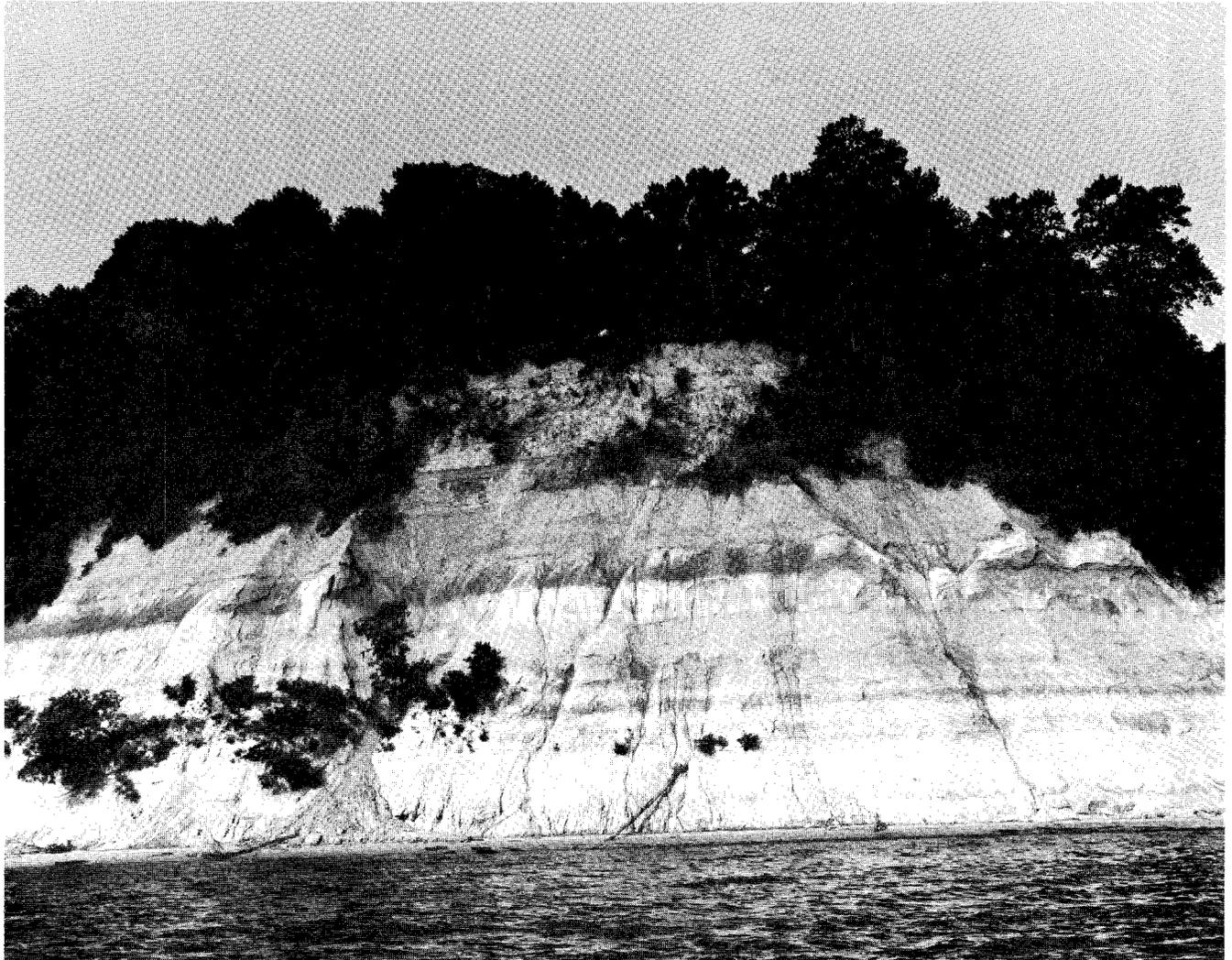




VIRGINIA CLAY MATERIAL RESOURCES

Palmer C. Sweet



COMMONWEALTH OF VIRGINIA

DEPARTMENT OF CONSERVATION AND ECONOMIC DEVELOPMENT
DIVISION OF MINERAL RESOURCES

Robert C. Milici, Commissioner of Mineral Resources and State Geologist

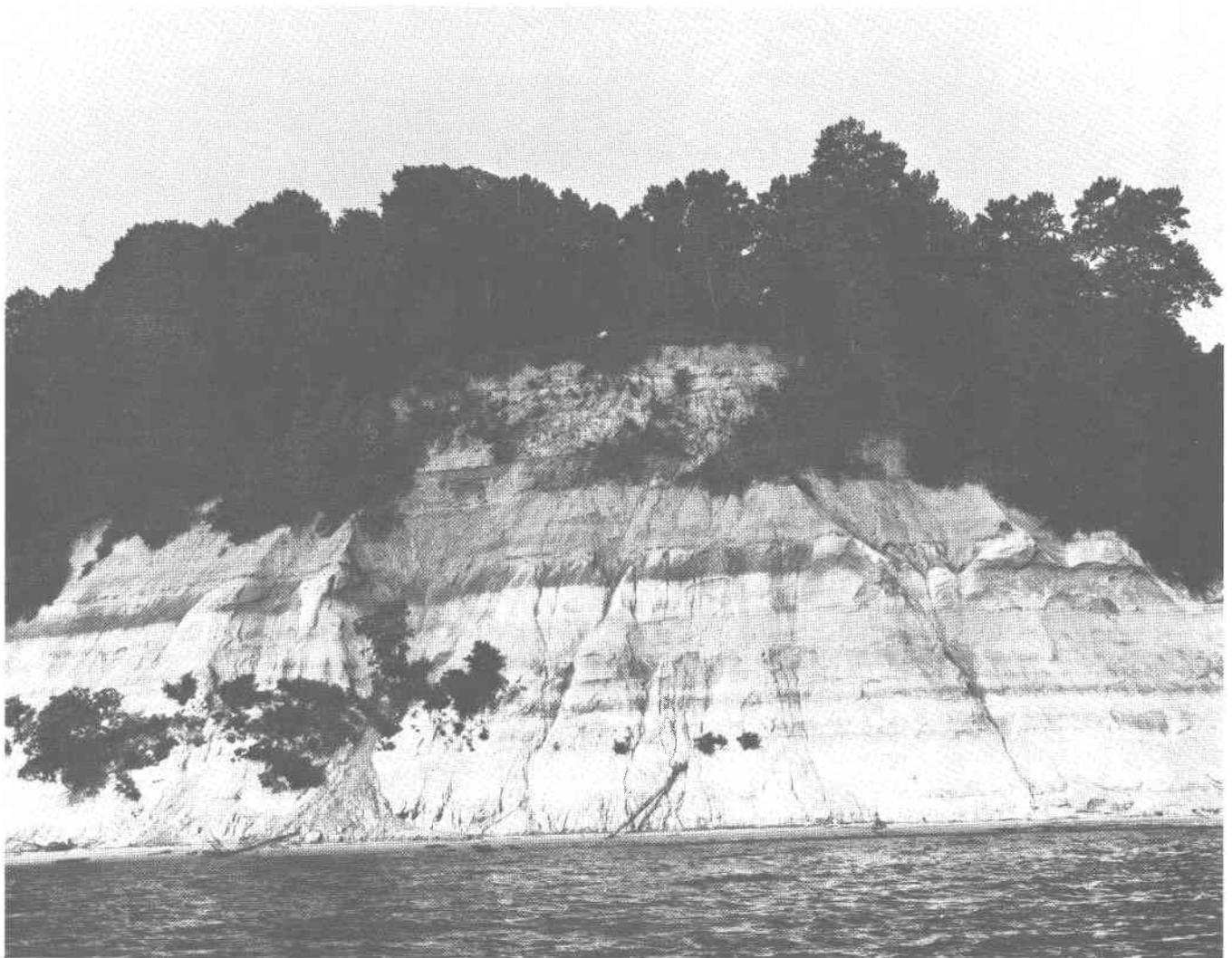
CHARLOTTESVILLE, VIRGINIA

1982



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1982

FRONT COVER: Miocene to Pliocene sand, silt, clay and diatomaceous clay in Horsehead Cliffs, Westmoreland State Park, south bank Potomac River. Sample No. R-7364 is from the middle heights of these cliffs, which are about 150 feet high. (Photo by W. L. Newell, U. S. Geological Survey.)

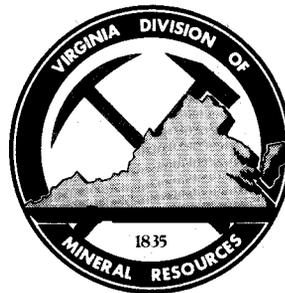
REFERENCE NOTE: Portions of this publication may be quoted if credit is given to the Virginia Division of Mineral Resources. It is recommended that reference to this report be made in the following form: Sweet, Palmer., 1982, Virginia clay material resources: Virginia Division of Mineral Resources Publication 36, 178 p.



VIRGINIA DIVISION OF MINERAL RESOURCES PUBLICATION 36

VIRGINIA CLAY MATERIAL RESOURCES

Palmer C. Sweet



COMMONWEALTH OF VIRGINIA

DEPARTMENT OF CONSERVATION AND ECONOMIC DEVELOPMENT
DIVISION OF MINERAL RESOURCES

Robert C. Milici, Commissioner of Mineral Resources and State Geologist

CHARLOTTESVILLE, VIRGINIA

1982

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COMMONWEALTH OF VIRGINIA

Department of General Services, Division of Purchases and Supply

Richmond, 1982

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VIRGINIA CLAY MATERIAL RESOURCES

by
Palmer C. Sweet

ABSTRACT

This report contains the results of tests on the properties of clay, shale and related materials required to evaluate their potential use for ceramic and nonceramic products. A total of 130 samples, collected in 37 counties and 3 independent cities in Virginia, were tested. These tests indicated that the material represented by 90 of the samples is potentially suitable for use as structural clay products, super-duty, high-duty, medium-duty and low-duty refractories, lightweight aggregate, or inert filler.

INTRODUCTION

This is the seventh study published by the Virginia Division of Mineral Resources containing field and laboratory data on clay materials relating to their potential uses as ceramic and nonceramic materials. In the previous six studies, a total of 485 samples collected in Virginia were determined to have some potential commercial value. In the present study 90 additional samples were found to be potentially suitable for use as structural clay products, super-duty, high-duty, medium-duty, and low-duty refractories, lightweight aggregate, or inert filler. Sample locations are indicated on a generalized geologic map of Virginia (Figure 1) and on county maps; specific location data for the samples are given with individual sample descriptions. UTM (Universal Transverse Mercator) coordinates and roadway numbers that do not appear on the county maps are on the quadrangles named in the location descriptions.

Materials suitable for use in making refractories (Table 1) are in Henry County (R-7476-B, R-7477, R-7478), Nelson County (R-7525, R-7526-B) and Pittsylvania County (R-7482); samples potentially suitable for the production of lightweight aggregate include those in Henrico County (R-7533, R-7867) and in the city of Virginia Beach (R-6810). Diatomaceous sediments sampled in King George County (R-3043) and Richmond County (R-3039, R-3040, R-3041, R-3042) tested suitable for use as inert filler. Results of detailed tests on these five samples of diatomaceous

sediments relating to their reaction to oil-decolorizing and absorbency agents are on open file at the Division of Mineral Resources. Results of chemical analyses on selected samples, performed chiefly to determine alumina content, are in Table 2.

Tests run on the clay-material samples were performed by the U.S. Bureau of Mines Tuscaloosa Research Center at Tuscaloosa, Alabama under a cooperative program with the Virginia Division of Mineral Resources. Splits of most samples are on file at the Division's rock repository, where they are available for examination. Data presented in this report are preliminary and will not suffice for appraisal of materials for use in plant or process design. Evaluations are based on test data from a single sample or from a small number of samples considered to be representative of material at the sampling site. Samples from other parts of the pit or roadcut may not have the same physical characteristics as those determined for the sample that was tested. Additional sampling and testing should be carried out to assess the potential for commercial development of the material at any particular locality.

NOTES ON SAMPLE INFORMATION

Descriptions of individual samples are arranged alphabetically by county. Information for the samples includes, in order, the sample number and its county location; the date that samples were submitted for analysis and the name of the laboratory performing the tests; detailed location data, beginning with UTM (Universal Transverse Mercator coordinates, for example, N 4,189,290 E 717,670 - Zone 17), the name of the 7.5-minute quadrangle in which the sample site is located, and other location data; a hand-sample description of the material from which the sample was taken; descriptions of the sample interval, and of the raw properties of the material; the results of a slow-firing test, and a preliminary bloating test; and the potential use of the material.

The appendices and the glossary contain information helpful in interpreting descriptions and test results.

VIRGINIA DIVISION OF MINERAL RESOURCES

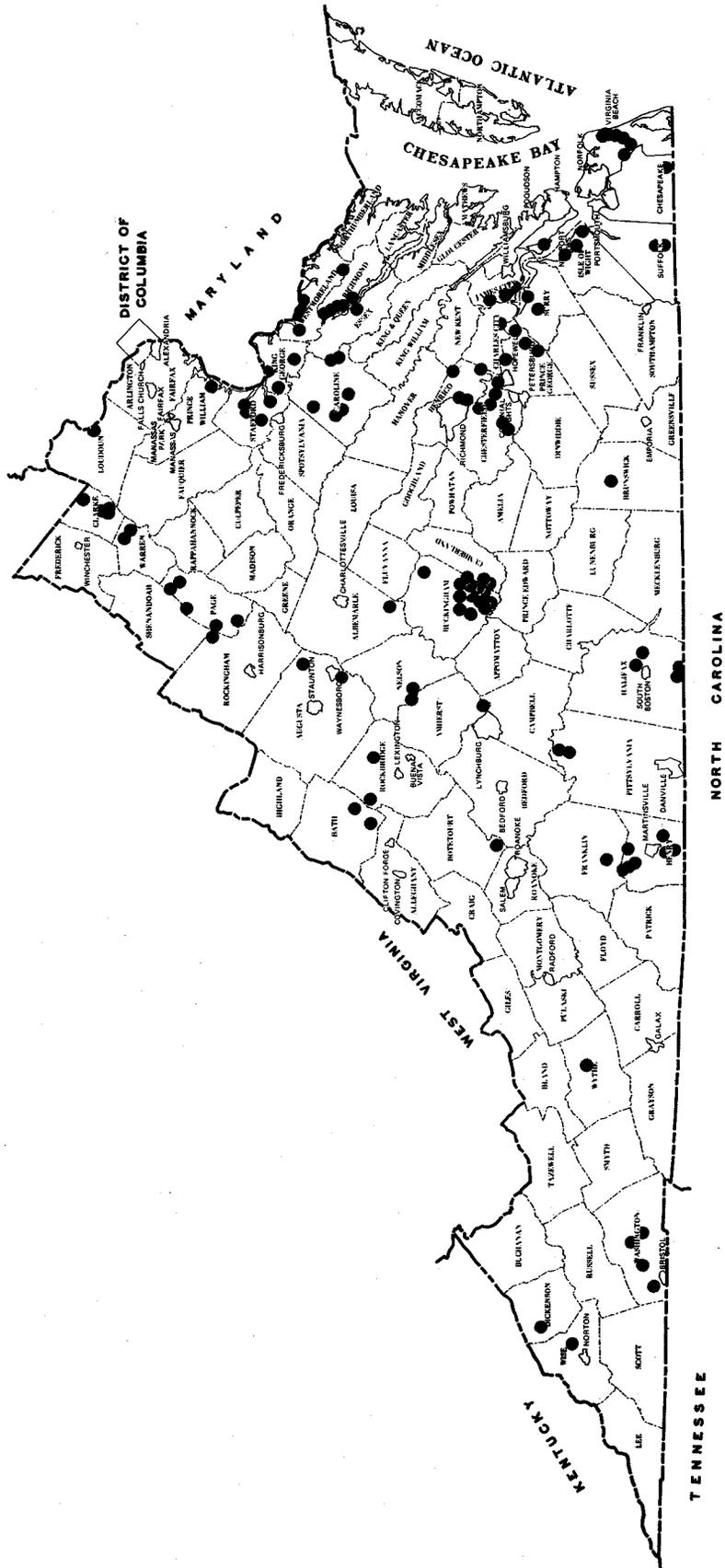


Figure 1. General location of clay material samples.

Table 1. Samples suitable for refractories*

County	Repository Number	Pyrometric Cone Equivalent	Refractories Use
Henry	R-7476-B	32 (3,123°F)	High-Duty
Henry	R-7477	19-20 (2,806-2,847°F)	Low-Duty
Henry	R-7478	30 (3,029°F)	Medium-Duty
Nelson	R-7526-B	31	Medium-Duty
Nelson	R-7525	31½	High-Duty
Pittsylvania	R-7482	34-35 (3,205-3,245°F)	Super-Duty

* Tests made by U.S. Bureau of Mines Tuscaloosa Research Center.

Table 2. Samples tested for alumina (Al₂O₃)*

County/City	Repository Number	Wt. % Al ₂ O ₃	Wt. % SiO ₂	Wt. % Fe ₂ O ₃
Chesapeake	R-7399	16.21	69.01	2.27
Henrico	R-7534	19.14	62.47	4.70
Henry	R-7476-A	30.27	56.43	0.60
Henry	R-7476-B	32.15	54.32	0.36
Henry	R-7477	19.22	73.85	0.57
Henry	R-7478	20.84	68.87	0.86
Henry	R-7481	22.75	64.83	0.53
James City	R-7539	13.06 (12.1)*	73.27	3.18
James City	R-7540	15.03 (13.6)*	71.27	2.75
James City	R-7541	14.15 (13.4)*	71.39	3.55
James City	R-7542	17.63 (15.6)*	64.02	4.75
James City	R-7543-A	14.65 (12.0)*	60.39	11.91
James City	R-7543-B	14.62 (13.7)*	71.58	2.99
Nelson	R-7525	35.55	45.85	2.09
Nelson	R-7526-A	33.91	47.84	0.88
Nelson	R-7526-B	31.22	50.70	0.87
Pittsylvania	R-7482	37.99	45.40	0.47
Stafford	R-7243	17.86	66.92	3.17
Virginia Beach	R-7179	12.04	76.61	2.27
Virginia Beach	R-7400	14.41	72.62	2.00
Virginia Beach	R-7401	9.54	80.84	1.26

* Tests made by U.S. Bureau of Mines Reno Research Center, Reno, Nevada.

SAMPLE DESCRIPTIONS, CHARACTERISTICS, AND EVALUATIONS

Abbreviations, Symbols, and Terms Used in Tables.

Abbreviations:

Abs. — Absorption

Appar. Poros. — Apparent porosity

Lin. Shk. — Linear shrinkage

LOF — Loss on firing (chemical analyses)

USBM-15.6 — weight percent as determined by
U.S. Bureau of Mines

Symbols:

— test not performed; or not applicable

Terms: Color as used in slow firing test is based on
Munsel Book of Colors, 1973, Neighboring
Hues Edition: Newburg, New York, Kollo-
morgan Corp.

All chemical analyses are in weight percent.

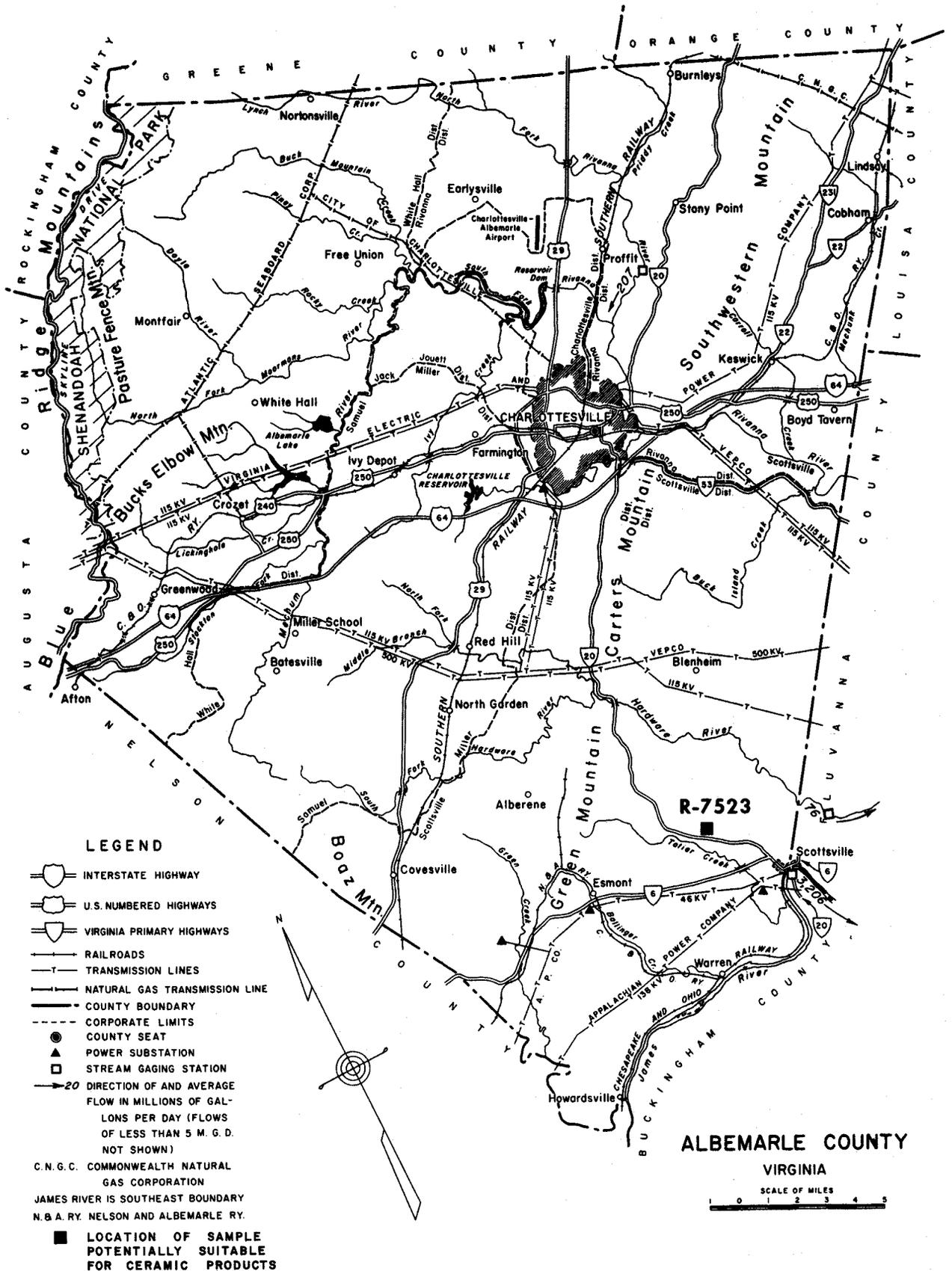


Figure 2.

SAMPLE: R-7523

COUNTY: Albemarle

Date: December, 1979—Tuscaloosa Research Center*Locality:* N4,189,670 E717,670 (Zone 17). Esmont 7.5-minute quadrangle. Roadcut, about 2.3 miles (3.7 km) northwest of Scottsville on the north side of State Highway 20, 0.5 mile (0.8 km) by road southeast of its intersection with State Road 626.*Description of Outcrop:* Pale- to moderate reddish-brown clay, some grayish-green and light-gray bits of shale, and weathered mudstone in a 250-foot (76-m) roadcut with a maximum height of 7 feet (2 m). Iron-oxide stain is on some joints.*Formation/(Age):* Residual clay.*Sampled Interval:* Representative sample across 6 feet (2m) of clay and mudstone in the eastern part of the roadcut.*Raw Properties:*

Working properties:	plastic
Water of plasticity:	24.5%
Drying shrinkage:	2.5%
Dry strength:	good
pH:	5.4

Slow Firing Test:

Temp. °C	Color	Hard- ness	%Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	7.5	18.2	33.9	1.86
1050	Brownish orange	3	7.5	14.0	28.0	2.00
1100	Strong brown	4	10.0	8.9	19.6	2.21
1150	Strong brown	4	12.5	5.7	13.2	2.33
1200	Moderate reddish brown	5	12.5	2.6	6.2	2.40
1250	—	—	Melted	—	—	—

Remarks: Slightly high shrinkage at 1,150°—1,200°C, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., building brick at 1,100°-1,200°C).

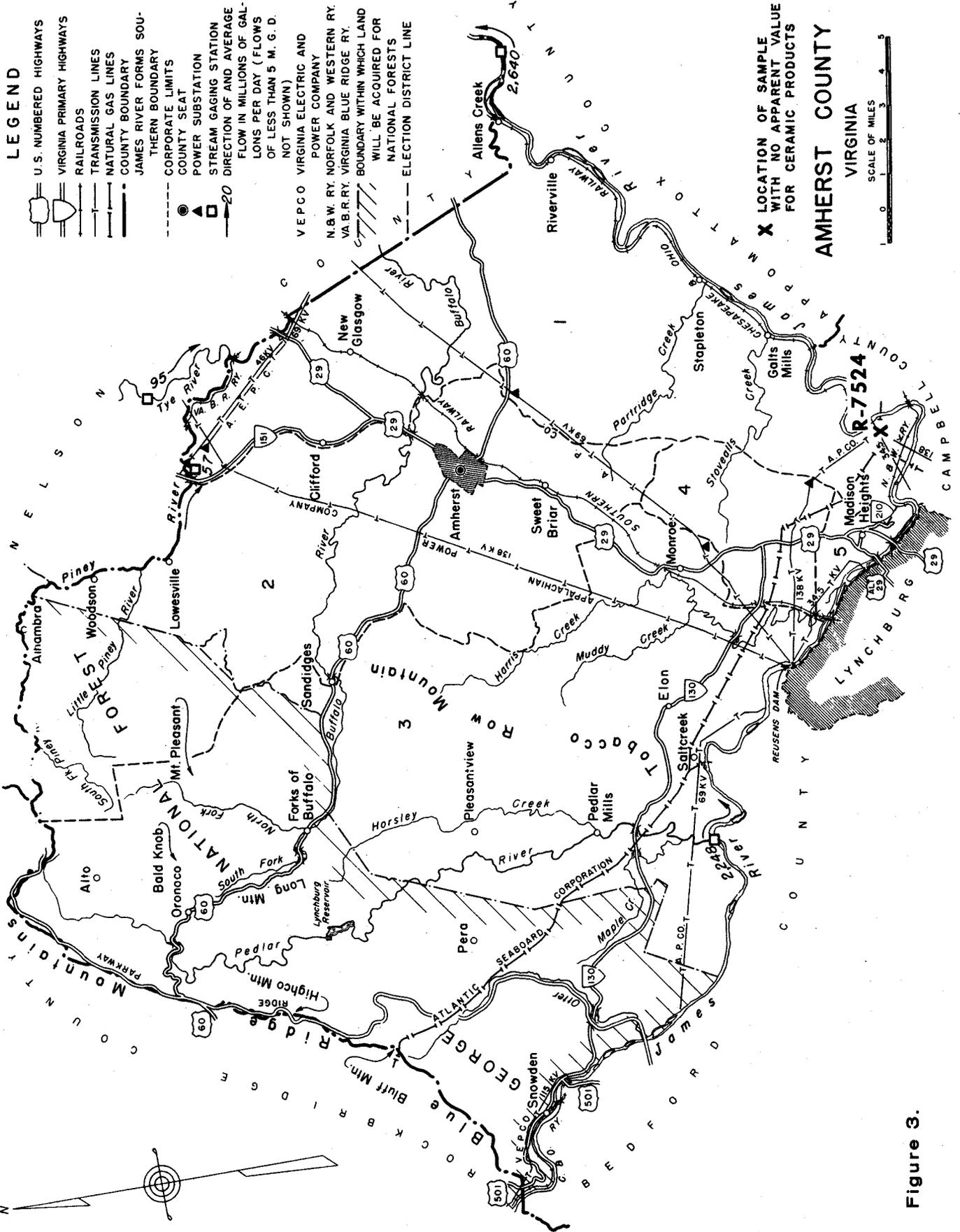


Figure 3.

SAMPLE: R-7524

COUNTY: Amherst

Date: December, 1979—Tuscaloosa Research Center.*Locality:* N4,141,450 E670,060 (Zone 17). Kelly 7.5-minute quadrangle. Roadcut, about 3 miles (5 km) southeast of Madison Heights, on the northeast side of State Road 672, approximately 2.5 miles (4.0 km) by road southeast of its intersection with State Road 622 (Wright Shop Road).*Description of Outcrop:* Light-silvery-gray and greenish-gray to medium-red phyllite in a 40-foot (12-m) roadcut and ditch with a maximum height of 3 feet (1 m). Some phyllite is weathered to grayish-orange, and dull-red to black. The phyllite has a strike of N40° E and a dip ranging from 75° SE to vertical. The grayish-orange overburden is silty.*Formation/(Age):* Candler Formation (Cambrian)*Sampled Interval:* Representative sample across 20 feet (6 m) of weathered and unweathered phyllite in the roadcut, ditch, and road.*Raw Properties:*

Working properties:	plastic
Water of plasticity:	22.1%
Drying shrinkage:	2.5%
Dry strength:	good
pH:	6.1

Slow Firing Test:

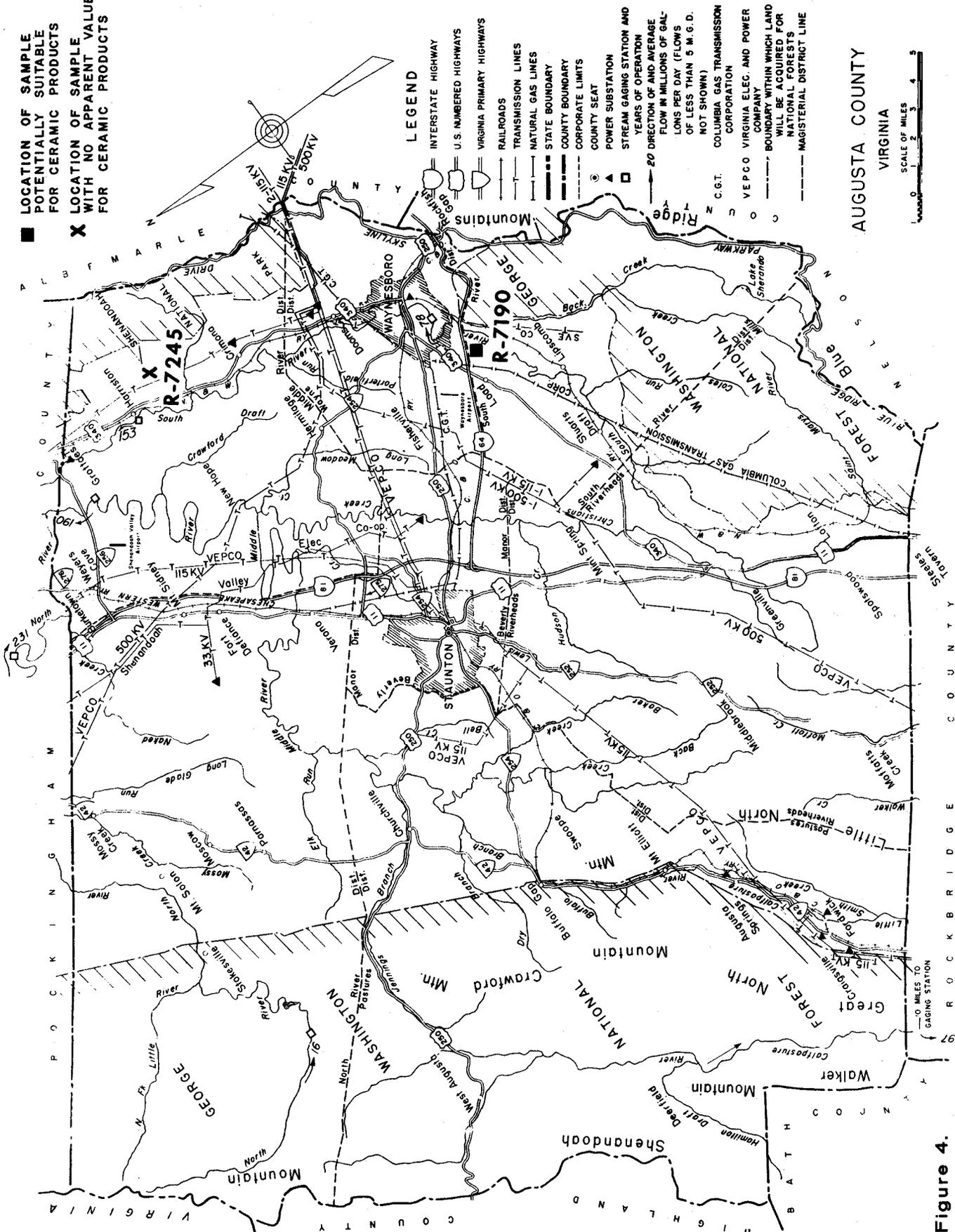
Temp. °C	Color	Hard- ness	%Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Grayish reddish orange	2	2.5	27.8	43.5	1.57
1050	Grayish reddish orange	2	2.5	24.1	40.1	1.66
1100	Strong brown	2	5.0	20.8	36.5	1.75
1150	Light reddish brown	2	7.5	17.2	32.1	1.87
1200	Moderate reddish brown	3	10.0	8.2	18.1	2.20
1250	—	—	Melted	—	—	—

Remarks: Too soft, no effervescence with HCl

Preliminary Bloating Test: Negative*Potential Use:* Not suitable for structural clay products.

