approximately 0.9 mile by road south of the intersection with State Road 619.

*Description:* An exposure of approximately 9 feet of dark-gray to light-brown clay and sandy clay is present in a roadcut 30 to 40 feet in height. The clay contains localized lenses of sand between laminae and small quantities of gravel and mica; carbonaceous material and invertebrate fossils are also present. An indurated, cross-bedded, ferruginous sandstone underlies the sampled clay; this sandstone is 3 to 4 feet thick in the north end of the cut. Approximately 25 feet of sand and sandy soil are present above the clay.

*Formation or Age:* Pleistocene (?)

*Sampled Interval:* Sample across 9 feet of clay and sandy clay.

*Raw Properties:*

Water of plasticity: 24.0%

Plasticity: medium

Drying shrinkage: 9.0%

Dry strength: good

Drying defects: warping

pH: 4.3

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Red-brown	3	10.0	19.3	34.7	1.80
1900	Red-brown	4	10.0	18.2	33.3	1.83
2000	Red-brown	5	10.0	15.6	29.5	1.89
2100	Chocolate	6	11.0	12.3	24.5	1.99
2200	Dk. brown	7	13.0	9.3	19.1	2.05
2300	—	—	(Expanded)	—	—	—

Remarks: Color marginal; high drying shrinkage; not suitable for use as the principal component in vitreous clay products.

*Bloating Test:* Negative

*Potential Use:* None

SAMPLES: R-2801 and R-2802

County: Essex

*Locality:* Roadcut, 3.3 miles southeast of Mount Landing, on the south side of State Road 659 (Figure 6) approximately 2.3 miles by road east of the intersection with State Road 618.

*Description:* An exposure of about 13 feet of sandy, micaceous, fossiliferous clay is present in a long roadcut that has a maximum height of 30 feet. The clay may be divided into two zones based on color. The lower zone (R-2802) is composed of 9 feet of gray-green clay that contains localized concentrations of indurated, slightly ferruginous sand; the upper zone (R-2801) is composed of about 4 feet of light-gray clay that is stained locally by moderate amounts of iron oxide. The clay is overlain by 16 feet of clayey sand and sandy soil.

*Formation or Age:* Pleistocene (?)

#### R-2801

*Sampled Interval:* Sample across approximately 4 feet of light-gray, sandy clay.

#### *Raw Properties:*

Water of plasticity: 22.2%

Plasticity: medium

Drying shrinkage: 4.0%

Dry strength: good

Drying defects: none

pH: 6.0

#### *Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	3	5.0	21.1	36.7	1.74
1900	Tan	4	5.0	20.4	35.9	1.76
2000	Tan	4	7.0	19.0	33.8	1.78
2100	Lt. brown	5	7.0	17.2	31.3	1.82
2200	Brown	5	7.0	14.8	27.8	1.88
2300	Gray	6	7.0	12.8	24.7	1.93

Remarks: Good color; high vitrification temperature.

*Pyrometric Cone Equivalent:* 18-19

*Bloating Test:* Negative

*Potential Use:* Flue lining

R-2802

*Sampled Interval:* Sample across 9 feet of gray-green, sandy clay.

*Raw Properties:*

Water of plasticity: 24.8%

Plasticity: medium

Drying shrinkage: 5.0%

Dry strength: good

Drying defects: none

pH: 4.3

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Red-tan	4	5.0	19.4	31.8	1.64
1900	Red-tan	4	5.0	18.5	30.7	1.66
2000	Red-tan	5	5.0	16.9	28.6	1.69
2100	Brown	5	6.0	15.0	26.0	1.73
2200	Red-gray	6	10.0	10.1	18.4	1.82
2300	Gray	7	10.0	9.2	17.0	1.85

Remarks: Good color; should fire to "MW" face-brick specifications at about 2200°F.

*Bloating Test:* Negative

*Potential Use:* Face brick

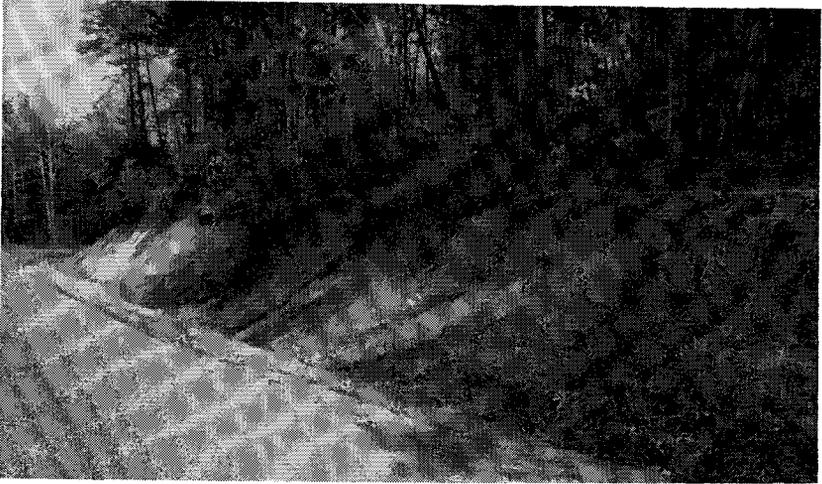


Figure 5. Exposure of clay of Pleistocene age (Sample R-2779) on the east side of State Road 635 approximately 0.7 mile by road north of the intersection with State Road 630.

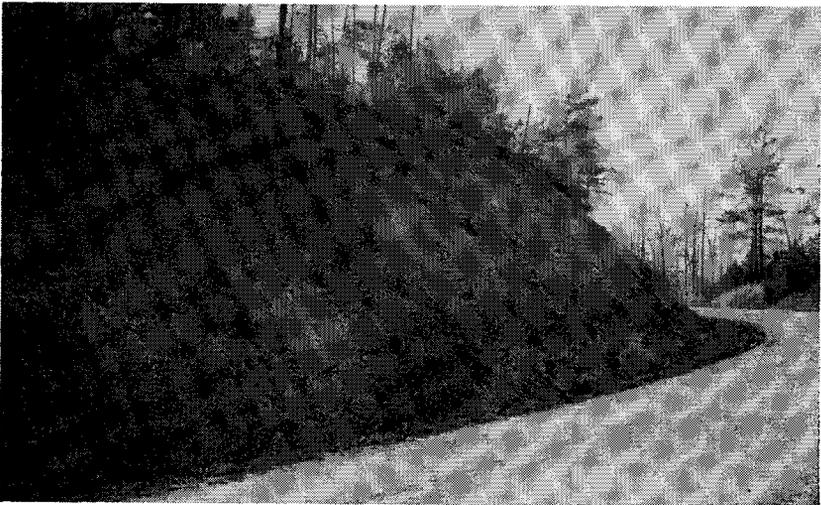


Figure 6. Exposure of clay of Pleistocene (?) age (Samples R-2801 and R-2802) on the south side of State Road 659 approximately 2.3 miles by road east of the intersection with State Road 618.



Figure 5. Exposure of clay of Pleistocene age (Sample R-2779) on the east side of State Road 635 approximately 0.7 mile by road north of the intersection with State Road 630.



Figure 6. Exposure of clay of Pleistocene (?) age (Samples R-2801 and R-2802) on the south side of State Road 659 approximately 2.3 miles by road east of the intersection with State Road 618.



## GLOUCESTER COUNTY

Samples were collected from three localities in Gloucester County. Laboratory testing indicates the following potential uses for the raw material:

<u>Sample</u>	<u>Formation or Age</u>	<u>Potential Use</u>
R-2775	Pleistocene (?)	Face brick
R-2776	Pleistocene	None
R-2777	Pleistocene	None

SAMPLE: R-2775

County: Gloucester

*Locality:* Roadcut on the west side of State Road 610 approximately 0.5 mile by road north of the intersection with State Road 617 at Signpine.

*Description:* Two layers of light-gray, greenish-yellow, and yellow fossiliferous clay, 7 feet and 3 feet thick, separated by 4 feet of sandy clay with interlayers of carbonaceous material, occur in a long roadcut approximately 20 to 25 feet in height where the sample was collected. The clay is underlain by 5 feet of sand and overlain by 2 to 3 feet of sandy, clayey soil. Staining by iron oxide occurs throughout the exposure.

*Formation or Age:* Pleistocene (?)

*Sampled Interval:* Sample across 14 feet of clay and sandy clay in the north end of the roadcut.

*Raw Properties:*

Water of plasticity: 25.2%

Plasticity: medium

Drying shrinkage: 6.0%

Dry strength: good

Drying defects: none

pH: 6.2

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Red-tan	3	7.0	20.3	35.9	1.77
1900	Red-tan	3	7.0	18.1	33.3	1.84
2000	Red-tan	4	11.0	16.5	31.2	1.89
2100	Red-brown	5	11.0	14.5	28.3	1.95
2200	Dk. brown	6	12.0	11.1	23.0	2.07
2300	V. dk. brown	7	15.0	8.4	18.1	2.16

Remarks: Fair color; should fire to "MW" face-brick specifications at about 2200°F.

*Bloating Test:* Negative

*Potential Use:* Face brick

SAMPLE: R-2776

County: Gloucester

*Locality:* Roadcut, 2.7 miles west of Cash, on the north side of State Highway 198 at its intersection with State Road 610.

*Description:* An exposure of 2 feet of mottled light-gray, yellow, and red sandy clay, overlain by about 2 feet of yellowish-brown sandy clay, occurs in a roadcut approximately 6 feet in height. The sand in the clay is well sorted, and subangular to rounded. Less than a foot of soil overburden is present.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across approximately 4 feet of sandy clay.

*Raw Properties:*

Water of plasticity: 19.0%

Plasticity: low

Drying shrinkage: 5.0%

Dry strength: fair

Drying defects: none

pH: 5.6

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Lt. tan	(Poor bond)	5.0	—	—	—
1900	Lt. tan	3	5.0	17.1	31.6	1.85
2000	Lt. tan	3	5.0	16.2	30.6	1.89
2100	Tan	3	5.0	16.0	30.2	1.89
2200	Lt. brown	(Poor bond)	5.0	—	—	—
2300	Lt. brown	(Poor bond)	—	—	—	—

Remarks: Weak ceramic bond; high vitrification temperature; not suitable for use as the principal component in vitreous clay products.

*Bloating Test:* Negative

*Potential Use:* None

SAMPLE: R-2777

County: Gloucester

*Locality:* Roadcut on the northeast side of State Road 601 approximately 0.8 mile by road northwest of the intersection with State Highway 198 at Cash.

*Description:* An exposure of 2 feet of light-gray clay, overlain by 4 to 5 feet of mottled light- to medium-gray and yellow-brown clayey sand, occurs in a roadcut that has a maximum height of 9 feet. Minor staining by iron oxide is present throughout the exposure, and is more common in the clayey sand. Approximately 2 feet of sandy soil overburden is present.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across 6 feet of clay and clayey sand in the northeast end of the roadcut.

*Raw Properties:*

Water of plasticity: 19.0%

Plasticity: low

Drying shrinkage: 5.0%

Dry strength: fair

Drying defects: none

pH: 5.1

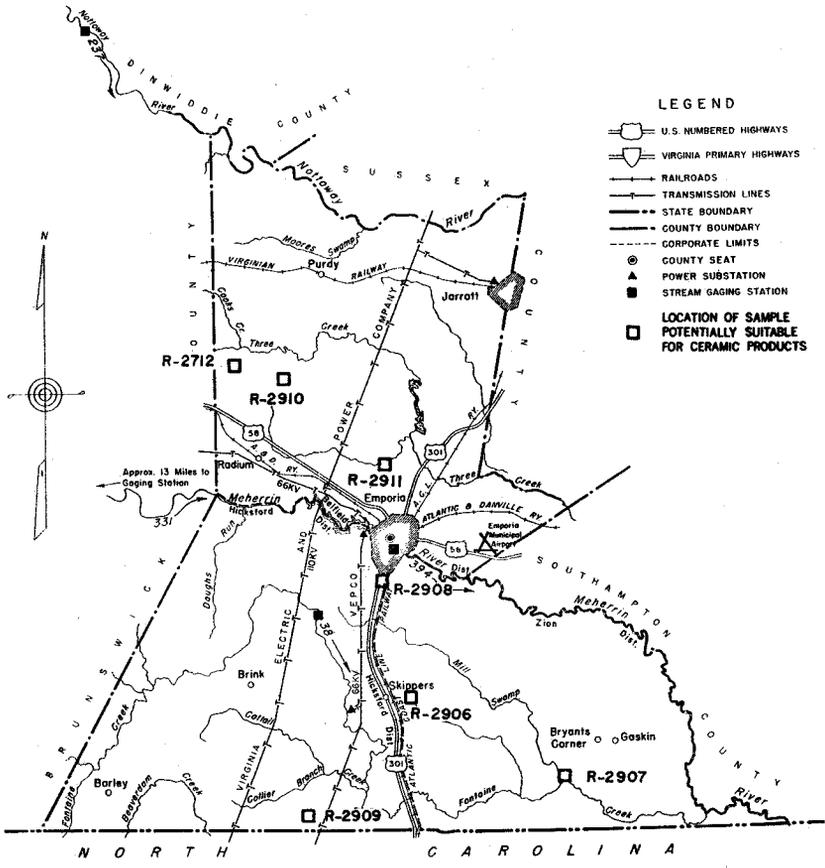
*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Red-tan	3	5.0	18.2	33.1	1.82
1900	Red-tan	3	5.0	18.1	32.9	1.82
2000	Red-tan	3	5.0	17.5	32.2	1.84
2100	Lt. red-brown	3	5.0	16.5	30.7	1.86
2200	Brown	4	5.0	15.9	29.7	1.87
2300	Brown	(Poor bond)	—	—	—	—

Remarks: Weak ceramic bond; high vitrification temperature; not suitable for use as the principal component in vitreous clay products.

*Bloating Test:* Negative

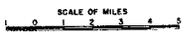
*Potential Use:* None



LEGEND

- U.S. NUMBERED HIGHWAYS
- VIRGINIA PRIMARY HIGHWAYS
- RAILROADS
- TRANSMISSION LINES
- STATE BOUNDARY
- COUNTY BOUNDARY
- CORPORATE LIMITS
- COUNTY SEAT
- POWER SUBSTATION
- STREAM GAGING STATION
- LOCATION OF SAMPLE POTENTIALLY SUITABLE FOR CERAMIC PRODUCTS

GREENVILLE COUNTY  
VIRGINIA



Location Map of Greenville County

## GREENSVILLE COUNTY

Samples were collected from seven localities in Greenville County. Laboratory testing indicates the following potential uses for the raw material:

<u>Sample</u>	<u>Formation or Age</u>	<u>Potential Use</u>
R-2712	Residual clay	Face brick
R-2906	Pleistocene (?)	Flue lining
R-2907	Pleistocene	Face brick and structural tile
R-2908	Tertiary	Face brick and structural tile
R-2909	Tertiary	Face brick, quarry tile, and sewer pipe
R 2910	Tertiary	Flue lining and garden pottery
R-2911	Tertiary	"NW" brick and garden pottery

SAMPLE: R-2712

County: Greenville

*Locality:* Roadside ditch, 3.2 miles north of Radium, on the northwest side of a forest fire trail (trail starts at the Norfolk and Western Railway crossing of State Road 608 about 1.1 miles east of Callaville) approximately 4.3 miles by road south of its intersection with State Road 608.

*Description:* Three feet of yellow-orange plastic clay was penetrated by a hole augered in a roadside ditch. The clay is residual and probably weathered from a granite, although some fragments have a schistose structure. Fragments of irregularly shaped quartz and iron oxide concentrations are present. No overburden is present where the clay was sampled.

*Formation or Age:* Residual clay

*Sampled Interval:* Sample across 3 feet of clay.

*Raw Properties:*

Water of plasticity: 29.2%

Plasticity: low

Drying shrinkage: 2.5%

Dry strength: low

Drying defects: none

pH: 5.2

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Orange-tan	(Poor bond)	2.5	28.0	43.2	1.53
1900	Orange-tan	(Poor bond)	2.5	27.9	42.9	1.53
2000	Orange-tan	3	7.5	19.8	35.0	1.77
2100	Lt. brown	4	10.0	10.6	22.0	2.08
2200	Red-brown	5	17.5	3.6	8.6	2.31
2300	Dk. brown	6	17.5	2.0	4.6	2.31

Remarks: Excessive shrinkage above 2100°F.; should fire to "MW" face-brick specifications at about 2100°F.

*Bloating Test:* Negative

*Potential Use:* Face brick

SAMPLE: R-2906

County: Greenville

*Locality:* Roadcut, 0.9 mile east of Skippers, on the southeast side of State Road 629 approximately 0.1 mile by road northeast of the intersection with State Road 626.

*Description:* An exposure of about 3 feet of yellow-tan silty clay, with gray and red mottling, is present in a roadcut that has a length of 130 feet and a maximum height of about 4 feet. Overburden consists of sandy soil.

*Formation or Age:* Pleistocene (?)

*Sampled Interval:* Sample across approximately 3 feet of silty clay.

*Raw Properties:*

Water of plasticity: 23.2%

Dry strength: fair

Drying shrinkage: none

pH: 4.3

Drying defects: none

Other: gritty

Plasticity: medium

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	2	2.5	19.5	34.1	1.75
1900	Tan	3	2.5	19.2	33.8	1.76
2000	Tan	4	2.5	18.9	33.6	1.78
2100	Dk. tan	5	5.0	17.4	31.5	1.81
2200	Lt. brown	5	5.0	16.4	30.0	1.83
2300	Brown	5	5.0	17.6	32.0	1.82

Remarks: Color marginal; high vitrification temperature.

*Bloating Test:* Negative

*Potential Use:* Flue lining

SAMPLE: R-2907

County: Greensville

*Locality:* Borrow pit, 1.7 miles southwest of Bryants Corner, off the northwest side of State Road 622, approximately 0.2 mile by road southwest of the intersection with State Road 625.

*Description:* An exposure of about 4 feet of mottled light-gray, yellow-brown, and brown clay occurs in a borrow pit approximately 150 feet wide, 110 feet long, and 5 feet deep. Predominantly light-gray clay is present in the northeast end of the pit; this clay probably underlies the main portion of the sampled mottled clay.

*Formation or Age:* Pleistocene

*Sampled Interval:* Representative sample of clay in pit.

*Raw Properties:*

Water of plasticity: 24.6%	Dry strength: good
Drying shrinkage: none	pH: 4.2
Drying defects: none	Other: smooth
Plasticity: medium	

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	3	2.5	14.6	27.2	1.86
1900	Tan	4	5.0	15.0	28.5	1.90
2000	Buff	4	7.5	10.9	21.9	2.01
2100	Lt. red	5	10.0	5.0	10.8	2.16
2200	Red-brown	7	10.0	3.0	6.8	2.25
2300	Dk. brown	7+	12.5	4.5	9.9	2.21

Remarks: Good color; should fire to "MW" face-brick specifications at about 1950°F.

*Bloating Test:* Negative

*Potential Use:* Face brick and structural tile.

SAMPLE: R-2908

County: Greenville

*Locality:* Roadcut, 1.5 miles south of Emporia, on the southwest side of State Road 730 approximately 0.5 mile by road southeast of the intersection with U. S. Highway 301.

*Description:* An exposure of 2 feet of gray and yellow-brown clay is present in a long roadcut that has a maximum height of 4 feet. The clay is overlain by up to 2 feet of sand, gravel, and soil.

*Formation or Age:* Tertiary

*Sampled Interval:* Sample across 2 feet of clay.

*Raw Properties:*

Water of plasticity: 31.6%

Dry strength: high

Drying shrinkage: 5.0%

pH: 3.6

Drying defects: none

Other: smooth

Plasticity: medium

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Lt. tan	2	5.0	21.5	35.9	1.67
1900	Lt. tan	3	5.0	20.5	34.9	1.70
2000	Lt. tan	4	7.5	16.4	29.8	1.82
2100	Buff	6	10.0	8.9	18.3	2.06
2200	Brown	7	12.5	4.7	10.3	2.19
2300	Gray	7+	12.5	1.6	3.7	2.32

Remarks: Good tan color; good firing range.

*Bloating Test:* Negative

*Extrusion Test:*

Body composition: 100% by weight raw clay thru 8 mesh

Water added for extrusion: 30% of dry batch weight

Shapes extruded: 1-inch x 1-inch bars, cut to 8-inch lengths

Vacuum on machine: 27 inches of mercury

Drying: 24 hours in air; 24 hours at 140°F

Drying shrinkage: 6.25%

**Firing:**

Time: 24 hours  
Temperature: 2050°F  
Cone: 2 over  
Total shrinkage: 12.5%  
Absorption: 5.3%

Appar. porosity: 11.0%  
Bulk density: 2.15 gm/cc  
Hardness: 7  
Color: orange-tan

**Remarks:**

Extrudes satisfactorily; color is better at firing temperatures below 2000°F.

*Potential Use:* Face brick and structural tile.

SAMPLE: R-2909

County: Greenville

*Locality:* Roadcut, 4.8 miles southwest of Skippers, on the north side of State Road 631 approximately 0.2 mile by road west of the intersection with State Road 629, and just east of the bridge crossing Beaverpond Creek.

*Description:* An exposure of approximately 5 feet of mottled gray, yellow, red, and brown clay is present in a long roadcut that has a maximum height of 7 feet. Weathered igneous rock crops out in the west end of the roadcut. The clay is overlain by up to 2 feet of clayey sand, sand, and gravel.

*Formation or Age:* Tertiary

*Sampled Interval:* Sample across 5 feet of clay.

*Raw Properties:*

Water of plasticity: 30.5%

Dry strength: high

Drying shrinkage: none

pH: 3.9

Drying defects: none

Other: smooth

Plasticity: medium

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	3	5.0	24.0	40.3	1.68
1900	Tan	4	7.5	19.7	34.7	1.76
2000	Tan	5	7.5	15.0	28.4	1.89
2100	Lt. brown	6	10.0	13.6	26.8	1.97
2200	Brown	7	10.0	9.8	20.4	2.08
2300	Dk. gray	7+	10.0	6.4	14.1	2.20

Remarks: Good tan color; good firing range.

*Bloating Test:* Negative

*Extrusion Test:*

Body composition: 100% by weight raw clay thru 8 mesh

Water added for extrusion: 35% of dry batch weight

Shapes extruded: 1-inch x 1-inch bars, cut to 8-inch lengths

Vacuum on machine: 27 inches of mercury

Drying: 24 hours in air; 24 hours at 140°F

Drying shrinkage: 5.2%

## Firing:

Time: 24 hours	Appar. porosity: 22.8%
Temperature: 2140°F	Bulk density: 2.24 gm/cc
Cone: 5 over	Hardness: 7
Total shrinkage: 15.5%	Color: dark red
Absorption: 10.2%	

## Remarks:

This clay develops good color and has a good firing range. It might be suitable for face brick, sewer pipe, and quarry tile although lamination and high shrinkage could be troublesome.

*Potential Use:* Face brick, quarry tile, and sewer pipe.

SAMPLE: R-2910

County: Greenville

*Locality:* Roadcut, 3.8 miles south of Purdy, on the east side of State Road 605 approximately 2.1 miles by road south of the intersection with State Road 613.

*Description:* An exposure of 4 feet of red-brown clay, with yellow mottling in the lower 2 feet, occurs in a roadcut that has a length of 130 feet and a maximum height of about 5 feet. The clay is slightly silty in places. Overburden consists of sandy clay and soil.

*Formation or Age:* Tertiary

*Sampled interval:* Sample across 4 feet of clay.

*Raw Properties:*

Water of plasticity: 31.3%

Dry strength: high

Drying shrinkage: none

pH: 3.9

Drying defects: none

Other: smooth

Plasticity: medium

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	2	0.0	28.6	44.0	1.54
1900	Tan	3	2.5	28.5	43.9	1.54
2000	Tan	4	2.5	27.5	43.2	1.57
2100	Lt. brown	4	5.0	23.2	39.0	1.68
2200	Brown	4+	5.0	21.4	37.2	1.74
2300	Red-brown	5	7.5	17.8	32.9	1.85

Remarks: Color marginal; high vitrification temperature.

*Bloating Test:* Negative

*Potential Use:* Flue lining and garden pottery.

SAMPLE: R-2911

County: Greensville

*Locality:* Roadcut, 2.7 miles north of Emporia, on the east side of State Road 619 approximately 1.3 miles by road north of the intersection with State Road 644.

*Description:* An exposure of 4 feet of red, micaceous, slightly silty clay is present in a roadcut that has a maximum height of about 5 feet. Overburden consists of sand and gravel.

*Formation or Age:* Tertiary

*Sampled Interval:* Sample across 4 feet of clay.

*Raw Properties:*

Water of plasticity: 33.8%

Dry strength: high

Drying shrinkage: 3.0%

pH: 4.7

Drying defects: none

Other: smooth

Plasticity: high

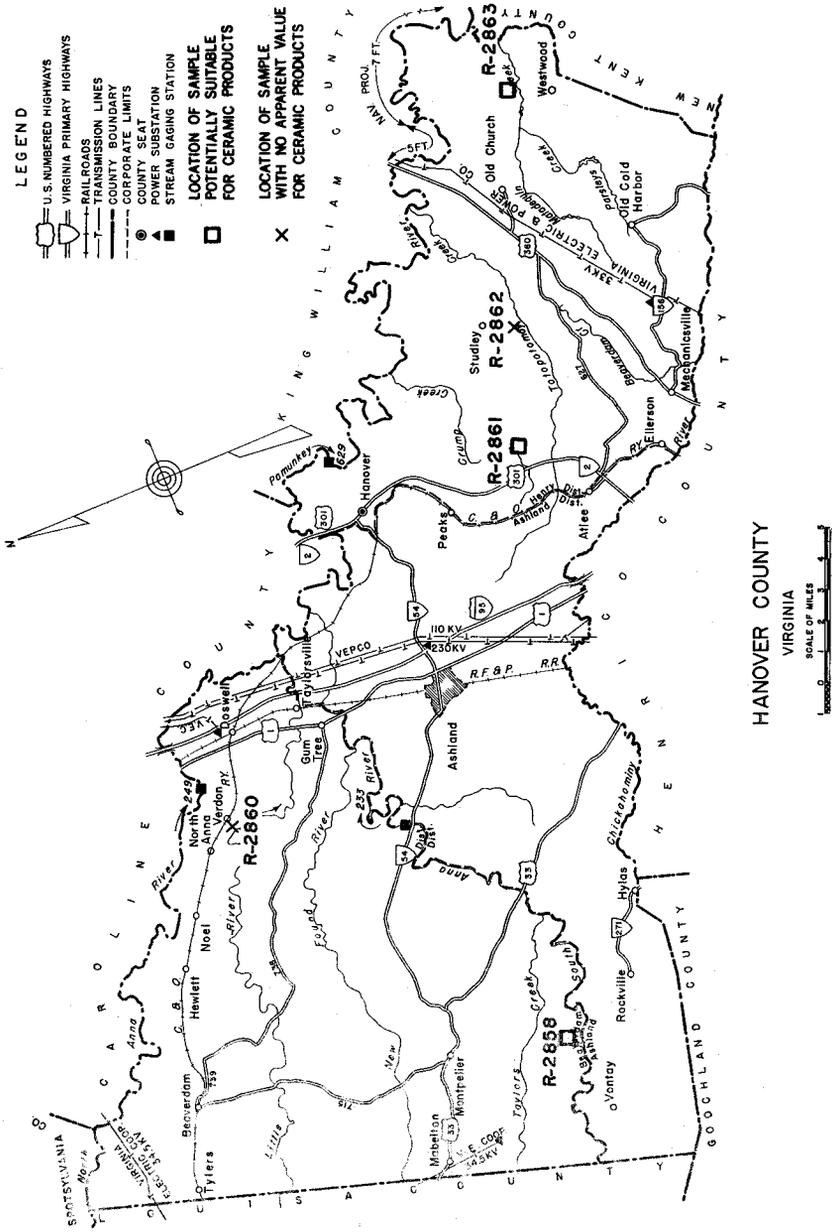
*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Dk. tan	3	5.0	27.3	44.0	1.61
1900	Dk. tan	4	5.0	26.1	42.5	1.63
2000	Dk. tan	4	7.5	18.4	34.4	1.87
2100	Lt. brown	4	10.0	15.5	30.1	1.94
2200	Brown	5	10.0	14.2	28.1	1.98
2300	Dk. brown	7	12.5	13.1	26.9	2.05

Remarks: Color marginal; high vitrification temperature.