■ LOCATION OF SAMPLE
 POTENTIALLY SUITABLE
 FOR CERAMIC PRODUCTS

 X LOCATION OF SAMPLE
 WITH NO APPARENT VALUE
 FOR CERAMIC PRODUCTS



LEGEND

- INTERSTATE HIGHWAY
- U.S. NUMBERED HIGHWAYS
- VIRGINIA PRIMARY HIGHWAYS
- RAILROADS
- TRANSMISSION LINES
- NATURAL GAS LINES
- STATE BOUNDARY
- COUNTY BOUNDARY
- CORPORATE LIMITS
- COUNTY SEAT
- POWER SUBSTATION
- STREAM GAGING STATION AND YEARS OF OPERATION
- DIRECTION OF AND AVERAGE FLOW IN MILLIONS OF GALLONS PER DAY (FLOWS OF LESS THAN 5 M.G.D. NOT SHOWN)
- COLUMBIA GAS TRANSMISSION CORPORATION
- VEPCO VIRGINIA ELEC. AND POWER COMPANY
- BOUNDARY WITHIN WHICH LAND WILL BE ACQUIRED FOR NATIONAL FORESTS
- MAGISTERIAL DISTRICT LINE

AUGUSTA COUNTY VIRGINIA

SCALE OF MILES 0 1 2 3 4 5

Figure 4.

SAMPLE: R-7190

COUNTY: Augusta

Date: April, 1978 — Tuscaloosa Research Center*Locality:* N4,213,140 E682,260 (Zone 17). Waynesboro West 7.5-minute quadrangle. Roadcut 1.7 miles (2.7 km) east of Ladd, on the southwest side of State Road 650 approximately 0.15 mile (0.24 km) by road southeast of its intersection with State Road 664.*Description of Outcrop:* About 1.5 feet (0.5 m) of yellowish-gray and pale-olive to light-gray shale and 4.5 feet (1.4 m) of pale-red to grayish-red shale with minor siltstone in a 165-foot (50-m) roadcut that has a maximum height of 5 feet (1.5 m). Some shale chips are at the exposure. Rusty brown iron-oxide stain is along joint planes and a minor amount is on bedding planes. The shale has a strike of N 38° E and a dip of 34° SE. About 1 foot (0.3 m) of soil overburden covers the shale.*Formation/(Age):* Rome Formation (Cambrian)*Sampled Interval:* Composite of representative samples taken across 6 feet (1.8 m) of shale.*Raw Properties:*

Working properties:	short
Water of plasticity:	15.3%
Drying shrinkage:	2.5%
Dry strength:	fair
pH:	6.8

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Brownish orange	4	2.5	8.3	17.4	2.10
1050	Brownish orange	4	5.0	6.7	14.4	2.16
1100	Strong brown	6	10.0	2.7	6.4	2.33
1150	—	—	Melted	—	—	—
1200	—	—	—	—	—	—
1250	—	—	—	—	—	—

Remarks: No effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., building brick at 1,000°-1050°C).

SAMPLE: R-7245

COUNTY: Augusta

Date: April, 1978—Tuscaloosa Research Center*Locality:* N4,229,410 E691,010 (Zone 17). Crimora 7.5-minute quadrangle. Roadcut, 3.1 miles (5.0 km) north-northeast of Crimora, on the northwest side of State road 615 approximately 0.45 (0.73 km) by road south-southwest of its intersection with State road 614.*Description of Outcrop:* About 6 feet (2 m) of white, very pale-orange and dark-yellowish-orange to light-brown plastic clay in a 300-foot (91-m) roadcut with a maximum height of 7 feet (2 m). The white and very pale-orange clay occurs as mottles in the lower part of the exposure. Clay becomes lighter in color towards the base.*Formation/(Age):* Residual clay on Rome Formation.*Sampled Interval:* Representative channel sample across 6 feet (2 m) of clay.*Raw Properties:*

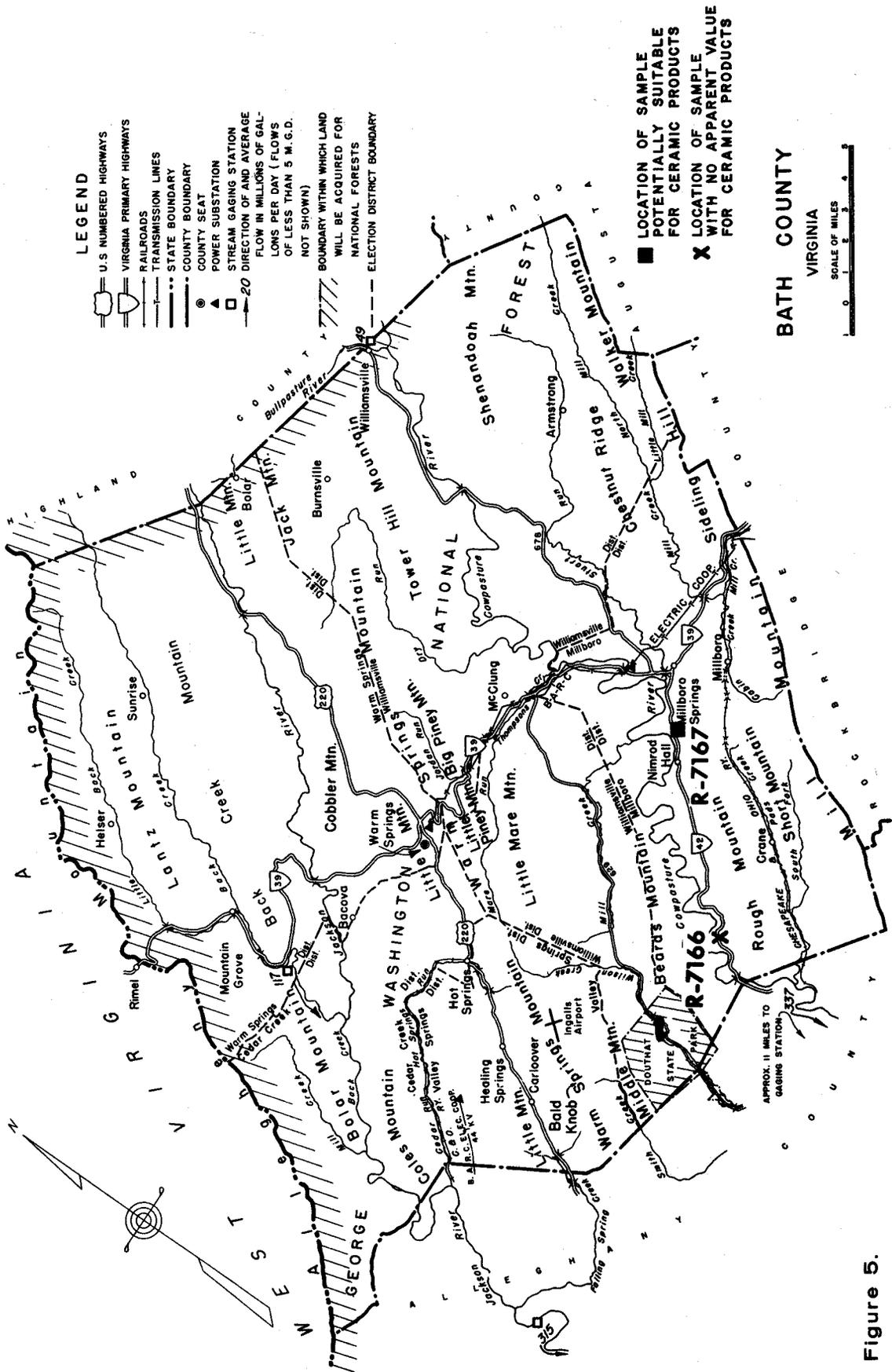
Working properties:	plastic
Water of plasticity:	41.4%
Drying shrinkage:	5.0%
Dry strength:	good
pH:	5.0

Slow Firing Test:

Temp. °C	Color	Hard- ness	%Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	7.5	27.3	43.2	1.59
1050	Moderate orange	4	12.5	21.1	37.4	1.77
1100	Brownish orange	5	15.0	6.1	14.3	2.34
1150	Strong brown	6	17.5	1.1	2.8	2.54
1200	—	—	Melted	Melted	—	—
1250	—	—	Melted	—	—	—

Remarks: Abrupt vitrification between 1050°—1100°C, high shrinkage, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Not suitable for structural clay products.



SAMPLE: R-7166

COUNTY: Bath

Date: September, 1977 — Tuscaloosa Research Center*Locality:* N4,195,970 E610,960 (Zone 17). Nimrod Hall 7.5-minute quadrangle. Roadcut, 5.3 miles (8.5 km) southwest of Nimrod Hall, on the southeast side of State Highway 42 approximately 0.15 mile (0.24 km) by road southwest of its intersection with State Road 631.*Description of Outcrop:* About 25 feet (8 m) of dark-gray to grayish-black, fissile shale in a 300-foot (91-m) roadcut with a maximum height of 40 feet (12 m). Dark-yellowish-orange to moderate-yellowish-brown and purplish-black iron-oxide stain is on bedding planes. Shale is carbonaceous in places; strike is N43°E and dip is 54°SE. One prominent joint has a strike of N75°W and a dip of 70°N. The shale weathers to form grayish-orange angular fragments. The shale extends in the roadcut on the NW side of State Highway 42 and across the road.*Formation/(Age):* Millboro (Devonian)*Sampled Interval:* Composite of representative samples taken across 25 feet (8 m) of shale.*Raw Properties:*

Working properties:	short
Water of plasticity:	17.0%
Drying shrinkage:	2.5%
Dry strength:	poor
pH:	7.0

Slow Firing Test:

Temp. °C	Color	Hard- ness	%Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	2.5	15.6	28.1	1.78
1050	Moderate orange	3	2.5	15.6	28.0	1.80
1100	Brownish orange	3	2.5	14.1	25.2	1.80
1150	—	—	Melted	—	—	—
1200	—	—	—	—	—	—
1250	—	—	—	—	—	—

Remarks: Vitrifies before maturity, presence of carbonates could cause problems, high effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Not suitable for use in structural clay products.

SAMPLE: R-7167

COUNTY: Bath

Date: September, 1977 — Tuscaloosa Research Center*Locality:* N4,204,310 E618,480 (Zone 17). Nimrod Hall 7.5-minute quadrangle. Roadcut 1.7 miles (2.7 km) northeast of Nimrod Hall on the southeast side of Va. Hwy. 42, approximately 0.55 (0.89 km) by road southwest of its intersection with State Road 602.*Description of Outcrop:* About 15 feet (5 m) of light-olive-gray to olive-gray shale and (mudstone?) in a 360-foot (110-m) roadcut with a maximum height of 25 feet (8 m). The shale has a strike of N54°E and a dip of 27°SE; shale weathers to light-gray and grayish-orange angular fragments. One joint plane has a strike of N80°W and a dip of 85°N. Some iron-oxide stain is on fracture surfaces. Shale was sampled to the top of the Millboro Shale, exposed in the southwest end of the roadcut.*Formation/(Age):* Brallier (Devonian)*Sampled Interval:* Composite of representative samples taken across 15 feet (5 m) of the shale.*Raw Properties:*

Working properties:	short
Water of plasticity:	21.7%
Drying shrinkage:	2.5%
Dry strength:	poor
pH:	7.0

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	2	2.5	19.1	33.6	1.76
1050	Moderate orange	3	5.0	17.2	31.0	1.81
1100	Moderate orange	3	5.0	11.4	22.6	1.98
1150	Strong brown	4	7.5	7.2	15.3	2.12
1200	Strong brown	5	7.5	5.6	12.0	2.15
1250	Moderate reddish brown	6	10.0	3.1	6.8	2.15

Remarks: No effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., building brick at 1150° — 1250°C).

SAMPLE: R-6921

COUNTY: Botetourt

Date: March, 1977 — Tuscaloosa Research Center*Locality:* N4,138,610 E599,500 (Zone 17). Daleville 7.5-minute quadrangle. Roadcut 1.85 miles (2.99 km) south of Troutville, Va., on the south side of State Road 652 approximately 0.55 mile (0.89 km) by road east-southeast of its intersection with State Road 653.*Description of Outcrop:* About 5 feet (1.5 m) of grayish-orange to moderate-yellowish-brown plastic clay in the upper part of the exposure to a moderate-reddish-brown plastic clay in the bottom of the exposure in a 400-foot (122-m) roadcut. Some yellowish-gray clay is in the top part of the exposure; material in the exposure formed by weathering of the Rome Formation. Small rounded pebbles (partly weathered sandstone of the Rome Formation) are in the bottom one-third of the exposure. There is 1.5 feet (0.5 m) of the overburden.*Formation/(Age):* Residual clay*Sampled Interval:* Representative channel sample taken across 25 feet (1.5 m) of clay.*Raw Properties:*

Working properties:	short
Water of plasticity:	21.5%
Drying shrinkage:	5.0%
Dry strength:	good
pH:	4.1

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	5.0	19.2	33.8	1.76
1050	Strong orange	3	5.0	18.7	33.3	1.78
1100	Deep orange	3	7.5	17.2	30.9	1.79
1150	Deep brown	3	10.0	14.0	26.3	1.88
1200	Brownish orange	3	10.0	12.5	24.0	1.92
1250	Moderate reddish brown	4	12.5	11.4	21.8	1.92

Remarks: High shrinkage at maturing temperature (1250°C); no effervescence with HCl.

Potential Use: Marginal for structural clay products (e.g., building brick at 1250°C).

SAMPLE: R-7532

COUNTY: Brunswick

Date: January, 1980 – Tuscaloosa Research Center*Locality:* N4,083,700 E244,840 (Zone 18). Lawrenceville 7.5-minute quadrangle. Roadcut about 1 mile (1.6 km) east of Alberta, on the west side of State Road 614, at its intersection with U.S. Hwy. 1.*Description of Outcrop:* Very-pale-orange and light-gray, dark-yellowish-orange and medium- to dark-reddish-brown plastic clay in a 125-foot (38-m) roadcut with a maximum height of 7 feet (2.1 m). The clay is mostly dark-yellowish-orange at the top and mostly orange to gray at the base. Overburden consists of 1 foot (0.3 m) of light-yellowish-orange, silty material.*Formation/(Age):* Residual clay.*Sampled Interval:* Representative channel sample across 6 feet (2 m) of clay in the southern end of the roadcut.*Raw Properties:*

Working properties:	No Bond
Water of plasticity:	—
Drying shrinkage:	—
Dry strength:	—
pH:	7.1

Slow Firing Test: Material failed to form cohesive mass when tested.

Remarks: No bond, slight effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Not suitable for structural clay products.

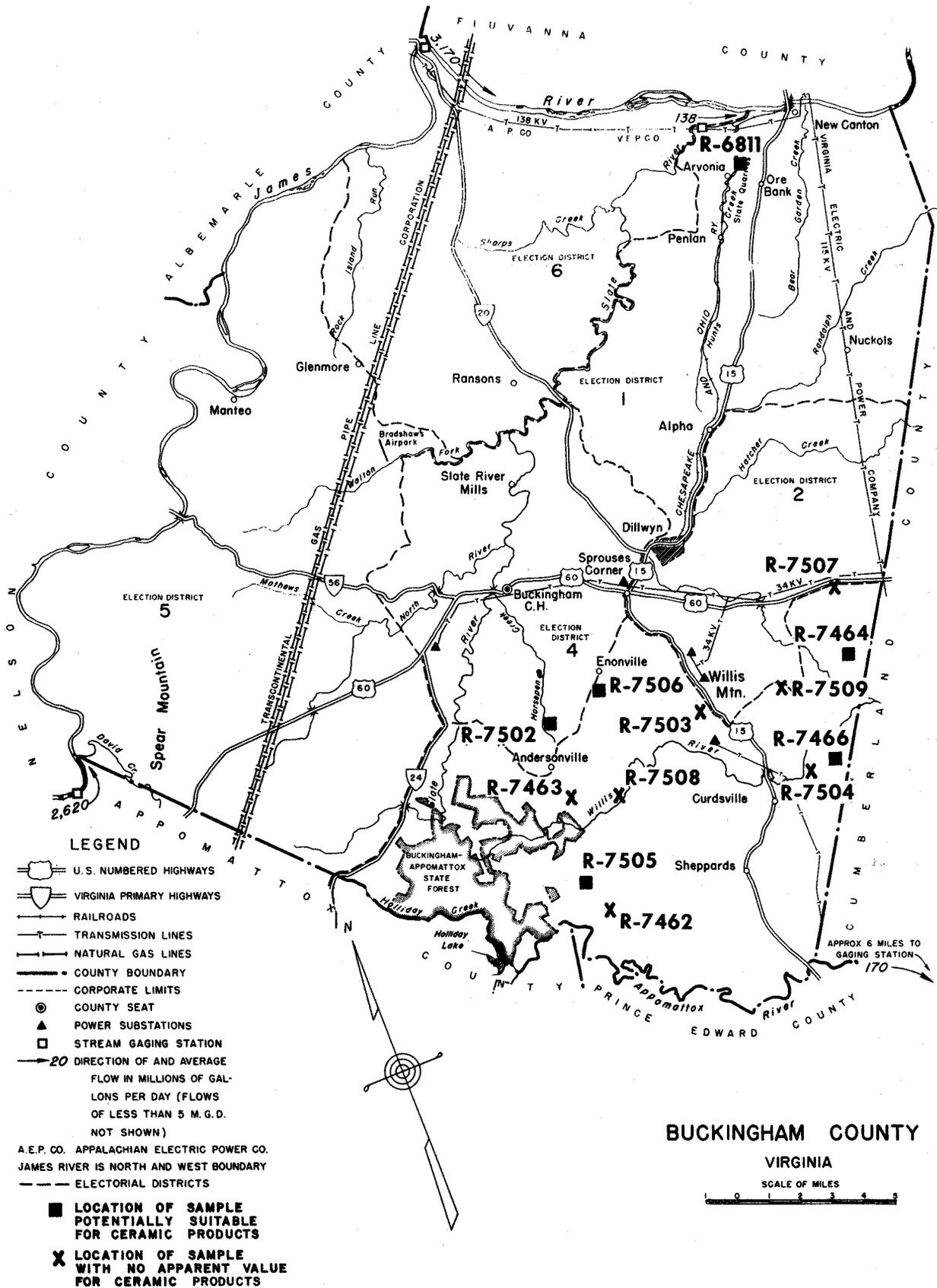


Figure 8.

SAMPLE: R-6811

COUNTY: Buckingham

Date: January, 1977 – Tuscaloosa Research Center

Locality: N4,174,680 E734,300 (Zone 17). Arvonía 7.5-minute quadrangle. Prospect pit 0.0 mile (1.5 km) north-west of Arvonía, 0.1 mile (0.2 km) off the east-southeast side of the Chesapeake and Ohio Railway, 0.45 mile (0.72 km) by railway northeast of its intersection with State Road 675.

Description of Outcrop: About 30 feet (9 m) of medium-dark-gray to dark-gray slightly weathered slate in a 15-foot (5-m) exposure in a prospect pit. Grayish-orange to dark-yellowish-orange iron-oxide stain is on cleavage and some joint planes. The cleavage of the slate has a strike of N33°E and a dip of 82°SE; strike of the bedding is almost parallel to cleavage in this exposure whereas the dip of the bedding averages about 76°SE. One prominent joint has a strike of N70°W and dip of 88°NE.

Formation/(Age): Arvonía Formation (Ordovician)

Sampled Interval: Representative samples taken across the entire 30 feet (9 m) of exposed slate.

Raw Properties:

Working properties:	short
Water of plasticity:	24.7%
Drying shrinkage:	2.5%
Dry strength:	fair
pH:	7.5

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Grayish reddish orange	3	5.0	22.6	37.6	1.66
1050	Grayish reddish orange	5	7.5	13.9	26.4	1.90
1100	Grayish reddish orange	7	7.5	8.3	16.9	2.03
1150	—	—	Melted	—	—	—
1200	—	—	—	—	—	—
1250	—	—	—	—	—	—

Remarks: Abrupt vitrification between 1100°C, no effervescence with HCl.

Preliminary Bloating Test: Negative

Potential Use: Structural clay products (e.g., facing brick at 1050° – 1100°C).

SAMPLE: R-7462

COUNTY: Buckingham

Date: March, 1979 — Tuscaloosa Research Center*Locality:* N4,140,970 E715,520 (Zone 17). Andersonville 7.5-minute quadrangle. Roadcut, 5.75 miles (9.26 km) south of Andersonville, on the east side of State Road 609, approximately 1.45 miles (2.34 km) by road south of its intersection with State Road 636.*Description of Outcrop:* Moderate-to dark-reddish-brown and light-brown plastic clay in a 250-foot (76-m) roadcut with a maximum height of 6 feet (2 m). Clay contains some grayish-orange, pink and light-gray plastic clay mottles near the middle and toward the top of the exposure. Material toward the bottom of the exposure contains quartz fragments and is pale-yellowish-brown in color. In the extreme southern end of the roadcut, the material is micaceous, yellow-brown to orange, weathered schist with very little plasticity. A small amount of this material was included in the sample.*Formation/(Age):* Residual clay*Sampled Interval:* Composite of two channel samples, each from across 6 feet (2 m) of clay; 2 samples approximately 25 feet (8 m) apart in the highest part of the roadcut plus a small amount of schist.*Raw Properties:*

Working properties:	plastic
Water of plasticity:	29.7%
Drying shrinkage:	5.0%
Dry strength:	good
pH:	6.7

Slow Firing Test:

Temp. °C	Color	Hard- ness	%Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. Gm/cc
1000	Moderate orange	3	5.0	24.7	39.3	1.59
1050	Moderate orange	3	5.0	23.7	38.1	1.60
1100	Moderate orange	3	7.5	22.7	36.8	1.62
1150	Grayish reddish orange	3	7.5	20.2	34.1	1.69
1200	Strong brown	3	10.0	17.9	31.1	1.74
1250	Grayish reddish orange	3	10.0	17.2	30.2	1.76

Remarks: Too soft; no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Not suitable for structural clay products.

SAMPLE: R-7463

COUNTY: Buckingham

Date: March, 1979 — Tuscaloosa Research Center

Locality: N4,146,980 E715,530 (Zone 17). Andersonville 7.5-minute quadrangle. Roadcut, 2.0 miles (3.2 km) south of Andersonville, on the east side of State Road 638 about 1 mile south of State Road 637.

Description of Outcrop: Moderate-reddish-brown plastic clay with very pale to yellowish-orange clay and medium-gray plastic clay mottles in the middle and near the bottom of the exposure, a 120-foot (37-m) roadcut with maximum height of 5.5 feet (1.7 m). Clay from an auger hole 2.5 feet (0.8 m) deep at the base of the exposure is less plastic than the exposed material, and is light-orange with medium-gray and yellowish-orange clay mottles and some fragments of partly weathered feldspar. Overburden consists of about 6 inches (15 cm) of light-brown loamy material.

Formation/(Age): Residual clay

Sampled Interval: Representative channel sample across 5 feet (1.5 m) of clay and 2.5 feet (0.8 m) of augered clay.

Raw Properties:

Working properties: plastic
 Water of plasticity: 30.9%
 Drying shrinkage: 5.0%
 Dry strength: good
 pH: 6.6

Slow Firing Test:

Temp. °C	Color	Hard- ness	%Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Brownish orange	3	7.5	20.8	36.1	1.74
1050	Brownish orange	3	7.5	18.7	33.0	1.76
1100	Brownish orange	3	10.0	17.3	31.9	1.84
1150	Strong brown	3	12.5	13.9	27.0	1.94
1200	Strong brown	3	12.5	13.8	26.9	1.96
1250	Moderate reddish brown	3	12.5	10.6	21.7	2.04

Remarks: Too soft; no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Not suitable for structural clay products.

SAMPLE: R-7464

COUNTY: Buckingham

Date: March, 1979 — Tuscaloosa Research Center*Locality:* N4,149,480 E731,370 (Zone 17). Willis Mountain 7.5-minute quadrangle. Roadcut, 4.45 miles (7.17 km) east of Willis Mountain, on the east side of State Road 654 at its intersection with State Road 634.*Description of Outcrop:* Light-brown, and yellowish-orange and dark-yellowish-orange plastic clay in a 450-foot (137-m) roadcut with a maximum height of 3.5 feet (1.1 m). There are some plastic red clay mottles. Light-brown loamy overburden contains some quartz pebbles. Auger hole one foot deep showed medium-gray and grayish-orange plastic clay with an abundance of quartz. A small pegmatite is near the northern end of the roadcut.*Formation/(Age):* (Pleistocene)*Sampled Interval:* Composite of three channel samples, equally spaced in the roadcut, across 3 feet (1 m) of clay in each of 3 channel samples and 1 foot (0.3 m) of augered clay.*Raw Properties:*

Working properties:	plastic
Water of plasticity:	31.6%
Drying shrinkage:	5.0%
Dry strength:	good
pH:	6.7

Slow Firing Test:

Temp. °C	Color	Hard- ness	%Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Brownish orange	3	7.5	20.8	36.5	1.76
1050	Brownish orange	3	7.5	17.7	32.7	1.85
1100	Grayish reddish orange	3	10.0	12.8	26.1	2.03
1150	Strong brown	4	12.5	8.4	18.2	2.16
1200	Strong brown	4	12.5	7.0	15.6	2.22
1250	Moderate reddish brown	5	15.0	5.8	12.9	2.24

Remarks: High shrinkage; surface crazing at all temperatures; no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Marginal for structural clay products (e.g., building brick at 1,150°-1,250°C).

SAMPLE: R-7466

COUNTY: Buckingham

Date: March, 1979 — Tuscaloosa Research Center

Locality: N4,145,200 E729,000 (Zone 17). Willis Mountain 7.5-minute quadrangle. Roadcut 4.75 miles (7.65 km) northeast of Sheppards, on the northwest side of State Road 600, approximately 0.35 mile (0.56 km) by road north of its intersection with State Road 621.

Description of Outcrop: Pale-red to grayish-red and dark-reddish-brown plastic clay and silty shale in a 275-foot (84-m) roadcut with a maximum height of 5 feet (2 m). Material is silty toward the base of exposure. Overburden is moderate-yellow-brown silt.

Formation/(Age): Residual clay on Triassic sedimentary rocks

Sampled Interval: Composite of two channel samples each from across 3.5 feet (1.1 m) of clay; samples about 100 feet (30 m) apart in the highest part of the exposure.

Raw Properties:

Working properties: plastic
 Water of plasticity: 23.1%
 Drying shrinkage: 5.0%
 Dry strength: good
 pH: 7.4

Slow Firing Test:

Temp. °C	Color	Hard- ness	%Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Grayish reddish orange	3	5.0	14.9	28.1	1.88
1050	Grayish reddish orange	3	7.5	11.7	23.3	1.99
1100	Moderate reddish brown	3	7.5	10.3	20.8	2.03
1150	Moderate reddish brown	3	10.0	8.8	18.2	2.06
1200	Moderate reddish brown	4	10.0	7.0	14.7	2.10
1250	Grayish reddish brown	5	10.0	3.1	6.8	2.21

Remarks: No effervescence with HCl.

Preliminary Bloating Test: Negative

Potential Use: Structural clay products (e.g., floor brick, building brick at 1,200°-1,250°C).

SAMPLE: R-7502

COUNTY: Buckingham

Date: July, 1979—Tuscaloosa Research Center*Locality:* N4,151,320 E714,640 (Zone 17). Andersonville 7.5-minute quadrangle. Roadcut, 1.3 miles (2.1 km) north of Andersonville, on the east side of State Road 638 approximately 1.0 mile (1.6 km) by road south of its intersection with State Road 641.*Description of Outcrop:* Moderate-reddish-brown and dark-red plastic clay, with some dark-yellowish-orange clay mottles, in a 300-foot (91-m) roadcut with a maximum height of 4.5 feet (1.4 m). Clay is progressively more micaceous toward the base of the exposure. There is thin quartz vein near the base of the exposure. The overburden is six inches (15 cm) of brown loam.*Formation/(Age):* Residual clay.*Sampled Interval:* Composite of three channel samples, about 40 feet (12 m) apart, each from across 4 feet (1 m) of clay.*Raw Properties:*

Working properties:	plastic
Water of plasticity:	31.0%
Drying shrinkage:	5.0%
Dry strength:	good
pH:	6.9

Slow Firing Test:

<i>Temp.</i> °C	<i>Color</i>	<i>Hard- ness</i>	<i>%Lin. Shk.</i>	<i>% Abs.</i>	<i>% Appar. Poros.</i>	<i>Bulk Dens. gm/cc</i>
1000	Deep orange	3	7.5	25.2	42.1	1.67
1050	Brownish orange	3	10.0	15.4	30.5	1.98
1100	Strong brown	4	12.5	8.6	19.1	2.22
1150	Strong brown	4	12.5	8.3	18.3	2.22
1200	Strong brown	4	12.5	6.8	15.4	2.25
1250	Moderate reddish brown	4	12.5	5.9	13.5	2.27

Remarks: Slightly high shrinkage, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., building brick at 1,100°—1,250°C).

SAMPLE: R-7503

COUNTY: Buckingham

Date: July, 1979— Tuscaloosa Research Center*Locality:* N4,148,520 E723,510 (Zone 17). Willis Mountain 7.5-minute quadrangle. Roadcut 3.1 miles (5.0 km) north of Curdsville on the west side of State Road 609 approximately 0.4 mile (0.6 km) by road southwest of its intersection with U.S. Highway 15.*Description of Outcrop:* Bright-red and reddish-orange silty, micaceous, slightly plastic clay in a 330-foot (101-m) roadcut with a maximum thickness of 5.5 feet (1.7 m). The overburden is about six inches (15 cm) of yellowish-brown loam.*Formation/(Age):* Residual clay.*Sampled Interval:* Composite of two channel samples, 30 feet (9m) apart; each from across 5 feet (2m) of clay.*Raw Properties:*

Working properties:	plastic
Water of plasticity:	32.3%
Drying shrinkage:	5.0%
Dry strength:	good
pH:	7.0

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	5.0	27.8	43.3	1.56
1050	Moderate orange	3	7.5	24.7	40.3	1.63
1100	Brownish orange	3	10.0	20.0	35.1	1.75
1150	Brownish orange	3	10.0	18.6	33.3	1.80
1200	Brownish orange	3	12.5	16.2	30.2	1.86
1250	Moderate reddish brown	3	12.5	15.9	29.8	1.88

Remarks: Too soft, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Not suitable for structural clay products.

SAMPLE: R-7504

COUNTY: Buckingham

Date: July, 1979 — Tuscaloosa Research Center*Locality:* N4,144,930 E727,800 (Zone 17). Willis Mountain 7.5-minute quadrangle. Roadcut, 1.8 miles (2.9 km) northeast of Curdsville, on the south side of State Road 621 approximately 0.7 (1.1 km) by road west of its intersection with State Road 600.*Description of Outcrop:* Moderate-to dark-reddish-brown plastic indurated clay in a long roadcut with a maximum height of 4 feet (1m). Some dark-orangish-yellow silty material and some quartz are near the base of the exposure.*Formation/(Age):* Residual clay on Triassic sedimentary rocks.*Sampled Interval:* Representative channel sample across 4 feet (1 m) of clay.*Raw Properties:*

Working properties: plastic
 Water of plasticity: 34.3%
 Drying shrinkage: 5.0%
 Dry strength: good
 pH: 7.0

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Brownish orange	3	7.5	25.0	41.6	1.66
1050	Brownish orange	3	10.0	19.6	35.6	1.82
1100	Strong brown	3	15.0	9.6	20.9	2.19
1150	Strong brown	3	15.0	7.4	16.7	2.26
1200	Moderate reddish brown	3	15.0	6.3	14.5	2.29
1250	Moderate reddish brown	4	15.0	5.3	12.5	2.35

Remarks: High shrinkage, effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Not suitable for structural clay products.

SAMPLE: R-7505

COUNTY: Buckingham

Date: August, 1979— Tuscaloosa Research Center*Locality:* N4,143,610 E715,030 (Zone 17). Andersonville 7.5-minute quadrangle. Roadcut, 3.5 miles (5.6 km) south of Andersonville, on the south side of State Road 636 approximately 0.1 mile (0.2 km) by road east of its intersection with State Road 638.*Description of Outcrop:* Pale-to moderate-reddish-brown plastic clay in a 225-foot (69-m) roadcut with a maximum height of 6.5 feet (2.0 m). Clay is harder, more silty and micaceous at the base, in the eastern part of the roadcut. In the bottom half of the western part of the roadcut, the clay is variegated with plastic, very pale-orange, yellowish-orange and gray clay. The overburden is about one foot (0.3 m) of light-yellowish-brown loam.*Formation/(Age):* Residual clay*Sampled Interval:* Composite of two channel samples taken 60 feet (18 m) apart, each sample across 5 feet (2m) of clay.*Raw Properties:*

Working properties: plastic
 Water of plasticity: 40.2%
 Drying shrinkage: 5.0%
 Dry strength: good
 pH: 5.2

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate reddish orange	3	10.0	25.9	43.3	1.67
1050	Moderate reddish orange	3	10.0	25.8	43.1	1.67
1100	Moderate reddish orange	3	12.5	19.2	36.1	1.88
1150	Dark reddish orange	3	15.0	12.4	26.5	2.13
1200	Moderate reddish brown	4	15.0	10.5	23.5	2.23
1250	Moderate reddish brown	4	17.5	9.6	21.5	2.24

Remarks: High shrinkage, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., building brick at 1200°—1250°C).

SAMPLE: R-7506

COUNTY: Buckingham

Date: August, 1979 — Tuscaloosa Research Center*Locality:* N4,151,150 E719,150 (Zone 17). Andersonville 7.5-minute quadrangle. Roadcut, 1.2 miles (1.9 km) south of Enonville, on the west side of State Road 633 approximately 0.4 mile (0.6 km) by road northwest of its intersection with State Road 774.*Description of Outcrop:* Reddish-brown very plastic clay, variegated with pale- to moderate-yellowish-brown and dark-yellowish-orange plastic clay in a 300-foot (91-m) roadcut with a maximum height of 6 feet (2m). Reddish-brown clay content increases from bottom to top and the clay near the top of the southern end of the roadcut is not plastic. Some quartz fragments are in the clay; the overburden is light-brown and silty.*Formation/(Age):* Residual clay*Sampled Interval:* Composite of two channel samples taken 50 feet (15m) apart, across 6 feet (2 m) of clay.*Raw Properties:*

Working properties: plastic
 Water of plasticity: 34.2%
 Drying shrinkage: 7.5%
 Dry strength: good
 pH: 6.0

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Brownish orange	3	10.0	17.2	32.0	1.86
1050	Brownish orange	3	10.0	15.0	29.3	1.95
1100	Strong brown	3	15.0	8.4	18.2	2.16
1150	Strong brown	4	15.0	6.7	14.8	2.22
1200	Moderate reddish brown	4	15.0	6.6	14.6	2.22
1250	Grayish red	4	15.0	5.1	11.6	2.28

Remarks: High shrinkage, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., building brick at 1,150° — 1250°C).

SAMPLE: R-7507

COUNTY: Buckingham

Date: August, 1979 — Tuscaloosa Research Center*Locality:* N4,153,310 E731,540 (Zone 17). Willis Mountain 7.5-minute quadrangle. Roadcut, 4.9 miles (7.8 km) northeast of Willis Mountain, on the east side of State Road 628 approximately 300 feet (91m) south of its intersection with U.S. Hwy. 60.*Description of Outcrop:* Light- to moderate-brown, plastic clay with some pale-yellowish-orange, grayish-orange, light-gray and minor amounts of pale-reddish-brown and reddish-orange plastic clay in a 250-foot (76-m) roadcut with a maximum height of 3 feet (1 m). Some red and yellowish-orange clay mottles are in the southern end of the roadcut along with some fine mica. Material is just east of an exposure of amphibolite at the northern end of the roadcut in the ditch. The overburden is about 6 inches (15cm) of the silty brown clay. Augered clay was red and moderate-brown, and plastic.*Formation/(Age):* Residual clay.*Sampled Interval:* Composite of two channel samples, taken about 30 feet (9m) apart and from across 2.5 feet (0.8) of the augered clay.*Raw Properties:*

Working properties:	plastic
Water of plasticity:	39.0%
Drying shrinkage:	5.0%
Dry strength:	good
pH:	5.5

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Brownish orange	2	10.0	23.3	40.8	1.75
1050	Brownish orange	3	10.0	21.3	37.9	1.78
1100	Strong brown	4	17.5	10.4	22.9	2.19
1150	Strong brown	4	17.5	4.5	11.0	2.44
1200	Strong brown	4	17.5	4.4	10.8	2.46
1250	Moderate reddish brown	4	17.5	3.9	9.7	2.49

Remarks: High shrinkage, briquettes cracked at all temperatures, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Not suitable for structural clay products.

SAMPLE: R-7508

COUNTY: Buckingham

Date: August, 1979 — Tuscaloosa Research Center*Locality:* N4,146,740 E717,500 (Zone 17). Andersonville 7.5-minute quadrangle. Roadcut, about 2.3 miles (3.7 km) southeast of Andersonville on the south side of State Road 637, approximately 0.3 mile (0.5 km) by road northwest of the Willis River.*Description of Outcrop:* Moderate-reddish-brown plastic clay with minor amounts of plastic clay mottles in 260-foot (79-m) roadcut with a maximum height of 5 feet (2 m). Material is silty near the base of the exposure, which is pale-yellowish-orange saprolite. Quartz is in the southeastern end of the roadcut. The overburden is light-red loam.*Formation/(Age):* Residual clay.*Sampled Interval:* Composite of two channel samples taken about 50 feet (15 m) apart, each from across 4.5 feet (1.4 m) of clay.*Raw Properties:*

Working properties: plastic
 Water of plasticity: 31.0%
 Drying shrinkage: 5.0%
 Dry strength: good
 pH: 6.9

Slow Firing Test:

Temp. °C	Color	Hard- ness	%Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Brownish orange	3	7.5	26.7	42.9	1.60
1050	Brownish orange	3	7.5	26.6	42.5	1.60
1100	Brownish orange	3	7.5	24.3	40.3	1.66
1150	Strong brown	3	7.5	20.2	35.7	1.76
1200	Strong brown	3	10.0	19.8	35.1	1.77
1250	Moderate reddish brown	3	10.0	17.6	32.4	1.84

Remarks: too soft; no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Not suitable for structural clay products.

SAMPLE: R-7509

COUNTY: Buckingham

Date: August, 1979—Tuscaloosa Research Center*Locality:* N4,149,410 E727,290 (Zone 17). Willis Mountain 7.5-minute quadrangle. Roadcut, 2.0 miles (3.2 km) east-southeast of Willis Mountain, on the southwest side of State Road 600 approximately 0.1 mile (0.2 km) by road southeast of its intersection with State Road 712.*Description of Outcrop:* Light-brown to moderate-reddish-brown plastic clay with some grayish-orange clay mottles in a roadcut with a maximum height of 4.5 feet (1.4 m). The clay is silty and very micaceous near the southeastern end of the roadcut. In the northwestern part of the exposure, the clay is plastic and contains quartz fragments and little mica. The overburden is about 6 inches (15 cm) thick.*Formation/(Age):* Residual clay.*Sampled Interval:* Composite of two channel samples taken 60 feet (18 m) apart in the western end of the roadcut.*Raw Properties:*

Working properties:	plastic
Water of plasticity:	38.5%
Drying shrinkage:	5.0%
Dry strength:	good
pH:	5.6

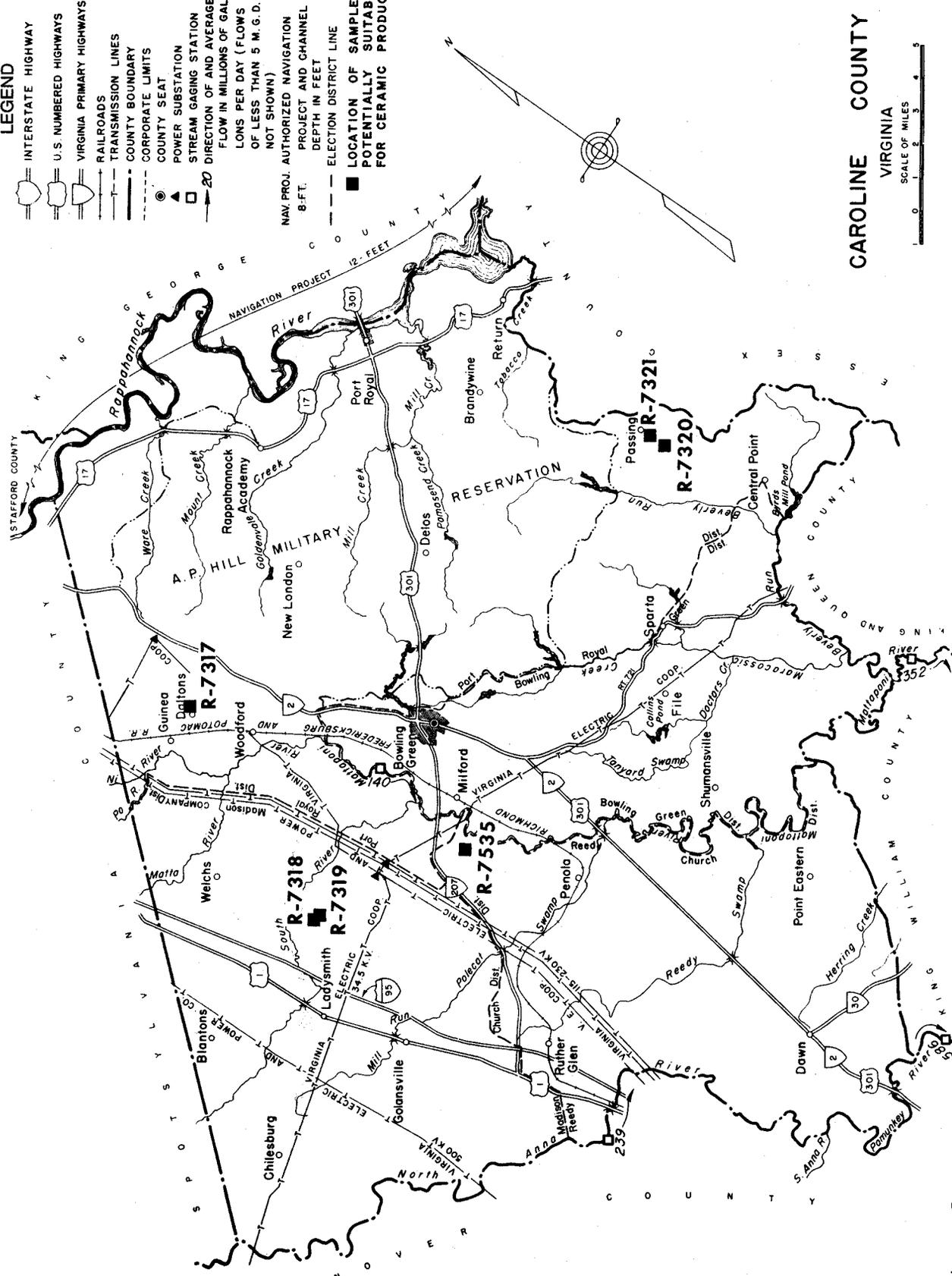
Slow Firing Test:

<i>Temp.</i> °C	<i>Color</i>	<i>Hard-</i> <i>ness</i>	<i>%Lin.</i> <i>Shk.</i>	<i>%</i> <i>Abs.</i>	<i>%</i> <i>Appar. Poros.</i>	<i>Bulk Dens.</i> <i>gm/cc</i>
1000	Deep orange	3	7.5	29.8	45.9	1.54
1050	Deep orange	3	7.5	28.6	44.3	1.55
1100	Brownish orange	3	10.0	21.5	37.4	1.74
1150	Strong brown	3	10.0	16.5	30.9	1.87
1200	Strong brown	3	12.5	16.2	30.3	1.88
1250	Moderate reddish brown	3	12.5	12.6	25.0	1.98

Remarks: Too soft; no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Not suitable for structural clay products.

- LEGEND**
- INTERSTATE HIGHWAY
 - U.S. NUMBERED HIGHWAYS
 - VIRGINIA PRIMARY HIGHWAYS
 - RAILROADS
 - TRANSMISSION LINES
 - COUNTY BOUNDARY
 - CORPORATE LIMITS
 - COUNTY SEAT
 - POWER SUBSTATION
 - STREAM GAGING STATION
 - DIRECTION OF AND AVERAGE FLOW IN MILLIONS OF GALLONS PER DAY (FLOWS OF LESS THAN 5 M.G.D. NOT SHOWN)
 - NAV. PROJ. AUTHORIZED NAVIGATION PROJECT AND CHANNEL DEPTH IN FEET
 - ELECTION DISTRICT LINE
 - LOCATION OF SAMPLE POTENTIALLY SUITABLE FOR CERAMIC PRODUCTS



CAROLINE COUNTY
VIRGINIA
SCALE OF MILES
0 1 2 3 4 5

Figure 9.

SAMPLE: R-7317

COUNTY: Caroline

Date: June, 1978—Tuscaloosa Research Center

Locality: N4,223,620 E288,050 (Zone 18). Guinea 7.5-minute quadrangle. Bank along the spillway of Dalton Millpond, 1.2 miles (1.9 km) east of Guinea about 90 feet (27 m) from the west side of State Road 607 approximately 0.15 mile (0.24 km) by road north of its intersection with State Road 609.

Description of Outcrop: Yellowish-gray, plastic to silty and slightly diatomaceous clay in a 200-foot (61-m) bank with a maximum height of 10 feet (3 m). The clay is mottled with light-yellow to dark-yellowish-orange iron-oxide stain, which is also along weathered joints; this stain is very prominent near the top of the exposure but is almost absent at its base. The clay is covered by three feet (1 m) of dark-yellowish-orange, sandy clay and the clay covers a dark-grayish-green silty clay.

Formation/(Age): (Miocene?)

Sampled Interval: Representative channel sample across 6 feet (2 m) of clay.

Raw Properties:

Working properties: short
 Water of plasticity: 26.1%
 Drying shrinkage: 5.0%
 Dry strength: fair
 pH: 6.4

Slow Firing Test:

Temp. °C	Color	Hard- ness	%Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	5.0	22.7	36.7	1.62
1050	Moderate orange	3	5.0	21.1	34.8	1.65
1100	Brownish orange	3	7.5	18.5	31.3	1.69
1150	Brownish orange	3	7.5	16.1	28.0	1.74
1200	Strong brown	4	7.5	13.4	24.4	1.82
1250	Grayish reddish brown	4	7.5	12.1	22.1	1.84

Remarks: No effervescence with HCl.

Preliminary Bloating Test: Negative

Potential Use: Structural clay products (e.g., building brick, possibly by soft-mud process, at 1,200°-1,250°C).

SAMPLE: R-7318

COUNTY: Caroline

Date: September, 1978—Tuscaloosa Research Center*Locality:* N4,210,980 E283,430 (Zone 18). Woodford 7.5-minute quadrangle. Roadcut, 5.9 miles (9.4 km) west of Milford, on the south side of State Road 639 approximately 0.3 mile (0.5 km) by road west of its intersection with State Road 672.*Description of Outcrop:* Light-olive-gray to yellowish-gray plastic, slightly silty clay at the west end of a 0.15 mile (0.24 km) roadcut that has a maximum height of 15 feet (5 m). The clay contains moderate red, yellowish-orange and light-brown clay mottles. Medium-size, clear quartz fragments are in the exposure, which is gritty at the base. Material in the auger hole consists of yellowish-gray and yellowish-orange silty clay and coarse sand. Clay is covered by 7 feet (2 m) of yellowish-gray to brown sandy overburden.*Formation/(Age):* Calvert (?) Formation (Miocene)*Sampled Interval:* Representative channel sample across 4 feet (1.2 m) of clay plus 1 foot (0.3 m) of augered clay.*Raw Properties:*

Working properties:	short
Water of plasticity:	23.1%
Drying shrinkage:	5.0%
Dry strength:	fair
pH:	6.6

Slow Firing Test:

Temp. °C	Color	Hard- ness	%Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	5.0	15.4	29.2	1.89
1050	Moderate orange	3	7.5	13.3	26.2	1.97
1100	Brownish orange	4	7.5	11.6	23.3	2.01
1150	Brownish orange	4	10.0	10.8	22.2	2.06
1200	Strong brown	5	10.0	9.4	19.6	2.09
1250	Moderate reddish brown	5	10.0	5.2	11.4	2.22

Remarks: Good firing range, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., building brick at 1,100°-1,250°C).

SAMPLE: R-7319

COUNTY: Caroline

Date: September, 1978—Tuscaloosa Research Center

Locality: N4,210,980 E283,520 (Zone 18). Woodford 7.5-minute quadrangle. Roadcut, 5.85 miles (9.42 km) west of Milford on the south side of State Road 639 approximately 0.25 mile (0.40 km) by road west of its intersection with State Road 672.

Description of Outcrop: Pale-red-purple to grayish-red-purple plastic clay and dark-yellowish-orange sandy clay near the eastern end of a 0.15-mile (0.34-km) roadcut with a maximum height of 15 feet (5 m). Some clay is light-gray and silty and contains mottles. About 10 feet (3 m) of sandy, yellowish-orange overburden covers the clay exposure.

Formation/(Age): (Pleistocene)

Sampled Interval: Representative channel sample across 2.5 feet (0.8 m) of clay.

Raw Properties:

Working properties: short
 Water of plasticity: 15.4%
 Drying shrinkage: 2.5%
 Dry strength: fair
 pH: 6.4

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate yellowish pink	3	5.0	15.3	28.8	1.88
1050	Moderate yellowish pink	4	5.0	15.3	28.8	1.88
1100	Light brown	4	5.0	14.4	27.2	1.88
1150	Light brown	4	5.0	14.3	26.8	1.88
1200	Light brown	4	5.0	13.8	26.2	1.90
1250	Light grayish reddish brown	4	5.0	13.3	25.4	1.90

Remarks: Very good firing range, no effervescence with HCl. Could possibly be used in the soft-mud process.

Preliminary Bloating Test: Negative

Potential Use: Structural clay products (e.g., building brick, structural tile, at 1,050°-1,250°C).

SAMPLE: R-7320

COUNTY: Caroline

Date: September, 1978—Tuscaloosa Research Center*Locality:* N4,211,100 E311,550 (Zone 18). Supply 7.5-minute quadrangle. Roadcut, 2.0 miles (3.2 km) southeast of Liberty Fork, on the west side of State Road 625 approximately 1.15 miles (1.84 km) by road south of its intersection with State Road 637.*Description of Outcrop:* Dark-yellowish-orange plastic clay, mottled yellowish-gray to medium-gray, grayish-orange and moderate-reddish-brown plastic clay in a 225-foot (69-m) roadcut with a maximum height of 5 feet (2m). The clay contains small fragments of clear quartz and is gritty at the base of the exposure. There is less mottling in the lower part of the exposure where the clay is dark-yellowish-orange. Overburden consists of 1.5 feet (0.5m) of yellowish-brown and light-reddish-brown silty clay with some small quartz fragments.*Formation/(Age):* (Pleistocene)*Sampled Interval:* Representative channel sample across 3.5 feet (1 m) of clay.*Raw Properties:*

Working properties:	plastic
Water of plasticity:	25.8%
Drying shrinkage:	5.0%
Dry strength:	good
pH:	6.4

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	7.5	20.7	36.2	1.75
1050	Moderate orange	3	7.5	17.9	32.8	1.83
1100	Moderate orange	3	10.0	13.4	26.3	1.96
1150	Moderate orange	3	10.0	12.5	24.8	1.98
1200	Brownish orange	3	10.0	11.5	23.0	2.00
1250	Brownish orange	4	10.0	10.2	20.7	2.04

Remarks: Too soft below 1,250°C, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., building brick at 1,250°C).

SAMPLE: R-7321

COUNTY: Caroline

Date: September, 1978 — Tuscaloosa Research Center*Locality:* N4,212,520 E311,560 (Zone 18). Supply 7.5-minute quadrangle. Roadcut, 1.6 miles (2.6 km) east of Liberty Fork on the east side of State Road 625 approximately 0.25 (0.40 km) by road south of its intersection with State Road 637.*Description of Outcrop:* White to very light-gray to light-medium-gray plastic, silty clay mottled with light-to dark-yellowish-orange plastic clay in a 350-foot (107-m) roadcut with a maximum height of 7 feet (2m). There is also some red clay mottlings. Above the clay interval is 4 feet (1m) of light-gray to yellowish-brown silty sand that in places is clean.*Formation/(Age):* (Pleistocene)*Sampled Interval:* Representative channel sample across 3 feet (1m) of clay at the base of the exposure.*Raw Properties:*

Working properties:	plastic
Water of plasticity:	19.4%
Drying shrinkage:	2.5%
Dry strength:	good
pH:	6.2

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	5.0	16.7	31.2	1.86
1050	Moderate orange	3	5.0	16.0	30.1	1.88
1100	Moderate orange	3	5.0	12.9	25.2	1.96
1150	Brownish orange	4	7.5	12.4	24.4	1.98
1200	Brownish orange	4	7.5	11.8	23.4	1.98
1250	Grayish reddish orange	4	7.5	10.2	20.5	2.01

Remarks: No effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., building brick at 1,150° — 1,250°C).

SAMPLE: R-7535

COUNTY: Caroline

Date: March, 1980—Tuscaloosa Research Center*Locality:* N4,209,770 E290,040 (Zone 18). Woodford 7.5-minute quadrangle. Roadcut about 1 mile (1.6 km) southwest of Milford, on the north side of State Road 676 approximately 0.4 mile (0.6 km) by road west-southwest of its intersection with State Road 722.*Description of Outcrop:* Two feet of shaly and well-indurated very pale-orange, pale-yellowish-orange and medium- to dark-yellowish-orange shale and clay in a roadcut with a maximum height of 10 feet (3m). Brownish stain is on joints. Material above the clay is yellowish-orange and silty; below it, material is silty with increasing amounts of sericite at depth. Clay probably thickens to the east.*Formation/(Age):* Calvert Formation (Miocene)*Sampled Interval:* Composite of two channel samples, approximately 10 feet (3m) apart, each across about 2 feet (1 m) of clay.*Raw Properties:*

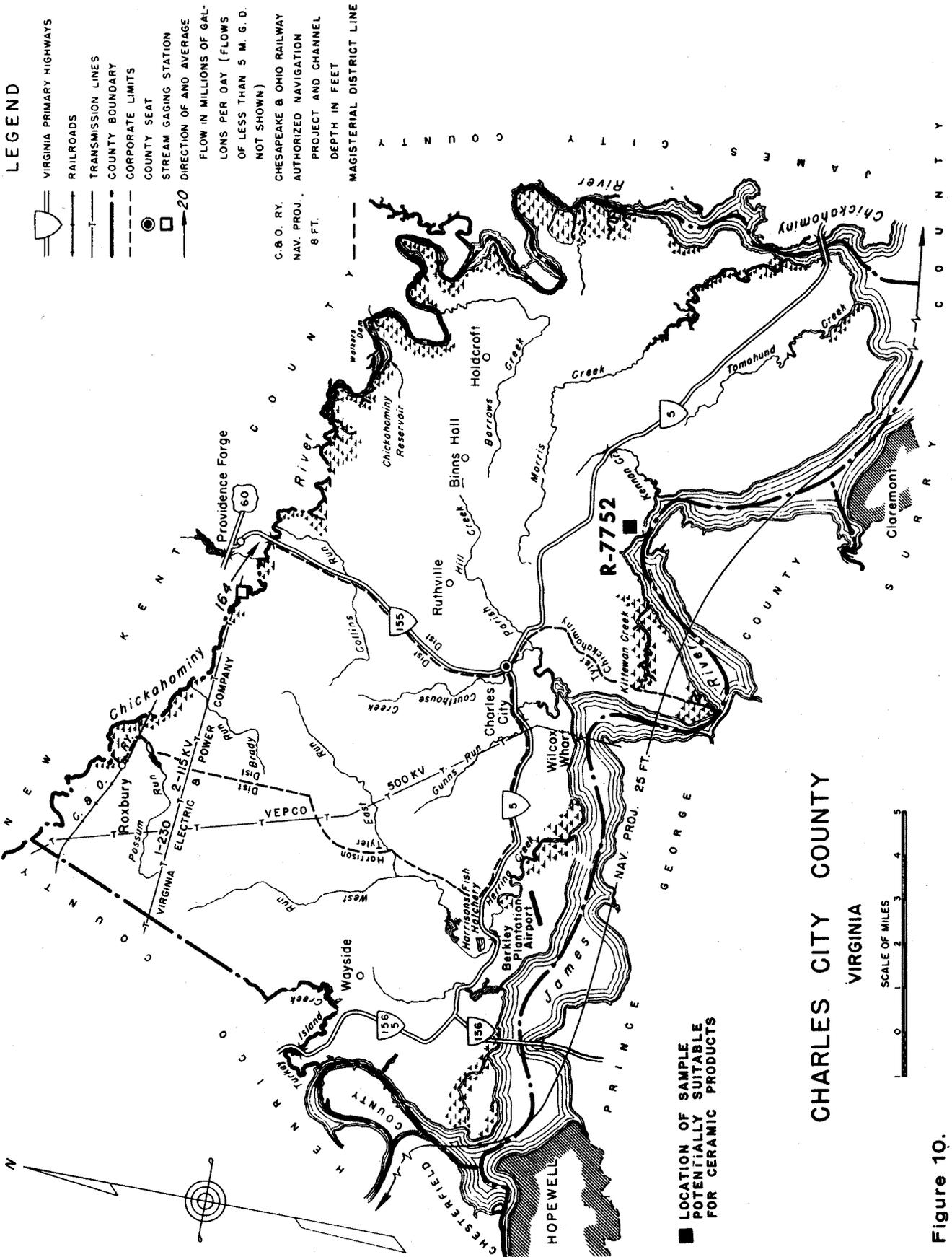
Working properties: plastic
 Water of plasticity: 27.2%
 Drying shrinkage: 5.0%
 Dry strength: good
 pH: 4.2

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	5.0	22.5	37.3	1.66
1050	Moderate orange	3	7.5	18.5	32.8	1.77
1100	Brownish orange	3	10.0	15.6	28.9	1.86
1150	Grayish reddish orange	4	10.0	13.5	25.8	1.91
1200	Strong brown	5	12.5	11.3	22.3	1.97
1250	—	—	Melted	—	—	—

Remarks: Slightly high shrinkage at 1,200°C, abrupt vitrification between 1,200°—1,250°C, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., building brick at 1,150°—1,200°C).



SAMPLE: R-7752

COUNTY: Charles City

Date: July, 1980—Tuscaloosa Research Center*Locality:* N4,130,770 E322,320 (Zone 18). Charles City 7.5-minute quadrangle. Bankcut just northeast of Sturgeon Point, off the west-northwest side of State Road 614.*Description of Outcrop:* Yellowish to dark yellowish-gray and pale-yellowish-brown silty clay in a bankcut with an exposed thickness of 7 feet (2m). There is some pale-yellowish-orange and pale-reddish-brown plastic clay, and a silty light-gray overburden.*Formation/(Age):* (Pleistocene)*Sampled Interval:* Representative composite sample taken across 5 feet of clay.*Raw Properties:*

Working properties:	plastic
Water of plasticity:	22.4%
Drying shrinkage:	5.0%
Dry strength:	good
pH:	4.0

Slow Firing Test:

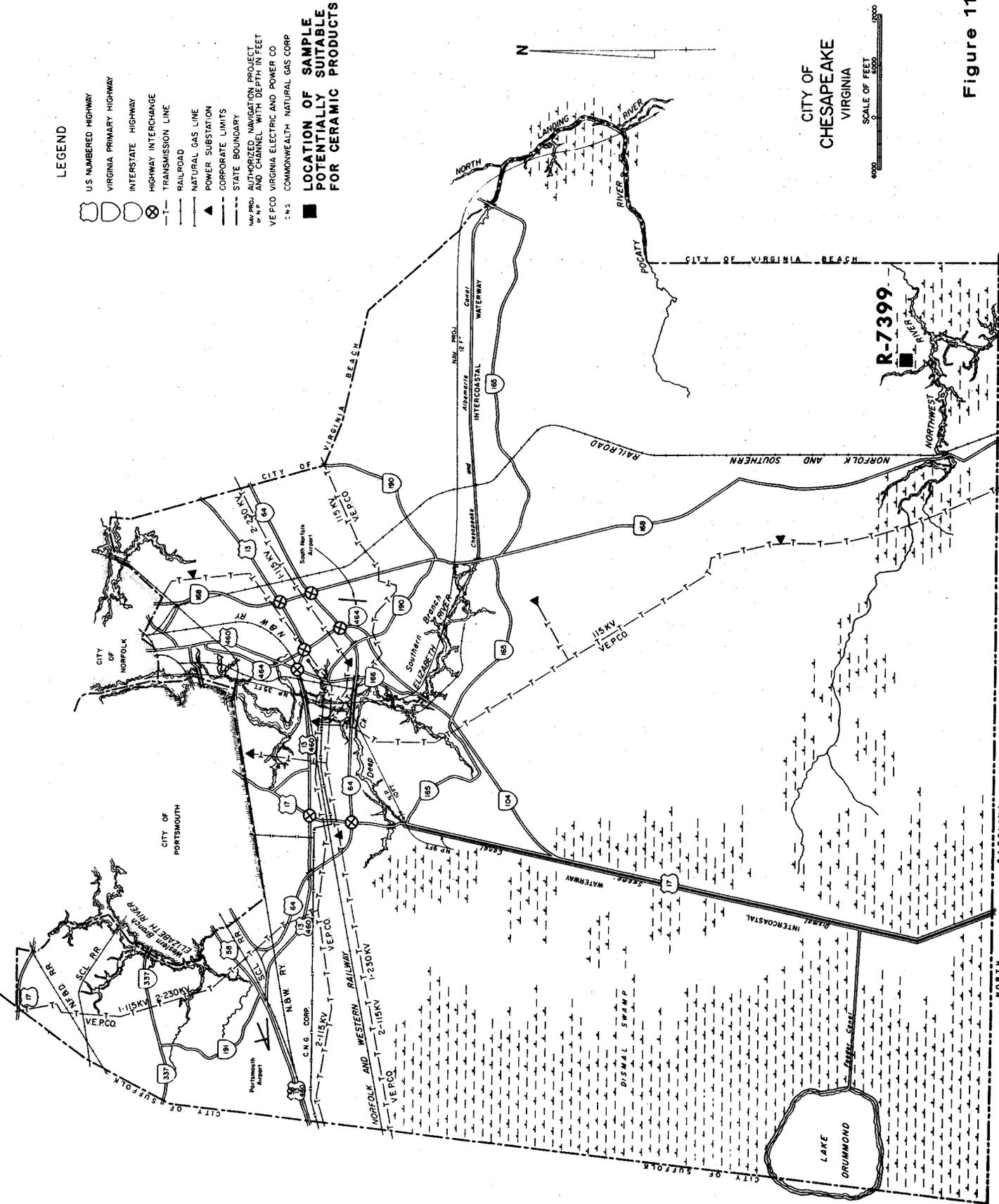
Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Pale orange yellow	3	5.0	18.0	32.3	1.79
1050	Moderate orange yellow	4	5.0	16.9	30.9	1.83
1100	Moderate orange	5	7.5	13.4	26.0	1.94
1150	Brownish orange	5	7.5	11.0	22.1	2.01
1200	Strong brown	5	10.0	8.0	16.9	2.11
1250	Moderate reddish brown	6	10.0	6.5	14.0	2.17

Remarks: Very good firing range, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., building brick at 1,050°–1,250°C).