*Bloating Test:* Negative

*Potential Use:* "NW" brick and garden pottery.



Location Map of Hanover County

## HANOVER COUNTY

Samples were collected from five localities in Hanover County. Laboratory testing indicates the following potential uses for the raw material:

<u>Sample</u>	<u>Formation or Age</u>	<u>Potential Use</u>
R-2858	Precambrian (?)	Face brick and drain tile
R-2860	Tertiary (?)	None
R-2861	Pleistocene	Flue lining
R-2862	Pleistocene	None
R-2863	Pleistocene	Face brick and structural tile

SAMPLE: R-2858

County: Hanover

*Locality:* Settling pond at plant of M and T Chemicals, Inc., located off the south side of State Road 677 at Gouldin and 3.8 miles south of Montpelier.

*Description:* The company utilizes raw material obtained from weathered pegmatite dikes. The plant extracts feldspar, rutile, and ilmenite, and other minerals that may prove to be economical, and tailings from the processed ore are discharged into settling ponds. The silt and clay in these ponds were derived from weathered pegmatites that contain a high percentage of feldspar and rutile, with lesser amounts of ilmenite, sphene, garnet, mica, and zircon. The clay appears to have a high content of kaolinite and mica. The plant adds approximately 75,000 to 100,000 tons of material to the ponds annually.

*Formation or Age:* Precambrian (?)

*Sampled Interval:* Representative sample of material in settling pond.

*Raw Properties:*

Water of plasticity: 33.4%	Plasticity: medium
Drying shrinkage: 5.0%	Dry strength: good
Drying defects: none	pH: 6.7

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	2	5.0	27.6	41.7	1.51
1900	Tan	3	6.0	23.3	38.0	1.63
2000	Lt. brown	4	11.0	16.9	30.4	1.80
2100	Brown	5	14.0	10.8	21.4	1.98
2200	Dk. brown	7	14.0	5.4	11.4	2.12
2300	Green-gray	7	14.0	3.4	7.3	2.14

Remarks: Good color; should fire to "MW" face-brick specifications at about 2050°F.

*Bloating Test:* Negative

*Potential Use:* Face brick and drain tile.

SAMPLE: R-2860

County: Hanover

*Locality:* Quarry of The General Crushed Stone Company located just southwest of the intersection of State Roads 684 and 685 at Verdon.

*Description:* Eight feet of micaceous and slightly silty, gray-green clay is exposed in the quarry. Crushed stone is produced from coarse-grained biotite gneiss, hornblende-biotite gneiss, and rock containing large masses of pink feldspar, quartz, chlorite, and epidote which underlie the clay. The clay is overlain by 10 to 20 feet of sand and gravel.

*Formation or Age:* Tertiary (?)

*Sampled Interval:* Sample across 8 feet of clay.

*Raw Properties:*

Water of plasticity: 28.4%

Plasticity: medium

Drying shrinkage: 4.0%

Dry strength: good

Drying defects: none

pH: 3.1

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	2	4.0	26.8	41.3	1.54
1900	Red-tan	2	5.0	24.8	39.7	1.60
2000	Brown	3	10.0	20.9	35.5	1.70
2100	Dk. brown	4	10.0	13.6	26.2	1.93
2200	V. dk. brown	6	10.0	8.6	17.6	2.05
2300	Gray-black	5	(Expanded)	—	—	—

Remarks: Fair color; abrupt vitrification; not suitable for use as the principal component in vitreous clay products.

*Bloating Test:* Negative

*Potential Use:* None

SAMPLE: R-2861

County: Hanover

*Locality:* Roadcut, 4.0 miles west of Studley, on the north side of State Road 643 approximately 0.7 mile by road west of the intersection with State Road 651.

*Description:* An exposure of about 6 feet of mottled brown, gray, and orange sandy clay is present in a long roadcut that has a maximum height of 7 feet.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across approximately 6 feet of sandy clay.

*Raw Properties:*

Water of plasticity: 22.5%

Plasticity: medium

Drying shrinkage: 4.0%

Dry strength: good

Drying defects: none

pH: 5.1

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Lt. tan	3	4.0	20.1	35.6	1.77
1900	Lt. tan	3	5.0	19.3	34.5	1.79
2000	Lt. tan	3	5.0	18.6	33.9	1.82
2100	Lt. tan	4	5.0	18.0	32.4	--
2200	Lt. brown	4	5.0	16.7	31.1	1.86
2300	Gray-brown	5	6.0	12.6	25.3	2.01

Remarks: Fair color; high vitrification temperature.

*Pyrometric Cone Equivalent:* 19-20

*Bloating Test:* Negative

*Potential Use:* Flue lining

SAMPLE: R-2862

County: Hanover

*Locality:* Roadcut, 1.2 miles southwest of Studley, on the west side of State Road 615 approximately 1.3 miles by road north of the intersection with State Road 627.

*Description:* An exposure of 12 feet of brown-red and gray, sandy clay occurs in a long roadcut that has a maximum height of 16 feet. The clay is composed of 2 different layers; the lower 6 feet is predominantly light-gray clay, mottled with yellow iron oxide stain, and the upper 6 feet is a brown-red sandy clay. Two to 4 feet of overburden is present.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across 12 feet of clay and sandy clay.

*Raw Properties:*

Water of plasticity: 22.2%

Plasticity: low

Drying shrinkage: 2.0%

Dry strength: poor

Drying defects: none

pH: 5.1

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	2	4.0	22.1	35.8	1.62
1900	Red-tan	2	4.0	19.9	33.4	1.68
2000	Brown	2	4.0	18.5	31.5	1.70
2100	Dk. brown	3	4.5	17.6	30.3	1.72
2200	V. dk. brown	4	4.5	16.1	28.5	1.77
2300	Dk. gray	5	6.0	11.7	21.9	1.87

Remarks: Weak ceramic bond; high vitrification temperature; not suitable for use as the principal component in vitreous clay products.

*Bloating Test:* Negative

*Potential Use:* None

SAMPLE: R-2863

County: Hanover

*Locality:* Borrow pit (Figure 7) off the east side of State Road 693 approximately 1.5 miles by road north of the intersection with State Road 619 at Westwood.

*Description:* An exposure of approximately 11 feet of gray clay occurs in a small borrow pit. The clay is stained yellow and orange in small fractures by iron oxide. Approximately 2 feet of sand and gravel overburden is present.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across 11 feet of clay.

*Raw Properties:*

Water of plasticity: 29.4%

Plasticity: medium

Drying shrinkage: 6.0%

Dry strength: good

Drying defects: none

pH: 5.3

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	3	9.0	20.0	34.0	1.70
1900	Red-tan	3	10.0	18.1	31.9	1.76
2000	Lt. brown	4	11.0	14.4	26.6	1.85
2100	Brown	5	11.0	11.8	22.5	1.91
2200	Dk. brown	6	14.5	7.5	15.3	2.04
2300	—	—	(Expanded)	—	7.8	—

Remarks: Fair color; should fire to "MW" face-brick specifications at about 2100°F.

*Bloating Test:* Negative

*Potential Use:* Face brick and structural tile.

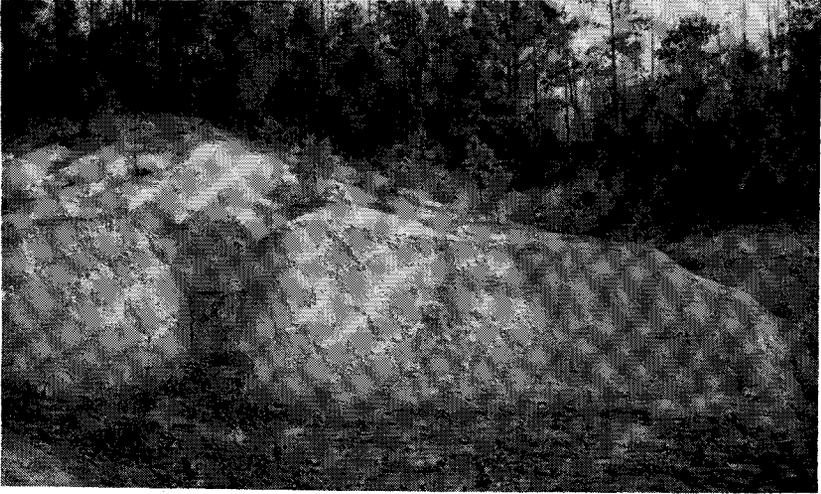


Figure 7. Exposure of clay of Pleistocene age (Sample R-2863) off the east side of State Road 693 approximately 1.5 miles by road north of the intersection with State Road 619 at Westwood.

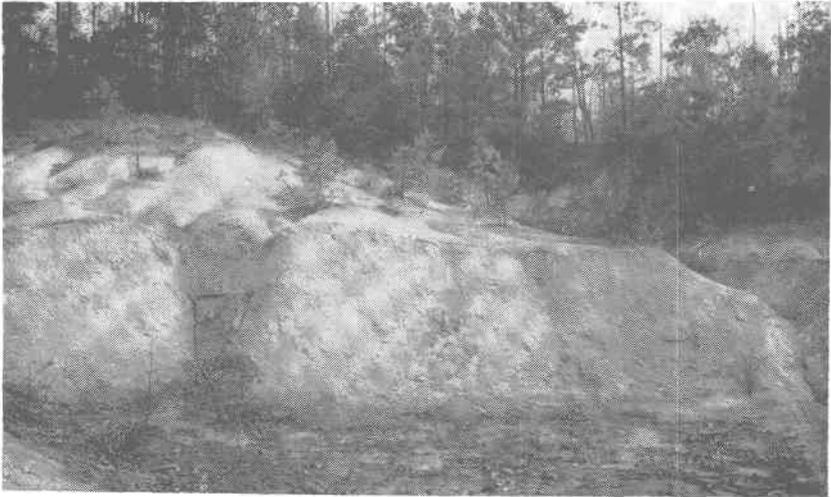


Figure 7. Exposure of clay of Pleistocene age (Sample R-2863) off the east side of State Road 693 approximately 1.5 miles by road north of the intersection with State Road 619 at Westwood.



## HENRICO COUNTY

Samples were collected from four localities in Henrico County. Laboratory testing indicates the following potential uses for the raw material:

<u>Sample</u>	<u>Formation or Age</u>	<u>Potential Use</u>
R-2864	Pleistocene	Flue lining
R-2865	Newark Group	Face brick and structural tile
R-2966	Pleistocene	None
R-2967	Pleistocene	None
R-2968	Miocene (?)	Face brick

SAMPLE: R-2864

County: Henrico

*Locality:* Exposure, 2.8 miles west of Elko, off the southwest side of Charles City Road (State Road 600) approximately 0.2 mile by road east of the intersection with Malvern Road (State Road 645).

*Description:* An exposure of mottled gray, red, and yellow clay occurs on a small hill on the southwest side of the road. The clay is underlain by a fine-grained yellow sand.

*Formation or Age:* Pleistocene

*Sampled Interval:* Representative sample of clay exposed on the hill.

*Raw Properties:*

Water of plasticity: 35.0%

Plasticity: medium

Drying shrinkage: 6.0%

Dry strength: good

Drying defects: none

pH: 5.7

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	2	6.0	26.9	42.2	1.57
1900	Tan	3	9.0	24.8	40.2	1.62
2000	Tan	3	10.0	20.6	35.8	1.74
2100	V. lt. brown	4	12.0	18.5	33.1	1.79
2200	Brown	5	14.0	16.4	30.2	1.84
2300	Purple-gray	6	15.0	13.3	25.5	1.92

Remarks: Fair color; high vitrification temperature.

*Bloating Test:* Negative

*Potential Use:* Flue lining

SAMPLE: R-2865

County: Henrico

*Locality:* Roadcut, 13.4 miles northwest of downtown Richmond, on the northeast side of Gayton Road (State Road 706) approximately 1.8 miles by road west of the intersection with Pump Road (State Road 707).

*Description:* An exposure of 8 feet of clay and silty clay occurs in a long roadcut that has a maximum height of 8 feet. The clay is predominantly a micaceous, mottled and layered, light- to medium-gray, red and yellow-brown material with layered zones of brown to black carbonaceous clay. In the north end of the roadcut, pale yellow-orange, friable, punky, silty, micaceous clay is present; this clay was not sampled. No overburden is present where the clay was sampled.

*Formation or Age:* Newark Group

*Sampled Interval:* Sample across 8 feet of clay and silty clay.

*Raw Properties:*

Water of plasticity: 35.0%

Plasticity: medium

Drying shrinkage: 5.0%

Dry strength: good

Drying defects: none

pH: 5.4

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Lt. tan	2	6.5	29.6	44.1	1.49
1900	Lt. tan	3	6.5	27.1	42.0	1.55
2000	Lt. tan	4	11.0	20.5	35.5	1.73
2100	Tan	4	15.0	16.6	30.5	1.84
2200	Lt. brown	5	15.0	12.3	24.1	1.96
2300	Gray	7	18.0	7.0	14.8	2.12

Remarks: Good color; should fire to "MW" face-brick specifications at about 2200°F.

*Bloating Test:* Negative

*Potential Use:* Face brick and structural tile.

SAMPLE: R-2966

County: Henrico

*Locality:* Settling pond of West Sand and Gravel Co., Inc., 1.3 miles southwest of Highland Springs, off the south side of State Road 654 approximately 0.1 mile by road west of the intersection with State Road 655.

*Description:* The company utilizes sand and gravel obtained from deposits of Pleistocene age. The clay obtained from the processing of the sand and gravel is discharged into settling ponds. The sampled clay (now relatively dry) is completely free of silt and sand and is very plastic and light orange in color. Company personnel estimate that at least 50,000 to 100,000 tons of this clay is available.

*Formation or Age:* Pleistocene

*Sampled Interval:* Representative sample of clay in settling pond.

*Raw Properties:*

Water of plasticity: 39.9%

Plasticity: medium

Drying shrinkage: 5.0%

Dry strength: good

Drying defects: none

pH: 5.8

*Slow Firing Test:*

Temp. °F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Orange-tan	3	10.0	28.9	45.2	1.56
1900	Orange-tan	4	12.5	24.3	41.0	1.69
2000	Orange-tan	5	17.5	13.2	27.2	2.06
2100	Lt. brown	6	20.0	3.9	9.4	2.42
2200	Red-brown	6	25.0	1.4	3.5	2.50
2300	Dk. maroon	7	25.0	0.5	1.3	2.52

Remarks: Excessive firing shrinkage; not suitable for use in vitreous clay products.

*Bloating Test:* Negative

*Potential Use:* None

SAMPLES: R-2967 and R-2968

County: Henrico

*Locality:* Pit of West Sand and Gravel Co., Inc., 1.5 miles southwest of Highland Springs, off the southwest side of State Road 654 approximately 0.4 mile by road west of the intersection with State Road 655.

*Description:* An exposure of approximately 40 feet of clay, sand, and gravel is present in the pit. The lower clay (R-2968) is green-gray, micaceous, fossiliferous, and silty and is overlain by up to 20 feet of sand and gravel of Pleistocene age. The sand and gravel are overlain by up to 20 feet of light-gray, slightly silty clay (R-2967) with minor iron oxide staining; this light-gray clay was formerly used in the manufacture of brick by Burroughs and Mankin, Inc., at this location.

## R-2967

*Formation or Age:* Pleistocene

*Sampled Interval:* Representative sample of light-gray clay exposed in the pit.

*Raw Properties:*

Water of plasticity: 22.6%

Plasticity: low

Drying shrinkage: none

Dry strength: low

Drying defects: none

pH: 3.4

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	2	5.0	21.7	35.1	1.62
1900	Tan	2	5.0	20.8	34.6	1.66
2000	Lt. brown	2	5.0	20.4	34.3	1.68
2100	Brown	3	7.5	15.2	26.7	1.76
2200	—	—	(Expanded)	—	—	—

Remarks: Poor color; abrupt vitrification; low green strength; not suitable for use in vitreous clay products.

*Bloating Test:* Negative

*Potential Use:* None

R-2968

*Formation or Age:* Miocene(?)*Sampled Interval:* Representative sample of green-gray clay taken from the exposed upper 4 feet.*Raw Properties:*

Water of plasticity: 22.1%

Plasticity: low

Drying shrinkage: 5.0%

Dry strength: good

Drying defects: none

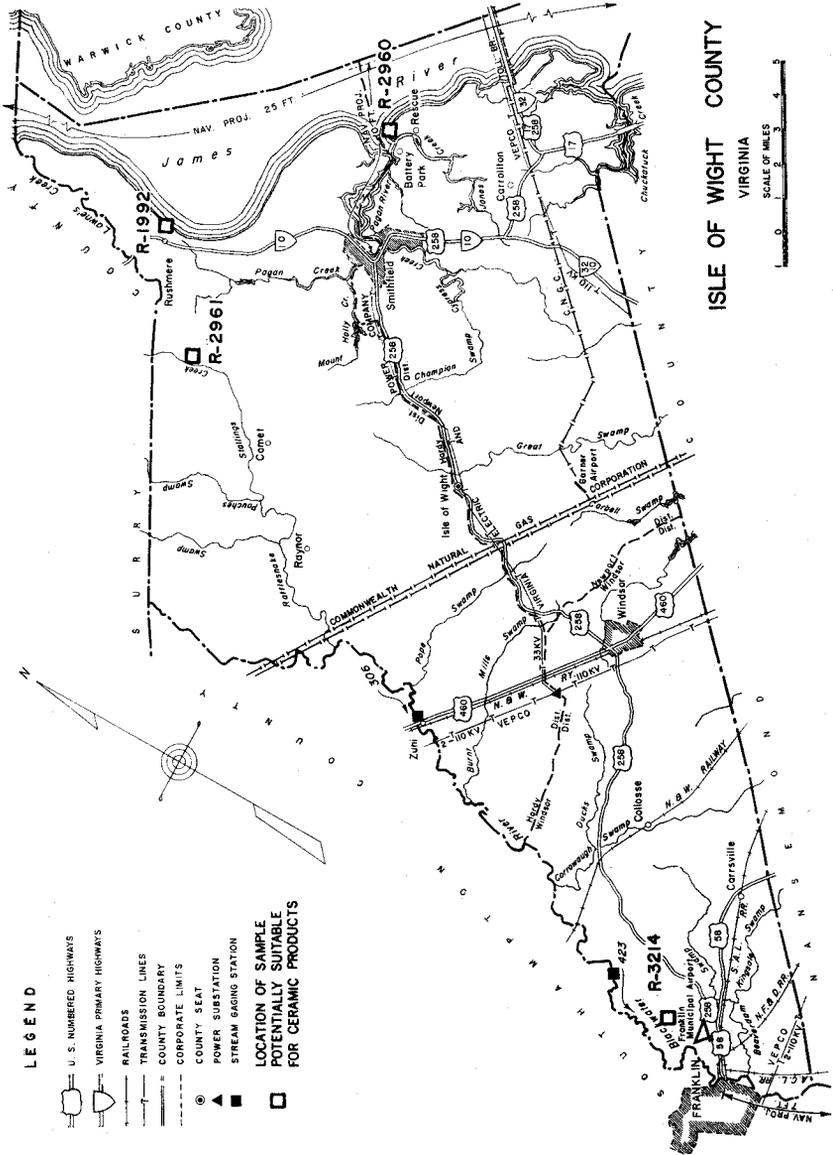
pH: 4.9

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	2	7.5	19.3	33.4	1.73
1900	Tan	3	10.0	17.8	32.1	1.80
2000	Tan	3	10.0	16.6	30.2	1.82
2100	Lt. brown	5	12.5	8.4	17.5	2.08
2200	Brown	7	15.0	4.0	8.9	2.22
2300	Dk. gray	7	15.0	2.3	5.3	2.29

Remarks: Good tan color; should fire to "MW" face-brick specifications at about 2050°F.

*Bloating Test:* Negative*Potential Use:* Face brick



Location Map of Isle of Wight County

## ISLE OF WIGHT COUNTY

Samples were collected from four localities in Isle of Wight County. Laboratory testing indicates the following potential uses for the raw material:

<u>Sample</u>	<u>Formation or Age</u>	<u>Potential Use</u>
R-1992	Yorktown Formation	Possible lightweight aggregate
R-2960	Pleistocene	Face brick and drain tile
R-2961	Plio-Pleistocene	Face brick and drain tile
R-3214	Pleistocene	Face brick

SAMPLE: R-1992

County: Isle of Wight

*Locality:* River bluff, 0.4 mile east of Rushmere, on the south side of the James River at Fergussons Wharf, and approximately 0.2 mile north of the termination of State Road 703.

*Description:* An exposure of 17 feet of gray-blue sandy clay that weathers greenish gray occurs in the river bluff. The bluff has a maximum height of about 56 feet and a length of about 300 feet. The clay is overlain by a bed of indurated shells 15 feet thick, and underlain by a bed of fossil material about 4 feet thick.

*Formation or Age:* Yorktown Formation

*Sampled Interval:* Grab sample of sandy clay from the base of the clay zone.

*Raw Properties:*

Water of plasticity: 30.0%

Plasticity: low

Drying shrinkage: 5.0%

Dry strength: low

Drying defects: none

pH: 7.2

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Brown-red	(Poor bond)	5.0	22.6	37.1	1.64
1900	Brown-red	(Poor bond)	5.0	22.5	36.9	1.64
2000	Brown-red	(Poor bond)	5.0	21.1	35.2	1.67
2100	Dk. brown	5	6.5	18.0	31.7	1.76
2200	Near black	6	12.5	7.8	15.8	2.02
2300	—	—	(Expanded)	—	—	—

Remarks: Small amount of calcareous material indicated by acid treatment.

*Bloating Test:* Positive

*Preliminary Bloating Test:*

Drying characteristics: good  
Particle size: —  $\frac{1}{2}$ " +  $\frac{1}{4}$ "

Crushing characteristics: fair  
Retention time: 15 min.

Temp. ° F	Bulk Dens.	Lb/ft <sup>3</sup>	% Abs.	Remarks
1900	1.32	82.2	20.9	No expansion
2000	1.23	76.6	19.5	No expansion
2100	1.14	71.0	13.3	Fair expansion
2200	1.03	64.1	8.2	Good expansion, very sticky

Remarks: Additional testing would be required to determine the lightweight aggregate possibilities of this clay.

*Potential Use:* Possible lightweight aggregate.

SAMPLE: R-2960

County: Isle of Wight

*Locality:* River bank, 1.0 mile northwest of Rescue, on the south side of the James River at Goodwin Point and approximately 0.7 mile by road northwest of the intersection of State Roads 665 and 704.

*Description:* An exposure of about 5 feet of compact stiff clay with lenses of fine sand occurs along the river bank. The clay may be separated into two zones; the lower 3 feet consists of blue-gray clay, and the upper 2 feet is composed of light-tan, slightly silty clay. Two inches of sand stained orange by iron oxide is present at the top of the upper zone. The clay is overlain by approximately 25 to 30 feet of sand and sandy clay.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across approximately 5 feet of clay.

*Raw Properties:*

Water of plasticity: 22.0%

Plasticity: medium

Drying shrinkage: 2.5%

Dry strength: fair

Drying defects: none

Other: gritty

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	(Poor bond)	2.5	—	—	—
1900	Tan	4	2.5	17.6	30.6	1.74
2000	Dk. tan	4	2.5	15.5	27.7	1.79
2100	Lt. brown	5	5.0	13.9	25.6	1.84
2200	Brown	6	7.5	8.9	17.8	2.00
2300	Gray	7	7.5	0.3	0.6	1.99

Remarks: Color marginal; overfired at 2300°F.

*Bloating Test:* Negative

*Potential Use:* Face brick and drain tile.

SAMPLE: R-2961

County: Isle of Wight

*Locality:* Roadcut, 3.5 miles southwest of Rushmere, on the southeast side of State Road 621 approximately 0.2 mile by road west of the intersection with State Road 627.

*Description:* An exposure of 2 feet of gray and yellow-orange clay occurs in a roadcut that has a maximum height of 11 feet. Overburden consists of 9 feet of silty to sandy clay.

*Formation or Age:* Plio-Pleistocene

*Sampled Interval:* Sample across 2 feet of clay.

*Raw Properties:*

Water of plasticity: 25.4%

Plasticity: medium

Drying shrinkage: 5.0%

Dry strength: fair

Drying defects: none

Other: gritty

*Slow Firing Test:*

Temp. °F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	3	5.0	19.9	34.0	1.71
1900	Tan	4	5.0	19.6	33.5	1.71
2000	Lt. brown	4	7.5	18.2	31.9	1.75
2100	Lt. brown	4	7.5	17.2	30.8	1.79
2200	Red-brown	5	7.5	14.2	26.6	1.87
2300	Dk. brown	6	12.5	6.5	13.7	2.10

Remarks: Fair color at 2200°F; should fire to "MW" face-brick specifications at about 2200°F.

*Bloating Test:* Negative

*Potential Use:* Face brick and drain tile.

SAMPLE: R-3214

County: Isle of Wight

*Locality:* Area off the northeast side of company road on property of Union Camp Corporation, in Block 204, approximately 1.0 mile by road off the south side of State Road 630, and 1.2 miles north of Franklin Municipal Airport.

*Description:* Gray clay, mottled olive brown in the upper 2 feet, was obtained from a vertical auger hole drilled to a depth of 4 feet.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across 4 feet of clay; the auger was still penetrating clay at the bottom of the hole.

*Raw Properties:*

Water of plasticity: 20.5%

Plasticity: low

Drying shrinkage: 5.0%

Dry strength: low

Drying defects: none

pH: 5.9

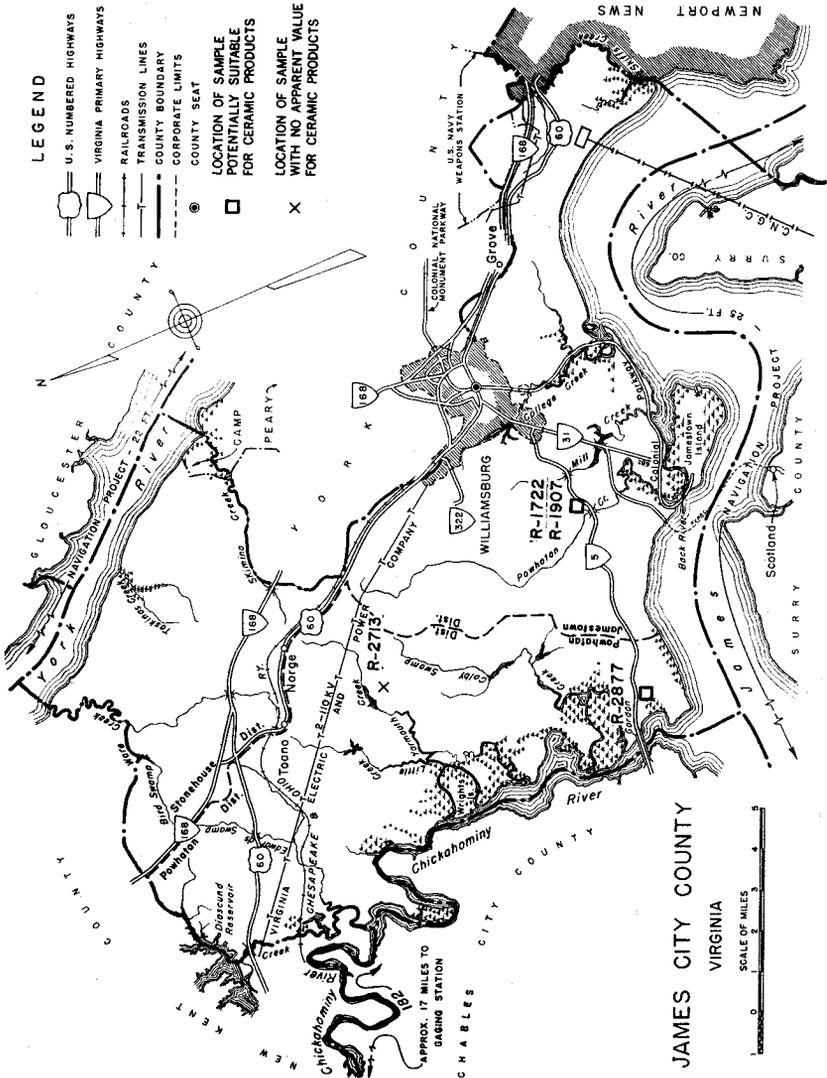
*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Orange-tan	2	5.0	19.9	34.8	1.75
1900	Orange-tan	3	5.0	17.4	31.8	1.82
2000	Orange-tan	4	5.0	14.7	27.6	1.88
2100	Lt. brown	4	10.0	11.9	23.4	1.97
2200	Dk. brown	4	12.5	9.9	20.1	2.03
2300	Maroon	5	12.5	9.6	19.5	2.03

Remarks: Best color at 2300°F; should fire to "MW" face-brick specifications at about 2100°F.

*Bloating Test:* Negative

*Potential Use:* Face brick



Location Map of James City County

## JAMES CITY COUNTY

Samples were collected from three localities in James City County. Laboratory testing indicates the following potential uses for the raw material:

<u>Sample</u>	<u>Formation or Age</u>	<u>Potential Use</u>
R-1722	Quaternary	Component in brick and tile
R-1907	Quaternary	"NW" brick and tile
R-2713	Pleistocene	None
R-2877	St. Marys Formation	Face brick, drain tile, sewer pipe, and pottery

SAMPLES: R-1722 and R-1907

County: James City

*Locality:* Site of former operations of Colonial Brick of Williamsburg, Inc., 3.9 miles west of Williamsburg, on the north side of State Highway 5 just east of Five Forks.

*Formation or Age:* Quaternary

## R-1722

*Sampled Interval:* Composite sample of weathered and fresh, reddish-brown, yellowish-brown, and light-gray sandy clay collected from the company stockpile believed to be representative of clay in adjacent pit.

*Raw Properties:*

Water of plasticity: 24.0%

Plasticity: low

Drying shrinkage: 5.0%

Dry strength: low

Drying defects: none

pH: 5.9

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Orange-buff	(Poor bond)	4.0	20.2	35.4	1.75
1900	—	(Poor bond)	—	—	—	—
2000	Orange-buff	(Poor bond)	6.0	18.3	33.1	1.81
2100	Dk. orange- buff	(Poor bond)	8.0	17.5	32.2	1.84
2200	Brown-red	(Poor bond)	8.0	15.6	29.3	1.88
2300	Dk. brown	(Poor bond)	8.0	14.7	27.9	1.90
2400	Near black	3	8.0	12.9	25.0	1.94

*Bloating Test:* Negative

*Potential Use:* Could be mixed with plastic clay and used for brick and tile.

## R-1907

*Sampled Interval:* Sample is a blend of 87 percent clay and 13 percent sand by weight. This approximates the composition of the material formerly used commercially by the company.

*Raw Properties:*

Water of plasticity: 20.0%

Drying shrinkage: 2.0%

Drying defects: none

Plasticity: low

Dry strength: low

pH: 4.8

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Buff-orange	(Poor bond)	2.5	19.2	34.2	1.78
1900	Buff-orange	(Poor bond)	2.5	19.0	34.0	1.79
2000	Dk. buff-orange	3	4.0	18.8	33.7	1.79
2100	Lt. brown	5	4.0	17.5	31.7	1.81
2200	Med. brown	6	5.0	16.3	29.8	1.83
2300	Brown-gray	6	5.0	15.7	28.7	1.83

*Bloating Test:* Negative

*Potential Use:* "NW" brick and tile.

SAMPLE: R-2713

County: James City

*Locality:* Roadcut, 7.6 miles northwest of Williamsburg, on the north side of State Road 611 just southwest of the intersection with State Road 632.

*Description:* An exposure of 6 feet of light- to medium-gray, mottled, clayey sand and sandy clay is present in a long roadcut that has a maximum height of 7 feet. The material can be divided into two zones; the lower 4 feet is a clayey sand with localized concentrations of sand, and the overlying 2 feet is a sandy clay with some quartz gravel.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across 6 feet of clayey sand and sandy clay.

*Raw Properties:*

Water of plasticity: 19.3%

Plasticity: low

Drying shrinkage: 5.0%

Dry strength: fair

Drying defects: none

pH: 5.1

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	(Poor bond)	5.0	—	—	—
1900	Tan	(Poor bond)	5.0	19.1	33.4	1.75
2000	Tan	3	5.0	18.3	32.2	1.76
2100	Tan	4	7.5	18.0	32.0	1.78
2200	Buff	4	10.0	16.8	30.2	1.80
2300	Buff	4	10.0	17.4	31.0	1.78

Remarks: Poor ceramic bond; high water absorption after firing at all above temperatures; not suitable for use in vitreous clay products.

*Bloating Test:* Negative

*Potential Use:* None

SAMPLE: R-2877

County: James City

*Locality:* Clay pit of Williamsburg Pottery Factory Inc., 8.6 miles west of Williamsburg, located approximately 900 feet off the south side of State Highway 5 about 0.4 mile by road west of the intersection with State Road 613.

*Description:* The clay is predominantly light- to medium-gray with some yellow-orange and yellow-brown clay; it is used in the manufacture of pottery.

*Formation or Age:* St. Marys Formation

*Sampled Interval:* Sample representative of clay in pit.

*Raw Properties:*

Water of plasticity: 36.2%	Plasticity: medium
Drying shrinkage: 7.5%	Dry strength: good
Drying defects: none	pH: 6.3

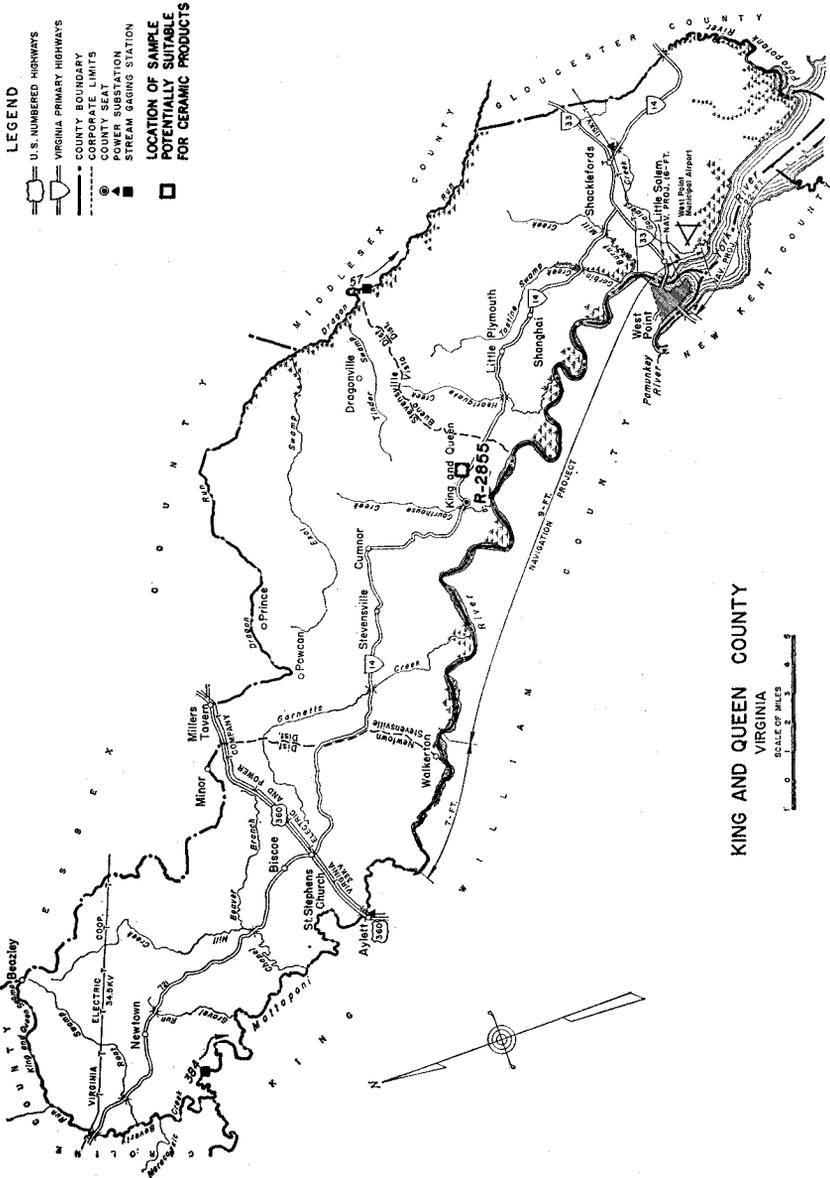
*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	2+	7.5	19.5	34.9	1.79
1900	Tan	2+	10.0	15.8	29.5	1.87
2000	Tan	2+	12.5	12.2	24.2	1.98
2100	Lt. brown	6	15.0	5.3	11.2	2.11
2200	Brown	7	15.0	2.7	6.0	2.24
2300	Dk. Brown	7	15.0	0.9	2.0	2.24

Remarks: Color marginal; should fire to "MW" face-brick specifications at about 2000°F.

*Bloating Test:* Negative

*Potential Use:* Face brick, drain tile, sewer pipe, and pottery (current use).



Location Map of King and Queen County

## KING AND QUEEN COUNTY

A sample was collected from one locality in King and Queen County. Laboratory testing indicates the following potential uses for the raw material:

<u>Sample</u>	<u>Formation or Age</u>	<u>Potential Use</u>
R-2855	Pleistocene	Face brick and drain tile

SAMPLE: R-2855

County: King and Queen

*Locality:* Roadcut, 1.1 miles east of King and Queen, on the north-east side of State Highway 14 just northwest of the intersection with State Road 654.

*Description:* An exposure of approximately 12 feet of light-gray, micaceous clay is present in a roadcut that has a maximum height of 15 feet. The clay contains silt-size quartz grains and flakes of muscovite and biotite. Yellow staining by iron oxide occurs along horizontal planes. One to 3 feet of soil overburden is present.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across 12 feet of clay.

*Raw Properties:*

Water of plasticity: 36.8%

Plasticity: medium

Drying shrinkage: 7.0%

Dry strength: good

Drying defects: none

pH: 7.3

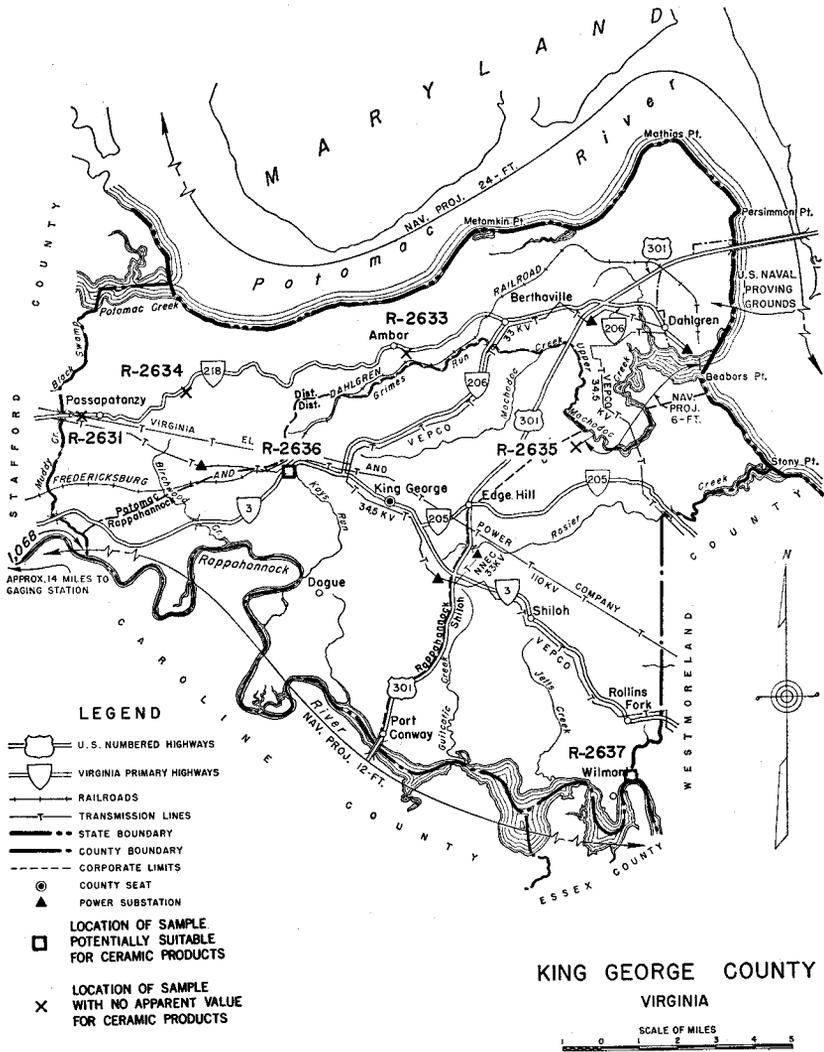
*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	3	9.0	17.6	31.3	1.78
1900	Red-tan	4	12.0	13.8	26.6	1.93
2000	Lt. brown	5	14.0	8.8	18.3	2.08
2100	Brown	6	17.0	6.5	13.9	2.14
2200	Dk. brown	7	17.0	5.1	10.9	2.14
2300	Green-gray	7	(Expanded)	—	—	—

Remarks: Good color; should fire to "SW" face-brick specifications at about 2000°F.

*Bloating Test:* Negative

*Potential Use:* Face brick and drain tile.



Location Map of King George County

## KING GEORGE COUNTY

Samples were collected from six localities in King George County. Laboratory testing indicates the following potential uses for the raw material:

<u>Sample</u>	<u>Formation or Age</u>	<u>Potential Use</u>
R-2631	Calvert Formation	None
R-2633	Calvert (?) Formation	None
R-2634	Calvert (?) Formation	None
R-2635	Calvert (?) Formation	None
R-2636	Pleistocene (?)	Face brick
R-2637	Calvert Formation	Possible mineral filler

SAMPLE: R-2631

County: King George

*Locality:* Roadcut, 0.5 mile west of Passapatanzy, on the south side of State Highway 218 just west of its intersection with State Road 651.

*Description:* An exposure of 9 feet of light-gray diatom-bearing clay, mottled in places by yellow-orange iron oxide, occurs in a roadcut about 10 feet in height and 150 feet in length. The upper 3 to 4 feet of clay contains fine-grained quartz sand. The clay stained by iron oxide separates into small, flat fragments. Approximately 1 foot of soil overburden is present.

*Formation or Age:* Calvert Formation

*Sampled Interval:* Sample across 9 feet of clay.

*Raw Properties:*

Water of plasticity: 56.0%

Plasticity: thixotropic

Drying shrinkage: 5.0%

Dry strength: fair

Drying defects: warping

pH: 4.4

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Pale tan	2	5.0	45.4	49.0	1.08
1900	Pale tan	2	5.0	41.5	47.3	1.14
2000	Pale tan	3	7.0	36.7	44.8	1.22
2100	Pale tan	3	7.0	33.9	42.7	1.26
2200	Tan	3	10.0	26.9	36.9	1.37
2300	Lt. gray	4	10.0	24.9	34.6	1.39

Remarks: Weak ceramic bond; high vitrification temperature; not suitable for use as the principal component in vitreous clay products.

*Bloating Test:* Negative

*Potential Use:* None

SAMPLE: R-2633

County: King George

*Locality:* Roadcut, 0.3 mile southeast of Ambar, on the west side of State Road 610 approximately 0.1 mile by road south of the intersection with State Highway 218.

*Description:* An exposure of about 6 feet of light-gray sandy clay occurs in a long roadcut that has a maximum height of 7 feet. The sand content is variable throughout the exposure. Some staining by iron oxide is present. The clay is overlain by about 1 foot of sandy soil.

*Formation or Age:* Calvert (?) Formation

*Sampled Interval:* Representative sample across approximately 6 feet of sandy clay.

*Raw Properties:*

Water of plasticity: 27.0%

Plasticity: medium

Drying shrinkage: 9.0%

Dry strength: good

Drying defects: none

pH: 4.7

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Red-tan	3	9.0	19.1	32.3	1.69
1900	Red-tan	4	9.0	18.6	31.8	1.71
2000	Red-brown	4	9.0	17.5	30.3	1.73
2100	Red-brown	5	9.0	16.1	28.2	1.75
2200	Dk. brown	6	10.0	12.6	23.3	1.85
2300	V. dk. brown	6	10.0	11.5	21.4	1.86

Remarks: Color marginal; high drying shrinkage; high vitrification temperature; not suitable for use as the principal component in vitreous clay products.

*Bloating Test:* Negative

*Potential Use:* None

SAMPLE: R-2634

County: King George

*Locality:* Roadcut, 2.3 miles east of Passapatanzy, on the northwest side of State Road 607 at its intersection with State Highway 218.

*Description:* An exposure of approximately 7 feet of gray sandy clay occurs in a long roadcut that has a maximum height of 18 feet. The clay is overlain by 8 feet of slightly indurated clayey sand and approximately 2 to 3 feet of red sandy soil that contains minor subangular to subrounded quartz gravel. Iron oxide staining is common in the exposure. The bottom of the gray sandy clay is approximately 158 feet above sea level; similar clay is exposed in a nearby creek at an elevation between 120 and 140 feet.

*Formation or Age:* Calvert (?) Formation

*Sampled Interval:* Sample across 7 feet of sandy clay.

*Raw Properties:*

Water of plasticity: 26.0%

Plasticity: low

Drying shrinkage: none

Dry strength: poor

Drying defects: none

pH: 4.1

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Lt. tan	(Poor bond)	1.0	—	—	—
1900	Tan	3	1.0	21.7	33.0	1.52
2000	Tan	3	1.0	21.4	32.5	1.52
2100	Tan	3	1.0	21.2	32.6	1.54
2200	Lt. brown	4	1.0	19.8	30.7	1.55
2300	Gray	4	1.0	20.0	30.8	1.54

Remarks: Weak ceramic bond; high vitrification temperature; not suitable for use as the principal component in vitreous clay products.

*Bloating Test:* Negative

*Potential Use:* None

SAMPLE: R-2635

County: King George

*Locality:* Roadcut, 3.2 miles northeast of Edge Hill, on the east side of State Road 617 approximately 1.8 miles by road southeast of the intersection with State Road 633.

*Description:* An exposure of light-gray and light gray-brown, clayey sand occurs in a long roadcut that has a maximum height of 20 feet. The sampled portion, the lower 12 feet of the exposure, is a uniform light-gray, slightly clayey sand; the upper 8 feet which was not sampled is a light gray-brown, very clayey sand. The sand is fine- to medium-grained, subangular to subrounded, with a small amount of magnetite and ilmenite (?). Staining by iron oxide occurs in places throughout the exposure. The 20 feet of clayey sand is underlain by light-green sand, partly stained yellow by iron oxide, that may contain glauconite.

*Formation or Age:* Calvert (?) Formation

*Sampled Interval:* Sample across 12 feet of clayey sand.

*Raw Properties:*

Water of plasticity: 27.0%

Plasticity: low

Drying shrinkage: 1.0%

Dry strength: poor

Drying defects: none

pH: 4.7

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Red-tan	(Poor bond)	—	—	—	—
1900	Red-tan	(Poor bond)	—	—	—	—
2000	Lt. brown	(Poor bond)	—	—	—	—
2100	Red-gray	2	1.0	28.0	38.1	1.36
2200	Gray	2	1.0	30.0	40.2	1.34
2300	Gray	3	1.0	29.6	40.0	1.35

Remarks: Weak ceramic bond; high vitrification temperature; not suitable for use as the principal component in vitreous clay products.

*Pyrometric Cone Equivalent:* 20-23

*Bloating Test:* Negative

*Potential Use:* None

SAMPLE: R-2636

County: King George

*Locality:* Roadcut, 2.8 miles west of King George, on the southeast side of State Highway 3 just southwest of its intersection with State Road 637.

*Description:* An exposure of 11 feet of red clay, variegated with light-gray, light-purple, and yellow clay, occurs in a long roadcut that has a maximum height of 18 feet. Overburden consists of approximately 6 to 7 feet of sandy clay, sand, and soil. The sand is fine- to medium-grained and angular to subrounded.

*Formation or Age:* Pleistocene (?)

*Sampled Interval:* Sample across 14 feet of clay and sandy clay.

*Raw Properties:*

Water of plasticity: 23.0%

Plasticity: medium

Drying shrinkage: 5.0%

Dry strength: fair

Drying defects: none

pH: 4.4

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Red-tan	3	5.0	18.9	32.9	1.74
1900	Red-tan	4	7.0	17.5	30.8	1.76
2000	Red-tan	5	7.0	15.9	28.5	1.79
2100	Red-tan	6	7.0	14.6	26.6	1.82
2200	Brown	6	7.0	13.3	24.6	1.85
2300	Gray	7	10.0	10.3	19.6	1.90

Remarks: Fair color; should fire to "MW" face-brick specifications at about 2200°F.

*Bloating Test:* Negative

*Potential Use:* Face brick

SAMPLE: R-2637

County: King George

*Locality:* River bluff, 1.5 miles south of Rollins Fork, on the north bank of the Rappahannock River approximately 350 feet west of the King George-Westmoreland county boundary.

*Description:* The exposure consists of approximately 80 feet of buff clay and diatomaceous mudstone that contains fine-grained detrital quartz. The diatom content ranges vertically from approximately 5 to 60 percent. The mudstone is overlain by 15 to 25 feet of clay, sand, and gravel, and underlain by dark-green claystone that contains glassy grains of quartz.

*Formation or Age:* Calvert Formation

*Sampled Interval:* Sample upward across 35 feet of diatomaceous mudstone beginning at high-tide level.

*Raw Properties:*

Water of plasticity: 75.0%

Plasticity: thixotropic

Drying shrinkage: 5.0%

Dry strength: fair

Drying defects: warping

pH: 3.4

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Pale tan	2	5.0	69.6	57.1	0.82
1900	Pale tan	2	5.0	64.1	55.8	0.87
2000	Pink-tan	2	9.0	58.1	54.0	0.93
2100	Pink-tan	3	9.0	54.8	52.6	0.96
2200	Gray-buff	3	11.0	51.0	50.0	0.98
2300	Gray-buff	4	14.0	47.3	47.8	1.01

Remarks: Not suitable for use in vitreous clay products.

*Oil Bleach Test:* Negative

*Bloating Test:* Negative

*Potential Use:* Possible mineral filler.



## KING WILLIAM COUNTY

Samples were collected from six localities in King William County. Laboratory testing indicates the following potential uses for the raw material:

<u>Sample</u>	<u>Formation or Age</u>	<u>Potential Use</u>
R-2809	Calvert Formation	Garden pottery
R-2810	Yorktown Formation	None
R-2811	Pleistocene (?)	None
R-2812	Pleistocene (?)	Garden pottery
R-2856	Pleistocene (?)	None
R-2857	Pleistocene (?)	Face brick

SAMPLE: R-2809

County: King William

*Locality:* River bank, 2.3 miles southwest of Manquin, on the north-east side of the Pamunkey River, just southeast of the bridge on U. S. Highway 360.

*Description:* Eleven feet of light-gray clay is exposed in the bank of the Pamunkey River. Anastomosing networks of cracks are prominent in the exposure. The clay is underlain by gray-green clayey sand mixed with gravel. The contact between the Calvert and Nanjemoy formations is in this underlying section. Ten feet of overburden is present.

*Formation or Age:* Calvert Formation

*Sampled Interval:* Sample across approximately 7 feet of clay.

*Raw Properties:*

Water of plasticity: 27.2%

Plasticity: medium

Drying shrinkage: 4.0%

Dry strength: good

Drying defects: none

pH: 4.2

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Lt. tan	3	4.0	22.1	35.6	1.61
1900	Red-brown	3	4.0	21.1	34.4	1.63
2000	Red-brown	4	6.0	17.9	30.6	1.71
2100	Brown	4	6.0	17.2	29.6	1.72
2200	Dk. brown	5	10.0	12.9	23.9	1.85
2300	Dk. gray	7	10.0	9.8	18.7	1.91

Remarks: Color marginal; high vitrification temperature.

*Bloating Test:* Negative

*Potential Use:* Garden pottery

SAMPLE: R-2810

County: King William

*Locality:* Roadcut, 0.4 mile northeast of Manquin, on the south side of U. S. Highway 360 approximately 0.8 mile by road southwest of the intersection with State Road 661.