LEGEND

- US NUMBERED HIGHWAY
- VIRGINIA PRIMARY HIGHWAY
- INTERSTATE HIGHWAY
- HIGHWAY INTERCHANGE
- TRANSMISSION LINE
- RAILROAD
- NATURAL GAS LINE
- POWER SUBSTATION
- CORPORATE LIMITS
- STATE BOUNDARY
- UNAPPROVED NAVIGATION PROJECT
- VEPCO VIRGINIA ELECTRIC AND POWER CO
- COMMONWEALTH NATURAL GAS CORP
- LOCATION OF SAMPLE POTENTIALLY SUITABLE FOR CERAMIC PRODUCTS



CITY OF CHESAPEAKE VIRGINIA



Figure 11.

SAMPLE: R-7399

COUNTY: City of Chesapeake

Date: March, 1979 — Tuscaloosa Research Center*Locality:* N4,049,410 E396,420 (Zone 18). Moyock 7.5-minute quadrangle. Ditchcut 1.65 miles (2.34 km) southeast of Saint Brides, on the north side of Indian Creek Road approximately 0.5 mile (0.8 km) by road east of its intersection with Cedarville Road.*Description of Outcrop:* Very light-gray, medium-gray and olive-gray plastic clay with some dark yellowish-orange clay mottles in a ditchcut. There are several inches of silty gray overburden.*Formation/(Age):* (Pleistocene)*Sampled Interval:* Channel sample across 3.5 feet (1.1 m) of clay.*Raw Properties:*

Working properties:	plastic
Water of plasticity:	22.6%
Drying shrinkage:	5.0%
Dry strength:	good
pH:	6.6

Slow Firing Test:

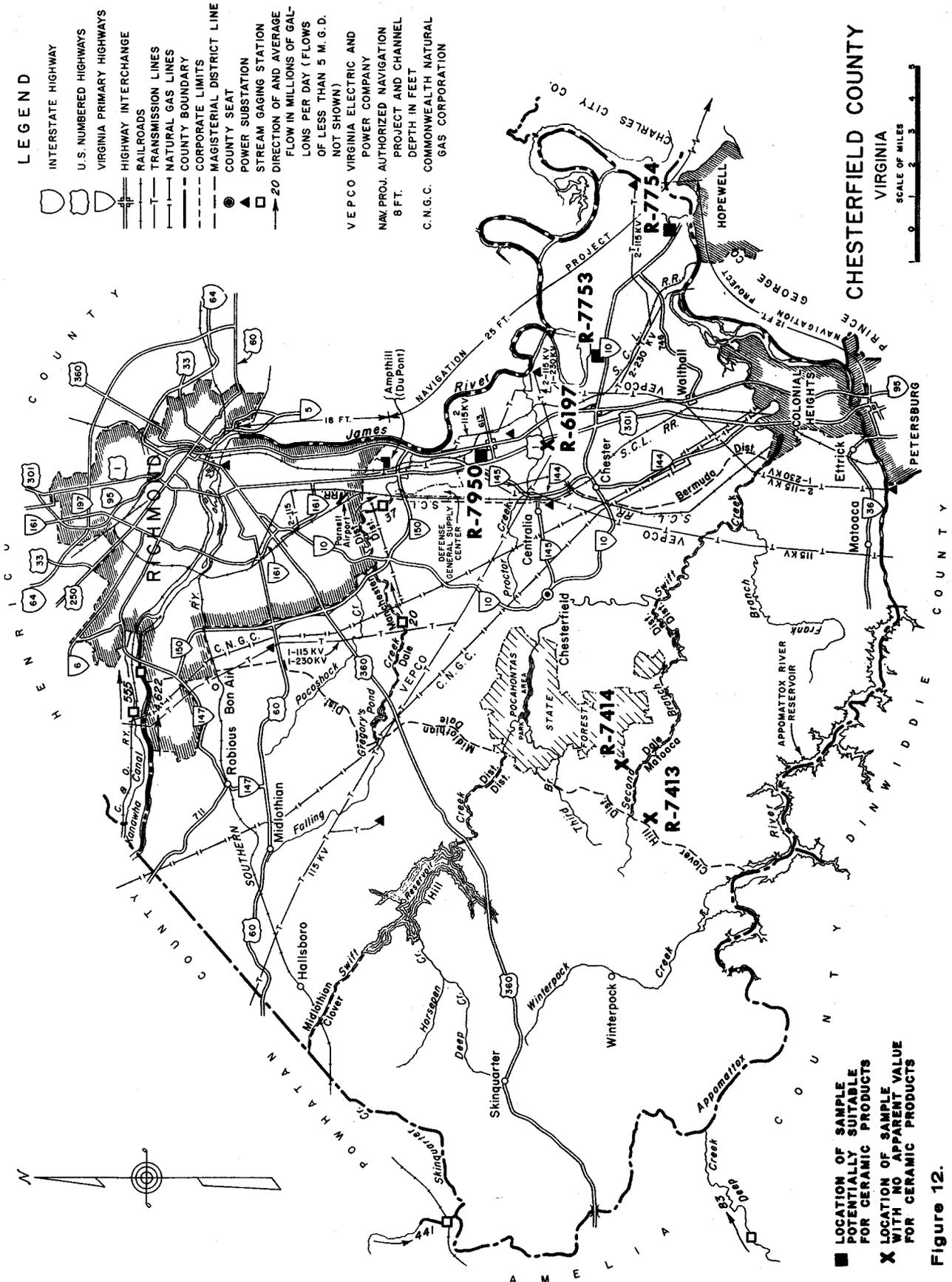
Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Pale orange yellow	3	5.0	16.5	29.9	1.81
1050	Pale orange yellow	3	7.5	13.5	25.2	1.87
1100	Moderate orange yellow	3	10.0	12.3	23.2	1.89
1150	Light brown	4	10.0	9.8	19.0	1.95
1200	Light brown	4	10.0	6.7	13.8	2.05
1250	Light grayish reddish brown	5	10.0	2.6	5.7	2.21

Remarks: No effervescence with HCl.

Analyses: (Division of Mineral Resources)

<i>Chemical:</i>		<i>Mineralogy:</i>
Si O ₂	69.01	Chlorite
Al ₂ O ₃	16.21	Quartz
Fe ₂ O ₃	2.27	Feldspar
Ca O	0.64	Halloysite
Mg O	0.57	Illite
Na ₂ O	1.44	
K ₂ O	1.69	
Ti O ₂	0.83	
Mn O	0.01	
P ₂ O ₅	0.00	
LOF	7.30	

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., building brick, structural tile at 1,150–1,250°C).



SAMPLE: R-6197

COUNTY: Chesterfield

Date: August 1975—Tuscaloosa Research Center*Locality:* N4,139,520, E285,390 (Zone 18). Drewrys Bluff 7.5-minute quadrangle. In the west bank of an old gravel pit, 0.1 mile (0.2 km) off the west side of U. S. Highway 1 and approximately 300 feet (91 m) by road south of Proctors Creek.*Description of Outcrop:* Light-gray clayey silt overlain by sands and gravels and underlain by quartz, glauconite sediments and silts.*Formation/(Age):* Mattaponi Formation (Miocene)*Sampled Interval:* Representative channel sample across approximately 6 feet (2 m) of clay material.*Raw Properties:*

Working properties:	short
Water of plasticity:	22.9%
Drying shrinkage:	5.0%
Dry strength:	fair
pH:	4.6

Slow Firing Test:

Temp. °F	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appr. Poros.	Bulk Dens. gm/cc
1800	Brownish orange	3	5.0	20.6	35.5	1.73
1900	Brownish orange	3	7.5	19.5	34.2	1.76
2000	Brownish orange	3	7.5	18.9	33.6	1.78
2100	Brownish orange	3	7.5	17.7	31.9	1.80
2200	Strong brown	3	7.5	16.7	30.5	1.83
2300	Moderate reddish brown	4	7.5	15.2	28.3	1.87

Remarks: Too soft, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Not suitable for structural clay products.

SAMPLE: R-7413

COUNTY: Chesterfield

Date: March, 1979 — Tuscaloosa Research Center*Locality:* N4,133,840 E266,270 (Zone 18). Winterpock 7.5-minute quadrangle. Roadcut, 4.8 miles (7.7 km) east-southeast of Winterpock, on the south side of State Road 602 (River Road) approximately 0.5 mile (0.8 km) by road east of its intersection with State Road 653 (Second Branch Road).*Description of Outcrop:* Red to light-reddish-brown and dark-yellowish-orange plastic clay in a 250-foot (76-m) roadcut with a maximum height of 5 (2 m) feet. Plastic clay is mottled with light-gray and grayish-pink, plastic clay near the middle and the base of the exposure. Clay becomes slightly gritty with some quartz fragments near the base of the exposure.*Formation/(Age):* (Pleistocene)*Sampled Interval:* Composite of two channel samples, each taken across 4 feet (1 m) of clay, and approximately 40 feet (12 m) apart in the thickest part of the exposure.*Raw Properties:*

Working properties: plastic
 Water of plasticity: 40.2%
 Drying shrinkage: 5.0%
 Dry strength: good
 pH: 6.3

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	5.0	26.9	42.5	1.58
1050	Moderate orange	3	7.5	25.1	40.8	1.62
1100	Moderate orange	3	7.5	17.6	31.0	1.76
1150	Grayish reddish orange	3	10.0	16.7	30.8	1.85
1200	Grayish reddish orange	3	10.0	14.8	28.3	1.91
1250	Grayish reddish orange	3	10.0	13.3	26.0	1.96

Remarks: Too soft, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Not suitable for structural clay products.

SAMPLE: R-7414

COUNTY: Chesterfield

Date: March, 1979— Tuscaloosa Research Center*Locality:* N4,135,450 E269,640 (Zone 18). Beach 7.5-minute quadrangle. Roadcut, 1.2 miles (1.9 km) south of Beach, on the east side of State Road 654 (Bundle Road), approximately 0.7 mile (1.1 km) by road south of its intersection with State Road 626.*Description of Outcrop:* Dark-yellowish-orange plastic clay with red and pale-reddish-brown clay mottles in a 325-foot (99-m) roadcut with a maximum height of 5.5 feet (1.7 m). One foot of additional yellowish-orange plastic clay with small fragments of quartz and feldspar was traversed in an auger hole at the base of the exposure. Clay is overlain by 1.5 feet (0.5 m) of yellow-brown overburden.*Formation/(Age):* (Pleistocene)*Sampled Interval:* Representative channel sample across 4 feet (1 m) of clay and one foot of augered clay.*Raw Properties:*

Working properties:	plastic
Water of plasticity:	34.3%
Drying shrinkage:	5.0%
Dry strength:	good
pH:	6.4

Slow Firing Test:

Temp. °C	Color	Hard- ness	%Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	5.0	26.6	43.5	1.58
1050	Moderate orange	3	7.5	25.7	42.2	1.65
1100	Grayish reddish orange	3	7.5	19.5	34.8	1.78
1150	Grayish reddish orange	3	10.0	13.0	25.8	1.99
1200	Strong brown	3	10.0	10.5	21.7	2.07
1250	Moderate reddish brown	3	10.0	9.0	19.1	2.11

Remarks: Too soft, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Not suitable for structural clay products.

SAMPLE: R-7753

COUNTY: Chesterfield

Date: July, 1980 — Tuscaloosa Research Center*Locality:* N4,136,270 E289,730 (Zone 18). Hopewell 7.5-minute quadrangle. Ditchcut, 2.7 miles (4.3 km) northwest of Screamersville, about 500 feet (152 m) off the north side of State Highway 10 east-northeast of the entrance to Harbour East Mobile Trailer Court.*Description of Outcrop:* Yellowish-gray and grayish-yellow to light-olive-gray silty clay with some dark-yellowish-orange and moderate-brown plastic clay in a drainage ditch with a maximum height of 12 feet (4 m). Joint fractures contain dark-yellowish-orange plastic clay on the surface. Material becomes more gritty near the base of the exposure.*Formation/(Age):* (Miocene)*Sampled Interval:* Composite of representative samples taken across 8 feet (2.4 m) of clay.*Raw Properties:*

Working properties:	plastic
Water of plasticity:	29.5%
Drying shrinkage:	5.0%
Dry strength:	good
pH:	3.9

Slow Firing Test:

Temp. °C	Color	Hard- ness	%Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	7.5	20.9	35.8	1.71
1050	Brownish orange	5	10.0	17.6	32.0	1.81
1100	Grayish reddish orange	6	10.0	10.8	22.1	2.05
1150	Strong brown	7	15.0	8.2	17.1	2.07
1200	—	—	Melted	—	—	—
1250	—	—	—	—	—	—

Remarks: High shrinkage at 1150°C, abrupt vitrification between 1150°-1200°C, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., building brick at 1,050°-1,100°C).

SAMPLE: R-7754

COUNTY: Chesterfield

Date: July, 1980 — Tuscaloosa Research Center*Locality:* N4,132,850 E295,520 (Zone 18). Hopewell 7.5-minute quadrangle. Bankcut, 0.4 mile (0.6 km) northeast of Rivermont about 275 feet (83 m) off the west side of State Road 827 approximately 0.2 mile (0.3 km) by road north of its intersection with State Highway 10.*Description of Outcrop:* Yellowish-gray and light-olive gray to greenish-gray silty clay in a bankcut with a maximum thickness of 7 feet (2 m). Moderate-reddish-brown stain is on some clay. Clay contains fragments of clear quartz. Material overlain by sand and gravels.*Formation/(Age):* Patuxent Formation(?)/Cretaceous(?)*Sampled Interval:* Channel sample across 4.5 feet (1.4 m) of clay.*Raw Properties:*

Working properties: plastic
 Water of plasticity: 19.7%
 Drying shrinkage: 5.0%
 Dry strength: good
 pH: 4.2

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange yellow	3	5.0	16.2	30.1	1.87
1050	Moderate orange	4	5.0	14.6	27.9	1.92
1100	Moderate orange	5	7.5	11.6	23.3	2.00
1150	Grayish reddish orange	7	10.0	9.5	19.9	2.10
1200	Moderate reddish brown	7	10.0	6.3	13.9	2.22
1250	Moderate reddish brown	8	10.0	3.3	7.4	2.28

Remarks: Very good firing range, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., building brick, floor brick at 1,050°-1,250°C).

SAMPLE: R-7950

COUNTY: Chesterfield

Date: August, 1980—Tuscaloosa Research Center*Locality:* N4,142,460 E284,710 (Zone 18). Drewrys Bluff 7.5-minute quadrangle. South of Richmond, about 400 feet (122 m) from the east side of U.S. Highway 1 and approximately 600 feet (183 m) south of Kingsland Creek.*Description of Outcrop:* Grayish-yellow and yellowish-gray plastic clay in a hillside with a maximum height of about 20 feet (6 m). Some yellowish-orange plastic clay is in fractures in the clay. Clay is overlain by silty yellowish glauconitic sand, and silty yellowish-orange sand and gravel.*Formation/(Age):* Nanjemoy Formation (Paleocene)*Sampled Interval:* Composite of representative samples taken across 10 feet (3 m) clay.*Raw Properties:*

Working properties:	plastic
Water of plasticity:	31.2%
Drying shrinkage:	7.5%
Dry strength:	good
pH:	3.8

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	4	7.5	20.0	34.7	1.74
1050	Moderate orange	5	10.0	16.8	30.9	1.84
1100	Moderate orange	5	12.5	10.0	20.5	2.05
1150	Brownish orange	6	15.0	5.7	11.5	2.20
1200	Moderate brown	6	15.0	2.1	4.9	2.32
1250	Light yellowish pink	8	15.0	1.2	2.9	2.32

Remarks: Slightly high shrinkage at 1,100°C, high shrinkage at 1,150°–1,250°C, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., building brick at 1,000°–1,100°C).

SAMPLE: R-6949

COUNTY: Clarke

Date: May, 1977 — Tuscaloosa Research Center*Locality:* N4,332,660 E243,750 (Zone 17). Ashby Gap 7.5-minute quadrangle. Roadcut and excavation, 2.2 miles (3.5 km) southeast of Pigeon Hill, 0.4 mile (0.6 km) from the north side of State Road 621 at Lockes Landing approximately 0.5 mile (0.8 km) by road west-northwest of its intersection with State Road 608.*Description of Outcrop:* About 10 feet (3 m) of yellowish-gray to grayish-orange weathered shale and light-olive-gray to grayish-green shale, in places with iron-oxide stain and some minor siltstone in a roadcut and hillside excavation. The hard shale has a strike of N10°E and a varying dip of 27-55°SE (overturned); the exposure is near a fault contact and off the west limb of the Slate Ridge anticline. There is about 3 feet (1 m) of additional plastic, dark-yellowish-orange clay in the hillside excavation. There may be 50 + feet (15 m) of additional material towards the top of the hill.*Formation/(Age):* Rome Formation (Cambrian)*Sampled Interval:* Composite of representative samples taken across 10 feet (3 m) of hard shale plus a channel sample across 3 feet (1 m) of clay.*Raw Properties:*

Working properties: short
 Water of plasticity: 17.5%
 Drying shrinkage: 2.5%
 Dry strength: fair
 pH: 6.0

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	2.5	14.3	27.3	1.91
1050	Brownish orange	3	5.0	12.3	24.0	1.95
1100	Strong brown	4	7.5	6.7	14.3	2.15
1150	Strong brown	5	10.0	3.5	7.9	2.26
1200	—	—	Melted	—	—	—
1250	—	—	—	—	—	—

Remarks: No effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., building and floor brick at 1,100° — 1,150°C).

SAMPLE: R-6951

COUNTY: Clarke

Date: May, 1977—Tuscaloosa Research Center*Locality:* N4,337,140 E248,470 (Zone 18). Berryville 7.5-minute quadrangle. Roadcut 3.9 miles (6.2 km) east of Berryville, on the west side of State Road 612 approximately 0.2 mile (0.3 km) by road southeast of its intersection with State Road 603.*Description of Outcrop:* About 4 feet (1 m) of light-and dark-yellowish-orange and moderate-yellowish-brown plastic clay and shale with black manganese or iron-oxide stain in a 300-foot (91-m) roadcut with a maximum height of 6 feet; minor amounts of weathered siltstone as well as small (1/8") clear quartz fragments are near the middle of the exposure. The shale has a strike of N65°E and a dip of 19°NE. About two feet (1 m) of yellowish-gray overburden covers the clay and shale in the roadcut.*Formation/(Age):* Rome Formation (Cambrian)*Sampled Interval:* Representative sample taken across the exposure.*Raw Properties:*

Working properties:	plastic
Water of plasticity:	26.4%
Drying shrinkage:	5.7%
Dry strength:	good
pH:	5.7

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	10.0	12.5	25.3	2.03
1050	Brownish orange	4	12.5	8.4	17.5	2.09
1100	Strong orange	5	15.0	1.4	3.3	2.47
1150	—	—	Melted	—	—	—
1200	—	—	—	—	—	—
1250	—	—	—	—	—	—

Remarks: Abrupt vitrification between 1,050°—1,100°C, high shrinkage, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Not suitable for structural clay products.

SAMPLE: R-7246

COUNTY: Clarke

Date: April, 1978—Tuscaloosa Research Center*Locality:* N4,327,380 E244,650 (Zone 18). Ashby Gap 7.5-minute quadrangle. Roadcut, 3.25 miles (5.23 km) north of Ashby Gap, on the north side State Road 606 approximately 0.3 mile (0.5 km) by road north of its intersection with State Road 649.*Description of Outcrop:* About 15 feet (5 m) of yellowish-gray and light-olive gray to greenish-gray hard slate in a roadcut with a maximum height of 12 feet (4 m). Some purplish and moderate-reddish-orange iron-oxide stain is along joint and cleavage planes. There is a thin sandstone bed below the slate and the slate is slightly sandy near the top of the exposure. The slate has a strike of N28°E and a dip of 34°SE; cleavage dips 73°SE. A prominent joint has a N50°E strike and a NW dip.*Formation/(Age):* Harpers Formation (Cambrian)*Sampled Interval:* Composite or representative samples taken across 15 feet (5 m) of slate.*Raw Properties:*

Working properties:	short
Water of plasticity:	20.0%
Drying shrinkage:	2.5%
Dry strength:	good
pH:	5.3

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	2.5	17.3	30.8	1.79
1050	Moderate orange	3	5.0	15.3	28.0	1.83
1100	Brownish orange	3	5.0	7.2	15.2	2.11
1150	—	—	Melted	—	—	—
1200	—	—	—	—	—	—
1250	—	—	—	—	—	—

Remarks: Too soft, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Not suitable for structural clay products.

SAMPLE: R-7247

COUNTY: Clarke

Date: April, 1978—Tuscaloosa Research Center*Locality:* N4,329,470 E242,180 (Zone 18). Ashby Gap 7.5-minute quadrangle. Hillside exposure, 4.5 miles (7.2 km) north of Ashby Gap on the north side of Calmes Neck on the south side of the Shenandoah River, 2.2 miles (3.5 km) N45°W of the intersection of State Road 606 with State Road 649.*Description of Outcrop:* About 7 feet (2 m) of pale-red-purple and grayish-red-purple to grayish-purple, very well-indurated shale and siltstone in a hillside exposure. Some black iron-oxide or manganese stain is along fracture planes. Shale has a north-south strike and a dip of 40° west.*Formation/(Age):* Rome Formation (Cambrian)*Sampled Interval:* Composite of representative samples taken across 7 feet (2 m) of shale.*Raw Properties:*

Working properties:	short
Water of plasticity:	14.8%
Drying shrinkage:	2.5%
Dry strength:	fair
pH:	6.4

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	2.5	14.0	26.7	1.91
1050	Moderate orange	3	2.5	13.5	26.0	1.92
1100	—	—	Melted	—	—	—
1150	—	—	—	—	—	—
1200	—	—	—	—	—	—
1250	—	—	—	—	—	—

Remarks: Abrupt vitrification between 1,050°C—1,100°C, too soft, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Not suitable for structural clay products.

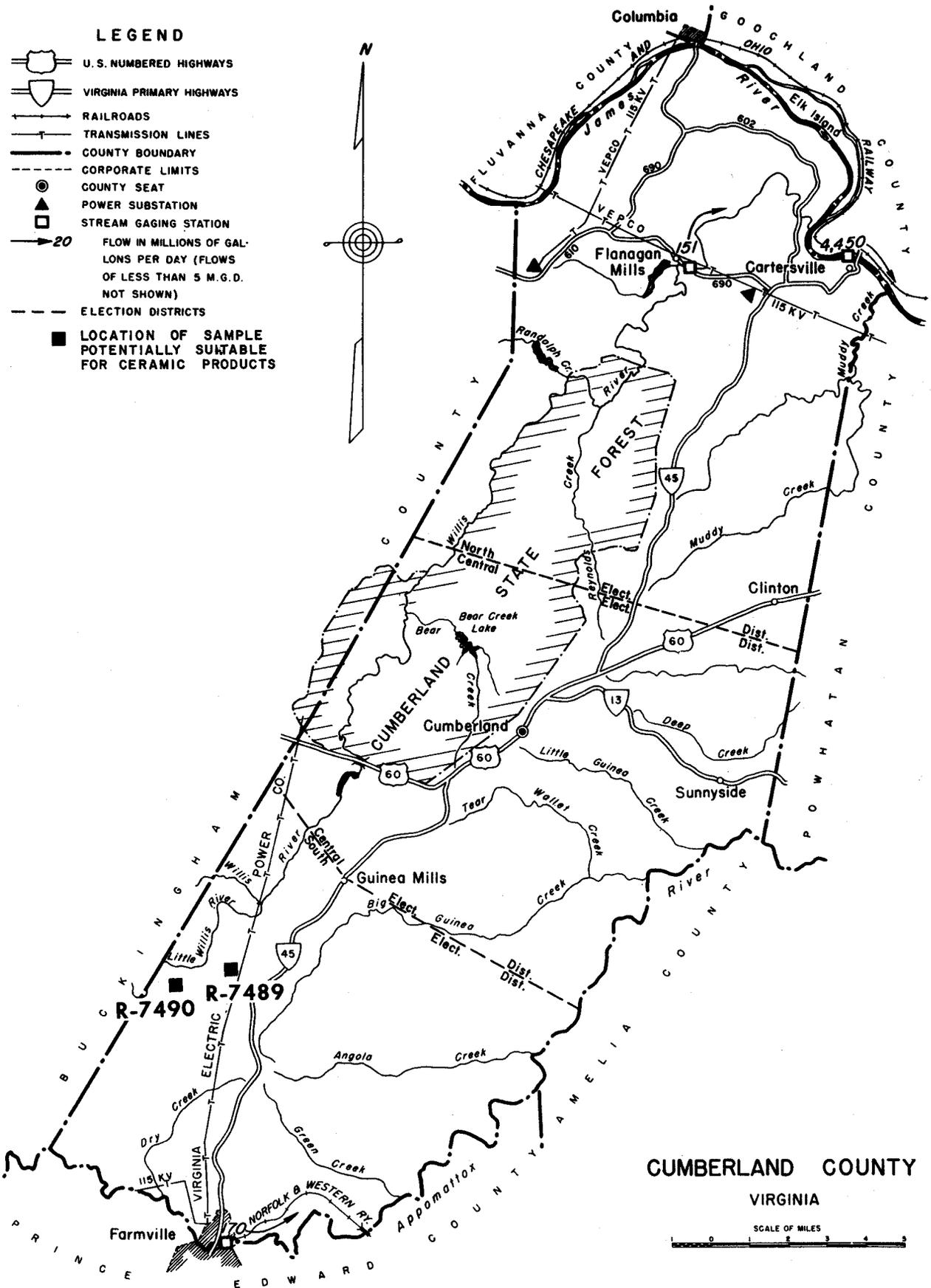


Figure 14.

SAMPLE: R-7489

COUNTY: Cumberland

Date: July, 1979—Tuscaloosa Research Center*Locality:* N4,142,550 E731,660 (Zone 17). Willis Mountain 7.5-minute quadrangle. Roadcut, 4.1 miles (6.6 km) east of Curdsville, Buckingham County, on the east side of State Road 676 approximately 0.1 miles (0.2 km) by road north of its intersection with State Road 692.*Description of Outcrop:* Pale-yellowish-brown and dark-yellowish-orange to moderate-yellowish-brown plastic clay and weathered shale in a roadcut with a maximum height of 6 feet (2 m). Below the shale is some grey, plastic clay and a minor amount of carbonaceous material and a reddish micaceous siltstone that is about 6 inches thick and overlies a light-olive-gray, indurated shale. The shale has a strike of N30° E and a dip of 50-55° NW. There is a thin light-yellowish-brown overburden.*Formation/(Age):* Residual clay.*Sampled Interval:* Composite of a channel sample taken across 5.5 feet (1.7 m) of clay near southern end of roadcut and a sample cut into the roadcut and the hard shale below the micaceous siltstone.*Raw Properties:*

Working properties: plastic
 Water of plasticity: 23.6%
 Drying shrinkage: 5.0%
 Dry strength: good
 pH: 6.8

Slow Firing Test:

Temp. °C	Color	Hard- ness	%Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	7.5	16.4	30.0	1.83
1050	Grayish reddish orange	3	10.0	11.1	22.2	2.00
1100	Grayish reddish orange	4	10.0	6.1	13.2	2.18
1150	Strong brown	4	12.5	4.0	9.0	2.24
1200	Moderate reddish brown	4	12.5	2.2	5.0	2.29
1250	—	—	Melted	—	—	—

Remarks: Slightly high shrinkage, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., building brick, floor brick at 1,100°-1,200°C).

SAMPLE: R-7490

COUNTY: Cumberland

Date: July, 1979 — Tuscaloosa Research Center*Locality:* N4,142,700 E729,410 (Zone 17). Willis Mountain 7.5-minute quadrangle. Roadcut 2.75 miles (4.43 km) east of Curdsville, on the northeast side of State Road 600 approximately 0.7 mile (1.1 km) by road north of its intersection with State Road 704.*Description of Outcrop:* Light-to moderate-brown, brownish-gray and dark-grayish-red-purple to greenish-gray, plastic clay in a roadcut with a maximum height of 4.5 feet (1.4 m). Clay becomes shaly and more silty near the base of the exposure.*Formation/(Age):* Residual clay.*Sampled Interval:* Composite of 3 channel samples, each across 3.5 feet (1.1 m) of clay and taken 15 feet (5 m) apart in the highest part of the exposure.*Raw Properties:*

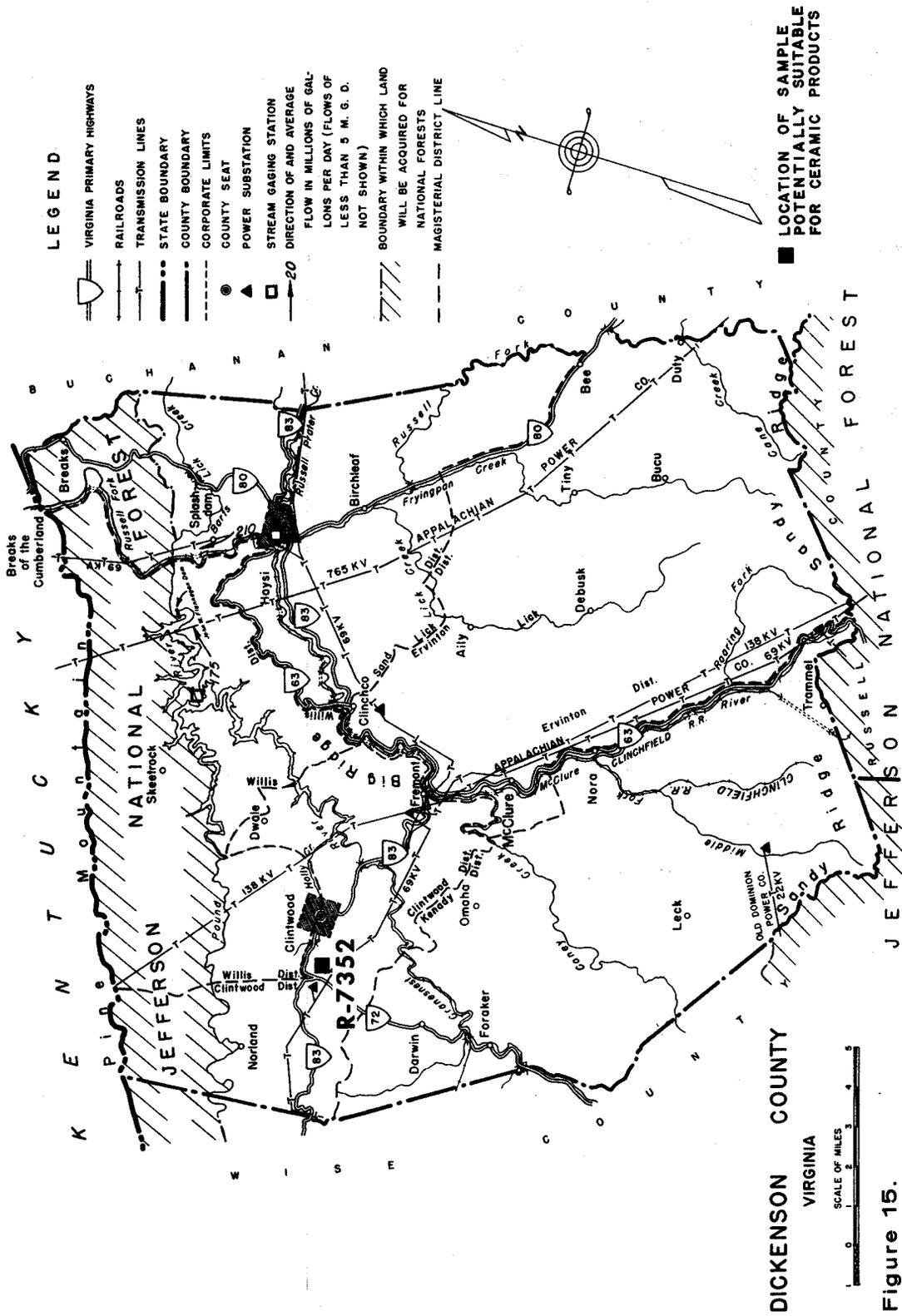
Working properties: plastic
 Water of plasticity: 25.6%
 Drying shrinkage: 5.0%
 Dry strength: good
 pH: 6.7

Slow Firing Test:

Temp. °C	Color	Hard- ness	%Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	7.5	11.9	23.7	1.99
1050	Grayish reddish orange	4	10.0	4.3	9.9	2.29
1100	Light orange reddish brown	4	12.5	1.7	4.2	2.41
1150	Light reddish brown	5	12.5	1.3	3.1	2.42
1200	—	—	Melted	—	—	—
1250	—	—	—	—	—	—

Remarks: Slightly high shrinkage, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., floor brick at 1,050°-1,150°C).



SAMPLE: R-7352

COUNTY: Dickenson

Date: September, 1978 — Tuscaloosa Research Center*Locality:* N4,110,150 E369,560 (Zone 17). Clintwood 7.5-minute quadrangle. Strip pit exposure, about 0.6 mile (1.0 km) from the southeast side of a haul road approximately 1.0 mile (1.6 km) by road east of its intersection with State Highway 72.*Description of Outcrop:* Medium to dark-gray clay, that is silty in places and contains some plant fossils as well as small coal lenses (up to 1/4" thick); clay occurs as a shale parting above the Upper Clintwood coal and below the Clintwood Marker.*Formation/(Age):* Wise Formation (Pennsylvanian)*Sampled Interval:* Representative channel sample across 8.4 inches (21.3 cm) of clay.*Raw Properties:*

Working properties: plastic
 Water of plasticity: 16.8%
 Drying shrinkage: 2.5%
 Dry strength: good
 pH: 5.9

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate yellowish pink	3	2.5	16.0	29.6	1.85
1050	Moderate orange	5	5.0	10.7	21.7	2.02
1100	Light brown	6	7.5	1.9	4.4	2.32
1150	Light grayish brown	6	10.0	0.8	1.8	2.36
1200	Light grayish yellowish brown	6	10.0	0.4	0.9	2.38
1250	—	—	Melted	—	—	—

Remarks: Abrupt vitrification between 1,050°-1,100°C, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., floor brick at 1,100°-1,200°C).

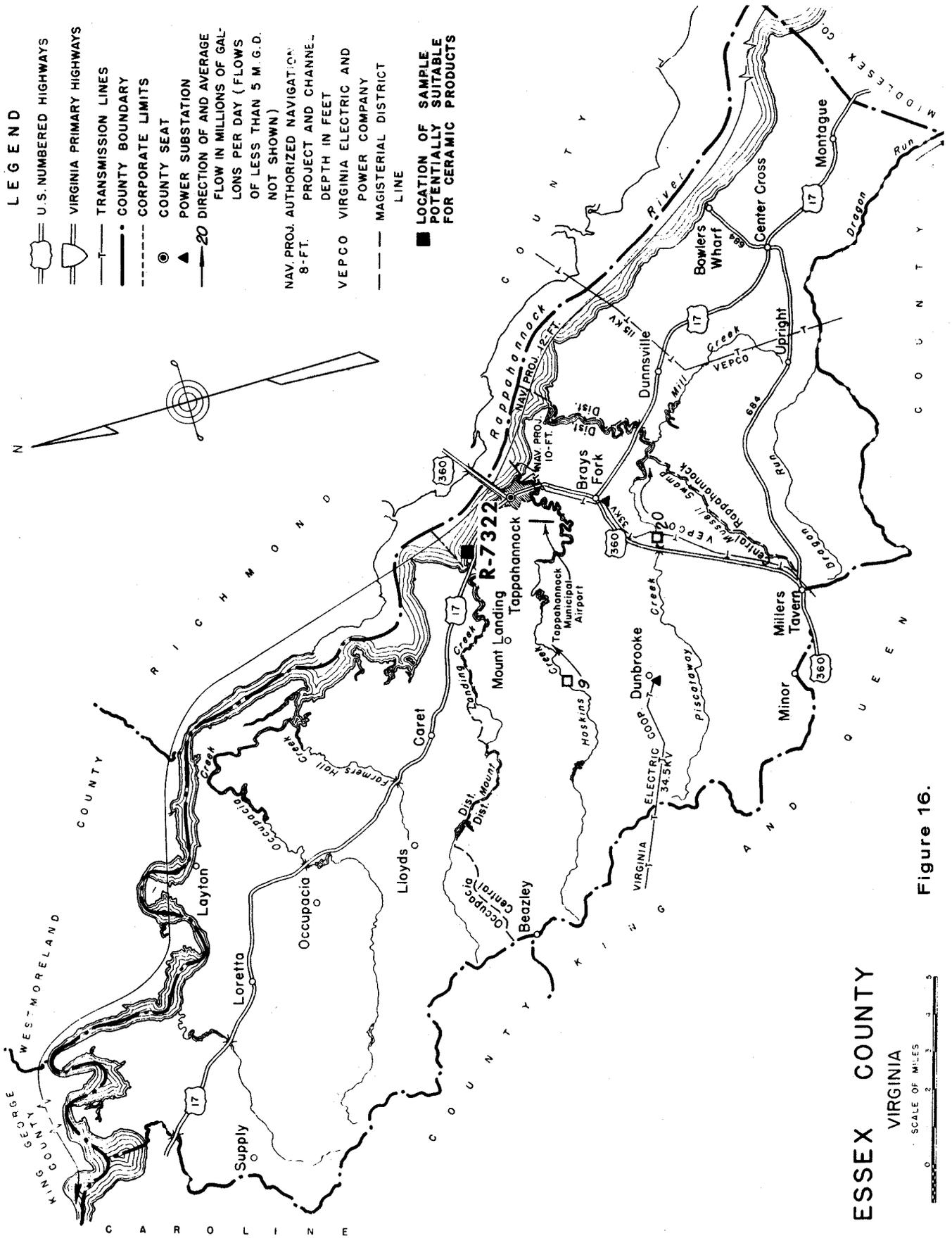


Figure 16.

SAMPLE: R-7322

COUNTY: Essex

Date: September, 1978—Tuscaloosa Research Center

Locality: N4,201,780 E334,800 (Zone 18). Mount Landing 7.5-minute quadrangle. Riverbank, 2.4 miles (3.8 km) northeast of Mount Landing, on the southwest bank of the Rappahannock River, 160 feet (49 m) northeast of State Road 702 at a point 0.3 mile (0.5 km) by road northeast of its intersection with U. S. Highway 17.

Description of Outcrop: Light-olive-gray to olive-gray to olive-black and greenish-gray plastic clay in 15-foot (5-m) cliff. The clay is covered by a 1.5 inch (3.8 cm) iron bed; rust-colored iron-oxide stain is along the joints in the clay. Overburden consists of about 12 feet (4 m) of light-gray and yellowish-brown clayey sand. Clay unit pinches out to the northwest in the cliff and is underlain by a coal layer. Some rootlets are in the clay.

Formation/(Age): (Miocene?)

Sampled Interval: Representative channel sample across 3 feet (1 m) of clay.

Raw Properties:

Working properties: plastic
 Water of plasticity: 21.2%
 Drying shrinkage: 2.5%
 Dry strength: good
 pH: 5.7

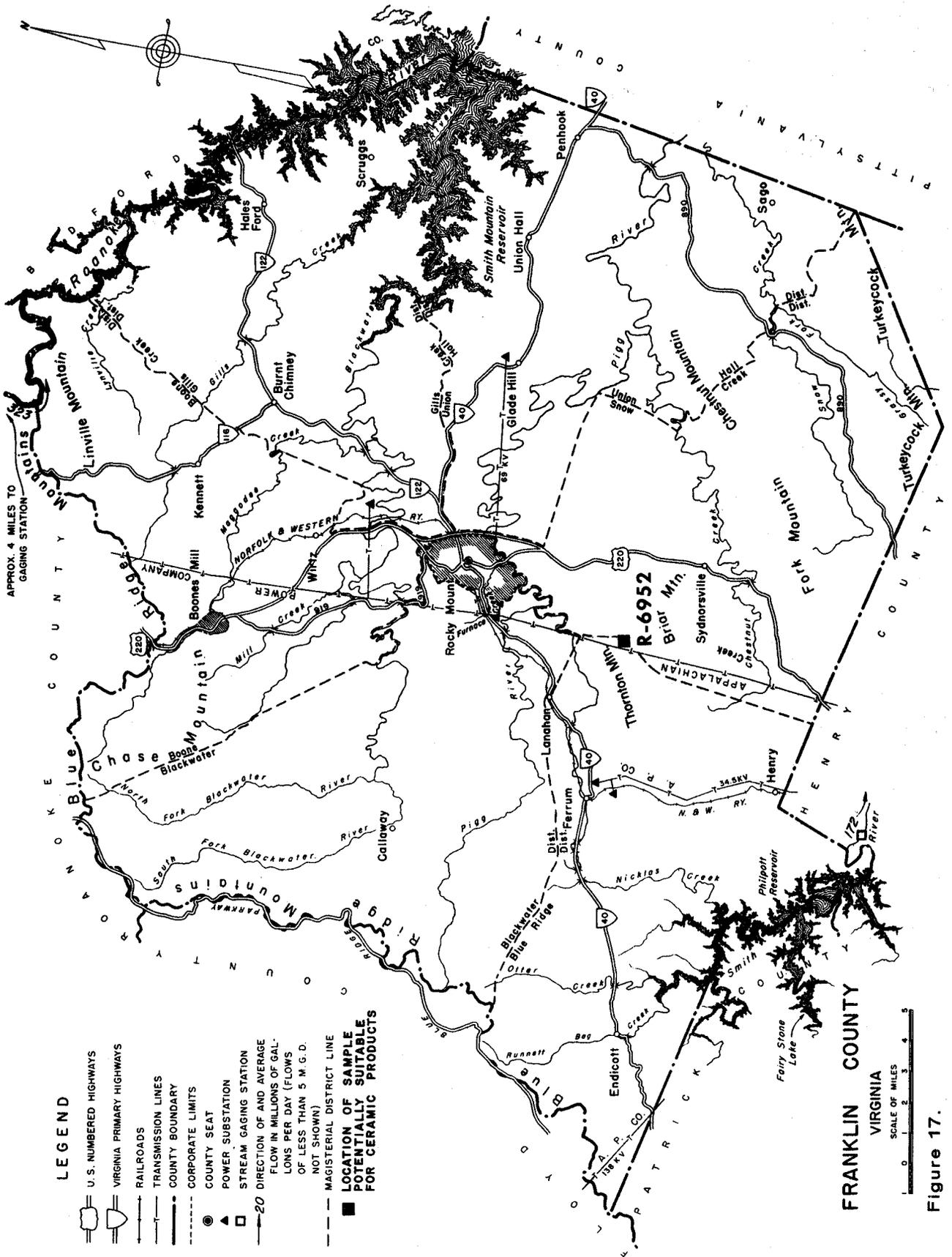
Slow Firing Test:

Temp. °C	Color	Hard- ness	%Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	5.0	19.4	33.1	1.70
1050	Moderate orange	4	7.5	13.5	25.8	1.91
1100	Grayish reddish orange	5	10.0	5.8	12.4	2.13
1150	Moderate reddish brown	5	10.0	1.7	3.7	2.18
1200	Grayish reddish brown	5	10.0	1.6	3.6	2.26
1250	—	—	Melted	—	—	—

Remarks: Abrupt vitrification between 1,050°-1,100°C, no effervescence with HCl.

Preliminary Bloating Test: Negative

Potential Use: Structural clay products (e.g., floor brick, building brick at 1,100°-1,200°C).



FRANKLIN COUNTY
VIRGINIA

Figure 17.

SAMPLE: R-6952

COUNTY: Franklin

Date: June, 1977 — Tuscaloosa Research Center*Locality:* N4,085,580 E596,200 (Zone 17). Rocky Mount 7.5-minute quadrangle. Bank of the North Fork of Little Chestnut Creek, 5.9 miles (9.4 km) south of Rocky Mount, just west of State Road 762 approximately 0.75 mile (1.21 km) south of its intersection with State Road 619.*Description of Outcrop:* Extensive gray to white clay along the North Fork of Little Chestnut Creek. Material is approximately 6 feet (2 m) thick and in an exposure several hundred feet long with white quartz cobbles.*Formation/(Age):* (Quaternary)*Sampled Interval:* Channel sample across 6 feet (2 m) of clay*Raw Properties:*

Working properties: short
 Water of plasticity: 22.0%
 Drying shrinkage: 0.0%
 Dry strength: fair
 pH: 5.5

Slow Firing Test:

<i>Temp.</i> °C	<i>Color</i>	<i>Hard- ness</i>	<i>% Lin. Shk.</i>	<i>% Abs.</i>	<i>% Appar. Poros.</i>	<i>Bulk Dens. gm/cc</i>
1000	Pale orange yellow	2	2.5	24.0	38.1	1.59
1050	Pale orange yellow	2	2.5	23.7	38.0	1.61
1100	Mod. yellowish pink	3	2.5	20.5	34.5	1.68
1150	Mod. yellowish pink	3	5.0	20.1	34.0	1.70
1200	Light brown	3	5.0	15.2	27.4	1.81
1250	Grayish yellowish brown	4	7.5	8.5	17.5	2.07

Remarks: Too soft below 1,250°C, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., building brick at 1,250°C).

SAMPLE: R-6812

COUNTY: Halifax

Date: March, 1977 — Tuscaloosa Research Center*Locality:* N4,065,510 E696,090 (Zone 17). Omega 7.5-minute quadrangle. Riverbank 1.4 miles (2.3 km) east of Wolf Trap, on the east-northeast bank of and under the bridge over the Bannister River on State Road 716 approximately 0.85 mile (1.37 km) by road east-northeast of its intersection with State Road 727.*Description of Outcrop:* About 4.5 feet (1.4 m) of dark-yellowish-brown to grayish-brown plastic clay at the top of the exposure to yellowish-gray and light-gray, fine sandy clay near the bottom in a 100-foot-(30-m-) long riverbank exposure. In the western part of the exposure the clay is mottled with a light-gray clay. Minor muscovite is in the lower part of the exposure. The clay is partly covered by about 5 feet (1.5 m) of a yellowish-orange clayey sand.*Formation/(Age):* Residual clay (on Triassic sedimentary rocks).*Sampled Interval:* Composite of two representative channel samples, taken about 25 feet (8 m) apart in the thickest part of the exposure.*Raw Properties:*

Working properties:	short
Water of plasticity:	24.0%
Drying shrinkage:	2.5%
Dry strength:	good
pH:	4.4

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	5.0	21.6	36.3	1.68
1050	Moderate orange	3	5.0	16.2	27.4	1.70
1100	Strong brown	4	7.5	11.2	22.0	2.00
1150	Strong brown	4	10.0	7.7	16.1	2.07
1200	Moderate reddish brown	5	10.0	4.1	8.7	2.09
1250	Grayish brown	6	10.0	4.0	8.6	2.18

Remarks: Good firing range, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., building brick at 1,100° — 1,250°C).

SAMPLE: R-6813

COUNTY: Halifax

Date: March, 1977 — Tuscaloosa Research Center*Locality:* N4,068,590 E694,030 (Zone 17). Omega 7.5-minute quadrangle. Roadcut, 2.2 miles (3.5 km) north of Wolf Trap, on the north side of State Road 613 approximately 0.85 miles (1.37 km) by road east of its intersection with State Highway 304.*Description of Outcrop:* About 4 feet (1 m) of moderate- to dark-reddish-brown, plastic clay in a 150-foot-(46 m) long roadcut. The clay tends to be plastic near the base of the exposure. Minor muscovite and small fragments of feldspar are near the middle of the exposure.*Formation/(Age):* Residual clay on Triassic (?) rocks*Sampled Interval:* Composite of two representative channel samples, taken about 25 feet (8 m) apart, in the thickest part of the exposure.*Raw Properties:*

Working properties: plastic
 Water of plasticity: 25.1%
 Drying shrinkage: 2.5%
 Dry strength: good
 pH: 4.6

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	5.0	17.4	31.6	1.82
1050	Moderate orange	3	7.5	16.0	29.2	1.83
1100	Brownish orange	3	7.5	13.6	26.0	1.91
1150	Grayish reddish orange	4	7.5	10.7	21.3	2.00
1200	Strong brown	4	7.5	9.1	18.7	2.05
1250	Moderate brown	5	10.0	8.3	16.7	2.02

Remarks: No effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., building brick at 1,150° — 1,250°C).

SAMPLE: R-7530

COUNTY: Halifax

Date: January, 1980 — Tuscaloosa Research Center*Locality:* N4,047,000 E693,050 (Zone 17). Virgilina 7.5-minute quadrangle. Exposure in the edge of a field 3.8 miles (6.1 km) west of Virgilina, off the west side of State Road 740, approximately 0.15 mile (0.24 km) by road southwest of its intersection with State Highway 96.*Description of Outcrop:* Yellowish-gray to very light-gray sericite schist with some residual material in a field. Schistosity of the material strikes NNE and dips steeply to the ESE.*Formation/(Age):* Hyco Formation (Precambrian)*Sampled Interval:* Representative sample across 6 feet (2 m) of weathered and fresh sericite schist.*Raw Properties:*

Working properties:	short
Water of plasticity:	13.5%
Drying shrinkage:	2.5%
Dry strength:	fair
pH:	5.0

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Pale orange yellow	3	2.5	21.2	35.8	1.68
1050	Moderate orange yellow	3	2.5	18.8	32.9	1.75
1100	Dark orange yellow	3	5.0	13.0	25.2	1.93
1150	Brownish orange	4	7.5	8.0	16.5	2.08
1200	Light brown	4	10.0	1.4	3.1	2.19
1250	—	—	Melted	—	—	—

Remarks: No effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., building brick at 1,150° — 1,200°C).

SAMPLE: R-7531

COUNTY: Halifax

Date: January, 1980 — Tuscaloosa Research Center*Locality:* N4,047,040 E692,690 (Zone 17). Virgilina 7.5-minute quadrangle. Water well site by the house of H. E. Hudson, Jr. 4.0 miles (6.4 km) west of Virgilina, about 0.3 mile (0.5 km) southwest of the intersection of State Road 740 with State Highway 96.*Description of Outcrop:* Yellowish-gray to very light-gray sericite schist with some residual material over the entire area.*Formation/(Age):* Hyc0 Formation (Precambrian)*Sampled Interval:* Sample believed representative of partly weathered to unweathered sericite schist from a 300 foot (30 m) hole drilled for a well.*Raw Properties:*

Working properties: plastic
 Water of plasticity: 38.2%
 Drying shrinkage: 5.0%
 Dry strength: good
 pH: 4.5

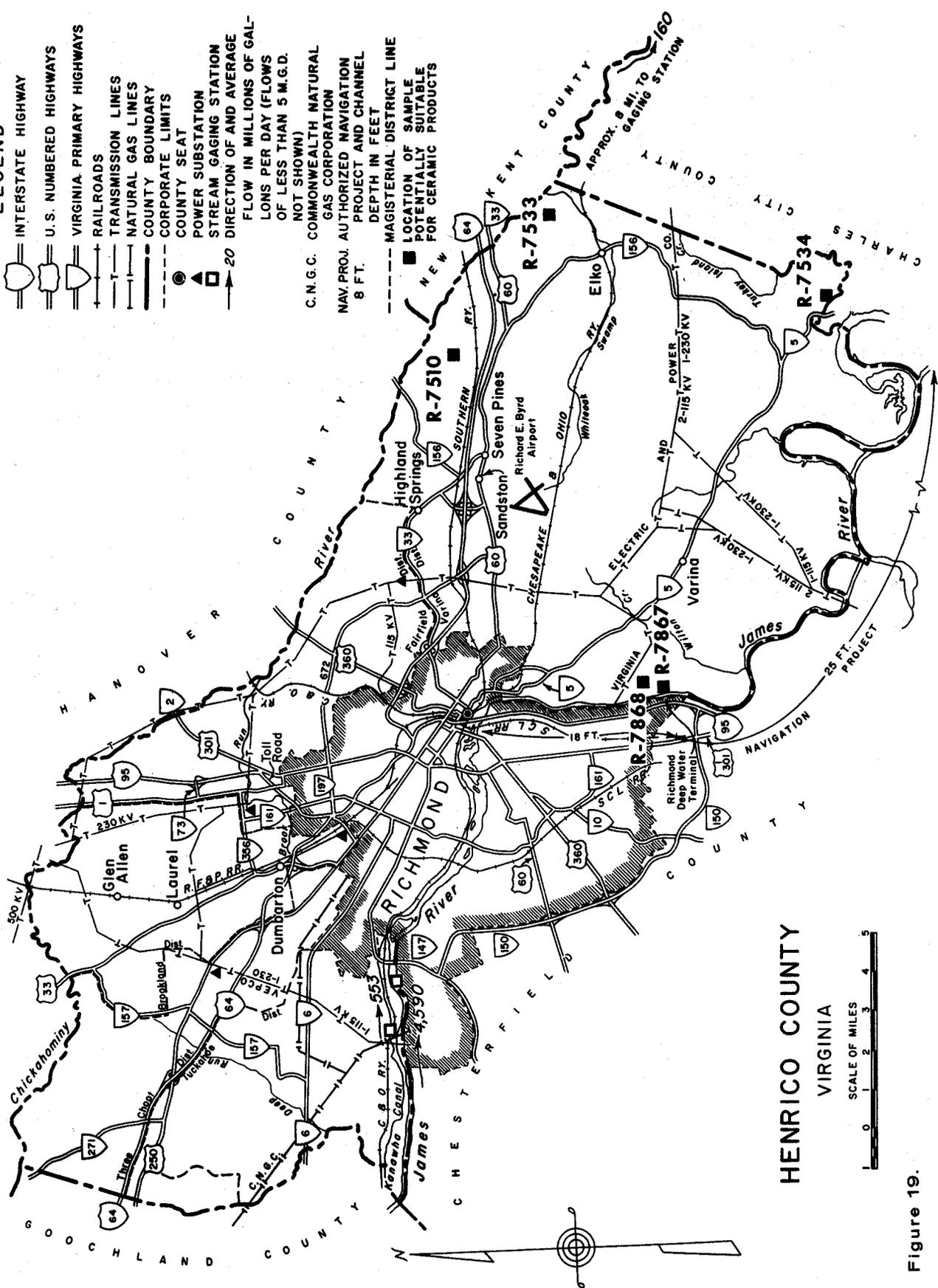
Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	10.0	29.3	46.4	1.58
1050	Moderate orange	3	10.0	27.0	44.2	1.64
1100	Moderate orange	4	12.5	20.1	37.2	1.85
1150	Grayish reddish orange	4	20.0	9.0	20.8	2.31
1200	Moderate reddish brown	5	20.0	4.7	11.8	2.53
1250	Moderate reddish brown	5	20.0	4.4	11.2	2.54

Remarks: High shrinkage, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Not suitable for structural clay products.

- LEGEND**
- INTERSTATE HIGHWAY
 - U.S. NUMBERED HIGHWAYS
 - VIRGINIA PRIMARY HIGHWAYS
 - RAILROADS
 - TRANSMISSION LINES
 - NATURAL GAS LINES
 - COUNTY BOUNDARY
 - CORPORATE LIMITS
 - COUNTY SEAT
 - POWER SUBSTATION
 - STREAM GAGING STATION
 - DIRECTION OF AND AVERAGE FLOW IN MILLIONS OF GALLONS PER DAY (FLOWS OF LESS THAN 5 M.G.D. NOT SHOWN)
 - C.N.G.C. COMMONWEALTH NATURAL GAS CORPORATION
 - NAV. PROJ. AUTHORIZED NAVIGATION PROJECT AND CHANNEL 8 FT.
 - DEPTH IN FEET
 - MAGISTERIAL DISTRICT LINE
 - LOCATION OF SAMPLE POTENTIALLY SUITABLE FOR CERAMIC PRODUCTS



HENRICO COUNTY
VIRGINIA



Figure 19.

SAMPLE: R-7510

COUNTY: Henrico

Date: August, 1979—Tuscaloosa Research Center

Locality: N4,155,870 E300,430 (Zone 18). Seven Pines 7.5-minute quadrangle. Exposure in the south bank of the pit operated by J. J. and B. Sand and Gravel Company, 3.2 miles (5.1 km east of Sandston), about 0.15 mile (0.24 km) off the north side of Meadow Road approximately 0.75 mile (1.21 km) by road east of its crossing over Interstate Highway 295.

Description of Outcrop: Light-gray to medium-light-gray and light-olive-gray plastic clay and clayey silts in a 350-foot-(107-m)-long exposure with a maximum height of about 18 feet (5 m). Clay is harder near the top of the exposure and sticky and plastic near the base. There are some dusky-red and pale-reddish-brown sandy laminations as well as some white to yellow-gray plastic clay laminations and fine sands. Clay near the top of the sampled portion is stained dark-yellowish-orange as a result of leaching of overlying material. Material is probably a marine, transgressive unit.

Formation/(Age): (Pleistocene)*Sampled Interval:* Representative sample across 6.5 feet (2.0 m) of clay.*Raw Properties:*

Working properties: plastic
 Water of plasticity: 20.1%
 Drying shrinkage: 2.5%
 Dry strength: good
 pH: 4.8

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Pale orange yellow	3	5.0	17.2	31.0	1.80
1050	Pale orange yellow	3	5.0	16.2	29.6	1.83
1100	Moderate yellowish pink	3	5.0	14.5	27.6	1.90
1150	Moderate yellowish pink	3	5.0	11.5	22.6	1.95
1200	Light brown	4	7.5	9.2	18.3	2.00
1250	Light grayish yellowish brown		10.0	2.8	6.1	2.22

Remarks: No effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., building brick, structural tile at 1,200°—1,250°C).

SAMPLE: R-7533

COUNTY: Henrico

Date: March, 1980—Tuscaloosa Research Center*Locality:* N4,151,500 E306,180 (Zone 18). Roxbury 7.5-minute quadrangle. Drainage ditch 1.7 miles (2.82 km) northeast of Elko 0.35 mile (0.56 km) off the northeast side of Scandia Road approximately 0.95 mile (1.53 km) by road east of its intersection with State Highway 156 (White Oak Road).*Description of Outcrop:* Olive-gray, grayish-olive-green and dark-gray, very plastic clay in a drainage ditch; minor amounts of dark-yellowish-orange sand are along joints in the clay. Plastic clay is in a drainage ditch. Eight feet (2 m) of clay is exposed below a 2- to 3-foot shell bed (Yorktown Formation). Because of slump in banks, only 2.5 feet (0.8 m) of additional clay could be augered.*Formation/(Age):* Calvert Formation (Miocene)*Sampled Interval:* Representative sample across 8 feet (2 m) of clay; augered 2.5 feet (0.8 m) of clay.*Raw Properties:*

Working properties:	plastic
Water of plasticity:	21.5%
Drying shrinkage:	5.0%
Dry strength:	good
pH:	5.0

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Brownish orange	3	5.0	19.1	33.6	1.76
1050	Strong brown	3	7.5	17.3	31.5	1.81
1100	Strong brown	3	10.0	14.5	27.8	1.92
1150	Moderate reddish brown	4	10.0	11.0	21.9	1.99
1200	—	—	Expanded	—	—	—
1250	—	—	—	—	—	—

Remarks: Short firing range, abrupt vitrification between 1,150°C—1,200°C; no effervescence with HCl.

Preliminary Bloating Test: Positive*Potential Use:* Structural clay products (e.g., building brick at 1,150°C) and lightweight aggregate at 1,150°—1,250°C.

SAMPLE: R-7534

COUNTY: Henrico

Date: March, 1980 — Tuscaloosa Research Center

Locality: N4,139,770 E302,880 (Zone 18). Roxbury 7.5-minute quadrangle. Roadcut about 1 mile (1.6 km) southeast of Malvern Hill on the south-southeast side of Carters Mill Road, about 0.05 mile (0.08 km) by road northeast of Turkey Island Creek.

Description of Outcrop: Very light-gray, yellowish-gray and light-olive-gray to grayish-red and dark-yellowish-orange plastic clay in a 135-foot- (41-m-) long roadcut, with a maximum height of 9.5 feet (2.9 m). Material ranges from light-gray clay at the top to grayish-red in the middle to light-gray with some yellowish-orange clay mottles at the bottom. The clay contains some organic material and a 1/2-inch layer of black carbonaceous material at the top of the clay; overburden consists of about 3.5 feet (1.1 m) of yellowish-orange silt with some fine- to medium-grained light-yellow sand. Could not sample nor auger at the bottom of the roadcut because of the slope of the bank.

Formation/(Age): (Paleocene)

Sampled Interval: Channel sample across 5 feet (2 m) of clay.

Raw Properties:

Working properties: plastic
 Water of plasticity: 26.1%
 Drying shrinkage: 5.0%
 Dry strength: good
 pH: 4.5

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	5.0	21.2	36.4	1.72
1050	Moderate orange	3	7.5	16.7	30.8	1.84
1100	Moderate orange	4	10.0	12.0	24.0	2.00
1150	Brownish orange	5	12.5	5.3	11.8	2.23
1200	Strong brown	5	12.5	1.8	4.3	2.35
1250	—	—	Melted	—	—	—

Remarks: Slightly high shrinkage at 1,150° — 1,200°C, no effervescence with HCl.

Chemical:

SiO ₂	62.47
Al ₂ O ₃	19.14
Fe ₂ O ₃	4.70
CaO	0.05
MgO	0.88
Na ₂ O	0.39
K ₂ O	2.81
TiO ₂	1.21
MnO	0.03
P ₂ O ₅	0.05
LOF	8.22

Mineralogy:

Kaolinite
 Illite

Preliminary Bloating Test: Negative

Potential Use: Structural clay products (e.g., building brick at 1,100° — 1,200°C).

SAMPLE: R-7867

COUNTY: Henrico

Date: July, 1980 — Tuscaloosa Research Center

Locality: N4,148,300 E286,700 (Zone 18). Drewrys Bluff 7.5-minute quadrangle. Ditch about 2 miles (3.2 km) southwest of Varina High School, 0.2 mile (0.3 km) W-NW of the intersection of Sexby Road with Warwick Park Road.

Description of Outcrop: Olive-gray to dark-greenish-gray plastic clay in a ditch, underlain by a glauconitic sand. The surface of the clay is weathered to light-gray. The top 3 feet (1 m) of the exposure is weathered light-yellowish-orange and the material is very sticky.

Formation/(Age): St. Marys Formation (Miocene)

Sampled Interval: Composite of representative samples each across 18 feet (5.4 m) of clay.

Raw Properties:

Working properties: plastic
 Water of plasticity: 32.5%
 Drying shrinkage: 5.0%
 Dry strength: good
 pH: 3.4

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	7.5	23.3	39.0	1.68
1050	Brownish orange	5	7.5	19.0	34.1	1.79
1100	Brownish orange	6	12.5	9.1	19.1	2.06
1150	Strong brown	7	12.5	4.3	9.8	2.10
1200	Moderate reddish brown	8	15.0	3.0	6.1	2.26
1250	—	—	Expanded	—	—	—

Remarks: Slightly high shrinkage at 1,100°C — high shrinkage at 1,200°C, short firing range, no effervescence with HCl.

Preliminary Bloating Test: Positive

Temp. °C	% Absorption	Bulk Dens. gm/cc (1b/ft ³)	Remarks
1100	8.6	1.78 (110.9)	Slight expansion
1150	7.0	1.74 (108.6)	Slight expansion
1200	5.7	1.23 (77.0)	Good pore structure
1250	6.9	0.91 (56.8)	Some large pores (sticky)

Potential Use: Structural clay products (e.g., building brick, floor brick at 1,050° — 1,150°C). Marginal for lightweight aggregate at 1,200° — 1,250°C.