*Description:* Eight feet of blue-green to blue-gray clay is exposed in a long roadcut that has a maximum height of 25 feet. The clay contains fragments of fossil pecten shells and is overlain by approximately 17 feet of sand and gravel.

*Formation or Age:* Yorktown Formation

*Sampled Interval:* Sample across 8 feet of clay.

*Raw Properties:*

Water of plasticity: 36.8%

Plasticity: medium

Drying shrinkage: 5.0%

Dry strength: good

Drying defects: none

pH: 3.1

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Lt. red-brown	3	5.0	29.4	42.3	1.44
1900	Red-brown	4	10.0	18.1	30.4	1.68
2000	Red-brown	4	10.0	17.3	29.4	1.70
2100	Brown	5	10.0	14.7	25.7	1.75
2200	Dk. brown	7	—	6.2	11.5	1.86
2300	V. dk. brown	7	—	6.1	9.8	1.61

Remarks: Color marginal; abrupt vitrification; not suitable for use as the principal component in vitreous clay products.

*Bloating Test:* Negative

*Potential Use:* None

SAMPLE: R-2811

County: King William

*Locality:* Roadcut, 3.5 miles southwest of Beulahville, on the south side of State Road 609 approximately 0.6 mile by road west of the intersection with State Road 608.

*Description:* An exposure of about 4 feet of yellow-brown silty clay is present in a long roadcut that has a maximum height of 4 feet. The clay is stained in places by iron oxide. No overburden is present.

*Formation or Age:* Pleistocene (?)

*Sampled Interval:* Sample across approximately 4 feet of silty clay.

*Raw Properties:*

Water of plasticity: 17.1%

Plasticity: low

Drying shrinkage: none

Dry strength: fair

Drying defects: none

pH: 4.4

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	2	0.0	15.6	28.7	1.84
1900	Tan	3	0.0	15.5	28.5	1.84
2000	Tan	3	0.0	15.3	28.2	1.84
2100	Tan	4	0.0	15.2	28.0	1.84
2200	Lt. brown	5	0.0	14.8	27.1	1.83
2300	Dk. brown	7	(Melted)	—	—	—

Remarks: Poor color; weak ceramic bond; not suitable for use as the principal component in vitreous clay products.

*Bloating Test:* Negative

*Potential Use:* None

SAMPLE: R-2812

County: King William

*Locality:* Roadcut, 0.8 mile west of Etna Mills, on the north side of State Road 614 approximately 0.9 mile by road west of the intersection with State Road 615.

*Description:* An exposure of 12 feet of nonuniform, mottled red, light-gray, and yellow-brown sandy clay is present in a roadcut that has a maximum height of 17 feet. The sand content increases in the upper 4 to 5 feet.

*Formation or Age:* Pleistocene (?)

*Sampled Interval:* Sample across 12 feet of sandy clay.

*Raw Properties:*

Water of plasticity: 28.4%

Plasticity: medium

Drying shrinkage: 5.0%

Dry strength: good

Drying defects: none

pH: 4.8

*Slow Firing Test:*

Temp. °F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Red-tan	3	6.0	21.1	35.7	1.69
1900	Tan	3	6.0	20.4	34.9	1.71
2000	Tan	3	6.0	19.1	33.0	1.73
2100	Lt. brown	4	6.0	17.4	30.8	1.77
2200	Brown	5	7.0	16.0	29.0	1.81
2300	Dk. brown	6	9.0	14.9	27.3	1.83

Remarks: Fair color; high vitrification temperature.

*Bloating Test:* Negative

*Potential Use:* Garden pottery

SAMPLE: R-2856

County: King William

*Locality:* Roadcut on the south side of State Road 632 approximately 0.6 mile by road southeast of the intersection with State Road 621 at Palls.

*Description:* An exposure of 9 feet of light-gray and yellow clay occurs in a roadcut that has a maximum height of 11 feet. The clay contains fragments of quartz and flakes of muscovite. The lower 4 feet of the clay is predominantly gray, with minor iron oxide staining in localized shrinkage cracks.

*Formation or Age:* Pleistocene (?)

*Sampled Interval:* Sample across 9 feet of clay.

*Raw Properties:*

Water of plasticity: 23.2%	Plasticity: low
Drying shrinkage: 3.0%	Dry strength: poor
Drying defects: none	pH: 6.2

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Red-tan	(Poor bond)	3.0	—	—	—
1900	Red-tan	2	3.0	28.1	43.0	1.53
2000	Lt. brown	2	3.0	26.4	41.2	1.56
2100	Red-brown	3	5.0	23.9	38.5	1.61
2200	Dk. brown	4	8.0	21.4	35.7	1.67
2300	Gray-brown	4	10.0	19.3	33.2	1.72

Remarks: Poor color; weak ceramic bond; not suitable for use as the principal component in vitreous clay products; high quartz content, clay content less than 40 percent.

*Bloating Test:* Negative

*Potential Use:* None

SAMPLE: R-2857

County: King William

*Locality:* Roadcut on the southwest side of State Road 632 approximately 0.4 mile by road southeast of the intersection with State Road 621 at Palls.

*Description:* An exposure of 11 feet of light-gray micaceous clay occurs in a long roadcut that has a maximum height of 15 feet. The clay is stained by iron oxide along localized shrinkage cracks. The upper 7 feet of clay is slightly silty and has a high mica content. Overburden consists of 4 feet of sandy clay, silt, and soil.

*Formation or Age:* Pleistocene (?)

*Sampled Interval:* Sample across 11 feet of clay.

*Raw Properties:*

Water of plasticity: 37.8%

Plasticity: medium

Drying shrinkage: 2.0%

Dry strength: good

Drying defects: none

pH: 6.7

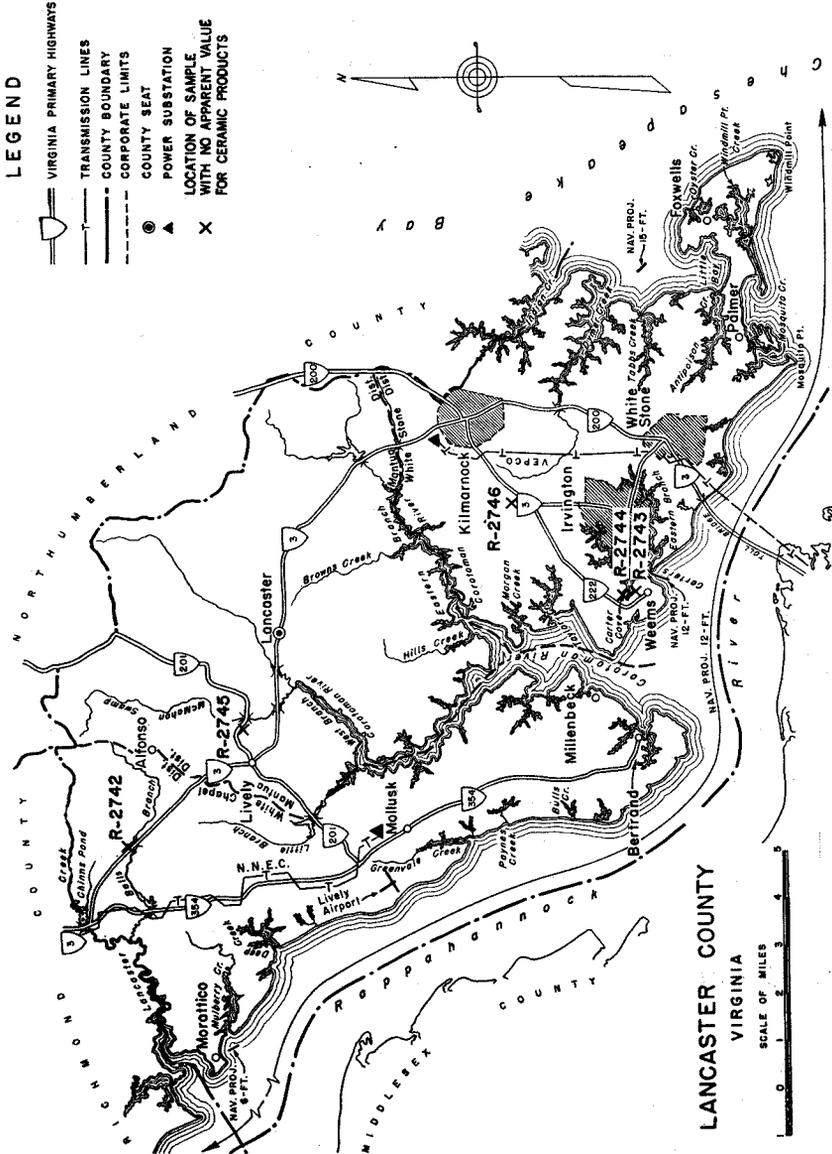
*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Lt. tan	2	3.0	23.8	37.8	1.59
1900	Lt. tan	3	9.0	22.9	37.6	1.64
2000	Tan	4	9.0	19.1	33.4	1.75
2100	Brown	5	11.0	13.7	26.0	1.90
2200	Dk. brown	6	15.0	9.0	18.5	2.05
2300	Gray	7	15.0	5.4	11.6	2.15

Remarks: Good color; should fire to "MW" face-brick specifications at about 2150°F.

*Bloating Test:* Negative

*Potential Use:* Face brick



Location Map of Lancaster County

## LANCASTER COUNTY

Samples were collected from five localities in Lancaster County. Laboratory testing indicates the following potential use for the raw material.

<u>Sample</u>	<u>Formation or Age</u>	<u>Potential Use</u>
R-2742	Pleistocene	None
R-2743	Pleistocene	None
R-2744	Pleistocene	None
R-2745	Pleistocene (?)	None
R-2746	Pleistocene	None

SAMPLE: R-2742

County: Lancaster

*Locality:* Roadcut, 2.1 miles west of Alfonso, on the northeast side of State Highway 3 approximately 0.7 mile by road northwest of the intersection with State Road 618.

*Description:* An exposure of approximately 9 feet of mottled gray and light-red clayey sand occurs in a long roadcut that has a maximum height of 14 feet. The fine-grained subangular sand is cemented in places by ferruginous cement, and contains minor quartz gravel. The clayey sand is overlain by approximately 6 feet of dark red-orange, slightly clayey sand that was not sampled.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across 9 feet of clayey sand.

*Raw Properties:*

Water of plasticity: 20.4%

Plasticity: low

Drying shrinkage: 4.0%

Dry strength: poor

Drying defects: none

pH: 6.8

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Lt. tan	(Poor bond)	4.0	—	—	—
1900	Lt. tan	2	4.0	22.7	38.1	1.68
2000	Lt. tan	2	4.0	22.5	37.8	1.68
2100	Red-tan	2	4.0	21.8	36.8	1.69
2200	Tan	3	4.0	—	—	—
2300	Gray-buff	3	4.0	21.6	36.3	1.68

Remarks: Weak ceramic bond; high vitrification temperature; not suitable for use as the principal component in vitreous clay products.

*Bloating Test:* Negative

*Potential Use:* None

SAMPLE: R-2743

County: Lancaster

*Locality:* Abandoned clay pit of the former Rappahannock River Brick Corporation located at the end of a dirt access road leading to Carter Cove from State Road 660 and approximately 0.4 mile north of Weems.

*Description:* An exposure of approximately 4 feet of slightly sandy, mottled, light-gray and yellow-orange clay occurs in an upper bench of the old pit of the abandoned brick operation. The sand in the clay is fine grained and subangular to subrounded. Two feet of clayey yellow-orange sand overlies the clay.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across 4 feet of clay.

*Raw Properties:*

Water of plasticity: 25.4%

Plasticity: medium

Drying shrinkage: 9.0%

Dry strength: good

Drying defects: none

pH: 5.9

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Red-tan	3	9.0	17.2	32.2	1.87
1900	Red-tan	4	10.0	15.9	30.2	1.90
2000	Lt. brown	5	12.0	12.1	24.6	2.03
2100	Brown	6	15.0	9.7	20.3	2.09
2200	Dk. brown	6	15.0	6.5	14.2	2.18
2300	V. dk. brown	7	15.0	5.0	11.1	2.21

Remarks: Fair color; high drying shrinkage; not suitable for use as the principal component in vitreous clay products.

*Bloating Test:* Negative

*Potential Use:* None

SAMPLE: R-2744

County: Lancaster

*Locality:* Home site, 0.6 mile north of Weems, at the end of a gravel road leading from State Road 632 to Carter Cove and approximately 0.4 mile due east from the south end of the intersection of State Highway 222 and State Road 666.

*Description:* The sample was obtained from clay excavated at this location during the construction of a home in 1961. The clay is light gray and orange-yellow and slightly sandy.

*Formation or Age:* Pleistocene

*Sampled Interval:* Representative of clay from excavation 30 inches deep.

*Raw Properties:*

Water of plasticity: 17.4%

Plasticity: medium

Drying shrinkage: 5.0%

Dry strength: fair

Drying defects: none

pH: 5.4

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Lt. red-brown	2	5.0	22.5	38.3	1.70
1900	Lt. red-brown	3	5.0	19.7	35.5	1.80
2000	Lt. brown	3	5.0	17.6	32.6	1.85
2100	Brown-red	4	5.0	17.0	31.6	1.86
2200	Dk. brown	5	10.0	15.5	29.3	1.89
2300	V. dk. brown	6	10.0	14.2	27.0	1.90

Remarks: Color marginal; high vitrification temperature; not suitable for use as the principal component in vitreous clay products.

*Bloating Test:* Negative

*Potential Use:* None

SAMPLE: R-2745

County: Lancaster

*Locality:* Roadcut, 2.3 miles northwest of Lancaster, on the south side of State Road 600 approximately 0.7 mile by road northwest of the intersection with State Highway 201.

*Description:* An exposure of approximately 10 feet of mottled and layered light-red, gray, yellow, and red-brown sandy clay occurs in a long roadcut that has a maximum height of 15 feet. The sandy clay contains 5 lenses of clay from 2 to 9 inches thick and is overlain by approximately 5 feet of sand.

*Formation or Age:* Pleistocene (?)

*Sampled Interval:* Sample across 10 feet of sandy clay.

*Raw Properties:*

Water of plasticity: 19.6%	Plasticity: medium
Drying shrinkage: 5.0%	Dry strength: fair
Drying defects: none	pH: 5.1

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	2	5.0	23.0	38.4	1.67
1900	Tan	3	5.0	21.9	37.0	1.69
2000	Lt. brown	3	5.0	21.1	36.1	1.71
2100	Brown	3	5.0	20.7	35.4	1.71
2200	Dk. brown	4	5.0	20.1	34.6	1.72
2300	Purple-brown	5	5.0	16.6	30.2	1.82

Remarks: Weak ceramic bond; high vitrification temperature; not suitable for use as the principal component in vitreous clay products.

*Bloating Test:* Negative

*Potential Use:* None

SAMPLE: R-2746

County: Lancaster

*Locality:* Roadcut, 1.9 miles north of Irvington, on the northwest side of State Highway 222 approximately 0.1 mile by road northeast of the intersection with State Roads 630 and 646.

*Description:* An exposure of 8 feet of mottled light-gray, yellow, and light-red sandy clay occurs in a long roadcut that has a maximum height of 12 feet. The sandy clay is overlain by 4 feet of clayey sand that is predominantly yellow.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across 8 feet of sandy clay.

*Raw Properties:*

Water of plasticity: 15.8%

Plasticity: low

Drying shrinkage: 5.0%

Dry strength: fair

Drying defects: none

pH: 5.1

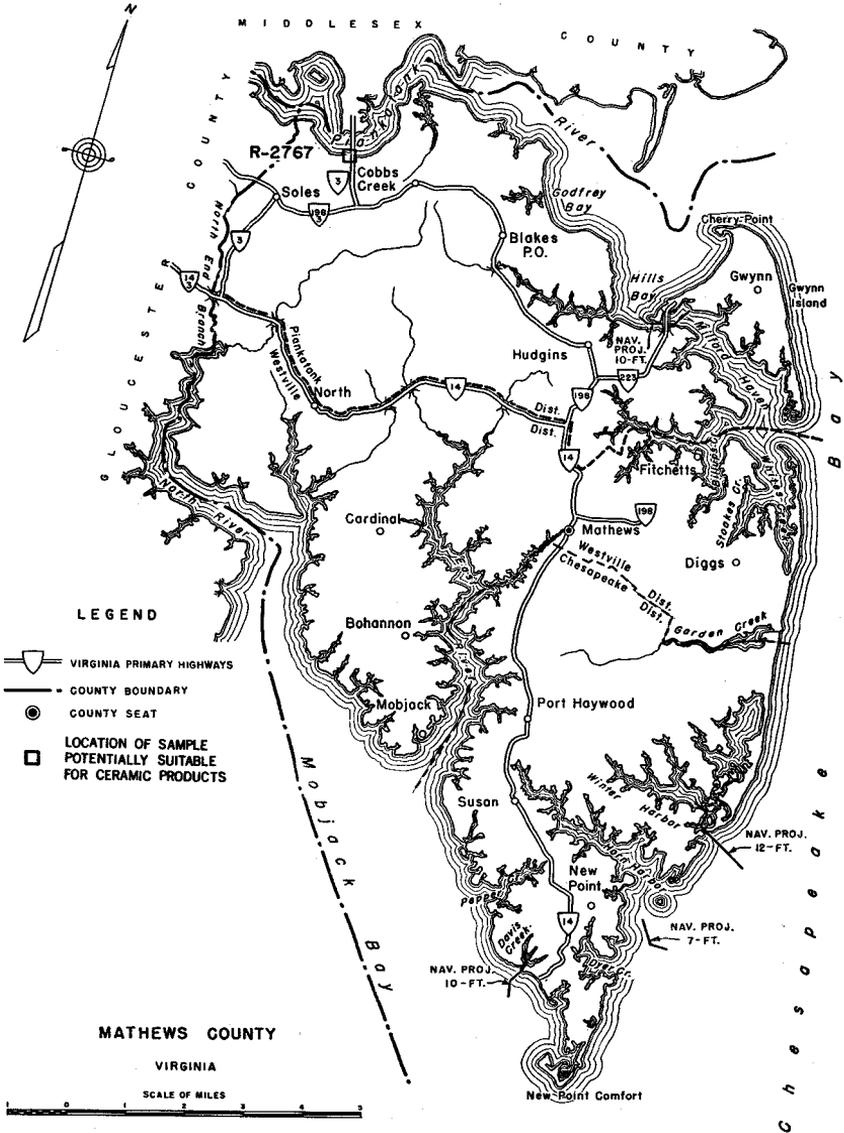
*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Buff-tan	(Poor bond)	—	—	—	—
1900	Buff-tan	(Poor bond)	—	—	—	—
2000	Buff-tan	3	5.0	17.9	32.8	1.83
2100	Lt. tan	3	5.0	17.0	31.5	1.85
2200	Tan	4	5.0	17.0	31.3	1.84
2300	Brown	6	(Melted)	—	—	—

Remarks: Weak ceramic bond; abrupt vitrification; not suitable for use as the principal component in vitreous clay products.

*Bloating Test:* Negative

*Potential Use:* None



Location Map of Mathews County

## MATHEWS COUNTY

A sample was collected from one locality in Mathews County. Laboratory testing indicates the following potential uses for the raw material:

<u>Sample</u>	<u>Formation or Age</u>	<u>Potential Use</u>
R-2767	Yorktown (?) Formation	Garden pottery and lightweight aggregate

SAMPLE: R-2767

County: Mathews

*Locality:* River bluff, 1.2 miles west of Cobbs Creek, on the south bank of the Piankatank River approximately 525 feet west of the bridge on State Highway 3.

*Description:* An exposure of 8 feet of blue-green, uniform, stiff, compact, micaceous, fossiliferous clay, overlain by about 30 feet of sand and slightly clayey sand, occurs in the river bluff. Small localized concentrations of well-sorted, subangular to rounded, quartz sand are present in the clay. Calcite occurs in small shrinkage cracks. The exposure contains two distinct fossil layers; the lower layer is 2 feet above the high-tide level, and the other is about 4 feet above the high-tide level. The zones are about 3 inches thick and contain fossil pelecypods, gastropods, and foraminifera.

*Formation or Age:* Yorktown (?) Formation

*Sampled Interval:* Sample across 8 feet of clay.

*Raw Properties:*

Water of plasticity: 38.0%

Plasticity: medium

Drying shrinkage: 5.0%

Dry strength: fair

Drying defects: warping

pH: 4.8

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	2	9.0	27.0	41.3	1.53
1900	Lt. brown	3	10.0	23.1	37.9	1.64
2000	Lt. Brown	3	10.0	20.3	34.7	1.71
2100	Dk. brown	4	14.0	15.2	28.3	1.86
2200	V. dk. brown	6	(Expanded)	—	—	—
2300	Steel-black	6	(Expanded)	—	—	—

Remarks: Color marginal; abrupt vitrification.

*Bloating Test:* Positive

*Preliminary Bloating Test:*

Drying characteristics: good

Crushing characteristics: good

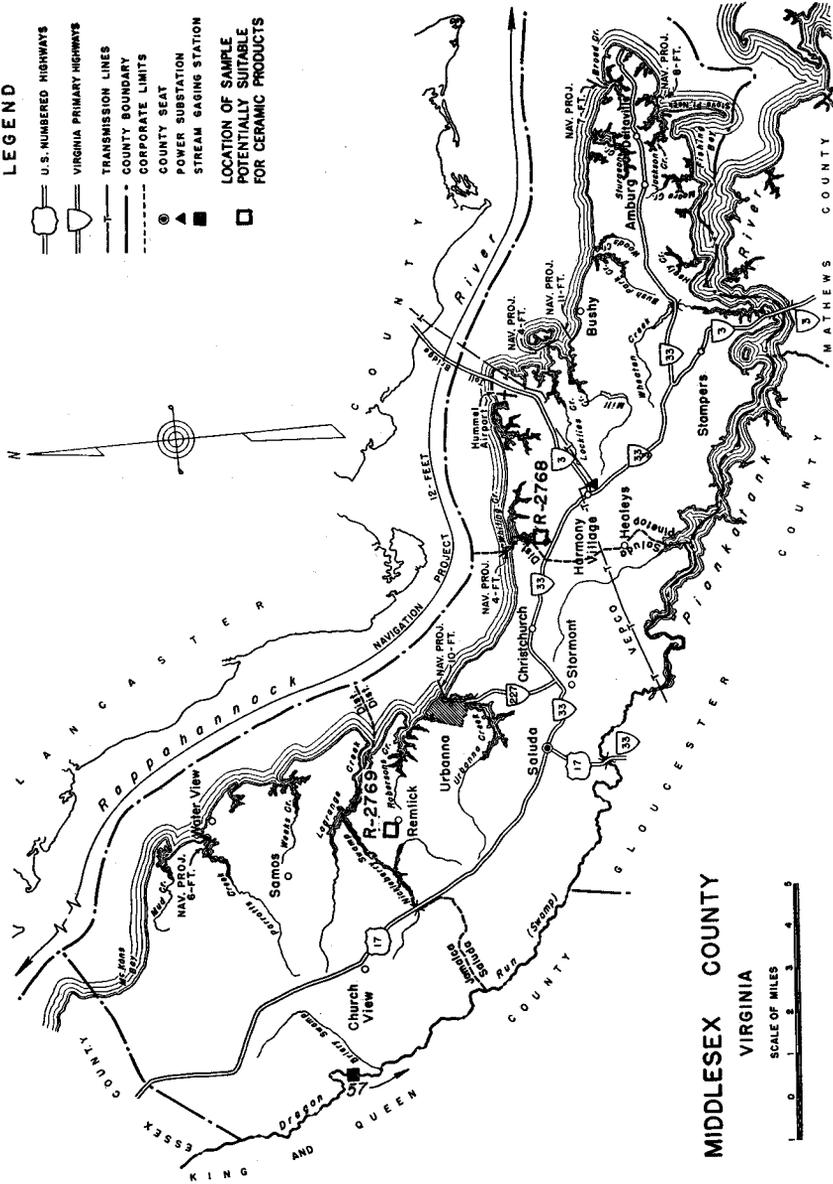
Particle size:  $-\frac{3}{4}'' + \frac{1}{2}''$

Retention time: 15 min.

Temp. ° F	Bulk Dens.	Lb/ft <sup>3</sup>	% Abs.	Remarks
2000	1.48	92	23.2	Very slight expansion
2100	1.17	72	17.8	Fair pore structure, semivitreous
2200	0.72	45	24.9	Good pore structure, vitreous

Remarks: Good lightweight aggregate possibility; firing range a little short.

*Potential Use:* Garden pottery and lightweight aggregate.



Location Map of Middlesex County

## MIDDLESEX COUNTY

Samples were collected from two localities in Middlesex County. Laboratory testing indicates the following potential uses for the raw material:

<u>Sample</u>	<u>Formation or Age</u>	<u>Potential Use</u>
R-2768	Pleistocene	Garden pottery
R-2769	Pleistocene	Face brick

SAMPLE: R-2768

County: Middlesex

*Locality:* Borrow pit, 1.5 miles northwest of Harmony Village, 800 feet north of State Highway 33 approximately 0.6 mile by road east of the intersection with State Road 619.

*Description:* Mottled white, gray, red, brown, and yellow sandy clay is exposed in a small borrow pit approximately 4 feet deep near Locust Hill. The clay contains subangular to subrounded quartz grains. A black opaque mineral, probably ilmenite, is present in minor amounts.

*Formation or Age:* Pleistocene

*Sampled Interval:* Representative sample of sandy clay in pit.

*Raw Properties:*

Water of plasticity: 22.1%

Plasticity: medium

Drying shrinkage: 5.0%

Dry strength: good

Drying defects: none

pH: 5.4

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	3	6.0	18.4	32.6	1.77
1900	Tan	3	6.0	18.4	32.4	1.76
2000	Tan	4	8.0	16.6	30.0	1.81
2100	Tan	4	8.0	16.3	29.5	1.81
2200	Lt. brown	5	10.0	14.3	26.6	1.86
2300	Gray-brown	7	(Expanded)	—	—	—

Remarks: Good color; abrupt vitrification.

*Bloating Test:* Negative

*Potential Use:* Garden pottery

SAMPLE: R-2769

County: Middlesex

*Locality:* Roadcut on the northeast side of State Road 602 just northwest of the intersection with State Road 637 at Remlik.

*Description:* An exposure of about 6 feet of mottled red, gray, and yellow micaceous clay occurs in a long roadcut that has a maximum height of 9 feet. Fine-grained sand and subangular to well-rounded quartz gravel are present in the southeast end of the roadcut. The clay breaks into small subangular fragments when dry. Three feet of slightly clayey sand underlies the clay where sampled.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across approximately 6 feet of clay.

*Raw Properties:*

Water of plasticity: 25.6%

Plasticity: medium

Drying shrinkage: 5.0%

Dry strength: good

Drying defects: none

pH: 5.7

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Brown-red	3	10.0	21.6	36.9	1.71
1900	Brown-red	3	10.0	20.1	35.4	1.76
2000	Brown-red	4	10.0	15.0	28.7	1.91
2100	Lt. brown	5	13.0	13.1	25.9	1.98
2200	Brown	6	15.0	10.2	20.8	2.04
2300	Purple-brown	7	15.0	8.3	17.7	2.13

Remarks: Fair color; should fire to "MW" face-brick specifications at about 2150°F.

*Bloating Test:* Negative

*Potential Use:* Face brick



## NANSEMOND COUNTY

Samples were collected from three localities in Nansemond County. Laboratory testing indicates the following potential uses for the raw material:

<u>Sample</u>	<u>Formation or Age</u>	<u>Potential Use</u>
R-2927	Pleistocene	Face brick
R-2958	Pleistocene	None
R-2959	Pleistocene	Face brick, structural tile, and stone-ware

SAMPLE: R-2927

County: Nansemond

*Locality:* Field, 1.4 miles south of Chuckatuck, off the northeast side of a farm road 0.25 mile from its intersection with State Road 603; entrance of farm road is 0.6 mile southeast of the intersection of State Highway 32 and State Road 603.

*Description:* Yellow-orange and light-gray silty clay was obtained from a vertical auger hole that penetrated 5 feet of clay. The clay at this locality is underlain by 8 feet of blue-gray, medium- to coarse-grained quartz sand and minor black chert gravel. Two feet of sand overburden is present.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across 5 feet of silty clay.

*Raw Properties:*

Water of plasticity: 20.6%	Dry strength: fair
Drying shrinkage: none	pH: 4.7
Drying defects: none	Other: short working
Plasticity: medium	

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	3	0.0	20.5	35.1	1.71
1900	Tan	4	0.0	19.9	35.8	1.80
2000	Tan	4	5.0	16.2	31.4	1.94
2100	Lt. brown	5	7.5	14.3	27.9	1.95
2200	Brown	7	7.5	11.0	22.3	2.03
2300	Dk. brown	7	7.5	12.1	24.0	1.98

Remarks: Color marginal; should fire to "MW" face-brick specifications at about 2150°F.

*Bloating Test:* Negative

*Potential Use:* Face brick

SAMPLE: R-2958

County: Nansemond

*Locality:* Ditch, 0.6 mile north of Belleville, off the east side of State Road 658 approximately 0.5 mile by road north of the intersection with U. S. Highway 17.

*Description:* An exposure of 3 feet of blue-gray, silty to sandy clay occurs in a large drainage ditch. The clay is overlain by approximately 3 feet of fine- to medium-grained sand.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across 3 feet of silty to sandy clay.

*Raw Properties:*

Water of plasticity: 12.0%

Plasticity: none

Drying shrinkage: none

Dry strength: low

Drying defects: none

Other: gritty

*Slow Firing Test:*

No ceramic bond developed

Remarks: Not suitable for use as the principal component in clay products.

*Bloating Test:* Negative

*Potential Use:* None

SAMPLE: R-2959

County: Nansemond

*Locality:* Pit of Webster Brick Co., Inc., 3.6 miles west of Suffolk, off the north side of State Road 644 approximately 0.5 mile by road west of the intersection with State Road 639.

*Description:* Light-gray, compact, uniform, stiff clay is present in the pit; thickness of the clay ranges from 3 to 10 feet. Overburden consists of variable thicknesses of silty to sandy clay that is stained by iron oxide.

*Formation or Age:* Pleistocene

*Sampled Interval:* Representative sample of clay in pit.

*Raw Properties:*

Water of plasticity: 26.0%

Plasticity: medium

Drying shrinkage: 7.5%

Dry strength: good

Drying defects: none

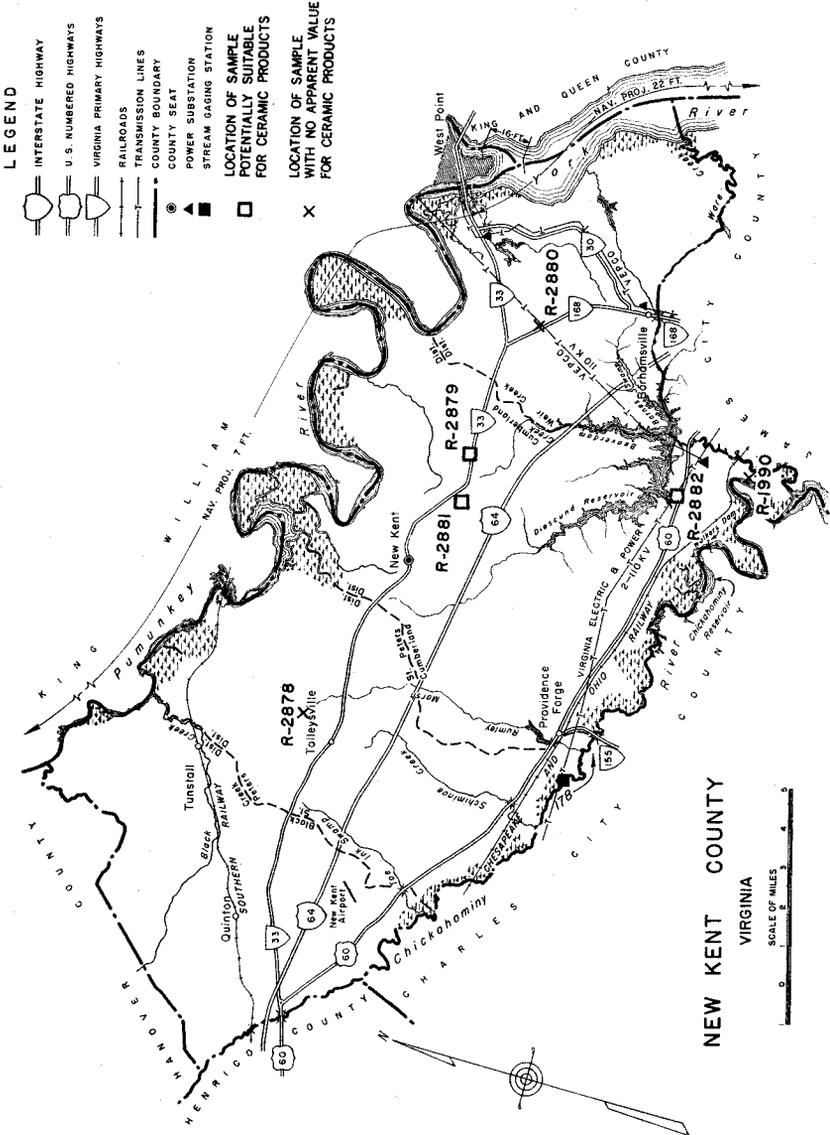
*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Cream	4	7.5	12.2	23.5	1.93
1900	Cream	4	7.5	12.2	23.8	1.95
2000	Ivory	5	12.5	5.9	12.7	2.15
2100	Buff	5	12.5	2.5	5.7	2.27
2200	Gray-buff	6	12.5	2.4	5.6	2.35
2300	Gray	7	12.5	0.7	1.5	2.11

Remarks: A good buff-firing clay; slightly overfired at 2300°F.

*Bloating Test:* Negative

*Potential Use:* Face brick (current use), structural tile, and stoneware.



Location Map of New Kent County

## NEW KENT COUNTY

Samples were collected from six localities in New Kent County. Laboratory testing indicates the following potential uses for the raw material:

<u>Sample</u>	<u>Formation or Age</u>	<u>Potential Use</u>
R-1990	Pleistocene	None
R-2878	St. Marys Formation	None
R-2879	Pleistocene	Garden pottery
R-2880	Pleistocene	None
R-2881	Pleistocene	Face brick and quarry tile
R-2882	St. Marys Formation	Face brick

SAMPLE: R-1990

County: New Kent

*Locality:* Bluff, 4.8 miles southwest of Barhamsville, off the east side of a private road approximately 0.7 mile by road southeast of its intersection with State Road 627; entrance to private road is 0.9 mile by road southeast of the intersection of State Roads 627 and 649.

*Description:* Approximately 10 feet of weathered clay is present in a low bluff along the road. The clay is exposed for a distance of about 50 feet and is light brown to buff, plastic, and laminated. Overburden consists of sand and gravel.

*Formation or Age:* Pleistocene

*Sampled Interval:* Composite sample from the bottom, middle, and top of the exposure of clay.

*Raw Properties:*

Water of plasticity: 25.0%

Plasticity: low

Drying shrinkage: 5.0%

Dry strength: fair

Drying defects: none

pH: 4.6

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Buff-orange	(Poor bond)	6.0	19.5	34.3	1.76
1900	Buff-orange	(Poor bond)	6.0	19.0	33.6	1.77
2000	Buff-orange	(Poor bond)	7.0	18.0	32.6	1.81
2100	Lt. brown	(Poor bond)	7.0	15.3	28.9	1.89
2200	Brown	5	7.5	13.5	26.2	1.94
2300	Brown	5	9.0	10.1	20.7	2.05

Remarks: Poor ceramic bond.

*Bloating Test:* Negative

*Potential Use:* None (unless mixed with a lower firing clay).

SAMPLE: R-2878

County: New Kent

*Locality:* Roadcut, 1.0 mile northeast of Tallysville, on the east side of State Road 609 approximately 0.1 mile by road north of the intersection with State Road 642.

*Description:* An exposure of 4 feet of mottled gray, red, and orange clay and sandy clay occurs in a long roadcut that has a maximum height of 5 feet. The lower 2 feet of exposed clay contains very little sand.

*Formation or Age:* St. Marys Formation

*Sampled Interval:* Sample across 4 feet of clay and sandy clay.

*Raw Properties:*

Water of plasticity: 24.6%

Dry strength: low

Drying shrinkage: 5.0%

pH: 6.2

Drying defects: none

Other: gritty

Plasticity: low

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	1+	5.0	20.9	36.4	1.74
1900	Tan	1+	5.0	18.7	33.3	1.78
2000	Tan	2+	6.5	19.6	34.5	1.76
2100	Lt. brown	2+	6.5	18.7	33.8	1.81
2200	Brown	2+	—	18.6	33.3	1.79
2300	Dk. brown	2+	—	18.2	32.4	1.78

Remarks: Poor color; high vitrification temperature.

*Bloating Test:* Negative

*Potential Use:* None

SAMPLE: R-2879

County: New Kent

*Locality:* Roadcut, 3.2 miles east of New Kent, on the north side of State Highway 33 approximately 0.5 mile by road west of the intersection with State Road 626.

*Description:* An exposure of 11 feet of mottled gray and orange clay occurs in a roadcut that has a maximum height of 14 feet. Red iron oxide staining is present in the upper 3 feet. The clay is overlain by 3 feet of clayey sand.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across 11 feet of clay.

*Raw Properties:*

Water of plasticity: 27.8%

Dry strength: good

Drying shrinkage: 7.5%

pH: 6.2

Drying defects: none

Other: some grit

Plasticity: medium

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	2+	7.5	20.5	35.7	1.74
1900	Tan	2+	7.5	20.6	35.4	1.72
2000	Tan	2+	7.5	19.8	35.0	1.77
2100	Tan	2+	7.5	19.2	34.2	1.78
2200	Lt. brown	2+	8.5	18.9	34.2	1.81
2300	Brown	2+	8.5	18.3	33.3	1.82

Remarks: Poor color; high vitrification temperature.

*Bloating Test:* Negative

*Potential Use:* Garden pottery

SAMPLE: R-2880

County: New Kent

*Locality:* Roadcut, 2.8 miles northwest of Barhamsville, on the north-west side of State Highway 168 approximately 0.5 mile by road southeast of the intersection with State Road 620.

*Description:* An exposure of 10 feet of mottled and layered red, orange, and gray slightly silty clay is present in a roadcut that has a maximum height of 11 feet. The clay is uniform throughout the exposure except for color variation.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across 10 feet of clay.

*Raw Properties:*

Water of plasticity: 24.6%

Plasticity: low

Drying shrinkage: 5.0%

Dry strength: low

Drying defects: none

pH: 6.1

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Salmon	2+	5.0	20.6	33.0	1.60
1900	Salmon	2+	5.0	18.7	30.7	1.64
2000	Salmon	2+	5.0	18.7	30.3	1.62
2100	Buff	2+	5.0	18.5	30.5	1.65
2200	Lt. brown	2+	5.0	17.5	28.9	1.65
2300	Gray-brown	2+	5.0	15.7	26.2	1.67

Remarks: Poor color; high vitrification temperature.

*Bloating Test:* Negative

*Potential Use:* None

SAMPLE: R-2881

County: New Kent

*Locality:* Roadcut, 2.1 miles southeast of New Kent, on the east side of State Road 627 just south of its intersection with State Highway 33.

*Description:* An exposure of 8 feet of mottled red, orange, and gray clay occurs in a long roadcut that has a maximum height of 10 feet. About 2 feet of sandy soil overburden is present.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across 8 feet of clay.

*Raw Properties:*

Water of plasticity: 38.4%

Plasticity: medium

Drying shrinkage: 7.5%

Dry strength: good

Drying defects: none

pH: 4.7

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	2+	10.0	22.0	34.8	1.58
1900	Tan	2+	11.0	18.9	30.8	1.63
2000	Buff	4	15.0	11.1	20.6	1.86
2100	Lt. brown	6+	18.0	2.8	5.8	2.08
2200	Brown	7	20.0	1.9	4.0	2.11
2300	Dk. brown	8	20.0	4.6	8.6	1.88

Remarks: Fair color; shrinkage excessive above 2000°F; might be difficult to extrude.

*Bloating Test:* Negative

*Potential Use:* Face brick and quarry tile.

SAMPLE: R-2882

County: New Kent

*Locality:* Roadcut, 4.6 miles southwest of Barhamsville, on the east side of State Road 627 at its intersection with U. S. Highway 60.

*Description:* An exposure of 8 feet of mottled red, brown, orange, and gray slightly silty clay occurs in a long roadcut that has a maximum height of 9 feet. Overburden consists of sandy soil.

*Formation or Age:* St. Marys Formation

*Sampled Interval:* Sample across 8 feet of clay.

*Raw Properties:*

Water of plasticity: 26.3%

Plasticity: low

Drying shrinkage: 7.5%

Dry strength: good

Drying defects: none

pH: 4.6

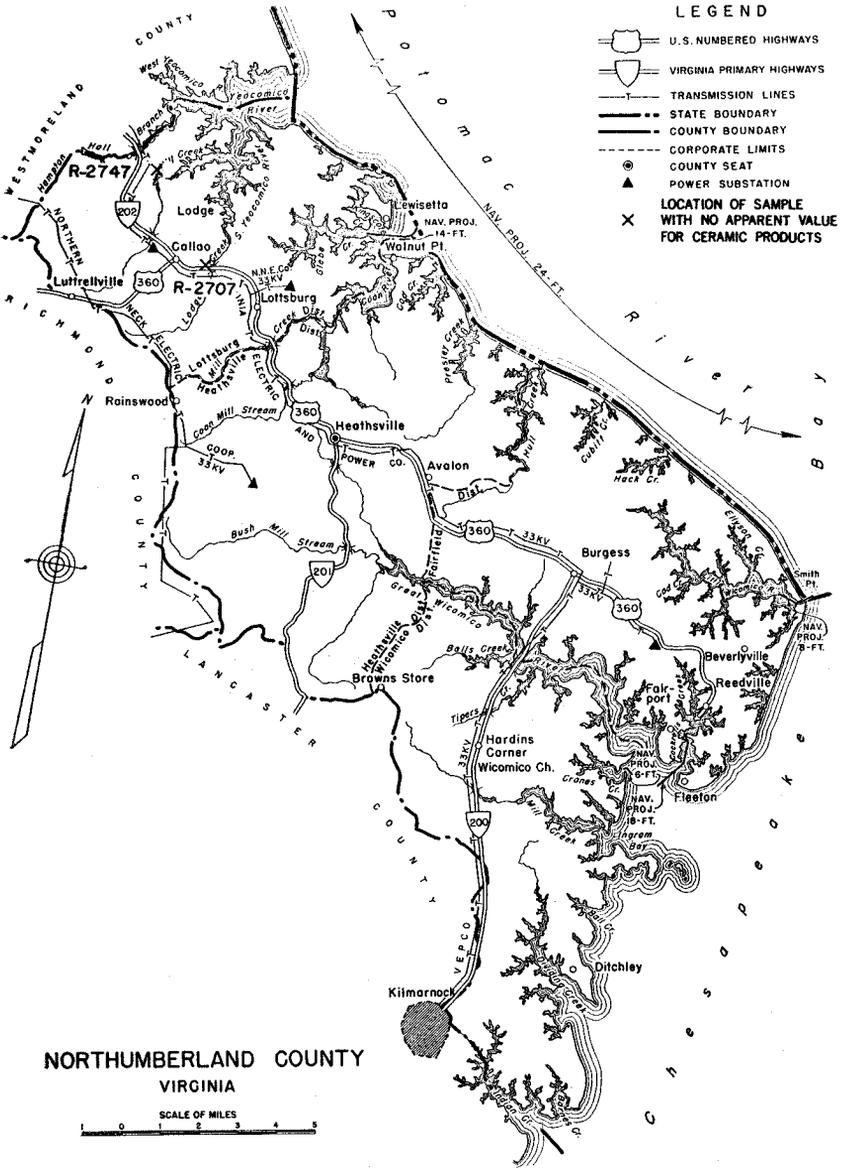
*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	2+	7.5	19.7	32.1	1.63
1900	Tan	2+	7.5	17.6	29.6	1.68
2000	Tan	2+	7.5	16.9	28.6	1.69
2100	Buff	3	8.5	14.5	25.4	1.75
2200	Lt. brown	4	8.5	11.5	20.9	1.82
2300	Gray	4	12.0	7.8	15.4	1.97

Remarks: Fair buff color; should fire to "MW" face-brick specifications at about 2150°F.

*Bloating Test:* Negative

*Potential Use:* Face brick



Location Map of Northumberland County

## NORTHUMBERLAND COUNTY

Samples were collected from two localities in Northumberland County. Laboratory testing indicates the following potential use for the raw material:

<u>Sample</u>	<u>Formation or Age</u>	<u>Potential Use</u>
R-2707	Pleistocene	None
R-2747	Pleistocene	None

SAMPLE: R-2707

County: Northumberland

*Locality:* Excavation, 1.0 mile east of Callao, 0.1 mile off the north side of U. S. Highway 360 approximately 0.7 mile east of the intersection with State Road 729.

*Description:* An exposure of about 4 feet of medium-gray, slightly sandy, micaceous clay is present in an excavation just northwest of the bridge crossing Lodge Creek. The clay is overlain by approximately 12 feet of overburden consisting of 1 foot of orange-yellow clayey sand that is separated from 11 feet of overlying yellow-orange and white unconsolidated sand by a 2-inch zone of hard, dark red-brown iron oxide.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across approximately 4 feet of clay.

*Raw Properties:*

Water of plasticity: 25.5%

Plasticity: low

Drying shrinkage: 5.0%

Drv strength: low

Drying defects: none

pH: 3.8

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	(Poor bond)	5.0	31.6	44.8	1.42
1900	Tan	(Poor bond)	5.0	27.3	41.2	1.51
2000	Tan	3	5.0	24.4	38.3	1.57
2100	Lt. brown	3	5.0	23.0	37.0	1.61
2200	Brown	4	7.5	17.8	30.4	1.71
2300	Gray	5	10.0	11.8	21.9	1.86

Remarks: Poor color; high water absorption after firing at all above temperatures; low green strength; not suitable for use in vitreous clay products.

*Bloating Test:* Negative

*Potential Use:* None

SAMPLE: R-2747

County: Northumberland

*Locality:* Roadcut, 2.3 miles north of Callao, on the north side of State Road 620 approximately 0.3 mile by road east of the intersection with State Road 621.

*Description:* An exposure of 8 feet of light-gray micaceous clay, overlain by 5 feet of yellow micaceous clay, occurs in a roadcut that has a maximum height of 15 feet at the north end of Courtney Millpond. Approximately 2 feet of sandy soil overburden is present.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across 13 feet of clay.

*Raw Properties:*

Water of plasticity: 28.6%

Plasticity: medium

Drying shrinkage: 9.0%

Dry strength: good

Drying defects: none

pH: 6.5

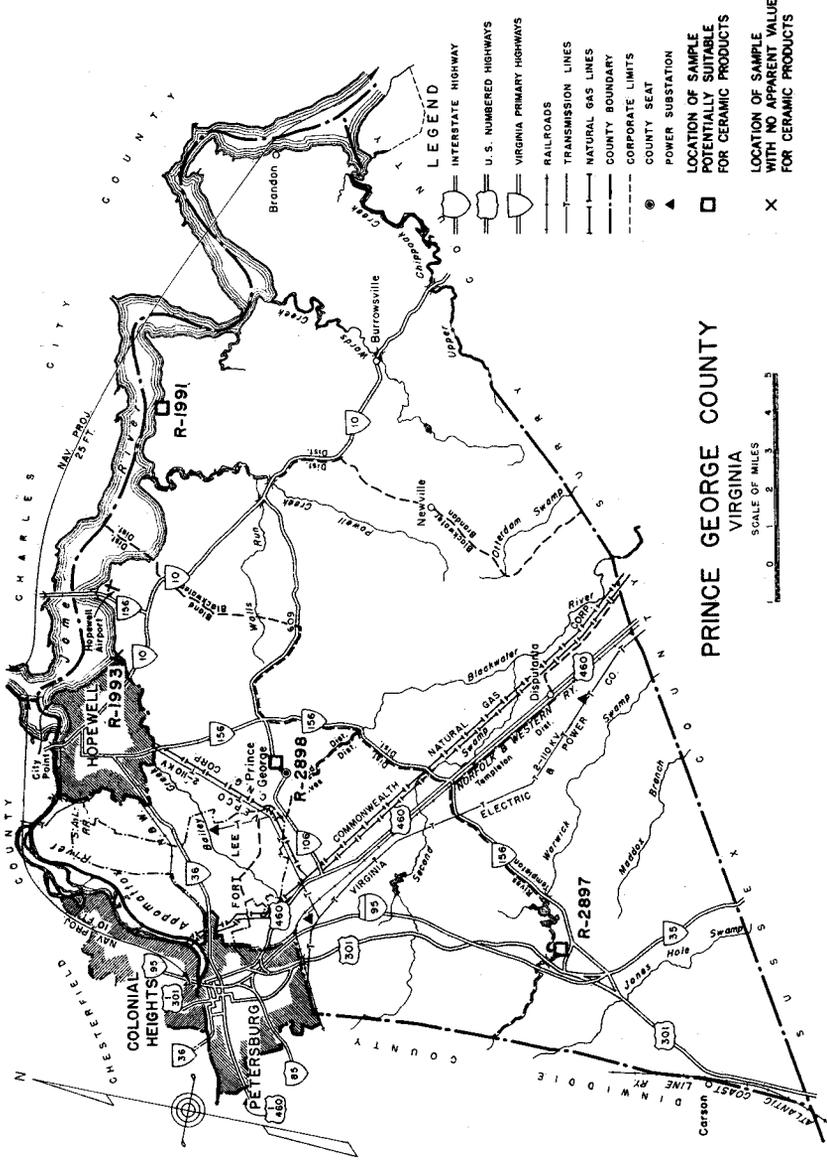
*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Red-tan	3	9.0	21.3	37.1	1.74
1900	Red-tan	4	9.0	18.7	33.8	1.81
2000	Lt. brown	5	15.0	13.1	26.1	1.99
2100	Chocolate	5	15.0	10.4	21.6	2.08
2200	Dk. brown	6	15.0	7.3	15.9	2.18
2300	V. dk. brown	7	15.0	4.7	10.6	2.25

Remarks: Fair color; high drying shrinkage; not suitable for use as the principal component in vitreous clay products.

*Bloating Test:* Negative

*Potential Use:* None



Location Map of Prince George County

## PRINCE GEORGE COUNTY

Samples were collected from four localities in Prince George County. Laboratory testing indicates the following potential uses for the raw material:

<u>Sample</u>	<u>Formation or Age</u>	<u>Potential Use</u>
R-1991	Calvert Formation	Brick and tile
R-1993	Nanjemoy Formation	None
R-2897	Pleistocene	Face brick and flue lining
R-2898	Pleistocene	Face brick and flue lining

SAMPLE: R-1991

County: Prince George

*Locality:* River bluff, 7.3 miles west of Brandon, on the south side of the James River just below Blairs Wharf.

*Description:* About 15 feet of weathered greenish-gray, tough, plastic clay occurs at the base of the exposure, which extends for about 150 feet. The clay is overlain by 19 feet of sand and gravel of Pleistocene age.

*Formation or Age:* Calvert Formation

*Sampled Interval:* Composite from lower, middle, and upper parts of exposed clay.

*Raw Properties:*

Water of plasticity: 26.0%

Plasticity: low

Drying shrinkage: 4.0%

Dry strength: fair

Drying defects: none

pH: 4.8

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Buff-brown	(Poor bond)	4.0	18.4	32.2	1.75
1900	Buff-brown	(Poor bond)	7.0	16.4	29.5	1.80
2000	Lt. brown	4	7.0	13.1	25.2	1.92
2100	Med. brown	5	8.0	8.0	16.4	2.05
2200	Dk. brown	6	10.0	2.6	5.8	2.23
2300	—	—	(Expanded)	—	—	—

Remarks: Should fire to "MW" face-brick specifications at about 2000°F.

*Bloating Test:* Negative

*Potential Use:* Brick and tile.

SAMPLE: R-1993

County: Prince George

*Locality:* River bluff, 2.0 miles southeast of City Point, on the south side of the James River.

*Description:* An exposure of 3 to 5 feet of pink, white, and drab, very compact clay occurs in the bluff that has a maximum height of 44 feet and a length of about 900 feet. The clay is underlain by glauconitic sand that contains gypsum, and is overlain by 24 feet of marl, sand, loam, and gravel of Miocene and Pleistocene ages.

*Formation or Age:* Nanjemoy Formation

*Sampled Interval:* Representative sample from the base of the clay.

*Raw Properties:*

Water of plasticity: 50.0%

Plasticity: medium

Drying shrinkage: 6.0%

Dry strength: good

Drying defects: none

pH: 2.8

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Buff-tan	(Poor bond)	7.5	33.5	46.2	1.38
1900	Buff-tan	(Poor bond)	7.5	32.1	44.9	1.40
2000	Buff-tan	4	10.0	25.8	39.7	1.54 (?)
2100	Tan	6	15.0	14.4	26.2	1.82
2200	Tan	6	17.5	5.8	11.9	2.05
2300	Tan	6	17.5	1.2	2.6	2.17

Remarks: Not suitable for use as the principal component in vitreous clay products.

*Bloating Test:* Negative

*Potential Use:* None (unless mixed with another clay).

SAMPLE: R-2897

County: Prince George

*Locality:* Roadcut, 6.9 miles west of Disputanta, on the northwest side of State Highway 156 approximately 0.3 mile by road north of the intersection with U. S. Highway 301.