SAMPLE: R-7868

COUNTY: Henrico

Date: July, 1980 — Tuscaloosa Research Center*Locality:* N4,149,790 E287,120 (Zone 18). Drewrys Bluff 7.5-minute quadrangle. Streambank about 1.6 miles (2.6 km) west of Varina High School. 0.35 miles (0.56 km) off the west side of Osborne Turnpike approximately 1.2 miles (1.9 km) by road south of its intersection with State Highway 5.*Description of Outcrop:* White to very light-gray sticky and very plastic clay in a streambank with a maximum height of about 3.5 feet (1 m). A coarse, rounded, white sand with quartz pebbles overlies the clay and rounded quartz cobbles and pebbles underlie it.*Formation/(Age):* (Pliocene)*Sampled Interval:* Grab sample of a small lense and 1.5-foot (0.5 m) seam of clay.*Raw Properties:*

Working properties: plastic
 Water of plasticity: 18.7%
 Drying shrinkage: 5.0%
 Dry strength: good
 pH: 3.7

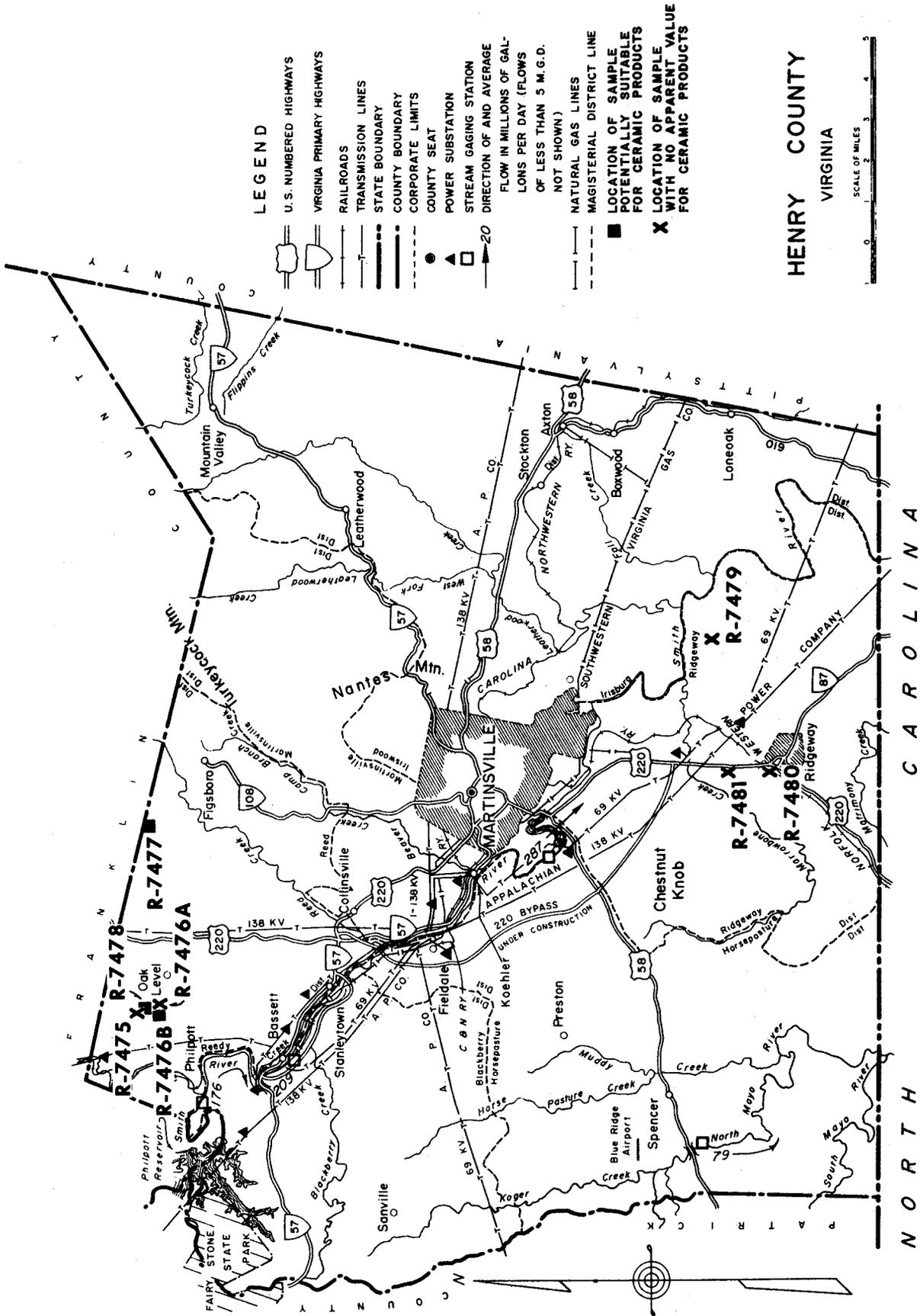
Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Pale orange yellow	4	5.0	18.2	32.6	1.81
1050	Yellowish white	5	5.0	18.0	32.9	1.81
1100	Pale yellow	5	5.0	17.1	31.4	1.84
1150	Pale yellow	6	5.0	16.0	29.8	1.87
1200	Grayish yellow	7	5.0	12.8	25.1	1.96
1250	Grayish yellow	7	7.5	10.5	21.4	2.04

Remarks: Excellent firing range, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., building brick, structural tile at 1,000° — 1,250°C).

VIRGINIA DIVISION OF MINERAL RESOURCES



SAMPLE: R-7475

COUNTY: Henry

Date: May, 1979—Tuscaloosa Research Center*Locality:* N4,073,920 E591,970 (Zone 17). Bassett 7.5-minute quadrangle. Pit on a ridge, 1.9 miles (3.0 km) west-southwest of Oak Level, approximately 0.2 mile (0.3 km) southwest of the intersection of State Road 606 with State Road 656.*Description of Outcrop:* White to pinkish-gray kaolinitic saprolite over an alaskite dike/sill. Quartz, scrap white mica as well as pieces of unweathered feldspar are in a pit 50 feet (15 m) by 70 feet (21 m) and 15 feet (5 m) deep. Overburden consists of a red-orange plastic clay.*Formation/(Age):* Residual clay on Fork Mountain Formation (Late Precambrian-Early Cambrian).*Sampled Interval:* Composite of a two-foot channel sample near the northeast side and the top of the pit and a one-foot channel sample taken 5 feet (2 m) from the bottom of the pit at the south side.*Raw Properties:*

Working properties:	short
Water of plasticity:	18.7%
Drying shrinkage:	0.0%
Dry strength:	poor
pH:	7.6

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Pale yellowish pink	2	0.0	22.6	36.5	1.62
1050	Pale yellowish pink	2	0.0	21.9	35.8	1.64
1100	Pinkish white	2	0.0	21.5	35.1	1.64
1150	Pinkish white	3	0.0	19.5	32.9	1.68
1200	Pinkish white	3	0.0	18.3	31.4	1.71
1250	Yellowish white	3	2.5	16.7	29.0	1.74

Remarks: Too soft, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Not suitable for structural clay products.

SAMPLE: R-7476-A and R-7476-B

COUNTY: Henry

Date: May, 1979—Tuscaloosa Research Center

Locality: N4,073,590 E592,040 (Zone 17). Bassett 7.5-minute quadrangle. Pit on a ridge 1.95 miles (3.14 km) southwest of Oak Level, approximately 0.35 mile (0.56 km) south of the intersection of State Road 606 with State Road 656.

Description of Outcrop: White to yellowish-gray kaolinitic saprolite over an alaskite dike/sill. Minor quartz, scrap mica (up to 3/8" in diameter) and some manganese near the middle of the sampled portion of R-7476-A from weathered out garnets or tourmaline is in a pit that is 70 feet (21 m) by 150 feet (46 m) and about 10 feet (3 m) deep.

Formation/(Age): Residual clay on the Fork Mountain Formation (Late Precambrian-Early Cambrian)

R-7476-A

Sampled Interval: Channel sample across 5 feet (2 m) of kaolinitic saprolite from the southwestern side of the pit.

Raw Properties:

Working properties: short
 Water of plasticity: 17.7%
 Drying shrinkage: 0.0%
 Dry strength: poor
 pH: 7.4

Slow Firing Test:

Temp. °C	Color	Hard- ness	%Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Pinkish white	2	0.0	29.8	43.2	1.45
1050	Yellowish white	2	0.0	27.0	40.8	1.52
1100	Pinkish white	2	0.0	26.1	40.4	1.55
1150	Pinkish white	3	2.5	24.0	38.1	1.59
1200	Pinkish white	3	2.5	23.0	37.3	1.62
1250	Pinkish white	3	2.5	22.2	36.0	1.62

Remarks: Too soft, no effervescence with HCl.

Analyses: (Virginia Division of Mineral Resources)

<i>Chemical:</i>		<i>Mineralogy:</i>
SiO ₂	56.43	Kaolinite
Al ₂ O ₃	30.27	Illite
Fe ₂ O ₃	0.60	Halloysite
CaO	0.00	Quartz
MgO	0.09	
Na ₂ O	0.14	
K ₂ O	1.68	
TiO ₂	0.03	
MnO	0.02	
P ₂ O ₅	0.00	
LOF	10.74	

Preliminary Bloating Test: Negative

Potential Use: Not suitable for structural clay products.

R-7476-B

Sampled Interval: Channel sample across 3 feet (1 m) of kaolinitic saprolite, below but including the bottom 1 foot of sample material R-7476-A.

Raw Properties:

Working properties: short
 Water of plasticity: 29.7%
 Drying shrinkage: 0.0%
 Dry strength: poor
 pH: 6.9

Slow Firing Test:

Temp. °C	Color	Hard- ness	%Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	White	2	2.5	35.6	49.1	1.32
1050	White	2	2.5	35.6	47.1	1.32
1100	White	2	2.5	34.4	47.1	1.35
1150	White	2	2.5	34.3	46.4	1.38
1200	White	2	2.5	32.7	45.1	1.40
1250	White	2	2.5	32.3	45.1	1.43

Remarks: Too soft, no effervescence with HCl.

Analyses: (Virginia Division of Mineral Resources)

<i>Chemical:</i>		<i>Mineralogy:</i>
SiO ₂	54.32	Kaolinite
Al ₂ O ₃	32.15	Illite
Fe ₂ O ₃	0.36	Halloysite
CaO	0.01	Quartz
MgO	0.03	
Na ₂ O	0.13	
K ₂ O	1.18	
TiO ₂	0.01	
MnO	0.02	
P ₂ O ₅	0.00	
LOF	11.78	

Preliminary Bloating Test: Negative

Pyrometric Cone Equivalent: 32 (3,123°F)

Potential Use: Not suitable for high-duty refractories.

SAMPLE: R-7477

COUNTY: Henry

Date: May, 1979—Tuscaloosa Research Center

Locality: N4,073,870 E598,880 (Zone 17). Bassett 7.5-minute quadrangle. Roadcut 2.5 miles (4.0 km) east of Oak Level, on the north side of State Road 657 approximately 0.65 mile (1.05 km) by road northeast of its intersection with State Road 609.

Description of Outcrop: White to pinkish, sandy kaolinitic saprolite over an alaskite dike/sill. Fine quartz, weathered and unweathered feldspar, fine mica and weathered garnets are in a 150-foot (46-m) roadcut with a maximum height of 10 feet (3 m). Alaskite material has a strike of N40°E and a dip of 55°SE. Overburden consists of light-brown plastic clay.

Formation/(Age): Residual clay on the Fork Mountain Formation (Late Precambrian-Early Cambrian)

Sampled Interval: Representative samples taken across 9 feet (3 m) of the most weathered part of the alaskite dike in the eastern part of the roadcut.

Raw Properties:

Working properties: short
 Water of plasticity: 22.0%
 Drying shrinkage: 0.0%
 Dry strength: poor
 pH: 7.0

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Pinkish white	2	0.0	24.9	38.0	1.52
1050	Pinkish white	2	0.0	23.5	36.9	1.57
1100	Pinkish white	2	0.0	23.3	36.6	1.57
1150	Pinkish white	2	2.5	21.1	34.2	1.62
1200	White	2	2.5	19.4	32.1	1.65
1250	White	3	2.5	17.2	29.4	1.70

Remarks: Too soft, no effervescence with HCl.

Analyses: (Virginia Division of Mineral Resources)

<i>Chemical:</i>		<i>Mineralogy:</i>
SiO ₂	73.85	Kaolinite
Al ₂ O ₃	19.22	Feldspar
Fe ₂ O ₃	0.57	Illite
CaO	0.01	Halloysite
MgO	0.08	Quartz
Na ₂ O	0.22	
K ₂ O	0.47	
TiO ₂	0.04	
MnO	0.01	
P ₂ O ₅	0.01	
LOF	5.51	

Preliminary Bloating Test: Negative

Pyrometric Cone Equivalent: 19-20 (2,806-2847°F).

Potential Use: Suitable for low-duty refractories.

SAMPLE: R-7478

COUNTY: Henry

Date: May, 1979 — Tuscaloosa Research Center*Locality:* N4, 073,680 E592,040 (Zone 17). Bassett 7.5-minute quadrangle. Pit on a ridge, 1.9 miles (3.0 km) southwest of Oak Level, approximately 0.3 mile (0.5 km) south of the intersection of State Road 606 with State Road 656.*Description of Outcrop:* White to light-yellow and pale-yellowish-orange kaolinitic saprolite over an alaskite dike/sill. Little quartz and little mica is in the weathered feldspar in a 40 foot (12 m) diameter pit that is 10 feet (3 m) deep. The clay material grades from loamy light yellow to orange at the top to white at the base. Some garnets have weathered out of the rock.*Formation/(Age):* Residual clay on the Fork Mountain Formation (Late Precambrian-Early Cambrian)*Sampled Interval:* Channel sample across 3.5 feet (1.1 m) in the lower half of the side of the pit.*Raw Properties:*

Working properties:	short
Water of plasticity:	26.1%
Drying shrinkage:	0.0%
Dry strength:	poor
pH:	7.0

Slow Firing Test:

Temp. °C	Color	Hard- ness	%Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Pale-yellowish-pink	2	0.0	35.3	47.4	1.34
1050	Pinkish white	2	0.0	34.7	47.2	1.36
1100	Pinkish white	2	2.5	33.2	45.7	1.38
1150	White	2	2.5	31.3	44.3	1.42
1200	White	2	2.5	29.6	42.7	1.44
1250	White	2	2.5	28.2	40.9	1.45

Remarks: Too soft, no effervescence with HCl.

Analyses: (Virginia Division of Mineral Resources)

<i>Chemical:</i>		<i>Mineralogy:</i>
SiO ₂	68.87	Kaolinite
Al ₂ O ₃	20.84	Illite
Fe ₂ O ₃	0.86	Quartz
CaO	0.00	Halloysite
MgO	0.16	
Na ₂ O	0.10	
K ₂ O	1.36	
TiO ₂	0.05	
MnO	0.04	
P ₂ O ₅	0.00	
LOF	7.71	

Preliminary Bloating Test: Negative*Pyrometric Cone Equivalent:* 30 (3,029°F)*Potential Use:* Suitable for medium-duty refractories.

SAMPLE: R-7479

COUNTY: Henry

Date: May, 1979 — Tuscaloosa Research Center

Locality: N4,051,080 E606,290 (Zone 17). Northwest Eden 7.5-minute quadrangle. Roadcut 3.35 miles (5.39 km) northeast of Ridgeway, on the southwest side of State Road 642 approximately 0.05 mile (0.08 km) by road north-northwest of its intersection with State Road 636.

Description of Outcrop: Very pale-orange and pale-yellowish-orange to grayish-orange plastic clay in a roadcut with a maximum height of 4 feet (1 m). The clay is mottled with reddish-orange plastic clay at the top of the exposure and there are increasing amounts of mottled medium-gray plastic clay towards the base of the exposure. Clay at the base is lighter yellow and contains more quartz and mica than parts higher in the cut; the basal part was not augered.

Formation/(Age): Residual clay

Sampled Interval: Channel sample across 3.5 feet (1 m) of clay.

Raw Properties:

Working properties: plastic
 Water of plasticity: 22.7%
 Drying shrinkage: 2.5%
 Dry strength: good
 pH: 6.8

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Pale orange yellow	3	5.0	20.5	34.3	1.67
1050	Pale orange yellow	3	5.0	19.1	33.0	1.73
1100	Pale orange yellow	3	5.0	17.0	30.0	1.76
1150	Pale orange yellow	3	7.5	12.4	23.4	1.88
1200	Light yellowish brown	3	7.5	10.5	20.2	1.92
1250	Light yellowish brown	3	7.5	10.3	19.9	1.92

Remarks: Too soft, no effervescence with HCl.

Preliminary Bloating Test: Negative

Potential Use: Not suitable for structural clay products.

SAMPLE: R-7480

COUNTY: Henry

Date: May, 1979—Tuscaloosa Research Center*Locality:* N4,048,960 E601,690 (Zone 17). Northwest Eden 7.5-minute quadrangle. Roadcut 0.45 mile (0.73 km) northwest of Ridgeway on the southeast side of Railroad Street approximately 0.1 mile (0.2 km) by road southwest of its intersection with Ridgeway Street (T639).*Description of Outcrop:* White to pale-yellow-orange kaolinitic saprolite over an alaskite dike/sill. Weathered feldspar, and quartz with very little mica as well as some manganese (?) from weathered-out garnets or tourmaline is in a roadcut that has a maximum height of 10 + feet (3 m).*Formation/(Age):* Residual clay on the Rich Acres Formation (Late Precambrian or Early Cambrian)*Sampled Interval:* Channel across 5 feet (2 m) of kaolinitic saprolite near the southwest end of the roadcut.*Raw Properties:*

Working properties: short
 Water of plasticity: 20.8%
 Drying shrinkage: 5.0%
 Dry strength: poor
 pH: 8.0

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Yellowish white	2	2.5	21.5	33.7	1.57
1050	Yellowish white	2	2.5	19.3	30.7	1.59
1100	Yellowish white	2	2.5	18.7	30.2	1.62
1150	Yellowish white	2	2.5	16.3	27.4	1.68
1200	Yellowish white	3	5.0	10.8	19.6	1.81
1250	Yellowish gray	3	7.5	4.4	9.0	2.01

Remarks: Too soft, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Not suitable for structural clay products.

SAMPLE: R-7481

COUNTY: Henry

Date: May, 1979 — Tuscaloosa Research Center*Locality:* N4,050,290 E601,690 (Zone 17). Northwest Eden 7.5-minute quadrangle. Bankcut, 1.25 miles (2.01 km) north of Ridgeway, off the west side of U.S. Highway 220 approximately 0.5 mile (0.8 km) by road north of its intersection with U.S. Highway 220 Business.*Description of Outcrop:* White sandy kaolinitic saprolite in an alaskite dike/sill in a talc schist; quartz, minor mica, kaolin, and the weathered remains of garnets are in the material in the long bankcut with maximum height of 12 feet (4 m). The material has a strike of N62°E and a dip of 37°SE.*Formation/(Age):* Residual clay*Sampled Interval:* Representative samples across a 6 foot (2 m) width of the easternmost portion of the alaskite material.*Raw Properties:*

Working properties: short
 Water of plasticity: 23.6%
 Drying shrinkage: 2.5%
 Dry strength: poor
 pH: 8.2

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Yellowish white	2	2.5	25.6	37.8	1.45
1050	Yellowish white	2	2.5	25.0	36.4	1.48
1100	Yellowish white	2	2.5	23.8	35.8	1.51
1150	Yellowish white	3	2.5	21.4	33.5	1.56
1200	Yellowish white	3	5.0	16.9	28.2	1.66
1250	Yellowish white	3	5.0	15.3	26.0	1.71

Remarks: Too soft, no effervescence with HCl.

Analyses: (Virginia Division of Mineral Resources)

<i>Chemical:</i>		<i>Mineralogy:</i>
SiO ₂	64.83	Kaolinite
Al ₂ O ₃	22.75	Halloysite
Fe ₂ O ₃	0.53	Illite
CaO	0.40	Feldspar
MgO	0.06	Quartz
Na ₂ O	2.22	
K ₂ O	2.07	
TiO ₂	0.02	
MnO	0.00	
P ₂ O ₅	0.00	
LOF	7.10	

Preliminary Bloating Test: Negative*Potential Use:* Not suitable for structural clay products.

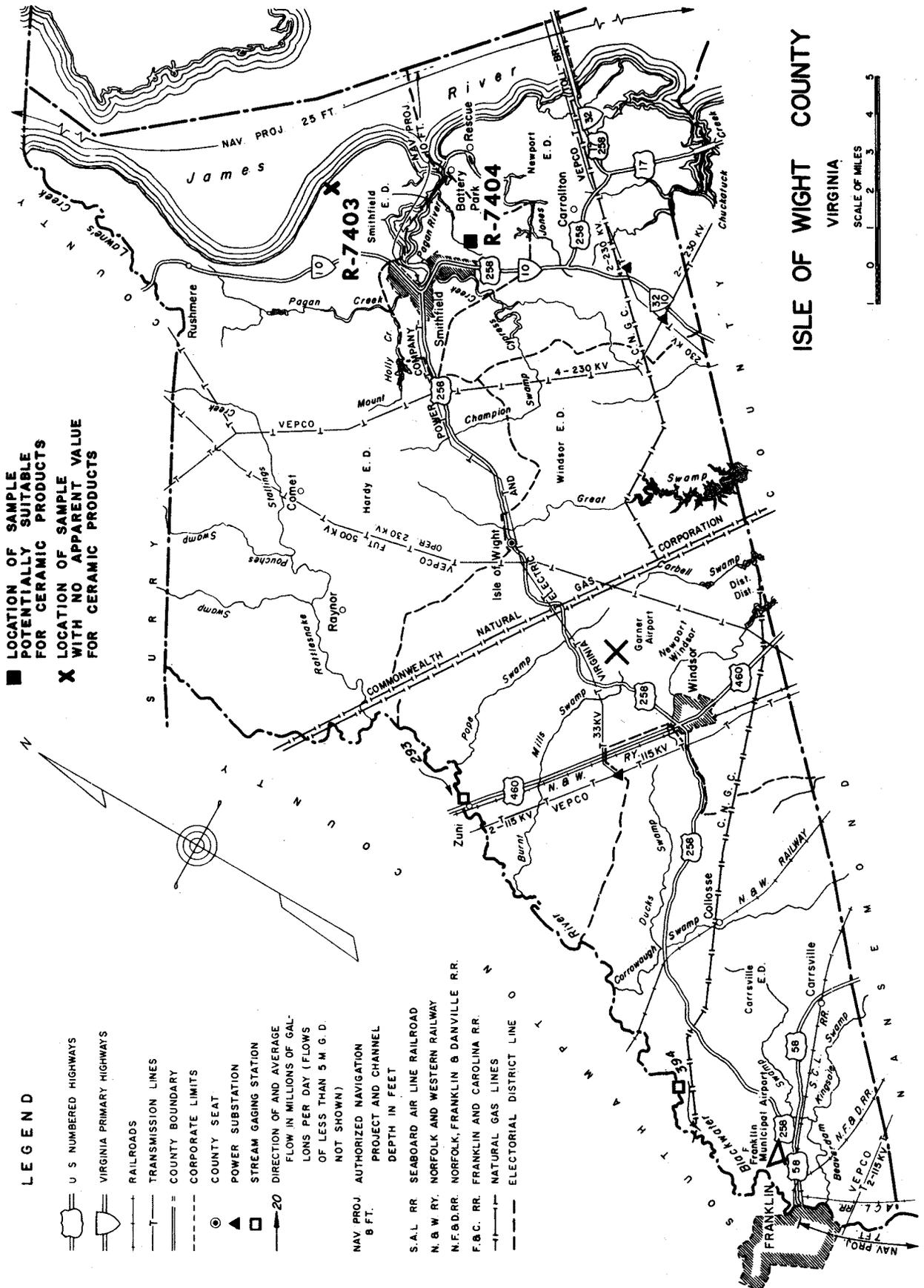


Figure 21.

SAMPLE: R-7403

COUNTY: Isle of Wight

Date: March, 1979—Tuscaloosa Research Center*Locality:* N4,099,530 E357,500 (Zone 18). Mulberry Island 7.5-minute quadrangle. Bluff along James River at Mogarts Beach north of State Road 673.*Description of Outcrop:* Very pale-orange or moderate-yellowish-brown and dark-grayish-brown, plastic clay with some broken shell fragments in a 15-foot (5-m) river bluff. Clay contains a few fossils.*Formation/(Age):* Yorktown (Pliocene)*Sampled Interval:* Channel sample across 8 (2 m) feet of clay.*Raw Properties:*

Working properties:	Plastic
Water of plasticity:	22.1%
Drying shrinkage:	5.0%
Dry strength:	good
pH:	7.8

Slow Firing Test: Material failed to form cohesive mass when tested.

Remarks: Slight effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Not suitable for structural clay products.

SAMPLE: R-7404

COUNTY: Isle of Wight

Date: March, 1979—Tuscaloosa Research Center*Locality:* N4,093,010 E357,320 (Zone 18). Bennis Church 7.5-minute quadrangle. Roadcut, 1.7 miles (2.7 km) east-southeast of Smithfield, on the south side of State Road 704 in front of the Church of Christ, 0.4 mile (0.6 km) by road east of its intersection with State Highway 10.*Description of Outcrop:* Light-gray and yellowish-gray, olive-gray and dark-grayish-brown plastic clay in ditchcut. An additional two and one-half feet of plastic clay was augered at the base of the exposure. Dark-yellowish-orange material at the base of the auger hole is very sandy.*Formation/(Age):* Sand Bridge (Pleistocene?)*Sampled Interval:* Representative channel sample across 2.5 feet (0.8 m) of augered clay.*Raw Properties:*

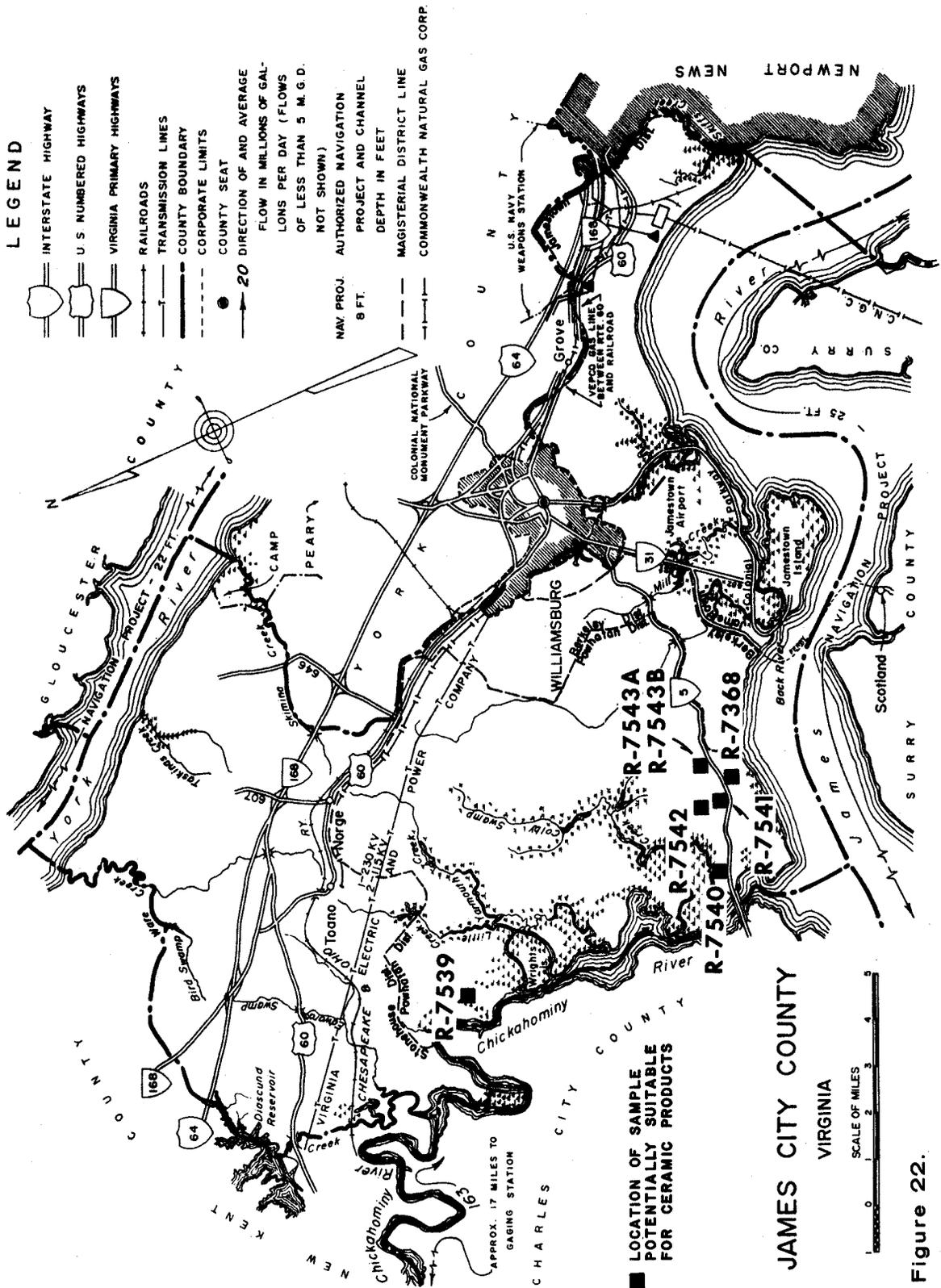
Working properties:	plastic
Water of plasticity:	21.7%
Drying shrinkage:	5.0%
Dry strength:	good
pH:	6.5

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange yellow	3	5.0	15.2	28.4	1.86
1050	Moderate orange	3	5.0	13.7	26.0	1.90
1100	Moderate orange	3	5.0	12.9	24.6	1.92
1150	Grayish reddish orange	4	7.5	9.9	19.8	2.00
1200	Grayish reddish orange	4	7.5	7.3	15.0	2.06
1250	Light reddish brown	5	10.0	5.6	11.8	2.10

Remarks: No effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., building brick, floor brick at 1,150°—1,250°C).



SAMPLE: R-7368

COUNTY: James City

Date: December, 1978—Tuscaloosa Research Center*Locality:* N4,123,740 E338,310 (Zone 18). Surry 7.5-minute quadrangle. Auger hole, 3.15 miles (5.07 km) west of Five Forks, 0.45 mile (0.73 km) off the south side of State Highway 5 at a point approximately 1.0 mile (1.6 km) by road east of its intersection with State Road 613.*Description of Outcrop:* Light-olive-gray, slightly silty clay covered by approximately 3 feet (1 m) of weathered dark-yellowish-orange overburden.*Formation/(Age):* Norfolk Formation (Pliocene)*Sampled Interval:* Representative composite sample of 3 feet (1 m) of augered clay.*Raw Properties:*

Working properties: plastic
 Water of plasticity: 23.4%
 Drying shrinkage: 5.0%
 Dry strength: good
 pH: 6.2

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Pale orange yellow	3	7.5	12.7	24.6	1.93
1050	Moderate orange	4	10.0	10.2	20.5	2.02
1100	Moderate orange	5	10.0	7.9	16.7	2.11
1150	Brownish orange	5	10.0	4.3	9.5	2.23
1200	Moderate reddish brown	6	10.0	1.7	4.0	2.32
1250	—	—	Melted	—	—	—

Remarks: No effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., building brick at 1,050°—1,200°C).

SAMPLE: R-7539

COUNTY: James City

Date: April, 1980 — Tuscaloosa Research Center*Locality:* N4,135,130 E334,570 (Zone 18). Norge 7.5-minute quadrangle. Auger hole 5.5 miles (8.8 km) west of Norge, on the northwest side of State Road 659 approximately 2.3 miles (3.7 km) by road southwest of its intersection with State Road 610.*Description:* Light-gray, yellowish-gray and grayish-orange and some dark-yellowish-orange plastic to silty clay and some carbonaceous material.*Formation/(Age):* Norfolk Formation (Pliocene)*Sampled Interval:* One foot (1.5-2.5 foot interval), of augered clay.*Raw Properties:*

Working properties: plastic
 Water of plasticity: 20.1%
 Drying shrinkage: 5.0%
 Dry strength: good
 pH: 4.2

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	5.0	17.4	31.5	1.81
1050	Moderate orange	3	5.0	16.7	30.6	1.84
1100	Moderate orange	3	7.5	14.5	27.4	1.89
1150	Moderate orange	4	7.5	11.6	23.0	1.97
1200	Brownish orange	5	10.0	8.4	17.3	2.06
1250	Grayish reddish orange	5	10.0	6.2	13.3	2.14

Remarks: No effervescence with HCl.

Analyses: (Virginia Division of Mineral Resources)*Chemical:*

SiO ₂	73.27	
Al ₂ O ₃	13.06	(USBM-12.1)
Fe ₂ O ₃	3.18	
CaO	0.07	
MgO	0.48	
Na ₂ O	0.37	
K ₂ O	1.44	
TiO ₂	1.06	
MnO	0.01	
P ₂ O ₅	0.01	
LOF	7.02	

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., building brick at 1,150° — 1,250°C).