*Description:* An exposure of 4 feet of mottled gray, red, and orange sandy clay is present in a long roadcut that has a maximum height of 7 feet. The clay is overlain by 3 feet of sand and clayey sand.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across 4 feet of sandy clay.

*Raw Properties:*

Water of plasticity: 23.7%

Dry strength: fair

Drying shrinkage: none

pH: 4.1

Drying defects: none

Other: gritty

Plasticity: medium

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	3	2.5	17.2	31.1	1.81
1900	Tan	4	5.0	17.1	31.1	1.82
2000	Tan	4	5.0	16.2	30.0	1.85
2100	Lt. brown	4	5.0	14.9	28.0	1.88
2200	Brown	4	5.0	14.2	27.1	1.91
2300	Gray-brown	4	5.0	15.0	28.2	1.88

Remarks: Good tan color at 2000°F; high vitrification temperature.

*Bloating Test:* Negative

*Potential Use:* Face brick and flue lining.

SAMPLE: R-2898

County: Prince George

*Locality:* Roadcut, 0.5 mile northeast of Prince George, on the north side of State Highway 106 approximately 0.5 mile by road northeast of the intersection with State Road 616.

*Description:* An exposure of about 5 feet of mottled gray, red, yellow, and orange slightly silty clay occurs in a roadcut that has a maximum height of 6 feet. No overburden is present where the clay was sampled.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across approximately 5 feet of clay.

*Raw Properties:*

Water of plasticity: 26.6%

Dry strength: good

Drying shrinkage: none

pH: 4.1

Drying defects: none

Other: smooth

Plasticity: medium

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	2	0.0	22.1	37.1	1.68
1900	Tan	3	2.5	20.9	35.9	1.72
2000	Tan	4	5.0	18.2	32.8	1.80
2100	Lt. brown	5	5.0	13.7	26.4	1.93
2200	Brown	6	7.5	10.4	21.2	2.04
2300	Dk. brown	7	10.0	5.7	12.6	2.21

Remarks: Fair tan and brown colors; good firing range.

*Bloating Test:* Negative

*Potential Use:* Face brick and flue lining.



## RICHMOND COUNTY

Samples were collected from six localities in Richmond County. Laboratory testing indicates the following potential uses for the raw material:

<u>Sample</u>	<u>Formation or Age</u>	<u>Potential Use</u>
R-2770	Pleistocene	Face brick, glazed structural tile, and flue lining
R-2771	Pleistocene	None
R-2772	Pleistocene	None
R-2773	Pleistocene	None
R-2774	Pleistocene	None
R-3044	Calvert Formation	Possible absorbent and mineral filler

SAMPLE: R-2770

County: Richmond

*Locality:* Roadcut, 3.4 miles northeast of Farnham, on the east side of State Road 603 approximately 0.5 mile by road southeast of the intersection with State Road 612.

*Description:* An exposure of approximately 5 feet of light-gray, sandy, slightly carbonaceous clay occurs in a roadcut that has a maximum height of 7 feet. Glassy subangular to subrounded quartz sand and scattered grains of magnetite, and possibly ilmenite, are present in the clay. Staining by iron oxide imparts local brown-red coloration to the clay, which is underlain by sand and overlain by about 2 feet of sandy soil.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across 5 feet of sandy clay.

*Raw Properties:*

Water of plasticity: 19.0%	Plasticity: medium
Drying shrinkage: 5.0%	Dry strength: fair
Drying defects: none	pH: 5.6

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Lt. tan	3	5.0	—	—	—
1900	Lt. tan	3	5.0	16.6	29.9	1.80
2000	Lt. tan	4	5.0	15.3	27.8	1.82
2100	Lt. tan	4	7.0	14.1	26.1	1.85
2200	Buff-tan	5	7.0	11.5	22.0	1.91
2300	Buff-gray	6	7.0	7.5	16.0	2.13

Remarks: Good color; should fire to "SW" face-brick specifications at about 2250°F.

*Bloating Test:* Negative

*Potential Use:* Face brick, glazed structural tile, and flue lining.

SAMPLE: R-2771

County: Richmond

*Locality:* Borrow pit, 1.8 miles northeast of Emmerton, on the east side of State Road 619 approximately 1.9 miles by road northeast of the intersection with State Highway 3.

*Description:* An exposure of about 4 feet of light-gray sandy clay occurs in a small borrow pit just north of Totuskey Creek. The sand in the clay is well sorted, subangular to subrounded, and fine to medium grained. A black opaque mineral, probably ilmenite or magnetite, is present in minor amounts. Localized concentrations of indurated sand with ferruginous cement are present. Approximately 5 feet of sand overburden is present.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across approximately 4 feet of sandy clay.

*Raw Properties:*

Water of plasticity: 17.6%

Plasticity: low

Drying shrinkage: 5.0%

Dry strength: fair

Drying defects: none

pH: 5.7

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Lt. tan	3	5.0	16.2	29.2	1.80
1900	Lt. tan	3	5.0	16.3	29.3	1.80
2000	Lt. tan	4	5.0	15.5	28.4	1.83
2100	Red-tan	4	5.0	15.1	27.8	1.84
2200	Chocolate	5	5.0	13.9	25.4	1.83
2300	Dk. brown	6	(Expanded)	—	—	—

Remarks: Fair color; abrupt vitrification; not suitable for use as the principal component in vitreous clay products.

*Bloating Test:* Negative

*Potential Use:* None

SAMPLE: R-2772

County: Richmond

*Locality:* Roadcut, 2.0 miles southwest of Emmerton, on the southeast side of State Road 614 approximately 0.5 mile by road north of the intersection with State Road 615.

*Description:* An exposure of 6 feet of mottled gray and brown-orange sandy micaceous clay occurs in a roadcut 9 feet in height. The clay contains grains of a black opaque mineral, probably ilmenite, and glassy quartz sand that is well sorted and subangular to sub-rounded. Approximately 3 feet of sandy soil overburden is present.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across 6 feet of sandy clay.

*Raw Properties:*

Water of plasticity: 17.0%

Plasticity: low

Drying shrinkage: 2.0%

Dry strength: fair

Drying defects: none

pH: 6.5

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Lt. brown	3	5.0	17.9	31.3	1.75
1900	Lt. brown	3	5.0	17.2	30.8	1.79
2000	Lt. brown	4	5.0	16.1	29.0	1.80
2100	Red-brown	4	5.0	—	—	—
2200	Dk. red-brown	5	5.0	15.3	27.7	1.81
2300	V. dk. brown	6	(Expanded)	—	—	—

Remarks: Poor color; abrupt vitrification; not suitable for use as the principal component in vitreous clay products.

*Bloating Test:* Negative

*Potential Use:* None

SAMPLE: R-2773

County: Richmond

*Locality:* Roadcut, 2.8 miles north of Newland, on the southeast side of State Road 624 approximately 0.3 mile by road southwest of the intersection with State Road 638.

*Description:* An exposure of 6 feet of mottled gray and yellow sandy clay occurs in a long roadcut that has a maximum height of 6 feet. The sand in the clay is subangular to subrounded, and small grains of a black opaque mineral, probably ilmenite or magnetite, are also present.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across 6 feet of sandy clay.

*Raw Properties:*

Water of plasticity: 21.1%	Plasticity: medium
Drying shrinkage: 5.0%	Dry strength: fair
Drying defects: none	pH: 5.7

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Red-tan	3	5.0	—	—	—
1900	Red-tan	3	5.0	20.0	34.0	1.70
2000	Red-tan	3	5.0	18.5	32.2	1.74
2100	Lt. red-brown	3	5.0	18.5	31.8	1.72
2200	Brown	4	5.0	18.4	31.8	1.73
2300	V. dk. brown	6	(Dunted)	—	—	—

Remarks: Poor color; high vitrification temperature; not suitable for use as the principal component in vitreous clay products.

*Bloating Test:* Negative

*Potential Use:* None

SAMPLE: R-2774

County: Richmond

*Locality:* Roadcut, 2.5 miles northeast of Newland, on the northwest side of State Road 622 approximately 0.2 mile by road northeast of the intersection with State Road 638.

*Description:* An exposure of about 5 feet of light-gray sandy clay, overlain by 6 inches of orange clay, occurs in a roadcut that has a maximum height of 10 feet. The light-gray clay is locally stained yellow-orange and yellow by iron oxide and contains mica and ilmenite. Approximately 4 feet of sandy clay and soil overlie the clay where the sample was taken.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across the lower 6 feet of sandy clay and clay.

*Raw Properties:*

Water of plasticity: 21.0%

Plasticity: medium

Drying shrinkage: 4.0%

Dry strength: poor

Drying defects: none

pH: 5.8

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Red-tan	2	4.0	22.0	37.2	1.69
1900	Red-tan	3	4.0	19.7	34.7	1.76
2000	Lt. red-brown	3	4.0	18.3	32.9	1.80
2100	Red-brown	3	4.0	18.1	32.6	1.80
2200	Dk. brown	3	6.0	—	—	—
2300	V. dk. brown	4	6.0	18.2	32.2	1.77

Remarks: Fair color; high vitrification temperature; not suitable for use as the principal component in vitreous clay products.

*Bloating Test:* Negative

*Potential Use:* None

SAMPLE: R-3044

County: Richmond

*Locality:* River bluff, 3.1 miles northwest of Newland, on the north side of the Rappahannock River approximately 900 feet southeast of the termination of State Road 622 at Carters Wharf.

*Description:* An exposure of 10 feet of buff to white diatomaceous mudstone, with fine-grained quartz sand, is present in a river bluff that has an approximate height of 50 feet where the sample was taken. The sampled zone of diatomaceous mudstone is underlain by 8 to 10 feet of diatom-bearing mudstone and greenish-gray clayey sand with traces of glauconite. The overburden is composed of 10 to 12 feet of brown sandy clay, about 10 feet of diatom-bearing mudstone, and 8 to 10 feet of sand and gravel of Pleistocene age.

*Formation or Age:* Calvert Formation

*Sampled Interval:* Sample taken approximately 10 feet above high-tide level upward across 10 feet of diatomaceous mudstone.

*Raw Properties:*

Water of plasticity: 59.7%  
Drying shrinkage: 5.0%  
Drying defects: none

Plasticity: medium  
Dry strength: fair  
pH: 3.4

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Pink	2	5.0	56.8	55.0	0.97
1900	Pink	3	7.5	52.7	54.5	1.03
2000	Pink	3	10.0	41.1	48.5	1.18
2100	Brown	5	22.5	14.2	25.1	1.77
2200	Gray	6	25.0	8.1	15.2	1.87
2300	Gray	6	25.0	7.3	12.5	1.72

Remarks: Not suitable for use in vitreous clay products; might be satisfactory for absorbents such as sweeping compounds.

*Bloating Test:* Negative

*Potential Use:* Possible absorbent and mineral filler.



## SOUTHAMPTON COUNTY

Samples were collected from six localities in Southampton County. Laboratory testing indicates the following potential uses for the raw material:

<u>Sample</u>	<u>Formation or Age</u>	<u>Potential Use</u>
R-2925	Pleistocene	None
R-2926	Pleistocene	Face brick
R-3206	Pleistocene	Face brick
R-3207	Pleistocene	None
R-3208	Pleistocene	Face brick
R-3209	Pleistocene	None

SAMPLE: R-2925

County: Southampton

*Locality:* Roadcut, 1.8 miles southwest of Adams Grove, on the east side of State Road 615 at its intersection with U. S. Highway 58.

*Description:* An exposure of 3 feet of mottled gray, red, and brown clay is present in a roadcut that has a maximum height of 4 feet. Overburden is composed of clayey sand and soil.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across 3 feet of clay.

*Raw Properties:*

Water of plasticity: 20.9%

Plasticity: medium

Drying shrinkage: none

Dry strength: good

Drying defects: none

pH: 4.7

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	4	0.0	20.7	36.6	1.77
1900	Tan	4	2.5	20.7	36.8	1.78
2000	Tan	4	2.5	19.7	35.3	1.79
2100	Tan	4	5.0	18.4	33.7	1.83
2200	Lt. brown	6	5.0	16.7	31.2	1.87
2300	Brown	6	5.0	16.3	30.8	1.89

Remarks: Fair tan color; high vitrification temperature.

*Bloating Test:* Negative

*Potential Use:* None

SAMPLE: R-2926

County: Southampton

*Locality:* Roadcut, 5.7 miles south of Drewryville, on the southeast side of State Road 653 at its intersection with State Road 661.

*Description:* An exposure of 4 feet of mottled gray, red, and yellow-orange clay is present in a roadcut that has a maximum height of about 5 feet.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across 4 feet of clay.

*Raw Properties:*

Water of plasticity: 19.7%

Dry strength: low

Drying shrinkage: 2.5%

pH: 4.7

Drying defects: none

Other: short working

Plasticity: low

gritty

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	4	2.5	19.2	34.2	1.78
1900	Tan	4	2.5	18.2	32.6	1.79
2000	Tan	4	2.5	17.4	31.5	1.81
2100	Lt. brown	5	2.5	17.6	31.7	1.80
2200	Brown	6	5.0	15.3	28.6	1.87
2300	Dk. brown	7	5.0	13.3	25.1	1.89

Remarks: Color marginal; friable to 2200°F.

*Bloating Test:* Negative

*Potential Use:* Face brick

SAMPLE: R-3206

County: Southampton

*Locality:* Roadcut, 1.5 miles northwest of Franklin, on the west side of State Road 703 approximately 0.3 mile by road north of the intersection with State Road 636.

*Description:* An exposure of 4 feet of gray plastic clay is present in a roadcut that has a maximum height of 5 feet. Brown stringers of clay and thin zones of orange to white quartz sand are present. Overburden consists of 1 foot of sandy, loamy soil.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across 6 feet of clay; the lower 2 feet was sampled by auger which was still penetrating clay at the bottom of the hole.

*Raw Properties:*

Water of plasticity: 26.8%

Plasticity: medium

Drying shrinkage: 7.5%

Dry strength: good

Drying defects: none

pH: 8.5

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Salmon	2	7.5	17.2	31.1	1.81
1900	Salmon	3	10.0	14.0	26.7	1.91
2000	Tan	4	12.5	10.5	21.3	2.03
2100	Lt. brown	4	12.5	6.3	13.6	2.16
2200	Dk. brown	5	12.5	5.5	12.3	2.23
2300	Gray-brown	6	12.5	4.8	10.5	2.18

Remarks: Should fire to "SW" face-brick specifications at about 2050°F.

*Bloating Test:* Negative

*Potential Use:* Face brick

SAMPLE: R-3207

County: Southampton

*Locality:* Roadcut on property of Union Camp Corporation, on the north side of company road in the northern end of the backfield of Block 12, approximately 0.4 mile east of State Road 661, and 4.4 miles south of Drewryville.

*Description:* An exposure of 5 feet of mottled red, yellow, and yellow-brown silty clay is present in a roadcut that has a maximum height of 7 feet. Overburden consists of 2 feet of yellow-brown sandy clay.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across 9 feet of silty clay; the lower 4 feet was sampled by auger which was still penetrating clay at the bottom of the hole.

*Raw Properties:*

Water of plasticity: 21.2%

Plasticity: low

Drying shrinkage: 2.5%

Dry strength: low

Drying defects: none

pH: 8.7

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Lt. brown	2	5.0	20.6	36.1	1.75
1900	Lt. brown	2	5.0	19.9	35.2	1.77
2000	Lt. brown	2	10.0	19.6	34.9	1.78
2100	Lt. brown	3	10.0	19.6	34.7	1.78
2200	Dk. brown	4	10.0	19.5	34.7	1.77
2300	Maroon	5	7.5	19.8	34.6	1.75

Remarks: Not suitable for use as the principal component in vitreous clay products; might be used as a nonplastic component for shrinkage control in face-brick mixtures.

*Bloating Test:* Negative

*Potential Use:* None

SAMPLE: R-3208

County: Southampton

*Locality:* Roadcut, 3.9 miles east of Joyner, on the southwest side of State Road 609 at the southeast end of the bridge across Three Creek, and approximately 1.0 mile by road northwest of the intersection with State Road 653.

*Description:* An exposure of 15 feet of clay is present in the roadcut that has a maximum height of 19 feet. The lower 11 feet of clay is predominantly gray, with some yellow-brown mottling, and the upper 4 to 5 feet is predominantly yellow-brown. Approximately 4 feet of overburden is present.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across 15 feet of clay; the lower 8 feet of the exposure was sampled by auger which was still penetrating clay at the bottom of the hole.

*Raw Properties:*

Water of plasticity: 27.6%

Plasticity: low

Drying shrinkage: 2.5%

Dry strength: low

Drying defects: none

pH: 8.4

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	2	7.5	21.0	35.6	1.71
1900	Tan	3	10.0	19.8	34.9	1.76
2000	Lt. brown	4	10.0	17.3	31.5	1.82
2100	Red-brown	4	12.5	14.9	28.3	1.90
2200	Red-brown	5	15.0	12.8	25.1	1.96
2300	Gray-brown	6	15.0	5.6	12.8	2.22

Remarks: Should fire to "MW" face-brick specifications at about 2200°F.

*Bloating Test:* Negative

*Potential Use:* Face brick

SAMPLE: R-3209

County: Southampton

*Locality:* Field off the east side of company road on property of Union Camp Corporation in Block 33, approximately 0.5 mile by road off the west side of State Road 616, and 2.2 miles north of Courtland.

*Description:* Gray clay, mottled yellow-orange in the upper part, with thin zones of fine-grained quartz sand, was obtained from a vertical auger hole drilled to a depth of 4 feet.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across 4 feet of clay and sand; the auger was still penetrating clay at the bottom of the hole.

*Raw Properties:*

Water of plasticity: 17.1%

Plasticity: low

Drying shrinkage: 2.5%

Dry strength: low

Drying defects: none

pH: 7.6

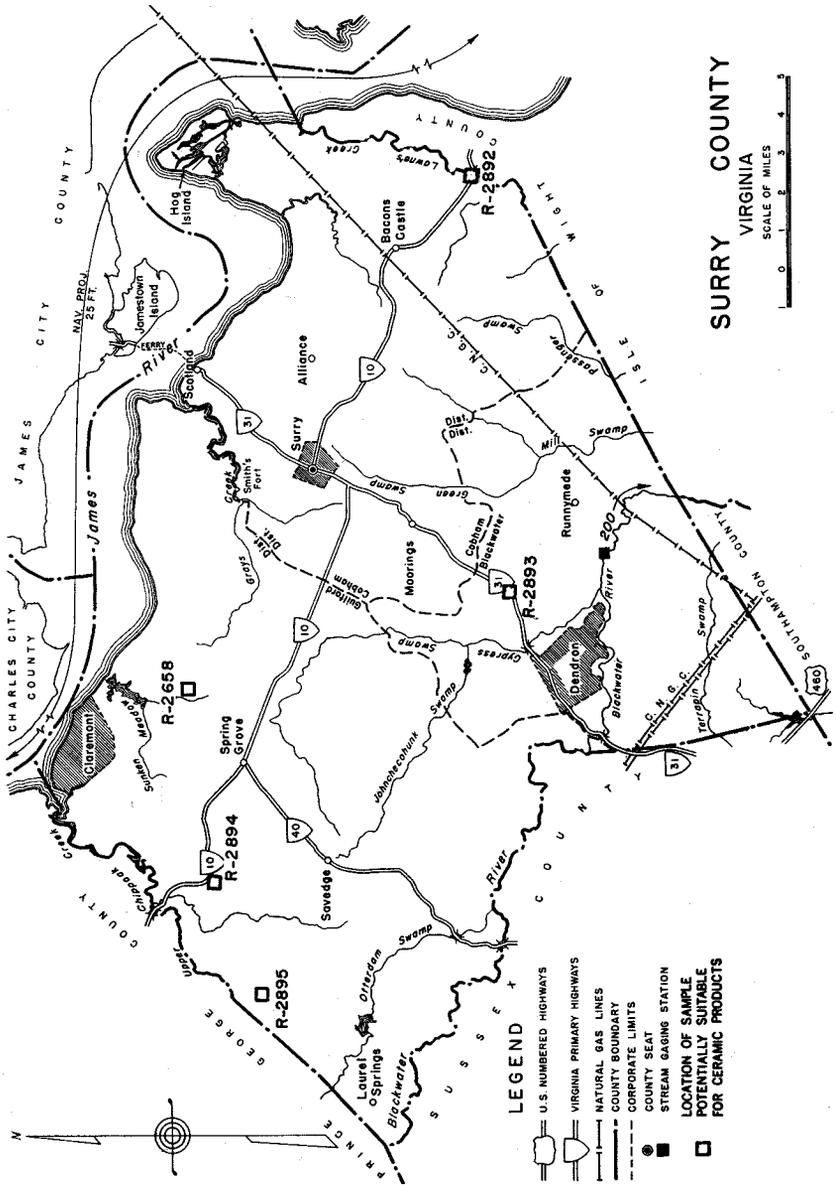
*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	2	5.0	15.7	—	1.91
1900	Tan	2	5.0	15.2	31.6	2.08
2000	Tan	2	5.0	14.7	31.3	2.13
2100	Lt. brown	3	5.0	14.4	—	2.20
2200	Lt. brown	3	5.0	13.7	29.3	2.14
2300	Red-brown	4	5.0	13.7	28.6	—

Remarks: Not suitable for use as the principal component in vitreous clay products; might be used as a nonplastic component for shrinkage control in face-brick or structural-tile mixtures.

*Bloating Test:* Negative

*Potential Use:* None



Location Map of Surry County

## SURRY COUNTY

Samples were collected from five localities in Surry County. Laboratory testing indicates the following potential uses for the raw material:

<u>Sample</u>	<u>Formation or Age</u>	<u>Potential Use</u>
R-2658	Pleistocene	Garden pottery
R-2892	Plio-Pleistocene	Face brick
R-2893	Pleistocene	Face brick
R-2894	Pleistocene	Face brick
R-2895	Pleistocene	Flue lining

SAMPLE: R-2658

County: Surry

*Locality:* Roadcut, 2.5 miles northeast of Spring Grove, on the north-west side of State Road 609 at its intersection with State Road 610.

*Description:* An exposure of buff to gray, massive, silty clay occurs in the roadcut. The clay weathers yellow-orange with red crusts, and has a thickness of from 5 to 15 feet.

*Formation or Age:* Pleistocene

*Sampled Interval:* Representative sample of silty clay.

*Raw Properties:*

Water of plasticity: 30.1%

Plasticity: low

Drying shrinkage: 5.0%

Dry strength: fair

Drying defects: none

pH: 6.9

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Salmon	2+	7.5	23.3	39.1	1.68
1900	Salmon	2+	7.5	22.2	37.7	1.70
2000	Salmon	2+	10.0	21.3	37.1	1.74
2100	Lt. brown	2+	10.0	19.7	35.3	1.79
2200	Lt. brown	2+	10.0	19.0	34.2	1.80
2300	Brown	2+	10.0	18.1	32.8	1.81

Remarks: Poor color; high vitrification temperature.

*Bloating Test:* Negative

*Potential Use:* Garden pottery

SAMPLE: R-2892

County: Surry

*Locality:* Roadcut, 2.8 miles southeast of Bacons Castle, on the north-east side of State Highway 10 approximately 1.0 mile by road southeast of the intersection with State Road 627.

*Description:* An exposure of 5 feet of clay, clayey sand, and gravel is present in a long roadcut that has a maximum height of about 6 feet. The lower 2 feet of the exposure consists of pink-gray clay. Iron oxide staining is present along shrinkage cracks.

*Formation or Age:* Plio-Pleistocene

*Sampled Interval:* Sample across approximately 3 feet of clay.

*Raw Properties:*

Water of plasticity: 27.0%

Dry strength: good

Drying shrinkage: 5.0%

pH: 4.1

Drying defects: none

Other: smooth

Plasticity: medium

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Peach	3	5.0	16.2	29.2	1.80
1900	Tan	4	5.0	13.4	25.7	1.92
2000	Buff	5	10.0	5.6	13.3	2.37
2100	Lt. brown	6	12.5	0.1	0.2	2.38
2200	Brown	7	12.5	0.5	1.2	2.39
2300	Gray	7+	10.0	0.8	1.6	1.98

Remarks: Fair buff color; should fire to "SW" face-brick specifications at about 1950°F.

*Bloating Test:* Negative

*Potential Use:* Face brick

SAMPLE: R-2893

County: Surry

*Locality:* Roadcut, 2.7 miles northeast of Dendron, on the north side of State Highway 31 approximately 0.7 mile by road northeast of the intersection with State Road 618.

*Description:* An exposure of about 4 feet of mottled light- to medium-gray, red, and yellow-brown clay is present in a long roadcut that has a maximum height of 8 feet. The clay is overlain by about 3 feet of clayey sand and sandy soil.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across approximately 4 feet of clay.

*Raw Properties:*

Water of plasticity: 26.0%

Dry strength: fair

Drying shrinkage: 2.5%

pH: 4.1

Drying defects: none

Other: smooth

Plasticity: medium

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Dk. tan	3	2.5	19.9	34.6	1.74
1900	Dk. tan	4	2.5	19.6	37.2	1.90
2000	Dk. tan	4	5.0	16.0	30.7	1.92
2100	Red-brown	5	7.5	10.3	21.1	2.05
2200	Brown	6	10.0	8.4	17.6	2.10
2300	Dk. brown	7	10.0	6.0	13.2	2.20

Remarks: Color marginal; should fire to "MW" face-brick specifications at about 2050°F.

*Bloating Test:* Negative

*Potential Use:* Face brick

SAMPLE: R-2894

County: Surry

*Locality:* Roadcut, 3.0 miles north of Savedge, on the north side of State Road 602 approximately 0.4 mile by road southwest of the intersection with State Highway 10.

*Description:* An exposure of 4 feet of predominantly orange-brown clay, mottled with red and gray streaks, occurs in a roadcut that has a maximum height of 5 feet. No overburden is present where the clay was sampled.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across 4 feet of clay.

*Raw Properties:*

Water of plasticity: 29.4%

Dry strength: good

Drying shrinkage: 2.0%

pH: 4.0

Drying defects: none

Other: smooth

Plasticity: medium

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	3	2.5	24.5	40.4	1.65
1900	Tan	4	2.5	23.2	39.2	1.69
2000	Lt. brown	4	5.0	19.2	34.9	1.82
2100	Brown	5	7.5	14.8	28.4	1.92
2200	Brown	6	10.0	14.3	27.9	1.95
2300	Dk. brown	7	10.0	10.9	22.6	2.07

Remarks: Fair color; rather high vitrification temperature.

*Bloating Test:* Negative

*Potential Use:* Face brick

SAMPLE: R-2895

County: Surry

*Locality:* Roadcut, 3.8 miles northwest of Savedge, on the south side of State Road 602 approximately 2.2 miles by road southwest of the intersection with State Road 600.

*Description:* An exposure of 5 feet of nonuniform, mottled gray, red, and yellow-brown, slightly silty clay is present in a roadcut that has a maximum height of about 7 feet. Overburden consists of clayey sand and sandy soil.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across 5 feet of clay.

*Raw Properties:*

Water of plasticity: 26.3%

Dry strength: good

Drying shrinkage: 2.5%

pH: 4.1

Drying defects: none

Other: smooth

Plasticity: medium

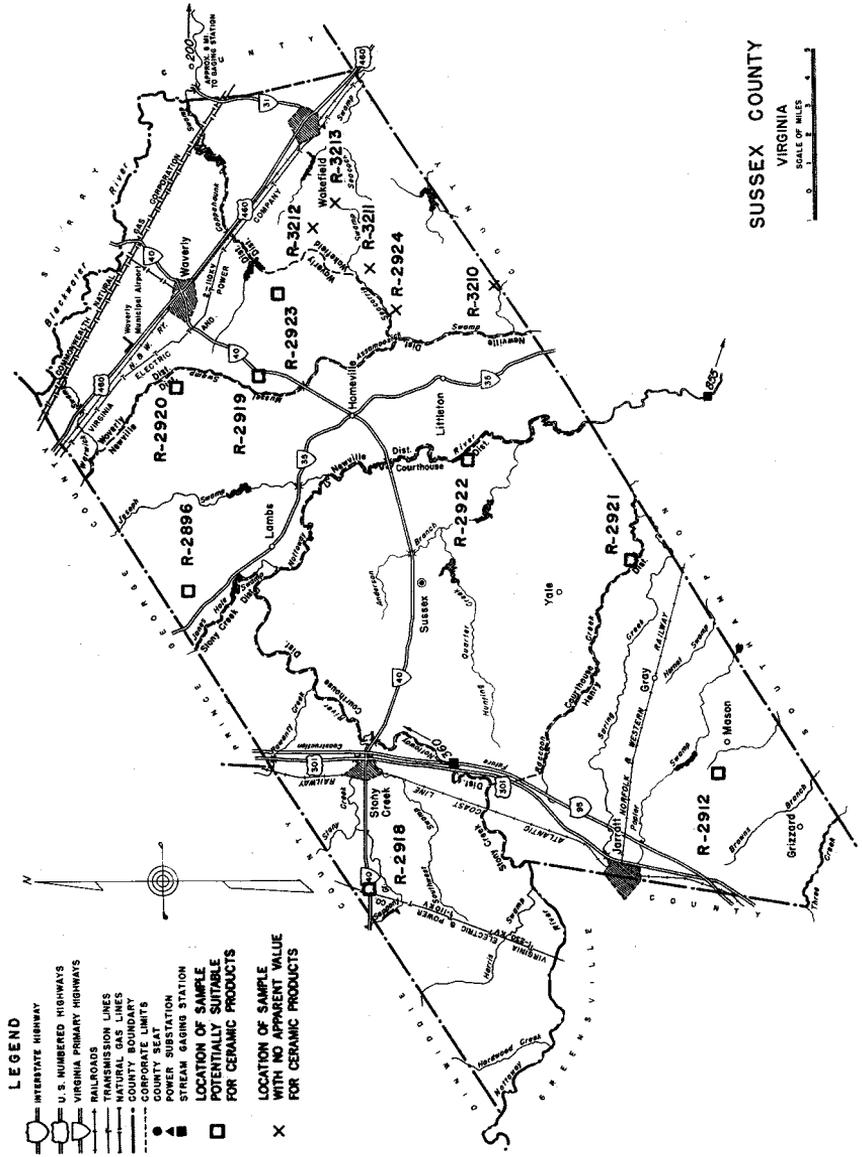
*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	(Poor bond)	2.5	—	—	—
1900	Tan	4	5.0	21.9	37.9	1.73
2000	Tan	4	5.0	20.6	36.7	1.78
2100	Lt. brown	4	5.0	18.8	34.0	1.81
2200	Lt. brown	4	7.5	18.4	33.5	1.82
2300	Brown	4	7.5	17.6	32.2	1.83

Remarks: Color marginal; high vitrification temperature.

*Bloating Test:* Negative

*Potential Use:* Flue lining



Location Map of Sussex County

## SUSSEX COUNTY

Samples were collected from 13 localities in Sussex County. Laboratory testing indicates the following potential uses for the raw material:

<u>Sample</u>	<u>Formation or Age</u>	<u>Potential Use</u>
R-2896	Pleistocene	Face brick
R-2912	Pleistocene	Brick, structural tile, and flue lining
R-2918	Pleistocene	Refractory addition
R-2919	Pleistocene	Face brick and flue lining
R-2920	Pleistocene	"NW" face brick
R-2921	Pleistocene	Face brick and sewer pipe
R-2922	Pleistocene	Face brick and sewer pipe
R-2923	Pleistocene	Refractory addition
R-2924	Pleistocene	None
R-3210	Pleistocene	None
R-3211	Pleistocene	None
R-3212	Pleistocene	None
R-3213	Pleistocene	None

SAMPLE: R-2896

County: Sussex

*Locality:* Roadcut, 8.8 miles northeast of Stony Creek, on the west side of State Road 627 approximately 1.1 miles by road north of the intersection with State Highway 35.

*Description:* An exposure of 10 feet of mottled and layered gray, red, and yellow-orange clay occurs in a roadcut that has a maximum height of 11 feet. Scattered zones of quartz sand, stained by iron oxide, are present in the lower 3 feet of the exposure, which contains more yellow-orange clay than the overlying 7 feet. No overburden is present where the clay was sampled.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across 10 feet of clay and sand.

*Raw Properties:*

Water of plasticity: 24.0%

Dry strength: good

Drying shrinkage: 5.0%

pH: 4.1

Drying defects: none

Other: smooth

Plasticity: medium

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	4	5.0	16.4	30.5	1.86
1900	Tan	4	5.0	16.8	31.2	1.86
2000	Tan	5	5.0	15.7	29.7	1.89
2100	Lt. brown	6	7.5	12.2	24.2	1.98
2200	Brown	7	7.5	11.5	23.1	2.01
2300	Dk. brown	7	7.5	11.1	22.5	2.03

Remarks: Color marginal; should fire to "MW" face-brick specifications at about 2100°F.

*Bloating Test:* Negative

*Potential Use:* Face brick

SAMPLE: R-2912

County: Sussex

*Locality:* Roadcut, 1.3 miles west of Mason, on the northwest side of State Road 609 approximately 0.6 mile by road southwest of the intersection with State Road 610.

*Description:* An exposure of 5 feet of mottled gray, red, brown, and yellow sandy micaceous clay is present in a long roadcut that has a maximum height of 6 feet. One foot of sand overburden is present.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across 5 feet of sandy clay.

*Raw Properties:*

Water of plasticity: 20.9%

Dry strength: fair

Drying shrinkage: 5.0%

pH: 3.8

Drying defects: none

Other: gritty

Plasticity: medium

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	3	5.0	18.7	33.1	1.77
1900	Tan	4	5.0	18.2	32.8	1.80
2000	Tan	4	5.0	17.6	31.9	1.81
2100	Sand	4	5.0	17.0	31.3	1.84
2200	Buff	4	5.0	16.5	30.5	1.85
2300	Gray	5	5.0	18.8	33.8	1.80

Remarks: Good buff color; high vitrification temperature.

*Bloating Test:* Negative

*Potential Use:* Brick, structural tile, and flue lining.

SAMPLE: R-2918

County: Sussex

*Locality:* Roadcut, 4.4 miles west of Stony Creek, on the south side of State Highway 40 at its intersection with State Road 713.

*Description:* An exposure of about 5 feet of mottled gray, red, and orange sandy clay is present in a long roadcut that has a maximum height of 7 feet. The sandy clay is overlain by light brown-yellow clayey sand and soil.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across approximately 5 feet of sandy clay.

*Raw Properties:*

Water of plasticity: 17.0%

Drying shrinkage: 5.0%

Drying defects: none

Plasticity: low

Dry strength: low

pH: 4.5

Other: short working  
gritty

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	3	5.0	18.7	34.4	1.84
1900	Tan	3	5.0	18.1	32.9	1.82
2000	Tan	5	5.0	17.9	32.9	1.84
2100	Lt. brown	5	5.0	16.9	31.4	1.86
2200	Brown	5	5.0	16.3	30.6	1.88
2300	Dk. brown	5	5.0	19.0	33.6	1.77

Remarks: Color marginal; might be used as a refractory addition to increase the firing range of brick and tile.

*Bloating Test:* Negative

*Potential Use:* Refractory addition

SAMPLE: R-2919

County: Sussex

*Locality:* Shallow excavation, 4.0 miles southwest of Waverly, off the southwest side of State Highway 40 approximately 0.5 mile by road southwest of the intersection with State Road 655.

*Description:* An exposure of mottled gray, red, yellow, and yellow-orange sandy clay is present in a shallow excavation on the southeast side of State Highway 40. The clay contains minor lenses of quartz sand.

*Formation or Age:* Pleistocene

*Sampled Interval:* Representative sample of sandy clay exposed in the excavated area.

*Raw Properties:*

Water of plasticity: 20.8%

Plasticity: medium

Drying shrinkage: 5.0%

Dry strength: fair

Drying defects: none

pH: 4.4

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Salmon	4	5.0	19.5	33.9	1.74
1900	Salmon	4	5.0	19.3	33.8	1.75
2000	Salmon	4	5.0	18.8	33.3	1.77
2100	Lt. buff	4	5.0	18.3	32.6	1.78
2200	Gray	4	5.0	17.5	31.7	1.81
2300	Gray	4	5.0	18.5	32.7	1.77

Remarks: Fair light-buff color; high vitrification temperature.

*Bloating Test:* Negative

*Extrusion Test:*

Body composition: 100% by weight raw clay thru 8 mesh

Water added for extrusion: 20% of dry batch weight

Shapes extruded: 1-inch x 1-inch bars, cut to 8-inch lengths

Vacuum on machine: 27 inches of mercury

Drying: 24 hours in air; 24 hours at 140°F

Drying shrinkage: 4.5%

**Firing:**

Time: 24 hours	Appar. porosity: 30.4%
Temperature: 2240°F	Bulk density: 1.77 gm/cc
Cone: 8 over	Hardness: 3
Total shrinkage: 6.25%	Color: tan
Absorption: 17.4%	

**Remarks:**

Handles well in extrusion and fires to a good tan at cone 8 (2240°F). The clay should be suitable for use in flue lining, but it is more refractory than those commonly used for face brick.

*Potential Use:* Face brick and flue lining.

SAMPLE: R-2920

County: Sussex

*Locality:* Roadcut, 3.3 miles west of Waverly, on the east side of State Road 626 approximately 1.5 miles by road northeast of the intersection with State Road 625.

*Description:* An exposure of 4 feet of mottled gray, red, and orange clay occurs in a long roadcut that has a maximum height of 7 feet. Overburden consists of clayey sand and soil.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across 4 feet of clay.

*Raw Properties:*

Water of plasticity: 21.8%

Plasticity: medium

Drying shrinkage: none

Dry strength: good

Drying defects: none

pH: 4.3

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	4	0.0	20.9	35.7	1.71
1900	Tan	4	0.0	19.3	34.2	1.77
2000	Tan	4	2.5	18.0	32.4	1.80
2100	Lt. brown	5	5.0	15.3	28.6	1.87
2200	Brown	5	7.5	13.1	25.4	1.94
2300	Dk. brown	6	7.5	11.0	21.7	1.97

Remarks: Fair color

*Bloating Test:* Negative

*Potential Use:* "NW" face brick

SAMPLE: R-2921

County: Sussex

*Locality:* Roadcut, 2.7 miles southeast of Yale, on the south side of State Road 631 approximately 1.0 mile by road southwest of the intersection with State Road 632.

*Description:* An exposure of 5 feet of mottled gray, red, and yellow-orange clay is present in a roadcut that has a maximum height of 7 feet. Overburden consists of clayey sand and soil.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across 5 feet of clay.

*Raw Properties:*

Water of plasticity: 25.3%	Plasticity: medium
Drying shrinkage: 2.5%	Dry strength: good
Drying defects: none	pH: 4.8

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	4	2.5	19.1	33.4	1.75
1900	Tan	4	5.0	16.7	30.2	1.81
2000	Tan	5	5.0	13.3	25.5	1.92
2100	Lt. brown	6	7.5	9.4	19.2	2.04
2200	Brown	6	7.5	7.7	16.1	2.09
2300	Dk. brown	7	10.0	2.0	4.5	2.26

Remarks: Fair color

*Bloating Test:* Negative

*Extrusion Test:*

Body composition: 100% by weight raw clay thru 8 mesh  
 Water added for extrusion: 30% of dry batch weight  
 Shapes extruded: 1-inch x 1-inch bars, cut to 8-inch lengths  
 Vacuum on machine: 27 inches of mercury  
 Drying: 24 hours in air; 24 hours at 140°F  
 Drying shrinkage: 6.5%

**Firing:**

Time: 24 hours	Appar. porosity: 19.8%
Temperature: 2140°F	Bulk density: 2.08 gm/cc
Cone: 5 over	Hardness: 7
Total shrinkage: 12.5%	Color: red
Absorption: 9.4%	

**Remarks:**

Develops good color at cone 5 (2140°F). The shrinkage might be excessive at higher temperatures but the clay looks fairly promising for use in face brick and sewer pipe.

*Potential Use:* Face brick and sewer pipe.

SAMPLE: R-2922

County: Sussex

*Locality:* Roadcut, 3.0 miles west of Littleton, on the north side of State Road 631 approximately 0.7 mile by road east of the intersection with State Road 650 and just west of the bridge crossing the Nottoway River.

*Description:* An exposure of at least 10 feet of gray clay, with yellow and yellow-orange mottling in the lower 7 feet and mottled red and brown in the upper 3 feet, occurs in a long roadcut that has a maximum height of 17 feet. Overburden is composed of sand, gravel, and soil. Directly overlying the uppermost clay is a 4-foot zone of angular quartz gravel and medium-grained quartz sand.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across about 10 feet of clay.

*Raw Properties:*

Water of plasticity: 21.8%

Plasticity: medium

Drying shrinkage: 5.0%

Dry strength: good

Drying defects: none

pH: 5.0

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	4	5.0	16.3	29.2	1.79
1900	Tan	4	5.0	15.4	28.2	1.83
2000	Tan	5	5.0	14.8	27.4	1.85
2100	Lt. brown	6	5.0	11.8	22.8	1.93
2200	Brown	6	5.0	10.9	21.4	1.96
2300	Dk. brown	7	10.0	4.7	10.3	2.19

Remarks: Fair color.

*Bloating Test:* Negative

*Extrusion Test:*

Body composition: 100% by weight raw clay thru 8 mesh

Water added for extrusion: 28.5% of dry batch weight

Shapes extruded: 1-inch x 1-inch bars, cut to 8-inch lengths

Vacuum on machine: 27 inches of mercury

Drying: 24 hours in air; 24 hours at 140°F

Drying shrinkage: 6.2%

**Firing:**

Time: 24 hours  
Temperature: 2140°F  
Cone: 5 over  
Total shrinkage: 9.4%  
Absorption: 10.7%

Appar. porosity: 21.3%  
Bulk density: 1.98 gm/cc  
Hardness: 5  
Color: dark red

Glaze: lead (clear)

**Remarks:**

This clay handles well in extrusion and fires to a good dark red at cone 5 (2140°F); it looks fairly promising for use in face brick or sewer pipe. No crazing or shivering was noted in the glazed pieces.

*Potential Use:* Face brick and sewer pipe.

SAMPLE: R-2923

County: Sussex

*Locality:* Roadcut, 3.3 miles south of Waverly, on the east side of State Road 606 approximately 1.6 miles by road south of the intersection with State Road 621.

*Description:* An exposure of about 3 feet of mottled gray, red, orange, and brown clay is present in a long roadcut that has a maximum height of 4 feet. Overburden consists of sandy clay, clayey sand, and soil.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across approximately 3 feet of clay.

*Raw Properties:*

Water of plasticity: 21.6%

Plasticity: medium

Drying shrinkage: none

Dry strength: good

Drying defects: none

pH: 4.7

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	4	0.0	19.3	34.0	1.76
1900	Tan	4	0.0	18.8	33.5	1.78
2000	Tan	4	2.5	18.7	33.3	1.78
2100	Tan	5	2.5	17.7	32.0	1.81
2200	Lt. brown	5	2.5	16.7	30.6	1.83
2300	Brown	6	2.5	16.5	31.2	1.89

Remarks: Fair tan colors; high vitrification temperature.

*Bloating Test:* Negative

*Extrusion Test:*

Body composition: 100% by weight raw clay thru 8 mesh

Water added for extrusion: 26% of dry batch weight

Shapes extruded: 1-inch x 1-inch bars, cut to 8-inch lengths

Vacuum on machine: 27 inches of mercury

Drying: 24 hours in air; 24 hours at 140°F

Drying shrinkage: 1.0%

**Firing:**

Time: 24 hours	Appar. porosity: 32.3%
Temperature: 2240°F	Bulk density: 1.79 gm/cc
Cone: 8 over	Hardness: 3
Total shrinkage: 2.1%	Color: light red
Absorption: 17.9%	

**Remarks:**

This clay is not suitable for use as the principal component in structural clay products; it does not pack well in extrusion and the vitrification temperature is too high. It might be used as a refractory addition to increase the firing range of face brick or tile.

*Potential Use:* Refractory addition

SAMPLE: R-2924

County: Sussex

*Locality:* Roadcut, 6.9 miles southwest of Wakefield, on the northeast side of State Road 622 approximately 0.2 mile by road southeast of the intersection with State Road 606.

*Description:* An exposure of 5 feet of mottled brown, gray, red, and yellow-orange sandy clay is present in a long roadcut that has a maximum height of about 7 feet. Overburden consists of clayey sand and soil.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across 5 feet of sandy clay.

*Raw Properties:*

Water of plasticity: 20.7%

Dry strength: fair

Drying shrinkage: none

pH: 4.6

Drying defects: none

Other: gritty

Plasticity: medium

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	4	0.0	19.5	33.9	1.74
1900	Tan	4	0.0	18.9	33.6	1.78
2000	Tan	4	0.0	18.2	32.6	1.79
2100	Lt. brown	5	2.5	17.8	32.0	1.80
2200	Brown	6	5.0	15.5	29.0	1.87
2300	Dk. brown	6	5.0	16.4	29.8	1.82

Remarks: Color marginal; high vitrification temperature.

*Bloating Test:* Negative

*Potential Use:* None

SAMPLE: R-3210

County: Sussex

*Locality:* Roadcut on property of Union Camp Corporation, on the south side of company road in Block 306, approximately 300 feet east of State Road 606 and 6.8 miles southeast of Homeville.

*Description:* An exposure of 4 feet of predominantly gray silty clay, mottled with red, is present in a roadcut that has a maximum height of 6 feet. Overburden consists of about 2 feet of silty soil.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across 7 feet of silty clay; the lower 3 feet was sampled by auger which was still penetrating clay at the bottom of the hole.

*Raw Properties:*

Water of plasticity: 19.8%

Plasticity: low

Drying shrinkage: 5.0%

Dry strength: low

Drying defects: none

pH: 8.5

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Orange-tan	(Poor bond)	5.0	—	—	—
1900	Orange-tan	2	5.0	20.3	40.2	1.98
2000	Lt. brown	2	5.0	18.6	38.7	2.08
2100	Dk. brown	2	5.0	18.3	38.8	2.12
2200	Red-brown	2	7.5	16.9	34.1	2.02
2300	Maroon	2	7.5	17.4	33.0	2.01

Remarks: Not suitable for use as the principal component in vitreous clay products; might be used as a nonplastic component for shrinkage control in face-brick mixtures.

*Bloating Test:* Negative

*Potential Use:* None

SAMPLE: R-3211

County: Sussex

*Locality:* Roadcut on property of Union Camp Corporation, on the west side of company road in Block 306, approximately 0.2 mile north of Lanier Field, and 5.5 miles southwest of Wakefield.

*Description:* An exposure of 3 feet of predominantly gray clay, mottled with red-brown, is present in a roadcut that has a maximum height of 4 feet. Overburden consists of approximately 1 foot of sandy soil.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across 6 feet of clay; the lower 3 feet was sampled by auger which was still penetrating clay at the bottom of the hole.

*Raw Properties:*

Water of plasticity: 22.0%

Plasticity: low

Drying shrinkage: 5.0%

Dry strength: fair

Drying defects: none

pH: 7.2

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Orange-tan	3	7.5	20.4	35.8	1.74
1900	Orange-tan	3	7.5	19.7	34.8	1.77
2000	Orange-tan	3	7.5	18.7	33.8	1.79
2100	Lt. brown	3	7.5	18.0	32.9	1.80
2200	Brown	3	7.5	17.4	32.0	1.80
2300	Red-brown	4	7.5	17.1	31.5	1.81

Remarks: Not suitable for use as the principal component in vitreous clay products; might be used as a nonplastic component for shrinkage control in face-brick mixtures.

*Bloating Test:* Negative

*Potential Use:* None

SAMPLE: R-3212

County: Sussex

*Locality:* Roadcut on property of Union Camp Corporation, on the north side of company road in Block 306, approximately 1.1 miles south of the intersection of State Roads 604 and 621 and 4.0 miles west of Wakefield.

*Description:* An exposure of 3 feet of gray slightly silty clay, mottled with yellow and red, is present in a roadcut that has a maximum height of about 4 feet from ditch level. Overburden consists of 1 foot of sandy to silty clayey soil.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across 3 feet of clay.

*Raw Properties:*

Water of plasticity: 15.2%

Plasticity: low

Drying shrinkage: 2.5%

Dry strength: low

Drying defects: none

pH: 7.2

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	3	5.0	15.6	28.7	1.84
1900	Tan	3	5.0	15.0	27.9	1.86
2000	Tan	3	5.0	15.0	28.1	1.87
2100	Lt. brown	3	5.0	14.8	27.8	1.88
2200	Lt. brown	4	5.0	14.0	26.4	1.88
2300	Red-brown	4	5.0	14.0	26.0	1.86

Remarks: Not suitable for use as the principal component in vitreous clay products; might be used as a nonplastic component for shrinkage control in face-brick mixtures.

*Bloating Test:* Negative

*Potential Use:* None

SAMPLE: R-3213

County: Sussex

*Locality:* Roadcut on property of Union Camp Corporation, on the east side of company road in Block 306, approximately 2.0 miles west of the intersection of State Roads 620 and 621 and 3.1 miles southwest of Wakefield.

*Description:* An exposure of 2 feet of dark-gray clay, with dark-brown to olive-brown mottling, is present in the roadcut.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across 4 feet of clay; the lower 2 feet was sampled by auger which was still penetrating clay at the bottom of the hole.

*Raw Properties:*

Water of plasticity: 18.7%

Plasticity: low

Drying shrinkage: 5.0%

Dry strength: fair

Drying defects: none

pH: 7.6

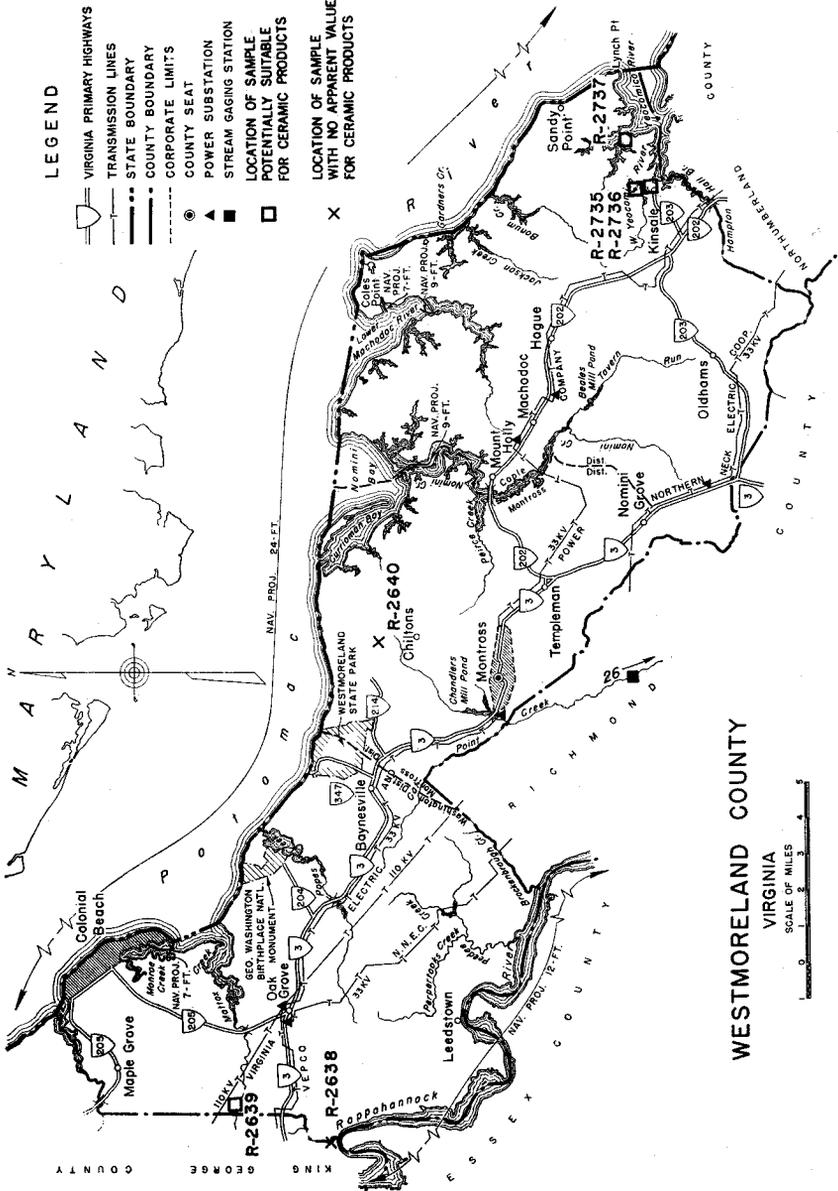
*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Tan	2	5.0	17.1	30.4	1.78
1900	Tan	2	5.0	16.6	29.9	1.80
2000	Tan	2	5.0	16.6	30.0	1.81
2100	Buff	3	5.0	16.1	28.8	1.79
2200	Buff	4	5.0	15.1	27.0	1.79
2300	Buff	4	5.0	15.2	27.4	1.80

Remarks: Not suitable for use as the principal component in vitreous clay products; might be used as a nonplastic component for shrinkage control in face-brick mixtures.

*Bloating Test:* Negative

*Potential Use:* None



Location Map of Westmoreland County

## WESTMORELAND COUNTY

Samples were collected from six localities in Westmoreland County. Laboratory testing indicates the following potential uses for the raw material:

<u>Sample</u>	<u>Formation or Age</u>	<u>Potential Use</u>
R-2638	Calvert Formation	None
R-2639	Calvert Formation	Possible mineral filler
R-2640	Pleistocene	None
R-2735	Pleistocene	Face brick and sewer pipe
R-2736	Pleistocene	Face brick and sewer pipe
R-2737	Pleistocene	Face brick and structural tile

SAMPLE: R-2638

County: Westmoreland

*Locality:* Streamcut, 4.0 miles southwest of Oak Grove, on the north-east side of an unnamed stream dividing King George and Westmoreland counties, approximately 0.1 mile upstream from its junction with the Rappahannock River.