SAMPLE: R-7540

COUNTY: James City

Date: April, 1980 — Tuscaloosa Research Center*Locality:* N4,125,300 E334,900 (Zone 18). Norge 7.5-minute quadrangle. Auger hole, 5.3 miles (8.5 km) west of Five Forks, off the north side of State Highway 5 and just east of the road to Claybank Landing.*Description:* Light-gray, yellowish-gray and grayish-orange plastic to silty clay.*Formation/(Age):* Norfolk Formation (Pliocene)*Sampled Interval:* One foot (from 2.5- to 3.5-foot interval) of augered clay.*Raw Properties:*

Working properties:	plastic
Water of plasticity:	23.5%
Drying shrinkage:	5.0%
Dry strength:	good
pH:	3.8

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Pale orange yellow	3	5.0	19.8	34.7	1.75
1050	Pale orange yellow	3	5.0	18.8	33.4	1.78
1100	Pale orange yellow	3	7.5	17.1	31.3	1.83
1150	Moderate orange	4	7.5	13.7	26.5	1.93
1200	Moderate orange	5	10.0	9.5	19.4	2.05
1250	Moderate orange	5	10.0	6.6	14.0	2.13

Remarks: No effervescence with HCl.

Analyses: (Virginia Division of Mineral Resources)

<i>Chemical:</i>	
SiO ₂	71.27
Al ₂ O ₃	15.03 (USBM-13.6)
Fe ₂ O ₃	2.75
CaO	0.05
MgO	0.50
Na ₂ O	0.30
K ₂ O	1.52
TiO ₂	1.13
MnO	0.01
P ₂ O ₅	0.03
LOF	7.38

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., building brick at 1,150° — 1,250°C).

SAMPLE: R-7541

COUNTY: James City

Date: April, 1980 — Tuscaloosa Research Center*Locality:* N4,124,650 E336,980 (Zone 18). Norge 7.5-minute quadrangle. Auger hole, 4 miles (6 km) west of Five Forks, off the southeast side of State Road 613 approximately 0.15 mile (0.24 km) by road northeast of its intersection with State Highway 5.*Description:* Yellowish-gray, light-gray with some grayish-orange to dark-yellowish-orange plastic clay in floodplain deposits.*Formation/(Age):* Norfolk Formation (Pliocene)*Sampled Interval:* Sample of 1 foot (from 3.5-4.5 foot interval) of augered clay.*Raw Properties:*

Working properties: plastic
 Water of plasticity: 24.4%
 Drying shrinkage: 5.0%
 Dry strength: good
 pH: 3.9

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	7.5	17.4	31.5	1.81
1050	Moderate orange	3	7.5	15.5	28.9	1.87
1100	Moderate orange	4	10.0	13.2	25.6	1.95
1150	Brownish orange	5	10.0	9.6	19.7	2.05
1200	Strong brown	5	10.0	6.7	14.2	2.14
1250	Strong brown	6	12.5	5.0	11.1	2.20

Remarks: Good firing range, slightly high shrinkage at 1,250°C; no effervescence with HCl.

Analyses: (Virginia Division of Mineral Resources)

<i>Chemical:</i>	
SiO ₂	71.39
Al ₂ O ₃	14.15 (USBM-13.4)
Fe ₂ O ₃	3.55
CaO	0.11
MgO	0.52
Na ₂ O	0.51
K ₂ O	1.98
TiO ₂	0.96
MnO	0.01
P ₂ O ₅	0.03
LOF	6.75

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., building brick at 1,100° — 1,250°C).

SAMPLE: R-7542

COUNTY: James City

Date: April, 1980—Tuscaloosa Research Center*Locality:* N4,125,470 E337,100 (Zone 18). Norge 7.5-minute quadrangle. Auger hole, 4 miles (6 km) west of Five Forks, off the south side of a private road approximately 0.5 mile (0.8 km) by road west of its intersection with State Road 613.*Description:* Light-gray, yellowish-gray and some dark-yellowish-orange plastic clay in floodplain deposits.*Formation/(Age):* Norfolk Formation (Pliocene)*Sampled Interval:* One foot (4.0-5.0 foot interval) of augered clay.*Raw Properties:*

Working properties:	plastic
Water of plasticity:	23.5%
Drying shrinkage:	5.0%
Dry strength:	good
pH:	3.8

Slow Firing Test:

<i>Temp.</i> °C	<i>Color</i>	<i>Hard- ness</i>	<i>% Lin. Shk.</i>	<i>% Abs.</i>	<i>% Appar. Poros.</i>	<i>Bulk Dens. gm/cc</i>
1000	Moderate orange	3	7.5	14.9	28.2	1.89
1050	Moderate orange	3	10.0	13.3	25.3	1.91
1100	Moderate orange	4	10.0	9.0	18.6	2.06
1150	Grayish reddish orange	5	10.0	5.8	12.5	2.17
1200	Strong brown	5	12.5	3.6	8.0	2.25
1250	Moderate reddish brown	6	12.5	1.8	4.2	2.34

Remarks: Good firing range, slightly high shrinkage at 1,200°—1,250°C, no effervescence with HCl.

Analyses: (Virginia Division of Mineral Resources)*Chemical:*

SiO ₂	64.02	
Al ₂ O ₃	17.63	(USBM-15.6)
Fe ₂ O ₃	4.75	
CaO	0.04	
MgO	0.71	
Na ₂ O	0.40	
K ₂ O	2.06	
TiO ₂	0.96	
MnO	0.01	
P ₂ O ₅	0.01	
LOF	9.36	

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., building brick, floor brick at 1,100°—1,250°C).

SAMPLE: R-7543-A and R-7543-B

COUNTY: James City

Date: April, 1980 — Tuscaloosa Research Center*Locality:* N4,124,670 E338,570 (Zone 18). Norge 7.5-minute quadrangle. Auger hole 3 miles (5 km) west of Five Forks, 0.15 miles (0.24 km) along a road north of State Hwy. 5 and just north of the pipeline approximately 1.15 miles (1.85 km) by road east of its intersection with State Road 613.

R-7543-A

Description: Grayish-orange to dark-yellowish-orange silty clay.*Formation/(Age):* Norfolk Formation (Pliocene)*Sampled Interval:* Six inches (from 2.5-3.0 foot interval) of augered clay.*Raw Properties:*

Working properties: plastic
 Water of plasticity: 28.1%
 Drying shrinkage: 5.0%
 Dry strength: good
 pH: 3.7

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	5.0	20.8	36.6	1.76
1050	Moderate orange	3	7.5	19.4	35.2	1.81
1100	Brownish orange	3	10.0	15.8	30.3	1.91
1150	Brownish orange	4	10.0	11.4	23.5	2.06
1200	Strong brown	5	12.5	9.4	20.0	2.12
1250	Strong brown	5	12.5	6.9	15.2	2.20

Remarks: Slightly high shrinkage at 1,200° — 1,250°C, no effervescence with HCl.

Analyses: (Virginia Division of Mineral Resources)*Chemical:*

SiO ₂	60.39	
Al ₂ O ₃	14.65	(USBM-12.0)
Fe ₂ O ₃	11.91	
CaO	0.04	
MgO	0.57	
Na ₂ O	0.27	
K ₂ O	1.58	
TiO ₂	0.92	
MnO	0.02	
P ₂ O ₅	0.04	
LOF	9.64	

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., building brick, roofing tile at 1,150° — 1,250°C).

R-7543-B

Description: Light-gray, yellowish-gray and a small amount of grayish-orange clay.

Sampled Interval: Six inches (from 4.5-5.0 foot interval) of augered clay.

Raw Properties:

Working properties: plastic
 Water of plasticity: 20.3%
 Drying shrinkage: 5.0%
 Dry strength: good
 pH: 3.7

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Pale orange yellow	3	5.0	17.6	31.9	1.80
1050	Pale orange yellow	3	7.5	17.3	31.4	1.81
1100	Moderate orange	3	7.5	17.2	31.1	1.82
1150	Moderate orange	4	7.5	13.4	25.4	1.90
1200	Brownish orange	5	10.0	11.5	22.7	1.97
1250	Strong brown	5	10.0	9.2	18.7	2.04

Remarks: No effervescence with HCl.

Sampled Interval: Six inches (from 4.5-5.0 foot interval) of augered clay.

Analyses: (Virginia Division of Mineral Resources)

Chemical:

SiO ₂	71.58	
Al ₂ O ₃	14.62	(USBM-13.7)
Fe ₂ O ₃	2.99	
CaO	0.09	
MgO	0.51	
Na ₂ O	0.50	
K ₂ O	1.82	
TiO ₂	0.97	
MnO	0.01	
P ₂ O ₅	0.01	
LOF	6.88	

Preliminary Bloating Test: Negative

Potential Use: Structural clay products (e.g., building brick at 1,150°–1,125°C).

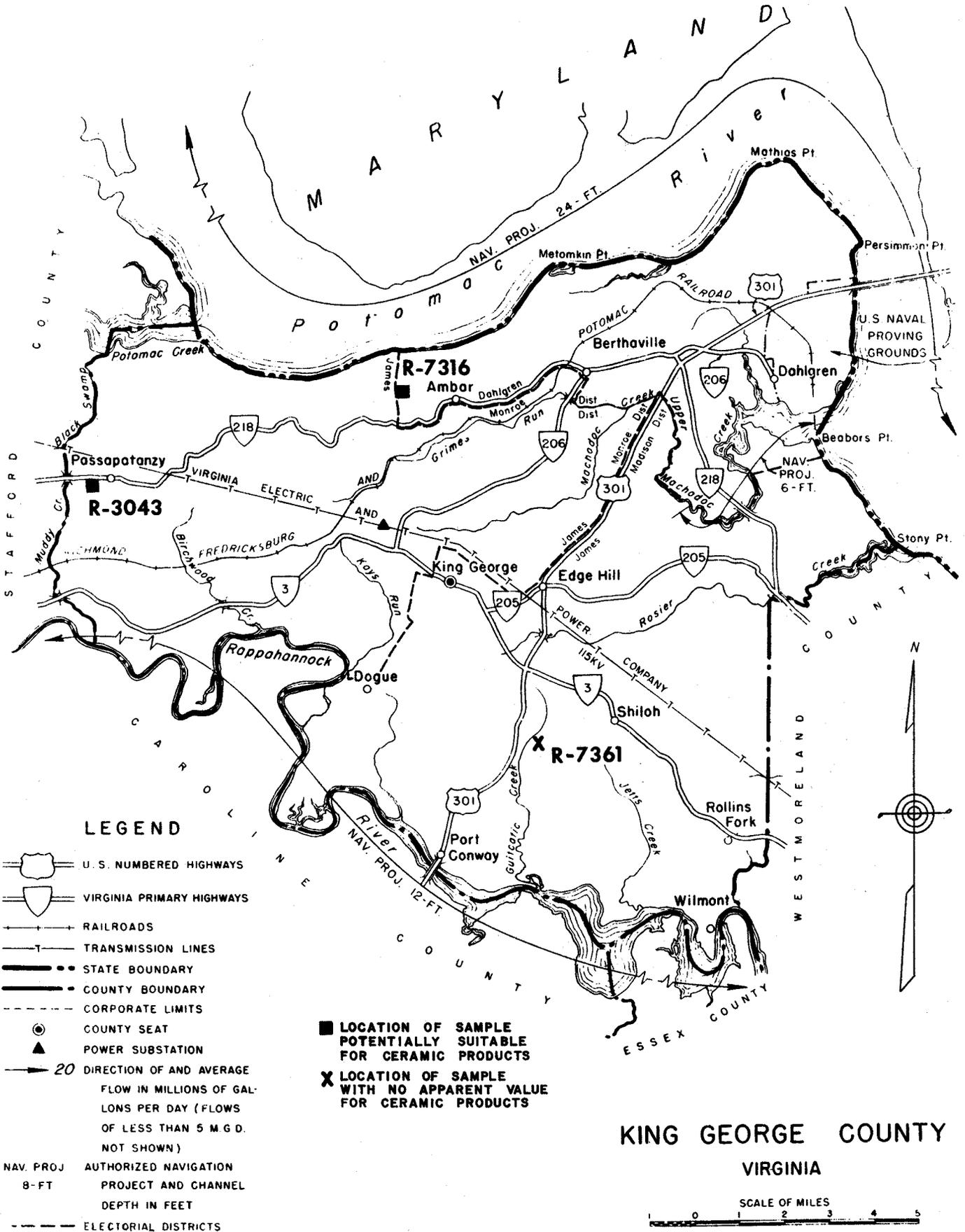


Figure 23.

SAMPLE: R-3043

COUNTY: King George

Date: July, 1966—Tuscaloosa Research Center*Locality:* N4,241,230 E296,600 (Zone 18). Passapatanzy 7.5-minute quadrangle. Roadcut, 0.5 mile (0.8 km) west of Passapatanzy, on the south side of State Highway 218, just west of its intersection with State Road 651.*Description of Outcrop:* An exposure of light-gray diatomaceous sediments, mottled in places by yellowish-orange iron-oxide staining in a 150-foot (46-m) roadcut with a maximum height of 9.5 feet (2.9 m). The upper three to four feet contain some fine-grained quartz sand. The material weathers into small, flat fragments, and is overlain by one-half foot of overburden.*Formation/(Age):* Calvert Formation (Miocene)*Sampled Interval:* Sample across 9 feet (3 m) of diatomaceous sediments.*Raw Properties:*

Working properties: low plasticity
 Water of plasticity: 68.1%
 Drying shrinkage: 2.5%
 Dry strength: low
 pH: 3.5

Slow Firing Test:

Temp. °F	Color	Hard- ness	%Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1800	Tan	2	5.0	60.6	57.6	0.95
1900	Tan	2	10.0	53.6	54.1	1.01
2000	Tan	2	15.0	39.4	47.3	1.20
2100	Buff	3	20.0	18.1	29.1	1.61
2200	Gray	4	25.0	4.8	9.6	1.99
2300	Gray	5	27.5	4.3	8.6	2.01

Remarks: High absorbency but slakes in water and oil, poor decolorizer, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Inert filler.

SAMPLE: R-7316

COUNTY: King George

Date: June, 1978—Tuscaloosa Research Center

Locality: N4,244,040 E307,400 (Zone 18). King George 7.5-minute quadrangle. Roadcut, about 2.2 miles (3.5 km) east of Fairview Beach on the east side of State Road 642 approximately 0.1 mile (0.2 km) by road south of its intersection with State Road 682.

Description of Outcrop: Very light-gray and yellowish-gray, plastic to silty clay, slightly diatomaceous, in a roadcut with a maximum height of 12 feet (4 m). The clay contains some dark-yellowish-orange to moderate-reddish-brown iron-oxide stain and clay mottles. Clay is more plastic near the top of the exposure and is more silty and diatomaceous near the base of the exposure. Clay is covered by several feet of yellowish-orange sandy clay with some light-gray clay.

Formation/(Age): Calvert Formation (Miocene)

Sampled Interval: Representative channel sample across 5 feet (2 m) of clay.

Raw Properties:

Working properties: short
 Water of plasticity: 28.3%
 Drying shrinkage: 7.5%
 Dry strength: fair
 pH: 7.4

Slow Firing Test:

Temp. °C	Color	Hard- ness	%Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	7.5	16.7	30.4	1.82
1050	Moderate orange	3	7.5	14.7	27.4	1.86
1100	Moderate orange	4	10.0	11.2	21.7	1.95
1150	Brownish orange	4	10.0	8.6	17.4	2.02
1200	Light reddish brown	4	12.5	3.7	8.1	2.16
1250	—	—	Melted	—	—	—

Remarks: No effervescence with HCl.

Preliminary Bloating Test: Negative

Potential Use: Structural clay products (e.g., building brick at 1,100°-1,200°C).

SAMPLE: R-7361

COUNTY: King George

Date: December, 1978—Tuscaloosa Research Center*Locality:* N4,231,090 E312,180 (Zone 18). Port Royal 7.5-minute quadrangle. Roadcut, 2.0 miles (3.2 km) south of Office Hall, on the north side of State Road 623 approximately 0.3 mile (0.5 km) by road west of its intersection with State Road 650.*Description of Outcrop:* Grayish-orange to dark-yellowish-orange plastic clay in a 500-foot (152-m) roadcut with a maximum height of 8 feet (2 m). The dark-yellowish-orange clay is mottled with moderate-red and moderate-reddish-brown, slightly silty clay is in the middle and lower part of the exposure; some light-gray clay mottles are also in the lower part of the exposure. Clay is overlain by about one foot of yellowish-gray, loamy overburden.*Formation/(Age):* (Pleistocene?)*Sampled Interval:* Representative channel sample across 6 feet (2 m) of clay.*Raw Properties:*

Working properties:	plastic
Water of plasticity:	26.0%
Drying shrinkage:	5.0%
Dry strength:	good
pH:	5.0

Slow Firing Test:

Temp. °C	Color	Hard- ness	%Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Brownish orange	3	7.5	22.4	38.2	1.70
1050	Brownish orange	3	7.5	20.0	36.1	1.80
1100	Brownish orange	3	10.0	16.5	31.3	1.90
1150	Strong brown	3	10.0	14.9	28.7	1.92
1200	Strong brown	3	10.0	14.5	28.2	1.94
1250	Moderate reddish brown	3	10.0	14.3	27.8	1.95

Remarks: Too soft, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Not suitable for structural clay products.

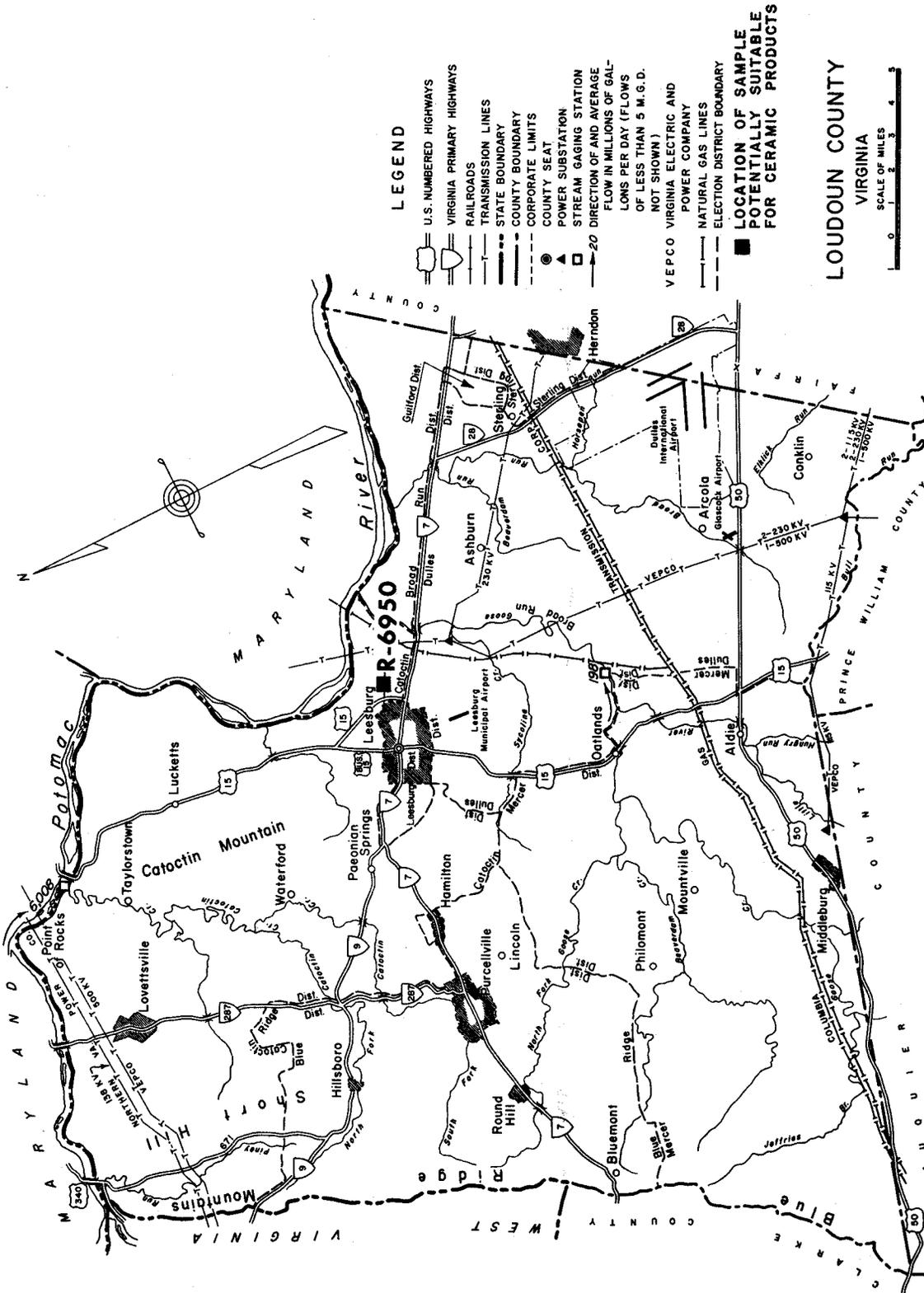


Figure 24.

SAMPLE: R-6950

COUNTY: Loudoun

Date: May, 1977—Tuscaloosa Research Center

Locality: N4,330,690 E282,820 (Zone 18). Leesburg 7.5-minute quadrangle. Roadcut 3.0 miles (4.8 km) east of downtown Leesburg, on the northwest side of State Road 773 approximately 1.85 miles (2.91 km) by road southeast of its intersection with U. S. Highway 15 (Bypass).

Description of Outcrop: About 20 feet (6 m) of pale-red and pale-reddish-brown to grayish-red, plastic clay and shale, with some black iron-oxide stain on bedding surfaces in a 300-foot (91-m) roadcut. A thin siltstone bed is about 10 feet (3 m) above the base of the exposure. The shale has a strike of N30°W and a dip of 22°SW.

Formation/(Age): (Triassic)

Sampled Interval: Composite of representative samples across 20 feet (6 m) of clay, shale and minor siltstone.

Raw Properties:

Working properties: short
 Water of plasticity: 17.7%
 Drying shrinkage: 0.0%
 Dry strength: good
 pH: 5.4

Slow Firing Test:

Temp. °C	Color	Hard- ness	%Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	2.5	16.7	13.1	1.86
1050	Moderate orange	3	5.0	15.4	29.2	1.89
1100	Brownish orange	4	5.0	10.0	20.8	2.08
1150	Strong brown	4	7.5	8.1	17.3	2.13
1200	Mod. reddish brown	6	10.0	3.8	8.6	2.28
1250	—	—	Melted	—	—	—

Remarks: No effervescence with HCl.

Preliminary Bloating Test: Negative

Potential Use: Structural clay products (e.g., building brick at 1,100°-1,200°C).

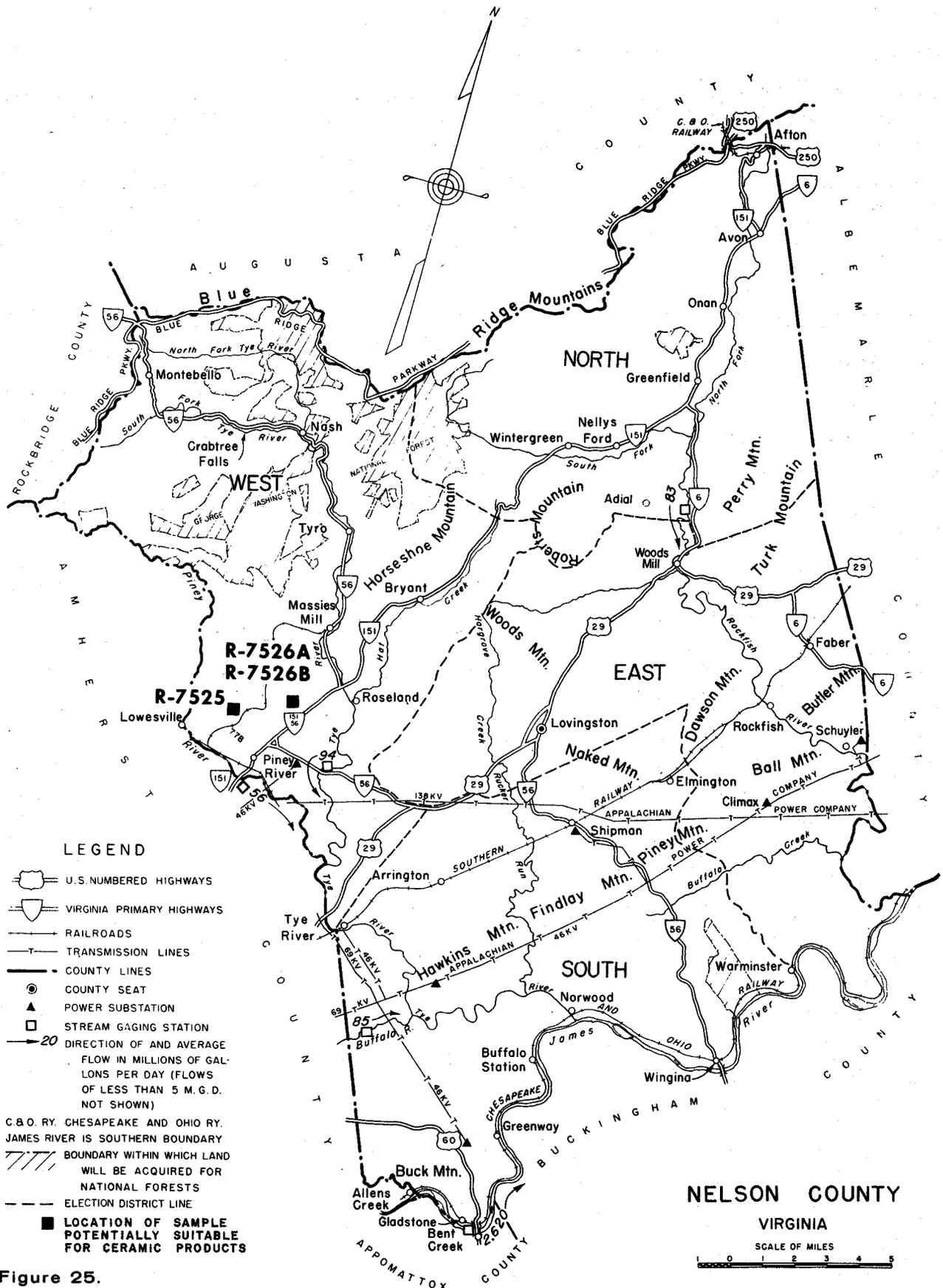


Figure 25.

SAMPLE: R-7525

COUNTY: Nelson

Date: December, 1979—Tuscaloosa Research Center

Locality: N4,177,280 E672,110 (Zone 17). Piney River 7.5-minute quadrangle. Trenchcut, 1.9 miles (3.0 km) northwest of Piney river, 0.25 mile (0.4 km) off the northwest side of State Road 676, on the property of B. W. Thompson.

Description of Outcrop: White clay stained very pale-orange to pale-reddish brown near the surface in a trenchcut (trends N50°E) on the side of a hill. The trenchcut is 8 feet (2 m) deep. Sample was taken near the lower part of the exposure in the northeast end of the trench. Overburden is dark-red.

Formation/(Age): Residual clay.

Sampled Interval: Representative sample across 4 feet (1 m) of white clay.

Raw Properties:

Working properties: plastic
 Water of plasticity: 44.6%
 Drying shrinkage: 0.0%
 Dry strength: good
 pH: 5.2

Slow Firing Test:

Temp. °C	Color	Hard- ness	%Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Pale yellowish pink	2	0.0	52.0	58.1	1.12
1050	Pale yellowish pink	2	0.0	50.6	57.1	1.14
1100	Yellowish white	2	0.0	48.2	56.6	1.17
1150	Yellowish white	2	2.5	43.2	53.8	1.25
1200	White	3	5.0	39.2	51.9	1.31
1250	White	3	5.0	36.3	49.8	1.37

Remarks: Too soft for structural clay products; no effervescence with HCl.

Analyses: (Virginia Division of Mineral Resources)*Chemical:*

SiO ₂	45.85
Al ₂ O ₃	35.55
Fe ₂ O ₃	2.09
CaO	0.00
MgO	0.65
Na ₂ O	0.12
K ₂ O	2.77
TiO ₂	0.19
MnO	0.01
P ₂ O ₅	0.01
LOF	12.75

Preliminary Bloating Test: Negative

Pyrometric Cone Equivalent: 31½

Potential Use: High duty refractories

SAMPLE: R-7526-A and R-7526-B

COUNTY: Nelson

Date: December, 1979—Tuscaloosa Research Center

Locality: N4,178,550 E675,220 (Zone 17). Piney River 7.5-minute quadrangle. Roadcut, 2.3 miles (3.7 km) north-northeast of Piney River, on the southeast side of State Road 676, just northeast of its intersection with State Road 678.

Description of Outcrop: White clay stained moderate-orange-pink, and light-brown in places in a roadcut with a maximum height of 7 feet (2 m). Clay near the top of an auger hole contains minor dark-yellowish-orange and moderate-red stain. Overburden consists of silty, yellowish-brown to brown clay.

Formation/(Age): Residual clay

R-7526-A

Sampled Interval: Representative sample across 4 feet (1 m) of clay.

Raw Properties:

Working properties: plastic
 Water of plasticity: 35.7%
 Drying shrinkage: 2.5%
 Dry strength: good
 pH: 4.8

Slow Firing Test:

Temp. °C	Color	Hard- ness	%Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Yellowish white	3	5.0	31.7	45.9	1.45
1050	White	3	5.0	30.5	45.0	1.47
1100	White	3	5.0	27.4	42.5	1.55
1150	White	3	7.5	22.5	37.7	1.68
1200	White	3	10.0	19.5	34.7	1.78
1250	White	4	10.0	18.1	33.0	1.82

Remarks: No effervescence with HCl.

Analyses: (Virginia Division of Mineral Resources)

<i>Chemical:</i>		<i>Mineralogy:</i>	
SiO ₂	47.84	Kaolinite	
Al ₂ O ₃	33.91	Feldspar	
Fe ₂ O ₃	0.88	Illite	
CaO	0.02	Halloysite	
MgO	0.17	Quartz	
Na ₂ O	0.22		
K ₂ O	2.34		
TiO ₂	0.25		
MnO	0.00		
P ₂ O ₅	0.00		
LOF	14.36		

Preliminary Bloating Test: Negative

Potential Use: Structural clay products (e.g., structural tile at 1,250°C).

R-7526-B

Sampled Interval: Three feet of augered clay

Raw Properties:

Working properties: plastic
 Water of plasticity: 28.6%
 Drying shrinkage: 0.0%
 Dry strength: good
 pH: 4.9

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	White	2	0.0	41.2	51.7	1.26
1050	White	2	0.0	36.7	49.2	1.34
1100	White	3	0.0	33.5	46.9	1.40
1150	White	3	2.5	30.1	44.2	1.47
1200	White	4	5.0	28.2	42.5	1.51
1250	White	4	5.0	27.1	41.7	1.54

Remarks: Too soft for structural clay products, no effervescence with HCl.

Analyses: (Virginia Division of Mineral Resources)

<i>Chemical:</i>		<i>Mineralogy:</i>
SiO ₂	50.70	Kaolinite
Al ₂ O ₃	31.22	Feldspar
Fe ₂ O ₃	0.87	Illite
CaO	0.10	Halloysite
MgO	0.25	Quartz
Na ₂ O	1.23	
K ₂ O	2.70	
TiO ₂	0.20	
MnO	0.01	
P ₂ O ₅	0.00	
LOF	12.71	

Preliminary Bloating Test: Negative

Pyrometric Cone Equivalent: 31

Potential Use: Medium-duty refractories.