*Description:* An exposure of 18 feet of green sandy clay occurs in the lower part of a streamcut approximately 80 feet deep. Minor localized concentrations of clay stained by iron oxide are present throughout the exposure and small glassy grains of subangular to subrounded quartz also occur. The sandy clay is overlain by sand, clay, and gravel of Pleistocene age.

*Formation or Age:* Calvert Formation

*Sampled Interval:* Sample across 18 feet of sandy clay.

*Raw Properties:*

Water of plasticity: 45.0%

Plasticity: high

Drying shrinkage: 10.0%

Dry strength: good

Drying defects: warping

pH: 6.8

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Lt. brown	3	13.0	26.0	40.8	1.57
1900	Tan	3	13.0	25.6	39.4	1.53
2000	Gray-tan	4	13.0	24.6	39.2	1.60
2100	Gray-buff	5	13.0	15.7	29.2	1.86
2200	Dk. brown	7	(Melted)	—	—	—
2300	Dk. brown	7	(Melted)	—	—	—

Remarks: Abrupt vitrification; not suitable for use in vitreous clay products.

*Bloating Test:* Negative

*Potential Use:* None

SAMPLE: R-2639

County: Westmoreland

*Locality:* Streamcut, 3.0 miles northwest of Oak Grove, along Mattox Creek 0.5 mile south of State Road 657.

*Description:* An exposure of light-gray diatom-bearing clay, with fine-grained subangular to subrounded detrital quartz, is present in a streamcut 14 feet deep. Overburden consists of 6 feet of soil, sand, and silt.

*Formation or Age:* Calvert Formation

*Sampled Interval:* Sample across 5 feet of clay.

*Raw Properties:*

Water of plasticity: 69.2%

Plasticity: low

Drying shrinkage: 2.0%

Dry strength: poor

Drying defects: warping

pH: 3.9

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Buff-tan	2	4.0	61.8	58.7	0.95
1900	Buff-tan	2	4.0	60.7	58.3	0.96
2000	Buff-tan	2	6.0	54.0	56.7	1.05
2100	Red-tan	2	6.0	49.1	54.5	1.11
2200	Pink-gray	3	6.0	40.2	49.0	1.22
2300	Red-tan	3	6.0	46.7	53.7	1.15

Remarks: Not suitable for use in vitreous clay products.

*Oil Bleach Test:* Negative

*Bloating Test:* Negative

*Potential Use:* Possible mineral filler.

SAMPLE: R-2640

County: Westmoreland

*Locality:* Roadcut, 1.1 miles north of Chiltons, on the northeast side of State Road 609 approximately 0.25 mile by road northwest of the intersection with State Road 684.

*Description:* An exposure of about 5 feet of variegated and mottled orange, red, brown, and gray clay is present in a roadcut up to 5 feet in height and 140 feet in length. The clay contains scattered fine-grained subrounded quartz grains. No overburden is present where the clay was sampled.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across approximately 5 feet of clay.

*Raw Properties:*

Water of plasticity: 17.8%

Plasticity: low

Drying shrinkage: 2.0%

Dry strength: poor

Drying defects: none

pH: 4.5

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Orange-brown	4	2.0	18.5	33.3	1.80
1900	Orange-brown	4	2.0	18.1	32.8	1.81
2000	Orange-brown	4	2.0	17.9	32.4	1.81
2100	Red-brown	4	2.0	17.1	31.3	1.83
2200	Brown	4	2.0	17.0	30.8	1.81
2300	Dk. brown	5	2.0	16.3	29.8	1.83

Remarks: Poor color; high vitrification temperature; not suitable for use as the principal component in vitreous clay products.

*Bloating Test:* Negative

*Potential Use:* None

SAMPLE: R-2735

County: Westmoreland

*Locality:* Southeast edge of field, 0.4 mile northeast of Kinsale, approximately 35 feet off the northwest side of State Road 607 and approximately 225 feet southwest of the intersection with State Road 608.

*Description:* Light-gray and orange-yellow clay was obtained from a vertical auger hole drilled to a depth of 5 feet. Approximately 2 feet of sandy soil overlies the clay where the sample was taken. The clay contains well-rounded quartz gravel in a zone approximately 1 inch thick.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across approximately 3 feet of clay; the auger was still penetrating clay at the bottom of the hole.

*Raw Properties:*

Water of plasticity: 25.6%

Plasticity: medium

Drying shrinkage: 5.0%

Dry strength: good

Drying defects: none

pH: 5.7

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Red-tan	3	5.0	20.7	35.8	1.73
1900	Red-tan	4	5.0	15.3	28.3	1.85
2000	Lt. brown	6	9.0	7.2	15.3	2.12
2100	Brown	7	15.0	4.4	9.6	2.19
2200	Chocolate	7	15.0	3.1	6.9	2.24
2300	Dk. gray	7	(Expanded)	—	—	—

Remarks: Good color; should fire to "SW" face-brick specifications at about 2000°F.

*Bloating Test:* Negative

*Potential Use:* Face brick and sewer pipe.

SAMPLE: R-2736

County: Westmoreland

*Locality:* North edge of field, 0.5 mile northeast of Kinsale, approximately 350 feet west of State Road 607 and approximately 775 feet northwest of the intersection with State Road 608.

*Description:* Predominantly slightly sandy yellow-orange clay, with some light-gray clay, was obtained from a vertical auger hole drilled to a depth of 4 feet. Approximately 1 foot of sand overburden is present where the sample was taken.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across approximately 3 feet of sandy clay; the auger was still penetrating clay at the bottom of the hole.

*Raw Properties:*

Water of plasticity: 31.0%

Plasticity: medium

Drying shrinkage: 6.0%

Dry strength: good

Drying defects: none

pH: 4.8

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Red-tan	3	9.0	23.8	39.5	1.66
1900	Red-tan	5	14.0	16.7	30.6	1.83
2000	Lt. brown	7	14.0	6.2	13.3	2.15
2100	Brown	7	15.0	3.6	8.1	2.25
2200	Brown	8	15.0	2.7	6.1	2.27
2300	Dk. gray	7	(Expanded)	—	—	—

Remarks: Good color; should fire to "SW" face-brick specifications at about 1950°F.

*Bloating Test:* Negative

*Potential Use:* Face brick and sewer pipe.

SAMPLE: R-2737

County: Westmoreland

*Locality:* River bank (Figure 8), 1.6 miles northeast of Kinsale, on the south side of the Yeocomico River approximately 800 feet west of White Point.

*Description:* An exposure of 8 feet of light-gray slightly silty clay, overlain by 4 feet of slightly sandy gray and yellow clay, occurs along a river bank on the Yeocomico River.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across 8 feet of light-gray clay.

*Raw Properties:*

Water of plasticity: 30.6%

Plasticity: medium

Drying shrinkage: 8.0%

Dry strength: good

Drying defects: none

pH: 5.1

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Pale tan	4	9.0	18.3	32.4	1.77
1900	Pale tan	5	10.5	13.6	25.4	1.87
2000	Tan	7	15.0	6.5	13.4	2.06
2100	Lt. brown	7	15.0	3.5	7.5	2.15
2200	Lt. brown	7	15.0	3.4	7.4	2.18
2300	Gray	7	(Expanded)	—	—	—

Remarks: High drying shrinkage; should fire to "SW" face-brick specifications at about 1950°F.

*Bloating Test:* Negative

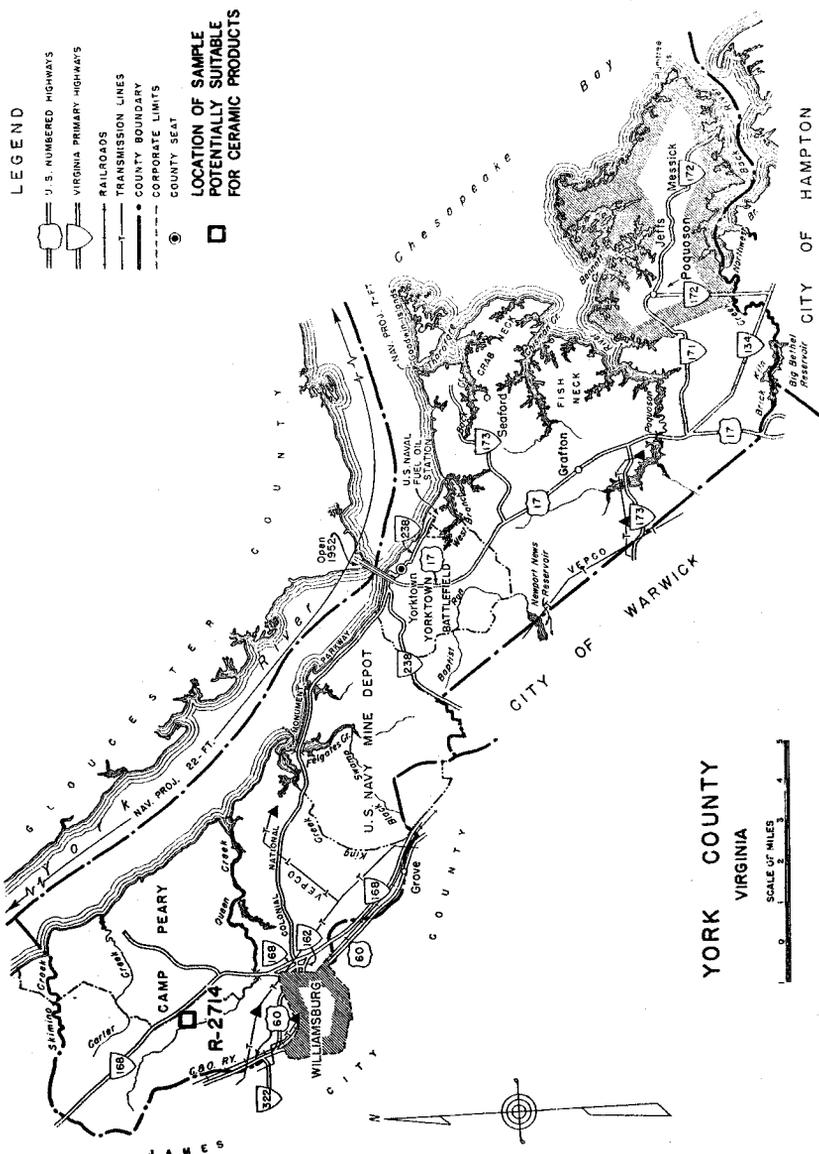
*Potential Use:* Face brick and structural tile.



Figure 8. Exposure of clay of Pleistocene age (Sample R-2737) on the south bank of the Yeocomico River approximately 800 feet west of White Point.



Figure 8. Exposure of clay of Pleistocene age (Sample R-2737) on the south bank of the Yeocomico River approximately 800 feet west of White Point.



Location Map of York County

## YORK COUNTY

A sample was collected from one locality in York County. Laboratory testing indicates the following potential use for the raw material:

<u>Sample</u>	<u>Formation or Age</u>	<u>Potential Use</u>
R-2714	Pleistocene	Face brick

SAMPLE: R-2714

County: York

*Locality:* Cut along an abandoned railroad (Figure 9), 3.2 miles north of Williamsburg, off the south side of State Road 645 approximately 0.3 mile by road west of the intersection with State Highway 168.

*Description:* At least 15 feet of clay and clayey sand is present in a cut along an abandoned railroad. The material can be divided into two distinctly different zones based on clay-sand content. The lower 5 feet of the exposure is predominantly light-gray, slightly mottled, plastic clay that is separated into thin beds by layers of fine-grained yellow quartz sand; the upper 10 feet is mottled gray, orange, red, and yellow clayey sand with a few thin sand zones.

*Formation or Age:* Pleistocene

*Sampled Interval:* Sample across 15 feet of clay, clayey sand, and sand on the south side of the cut.

*Raw Properties:*

Water of plasticity: 22.3%  
Drying shrinkage: 5.0%  
Drying defects: none

Plasticity: low  
Dry strength: fair  
pH: 5.8

*Slow Firing Test:*

Temp. ° F	Color	Hard- ness	% Total Lin. Shk.	% Abs.	% Appar. Porosity	Bulk Dens. gm/cc
1800	Salmon	2	5.0	18.3	32.2	1.76
1900	Salmon	2	7.5	15.6	28.7	1.84
2000	Tan	3	7.5	12.8	23.9	1.87
2100	Lt. brown	4	10.0	12.3	23.7	1.93
2200	Red-brown	5	10.0	10.0	20.1	2.01
2300	Gray	6	12.5	7.7	16.0	2.08

Remarks: Good color at 2000°F; should fire to "MW" face-brick specifications at about 2000°F.

*Bloating Test:* Negative

*Extrusion Test:*

Body composition: 100% by weight raw clay thru 6 mesh

Water added for extrusion: 22% of dry batch weight

Vacuum on machine: 22 inches of mercury

Drying: 24 hours in air; 24 hours at 140°F

Drying shrinkage: 4.2%

Modulus of rupture (dry, unfired): 650 psi

*Firing:*

Time: 24 hours

Temperature: 2200°F

Cone: 8 over

Total shrinkage: 7.3%

Absorption: 8.7%

Appar. porosity: 17.9%

Bulk density: 128.5 lb/ft<sup>3</sup>

Modulus of rupture (fired):

2290 psi

Hardness: 6

Color: dark tan

*Remarks:*

Should meet "SW" face-brick specifications as processed.

*Potential Use:* Face brick

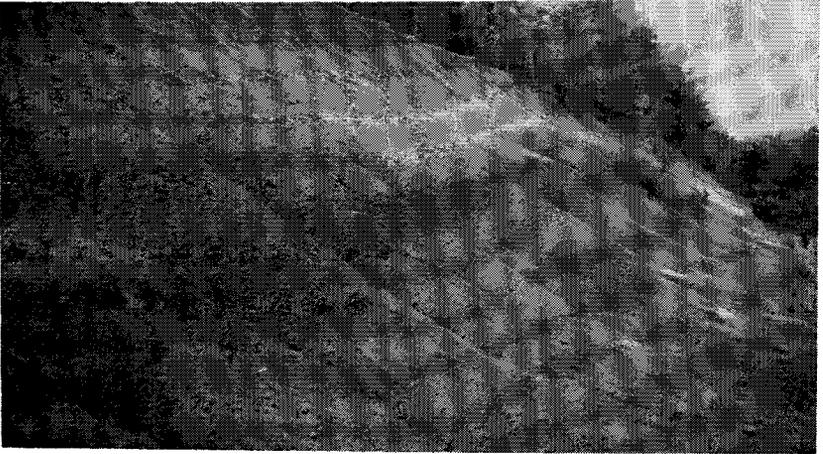


Figure 9. Exposure of clay and clayey sand of Pleistocene age (Sample R-2714) in a cut along an abandoned railroad off the south side of State Road 645 approximately 0.3 mile by road west of the intersection with State Highway 168.



Figure 9. Exposure of clay and clayey sand of Pleistocene age (Sample R-2714) in a cut along an abandoned railroad off the south side of State Road 645 approximately 0.3 mile by road west of the intersection with State Highway 168.

APPENDIX I  
CRITERIA USED IN EVALUATING MATERIAL FOR STRUCTURAL CLAY PRODUCTS

	Common brick	Face brick	Decorative brick	Hollow tile	Wall tile	Drain tile
<i>Unfired properties</i>						
Workability	Fairly plastic to plastic	Fairly plastic to plastic	Fairly plastic to plastic	Plastic to very plastic and smooth	Plastic to very plastic and smooth	Plastic to very plastic and smooth
Water of plasticity %	15-40	15-40	15-40	15-35	15-35	15-40
Green strength						
Wet	Low to high	Low to high	Low to high	Average to high	Average to high	Average to high
Dry	Low to high	Low to high	Low to high	Average to high	Average to high	Average to high
Drying characteristics	No warping or cracking	No warping or cracking	No warping or cracking	No warping or cracking	No warping or cracking	No warping or cracking
Drying shrinkage %*	0-8	0-8	0-8	0-8	0-8	0-8
<i>Fired properties</i>						
Maturing temp. °F	1800-2000	1800-2200	1800-2200	1800-2100	1800-2100	1800-2000
Hardness	Very hard to steel hard (5-6)	Steel hard (6)	Steel hard (6)	Steel hard (6)	Steel hard (6)	Very hard (5)
Absorption %	Up to 20	Up to 17	Up to 15	Up to 15	0-10	0-12
Shrinkage %*	0-8	0-8	0-8	0-8	0-8	0-8
Color	Reds to browns	Reds, browns, buff, creams	Unusual colors, pinks, grays, etc.	Not critical usually red, brown-red, buff	White, buff, reds, creams	Buff, red-browns
Scumming	Slight	None	None	Slight	None	Slight

APPENDIX I  
CRITERIA USED IN EVALUATING MATERIAL FOR STRUCTURAL CLAY PRODUCTS—Continued.

	Roofing tile	Floor tile	Flue lining (Flue tile)	Architectural terra cotta	Sewer pipe
<i>Unfired properties</i>					
Workability	Plastic to very plastic and smooth	Plastic to very plastic and smooth	Plastic to very plastic and smooth	Very plastic and smooth	Plastic to very plastic and smooth
Water of plasticity %	15-35	15-35	15-40	18-35	15-35
Green strength					
Wet	Average to high				
Dry	Average to high				
Drying characteristics	No warping or cracking				
Drying shrinkage %*	0-8	0-8	0-8	Up to 8	0-8
<i>Fired properties</i>					
Maturing temp. °F	1800-2200	1800-2200	1800-2400	2000-2200	1800-2100
Hardness	Steel hard (6)	Steel hard (6)	Very hard (5)	Steel hard (6)	Steel hard (6)
Absorption %	0-10	0-20	0-20	8-25	0-8
Shrinkage %	0-8	0-8	0-8	0-8	0-8
Color	Bufs, reds, browns	Reds, bufes, dark browns	Bufs, red, and red-brown	Reds, buff, gray-bufes, off-whites	Reds, red-brown
Scumming	None	None	None	None	None

\*Commercially, total linear shrinkage of unfired and fired product should not exceed 15 percent (plastic basis).

APPENDIX II  
CRITERIA USED IN EVALUATING MATERIAL FOR LIGHTWEIGHT AGGREGATE

	Rotary kiln process	Sintering process
<i>Unfired properties</i>		
Drying characteristics	Dry readily and show only slight disintegration	Not critical, water used to pelletize before firing
Dry strength	Must be sufficient for proper sizing when crushed for kiln feed	Not critical
Crushing characteristics	—8 mesh material should not exceed 20%*	Not critical except where particles tend to be thin and platy
<i>Fired properties</i>		
Firing range	1800-2200°F	Vitreous and glazed between 2200-2300°F
Bloating range	Minimum 100°F, 200° preferred	Not critical
Density	55 lb/ft <sup>3</sup> (½" To No. 4)	55 lb/ft <sup>3</sup> (½" To No. 4)
Expansion	Gradual weight decrease through bloating range	Slight
Absorption	0—18.0% at best bloating temp	0—6.0%
Color	Light reds to light grays preferred although color not too critical	Light red-grays preferred although color not too critical
Strength	Determined by concrete performance test	Determined by concrete performance test

\* Generally, an excess of 10 percent of —8 mesh particles will result in sticking, as the fines will overfire. Excessive fines in soft clays are not a serious problem; they can be removed by screening and allowed to compact into lumps for reprocessing. Fines from harder material do not compact naturally and are often discarded as waste material, but they can be pelletized and expanded. If screen analyses indicate fines above 20 percent, a study should be made of the crushing characteristics to determine if different techniques will reduce the percentage of fines.

APPENDIX III

STANDARD CLASSIFICATION OF FIRECLAY REFRACTORY BRICK\*

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Class	Pyrometric cone equivalent
Super duty	33
High duty	31-32
Intermediate duty	29-31
Low duty	19-29

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\* ASTM C27-41

## GLOSSARY

- absorption**—The relationship of the weight of water absorbed by a ceramic specimen to the weight of the specimen before immersion in water, expressed as a percent.
- aggregate**—Inert material comprising the bulk of concrete or mortar; usually sand, gravel, or crushed stone. (*See also* lightweight aggregate).
- ASTM**—American Society for Testing Materials.
- ball clay**—A highly plastic clay consisting principally of kaolinite, and characterized by a high organic content, high dry strength, and long vitrification range.
- batch weight**—The weight of materials in a ceramic mix.
- bloat**—To swell under the application of heat and thus form a vesicular structure.
- bloating test**—A test to determine the ability of a ceramic material or product to expand when heated.
- bulk density**—The weight of a solid per unit of exterior volume expressed in gm/cc or lb/ft<sup>3</sup>.
- ceramic bond**—Strength imparted to a ceramic body upon vitrification within the body.
- ceramic ware**—Products composed essentially of nonmetallic material which have been subjected to high temperature during the manufacturing process.
- china clay**—A refractory clay composed mainly of hydrous aluminum silicates which fires to a white or off-white color.
- clay**—A mineral aggregate consisting essentially of hydrous aluminum silicates, and occasionally hydrous magnesium silicates, characterized by extremely fine particle size. Clays become plastic when wetted, and can be vitrified by heating to high temperatures.
- crazing**—The cracking of fired glazes due to tensile stresses. The opposite of shivering.
- crushing characteristics**—The shape of lightweight aggregate fragments resulting from the action of a crusher.
- diatom**—Microscopic tests composed of siliceous material.
- diatomaceous**—Containing diatoms.
- drying characteristics**—The characteristics which develop in, or on, a ceramic body upon drying, such as strength, warping, etc.
- drying defects**—Features such as cracking, warping, and efflorescence which develop during the drying of a ceramic body.
- drying shrinkage**—The percent of linear change of a ceramic body upon drying, usually at 110° C.

**dry strength**—The mechanical strength of a ceramic body after being dried, usually at 110° C.

**dunting**—Thermally induced cracking in fired ceramic objects.

**earthenware**—Nonvitreous ceramic whiteware, either glazed or unglazed, with an absorption of more than 3 percent.

**efflorescence**—The staining of a masonry surface as a result of the deposition of water-soluble salts.

**extrusion**—The forcing of clay material through an opening or die to form a continuous body of like cross section throughout its length.

**face brick**—Brick of various colors, often with imparted surface texture, manufactured especially for use in exposed walls or masonry units. Face brick are designated "NW", "MW", or "SW" to indicate suitability for use under negligible, mild, or severe weather conditions. (Also called facing brick).

**flue lining**—A fireproof ceramic unit used to line flues and chimneys.

**glaze**—A ceramic coating matured to the glassy state on a ceramic object; also, the mixture from which the coating is made.

**green strength**—The resistance to breaking of a ceramic body in the plastic state.

**hardness**—The resistance to scratching or abrasion expressed verbally, or by Mohs scale of hardness as follows:

Mohs scale of hardness	Descriptive term	Criteria used to determine hardness
— —	poor bond, crumbled	cannot be tested
2 gypsum	soft	scratched by fingernail
3 calcite	fairly hard	scratched by nail
4 fluorite	hard	scratched by knife
5 apatite	very hard	scratched by steel file
6 orthoclase feldspar	steel hard	not scratched by steel file

**kaolin**—A clay composed mainly of minerals of the kaolinite group.

**kaolinite**—Two-layer hydrous aluminum silicate having the general formula  $Al_2(Si_2O_5)(OH)_4$ .

**laminae, laminations**—In ceramic usage, planes of weakness in a ceramic product.

**lb/ft<sup>3</sup>**—Pounds per cubic foot.

**lightweight aggregate**—Aggregate produced by expanding, or bloating, of such materials as clay, shale, or slate which have been heated. (See aggregate).

**linear shrinkage**—The percent of linear contraction of a ceramic body, measured both after drying and after firing.

- mechanical strength**—The resistance to breaking of a ceramic body, either dry or fired.
- mineral filler**—An inert mineral substance added to certain manufactured products to impart desirable properties such as weight, wear-resistance, and opacity.
- muffle kiln**—A furnace in which the fuel is burned within refractory chambers, from which the heat is conducted into the ware chamber.
- overfired**—Heated to the point of pronounced deformation or bloating.
- pH**—Hydrogen ion concentration; a measurement of acidity or alkalinity.
- plasticity**—The property of a moistened material to be deformed under pressure, with the deformed shape being retained when the deforming force is removed.
- pore structure**—The geometry or arrangement of the void spaces in a material or object.
- porosity**—The ratio of the aggregate volume of interstices, or void spaces, in a ceramic material to the total volume, expressed in percent.
- psi**—Pounds per square inch.
- pyrometric cone**—A trigonal cone, standardized as to shape and softening point, used as a control in firing ceramic products.
- pyrometric cone equivalent**—The designation number of a pyrometric cone which softens simultaneously with a cone of the ceramic material under investigation when tested in accordance with a standard method of testing (ASTM designation C24).
- refractory**—Heat-resisting ceramic material, e.g., refractory brick, refractory clay.
- retention time**—The length of time a lightweight aggregate is exposed to bloating temperature.
- semivitreous**—The degree of vitrification of ceramic objects, except floor and wall tile, having a water absorption capacity of from 0.3 to 3.0 percent water. Floor and wall tile are considered semivitreous when water absorption is between 3.0 and 7.0 percent.
- sewer pipe**—Ceramic pipe, characterized by low absorption, used in the construction of sewers and drains.
- shivering**—The splintering of fired glazes due to compressive stresses. The opposite of crazing.
- shrinkage**—The reduction in size of ceramic material upon drying and firing.
- shrinkage cracks**—The parting, or separation, of laminae upon drying.
- single fire**—The maturing of a glazed ceramic object in one firing operation.

**slow firing test**—A test to determine the firing characteristics of ceramic raw materials in which dried samples are fired in a kiln started at room temperature and raised to maximum temperature over a period of hours. Samples removed at specified temperatures are evaluated for hardness, color, percent of total linear shrinkage, percent absorption, percent apparent porosity, and bulk density.

**stoneware**—Fine-textured ceramic products, either vitreous or semivitreous, generally made from low-grade plastic fireclay.

**structural clay products**—Any of a class of load-bearing, ceramic building units.

**structural tile**—Hollow, fired-clay building units with parallel cells.

**tile**—Ceramic units, characterized by thinness with respect to length and width, used for refractory shapes, building units, or facing units. The latter may be glazed or unglazed.

**vitriification**—The continual reduction in porosity of a ceramic object or material as a result of firing.

**vitriification temperature**—The temperature at which a ceramic product or substance has vitrified to a predetermined degree.

**vitriify**—To produce (in a ceramic ware) enough glassy phase or close crystallization by high firing to make nonporous.

**warping**—The bending of a ceramic body upon either drying or firing.

**water of plasticity**—The percent of water required to make a clay material plastic.

**whiteware**—Ceramic products that have a white or ivory body when fired.