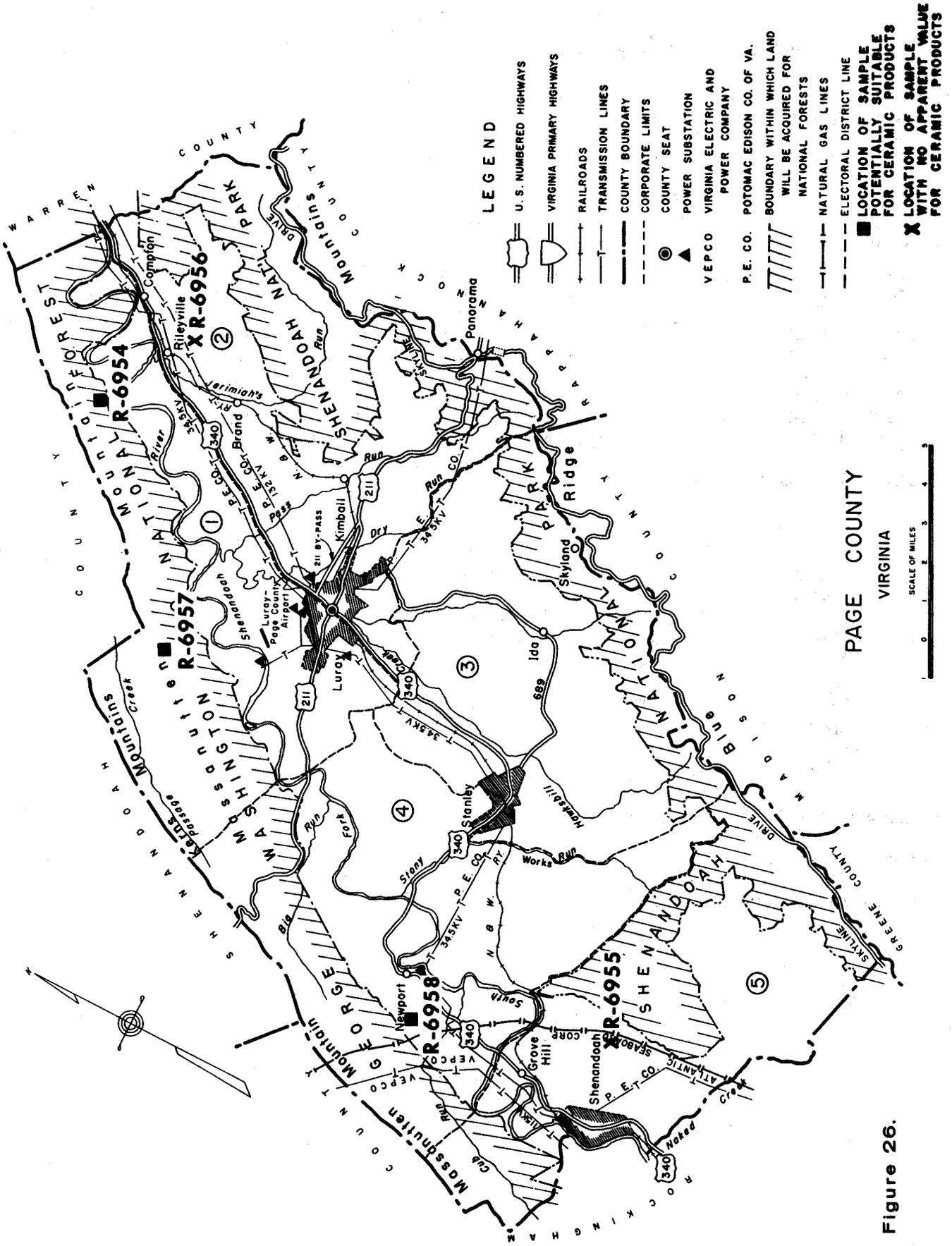


Figure 26.

SAMPLE: R-6954

COUNTY: Page

Date: June, 1977 – Tuscaloosa Research Center

Locality: N4,295,090 E724,100 (Zone 17). Rileyville 7.5-minute quadrangle. Roadcut 2.0 miles (3.2 km) northwest of Rileyville, on the north-northwest side of State Road 684 approximately 0.15 mile (0.24 km) by road west of its intersection with State Road 684 approximately 0.15 mile (0.24 km) by road west of its intersection with State Road 717.

Description of Outcrop: About 85 feet (26 m) of medium-light-gray to medium-dark-gray, thin-bedded silty shale and shale, slightly calcareous in places, in a 300-foot (91-m) roadcut with a maximum height of 6 feet (2 m). The shale has a strike of N37°E and a dip of 58 °SE; the beds are overturned. Some reddish-orange, iron-oxide stain is on bedding surfaces. Some of the material is weathered to a grayish-orange and light-olive-gray; there is one-foot (0.3 m) of loamy, light-orange overburden.

Formation/(Age): Martinsburg Formation (Ordovician)

Sampled Interval: Composite of representative samples taken across 85 feet (26 m) of shale in the roadcut.

Raw Properties:

Working properties: short
 Water of plasticity: 16.1%
 Drying shrinkage: 2.5%
 Dry strength: fair
 pH: 6.7

Slow Firing Test:

Temp. °C	Color	Hard- ness	%Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	2.5	12.3	24.6	2.00
1050	Brownish orange	3	5.0	12.1	24.0	1.98
1100	Strong brown	4	7.5	6.2	13.5	2.20
1150	Strong brown	5	7.5	4.4	9.8	2.23
1200	—	—	Melted	—	—	—
1250	—	—	—	—	—	—

Remarks: Presence of carbonate may cause problems, slight effervescence with HCl.

Preliminary Bloating Test: Negative

Potential Use: Structural clay products (e.g., building brick at 1,100°-1,150°C).

SAMPLE: R-6955

COUNTY: Page

Date: July, 1977 — Tuscaloosa Research Center*Locality:* N4,263,660 E710,440 (Zone 17). Elkton 7.5-minute quadrangle. On the north side of State Road 602 approximately 0.05 mile (0.1 km) by road east of its intersection with State Road 603.*Description of Outcrop:* Three feet (1 m) of dark-yellowish-orange to moderate-reddish-brown plastic clay, overlying 3 feet (1 m) of dark-yellowish-orange clay variegated with pale-yellowish-brown and moderate-brown, slightly plastic clay in a 270-foot (82-m) roadcut. Material is more silty and less plastic near the bottom of the roadcut. Some very pale-orange, plastic clay mottles are near the middle of the exposure. There is about two feet (1 m) of yellowish-gray, loamy overburden.*Formation/(Age):* Residual clay*Sampled Interval:* Channel sample across 6 feet (2 m) of clay in the northeasternmost part of the roadcut.*Raw Properties:*

Working properties: plastic
 Water of plasticity: 34.2%
 Drying shrinkage: 5.0%
 Dry strength: good
 pH: 5.8

Slow Firing Test:

<i>Temp.</i> °C	<i>Color</i>	<i>Hard- ness</i>	<i>%Lin. Shk.</i>	<i>% Abs.</i>	<i>% Appar. Poros.</i>	<i>Bulk Dens. gm/cc</i>
1000	Moderate orange	3	7.5	24.7	40.8	1.65
1050	Moderate orange	3	10.0	23.4	39.5	1.68
1100	Brownish orange	3	15.0	8.2	18.2	2.20
1150	Brownish orange	4	17.5	8.1	17.8	2.20
1200	Strong brown	5	17.5	5.8	13.1	2.27
1250	Moderate reddish brown	5	17.5	3.2	7.5	2.38

Remarks: High shrinkage, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Not suitable for structural clay products.

SAMPLE: R-6956

COUNTY: Page

Date: June, 1977 — Tuscaloosa Research Center*Locality:* N4,292,940 E728,290 (Zone 17). Bentonville 7.5-minute quadrangle. Roadcut 1.65 miles (2.66 km) south of Compton on the east side of State Road 605 at its intersection with State Road 662.*Description of Outcrop:* About 4 feet (1 m) of moderate-reddish-brown to dark-reddish-brown, plastic clay in a roadcut almost completely grassed over. Clay is slightly gritty and some siltstone pebbles are in the middle and bottom of the exposure. Some moderate-yellowish-brown clay mottles are near the base of the exposure. Overburden consists of light, reddish-orange plastic clay.*Formation/(Age):* Residual clay on Rome Formation(?)*Sampled Interval:* Composite of representative channel samples were taken across 4 feet (1 m) of clay.*Raw Properties:*

Working properties: plastic
 Water of plasticity: 37.9%
 Drying shrinkage: 7.5%
 Dry strength: good
 pH: 5.3

Slow Firing Test:

Temp. °C	Color	Hard- ness	%Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Deep orange	3	10.0	23.0	40.0	1.74
1050	Deep orange	3	12.5	21.7	38.6	1.78
1100	Brownish orange	3	15.0	9.2	20.5	2.21
1150	Brownish orange	3	17.5	9.0	19.9	2.22
1200	Brownish orange	3	17.5	8.7	19.4	2.23
1250	Strong brown	4	17.5	7.6	17.7	2.32

Remarks: High shrinkage, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Not suitable for structural clay products.

SAMPLE: R-6957

COUNTY: Page

Date: June, 1977 — Tuscaloosa Research Center*Locality:* N4,287,280 E715,910 (Zone 17). Hamburg 7.5-minute quadrangle. Roadcut 3.6 miles (5.8 km) north of Hamburg, on the northeast side of State Road 675, approximately 1.15 miles (1.85 km) by road W of its intersection with State Road 615.*Description of Outcrop:* About 60 feet (18 m) of olive-gray shale and grayish-orange weathered shale in a 250-foot (76-m) roadcut with a maximum height of 9 feet (3 m). Some dusky-blue stain is on bedding surfaces. Broken pieces of shale weather to light-olive-gray and grayish-orange. The shale has a strike of N32°E and a dip of 71°NW.*Formation/(Age):* Martinsburg Formation (Ordovician)*Sampled Interval:* Composite of representative samples, each taken across 60 feet (18 m) of shale.*Raw Properties:*

Working properties:	plastic
Water of plasticity:	18.5%
Drying shrinkage:	2.5%
Dry strength:	fair
pH:	5.5

Slow Firing Test:

Temp. °C	Color	Hard- ness	%Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	2.5	14.6	28.1	1.92
1050	Moderate orange	3	5.0	13.6	26.5	1.95
1100	Brownish orange	4	7.5	6.9	14.9	2.17
1150	Strong brown	5	7.5	6.5	14.1	2.17
1200	Mod. reddish-brown	6	7.5	3.4	7.6	2.26
1250	—	—	Expanded	—	—	—

Remarks: No effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., building and floor brick at 1,100°-1,200°C).

SAMPLE: R-6958

COUNTY: Page

Date: June, 1977—Tuscaloosa Research Center*Locality:* N4,271,150 E707,920 (Zone 17). Stanley 7.5-minute quadrangle. Roadcut 1.25 miles (2.01 km) southwest of Newport on the northwest side of State Road 685 approximately 0.7 mile (1.1 km) by road southwest of its intersection with State Road 651.*Description of Outcrop:* About 250 feet (76 m) of light-olive-gray shale, moderate-orangish-pink, very pale-orange and grayish-orange to moderate-reddish-brown weathered shale in a 400-foot (122-m) roadcut with a maximum height of 7 feet (2 m). The shale has a strike of N8°E and a dip of 73°SE; the beds are overturned. This weathered shale is predominantly a very plastic and sticky saprolite in much of the northeastern part of the roadcut. A thin siltstone bed is about half way up the roadcut.*Formation/(Age):* Martinsburg Formation (Ordovician)*Sampled Interval:* Composite of representative samples taken across 250 feet (76 m) of shale and clay.*Raw Properties:*

Working properties:	plastic
Water of plasticity:	22.8%
Drying shrinkage:	0.0%
Dry strength:	good
pH:	4.6

Slow Firing Test:

Temp. °C	Color	Hard- ness	%Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	2.5	19.5	34.6	1.78
1050	Moderate orange	3	5.0	18.0	32.6	1.81
1100	Brownish orange	4	7.5	9.1	19.0	2.09
1150	Brownish orange	5	7.5	7.1	15.3	2.14
1200	Strong brown	5	10.0	3.5	7.9	2.28
1250	Grayish reddish brown	6	10.0	1.7	3.8	2.26

Remarks: Good firing range, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., building and floor brick at 1,100°-1,250°C).

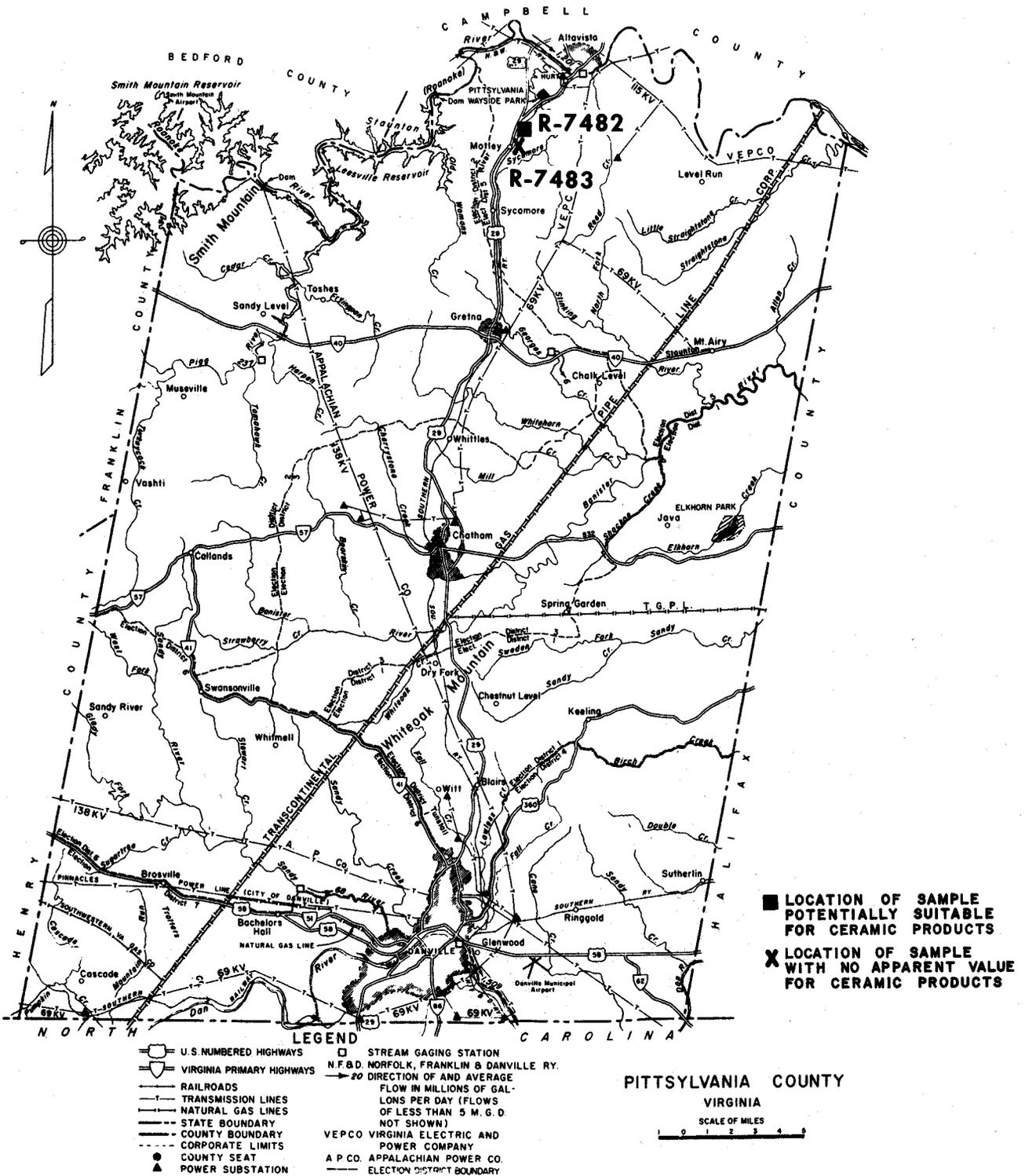


Figure 27.

SAMPLE: R-7482

COUNTY: Pittsylvania

Date: May, 1979—Tuscaloosa Research Center*Locality:* N4,103,250 E647,560 (Zone 17). Altavista 7.5-minute quadrangle. Railroad cut, 0.25 mile (0.4 km) south of Motley on the southeast side of the Southern Railway approximately 700 feet (213 m) by railway north east of its crossing at State Road 642.*Description of Outcrop:* White to light-red lens of kaolin in a garnet-mica-schist in railroad cut with a maximum height of 25 feet (8 m). Foliation strikes N50°E and dips 68°SE. The kaolin lens, which is about 4-feet (1-m) long and 1-foot thick, is stained dark red in places from the weathering of the enclosing schist.*Formation/(Age):* Residual clay*Sampled Interval:* Channel sample across and along the entire lens of kaolin.*Raw Properties:*

Working properties: short
 Water of plasticity: 27.4%
 Drying shrinkage: 2.5%
 Dry strength: poor
 pH: 7.4

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Pale yellowish pink	3	5.0	28.9	43.1	1.49
1050	Pale yellowish pink	3	5.0	26.6	40.8	1.53
1100	Pinkish white	3	5.0	26.2	40.3	1.54
1150	Pinkish white	3	5.0	26.0	40.2	1.55
1200	White	3	7.5	25.5	39.8	1.56
1250	White	3	7.5	24.0	38.7	1.61

Remarks: Too soft, no effervescence with HCl.

Analyses: (Virginia Division of Mineral Resources)

<i>Chemical:</i>		<i>Mineralogy:</i>
SiO ₂	45.40	Kaolinite
Al ₂ O ₃	37.99	Illite
Fe ₂ O ₃	0.47	Halloysite
CaO	0.02	
MgO	0.03	
Na ₂ O	0.16	
K ₂ O	0.36	
TiO ₂	0.02	
MnO	0.01	
P ₂ O ₅	0.00	
LOF	15.52	

Preliminary Bloating Test: Negative*Pyrometric Cone Equivalent:* 34—35 (3,205—3,245°F)*Potential Use:* Suitable for super-duty refractories.

SAMPLE: R-7483

COUNTY: Pittsylvania

Date: May, 1979—Tuscaloosa Research Center

Locality: N4,102,650 E647,050 (Zone 17). Altavista 7.5-minute quadrangle. Railroad cut, 0.65 mile (1.05 km) south of Motley on the southeast side of the Southern Railway approximately 0.35 mile (0.56 km) by railway southwest of its crossing at State Road 642.

Description of Outcrop: Pale-yellowish-orange and light-brown to dark-yellowish-orange plastic clay in a 750-foot (229-m) railroad cut with a maximum height of 12 feet (4 m). White to medium-light-gray plastic clay mottles are near the top of the exposure; gray clay mottles are near the bottom of the exposure. Material is saprolitic at base of exposure. There are some light-reddish-brown plastic clay mottles, and some quartz fragments. Clay was not augered because of slump at base of exposure.

Formation/(Age): Residual clay

Sampled Interval: Channel sample across top 6 feet (2 m) of exposure.

Raw Properties:

Working properties: plastic
 Water of plasticity: 37.9%
 Drying shrinkage: 5.0%
 Dry strength: good
 pH: 6.6

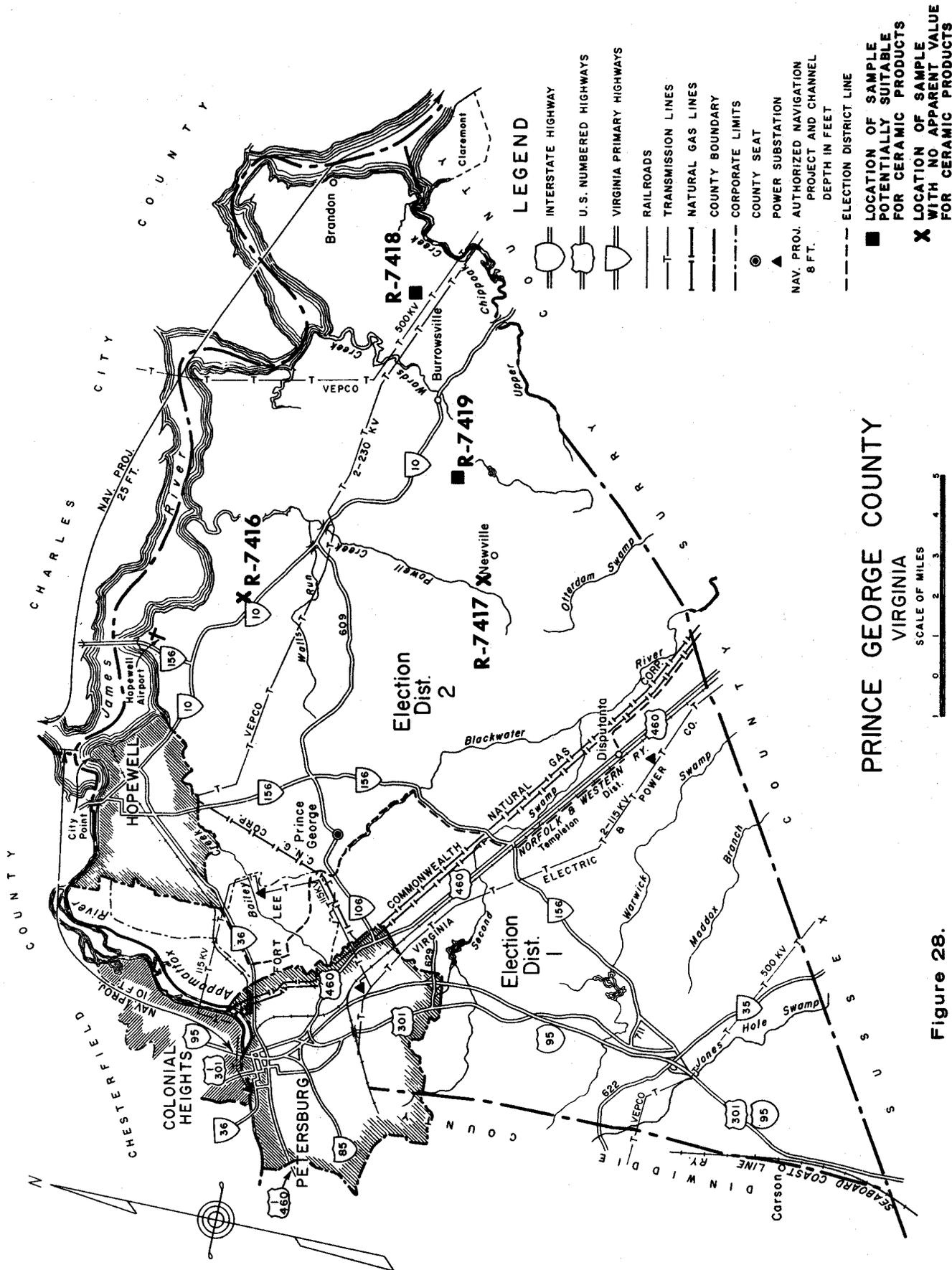
Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Brownish orange	3	7.5	28.2	44.3	1.57
1050	Brownish orange	3	7.5	25.0	41.6	1.66
1100	Strong brown	3	10.0	20.3	36.3	1.78
1150	Strong brown	3	15.0	13.0	26.5	2.04
1200	Strong brown	3	15.0	11.3	23.7	2.10
1250	Moderate reddish brown	3	15.0	10.0	21.6	2.16

Remarks: Too soft, high shrinkage, no effervescence with HCl.

Preliminary Bloating Test: Negative

Potential Use: Not suitable for structural clay products.



PRINCE GEORGE COUNTY VIRGINIA

Figure 28.

SAMPLE: R-7416

COUNTY: Prince George

Date: March, 1979—Tuscaloosa Research Center

Locality: N4,126,890 E305,890 (Zone 18). Westover 7.5-minute quadrangle. Roadcut 3.5 miles (5.6 km) southeast of Jordan Point, on the south side of State Road 641 approximately 0.4 mile (0.6 km) by road east of its intersection with State Highway 10.

Description of Outcrop: Grayish-orange to dark-yellowish-orange plastic clay in a 200-foot (61-m) roadcut with a maximum height of 4.5 feet (1.5 m). Some light-brown plastic clay mottles are near the middle and bottom of the exposure. Clay in an auger hole was silty and less plastic than that exposed. Minor quartz fragments are near the lower part of the exposure. Overburden consists of several inches of yellowish-brown silty.

Formation/(Age): (Pleistocene)

Sampled Interval: Composite of a representative channel sample across 4 feet (1 m) of clay and one foot of augered clay.

Raw Properties:

Working properties: plastic
 Water of plasticity: 27.4%
 Drying shrinkage: 5.0%
 Dry strength: good
 pH: 6.2

Slow Firing Test:

Temp. °C	Color	Hard- ness	%Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	7.5	20.8	36.3	1.74
1050	Moderate orange	3	7.5	17.0	31.5	1.85
1100	Moderate orange	3	10.0	14.9	28.6	1.92
1150	Brownish orange	3	10.5	13.8	26.7	1.93
1200	Strong brown	3	12.5	12.6	24.6	1.96
1250	Moderate reddish brown	3	12.5	12.1	23.7	1.97

Remarks: Too soft, no effervescence with HCl.

Preliminary Bloating Test: Negative

Potential Use: Not suitable for structural clay products.

SAMPLE: R-7417

COUNTY: Prince George

Date: March, 1979 — Tuscaloosa Research Center*Locality:* N4,117,820 E308,320 (Zone 18). Disputanta North 7.5-minute quadrangle. Roadcut, 0.7 mile (1.1 km) west-northwest of Newville on the north side of State Road 616 approximately 0.45 mile (0.73 km) by road east of its intersection with State Road 666.*Description of Outcrop:* Pale-yellowish-orange to dark-yellowish-orange plastic clay, with some light-gray and moderate-reddish-orange clay mottles from the center to the base of the exposure in a 120-foot (37-m) roadcut with a maximum height of 4.5 feet (1.5 m). Clay in auger hole is slightly silty, but plastic and tough; near the base the clay is a bright red. Overburden consists of 1.5 feet (0.5 m) of dark-yellowish-brown silty clay.*Formation/(Age):* (Pleistocene)*Sampled Interval:* Composite of representative channel sample across 3 feet (1 m) of clay and 3 feet (1 m) of augered clay.*Raw Properties:*

Working properties:	plastic
Water of plasticity:	24.2%
Drying shrinkage:	5.0%
Dry strength:	good
pH:	6.3

Slow Firing Test:

Temp. °C	Color	Hard- ness	%Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	5.0	19.7	34.8	1.77
1050	Moderate orange	3	7.5	19.1	34.1	1.78
1100	Moderate orange	3	7.5	17.8	32.6	1.82
1150	Brownish orange	3	10.0	17.6	32.0	1.83
1200	Strong brown	3	10.0	15.7	29.0	1.85
1250	Grayish reddish orange	3	10.0	14.8	27.3	1.85

Remarks: Too soft, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Not suitable for structural clay products.

SAMPLE: R-7418

COUNTY: Prince George

Date: March, 1979—Tuscaloosa Research Center

Locality: N4,122,020 E318,950 (Zone 18). Savedge 7.5-minute quadrangle. Roadcut, at Taylors Corner 2.2 miles (3.5 km) east-southeast of Burrowsville, on the east side of State Road 610 approximately 75 feet (23 m) by road south of its intersection with State Road 611.

Description of Outcrop: Very plastic dark-yellowish-orange clay with some brown to light-red shale in a 190-foot (58-m) roadcut with a maximum height of 4.5 feet (1.5 m). Clay is pale-yellowish-orange to light-yellowish-gray to very light-gray near the base of the exposure. At the base, the clay is hard, plastic and light-gray. Overburden consists of 6 inches (15 cm) of yellowish-gray clayey silt and contains rootlets.

Formation/(Age): St. Marys Formation (Miocene)

Sampled Interval: Representative channel sample across 4 feet (1 m) of clay.

Raw Properties:

Working properties: plastic
 Water of plasticity: 28.1%
 Drying shrinkage: 5.0%
 Dry strength: good
 pH: 6.0

Slow Firing Test:

Temp. °C	Color	Hard- ness	%Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	5.0	19.8	34.3	1.73
1050	Moderate orange	3	7.5	15.2	28.8	1.90
1100	Grayish reddish orange	3	10.0	11.9	23.5	1.98
1150	Grayish reddish orange	4	10.0	8.7	18.2	2.09
1200	Strong brown	4	10.0	4.5	9.8	2.18
1250	Moderate reddish brown	4	12.5	2.4	5.4	2.28

Remarks: No effervescence with HCl.

Preliminary Bloating Test: Negative

Potential Use: Structural clay products (e.g., floor brick, building brick at 1,150-1,250°C).

SAMPLE: R-7419

COUNTY: Prince George

Date: March, 1979 — Tuscaloosa Research Center*Locality:* N4,119,220 E312,210 (Zone 18). Savedge 7.5-minute quadrangle. Roadcut, 2.35 miles (3.78 km) west-southwest of Burrowsville, on the west side of State Road 616 approximately 0.35 mile (0.56 k) by road northeast of its intersection with State Road 658.*Description of Outcrop:* Very light-gray to light-gray, plastic clay, with some dark-yellowish-orange mottlings near the middle of the exposure in a 225-foot (69-m) roadcut with a maximum height of 7 feet (2 m). Some hard shaly material is near the base of the exposure. A minor amount of carbonaceous material is in the clay.*Formation/(Age):* St. Marys (Miocene)*Sampled Interval:* Representative channel sample across 4 feet (1 m) of clay.*Raw Properties:*

Working properties:	plastic
Water of plasticity:	21.8%
Drying shrinkage:	5.0%
Dry strength:	good
pH:	6.2

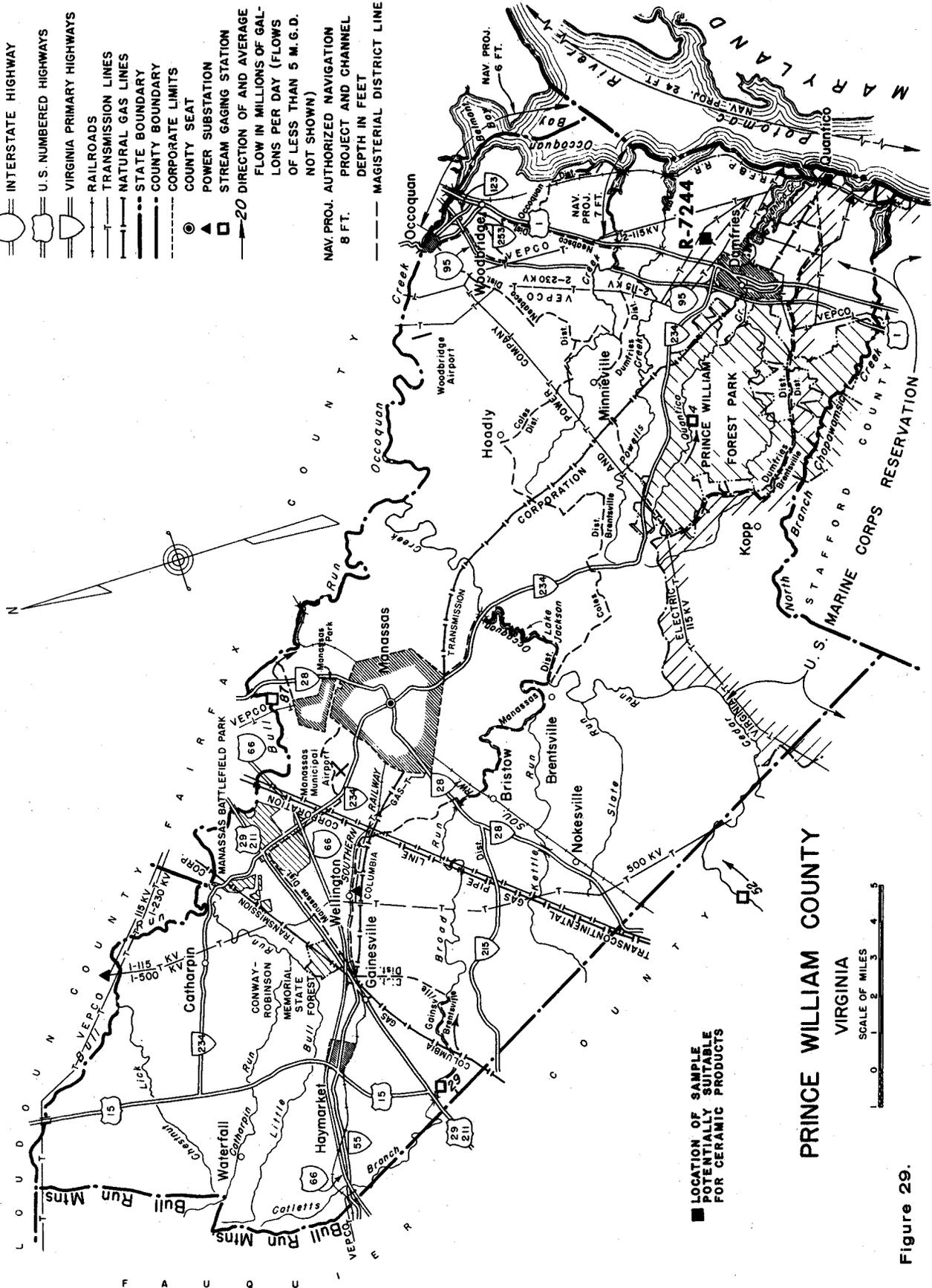
Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	5.0	17.8	31.4	1.76
1050	Moderate orange	3	5.0	17.0	30.9	1.81
1100	Moderate orange	3	5.0	14.8	27.7	1.87
1150	Grayish reddish orange	3	5.0	12.5	24.0	1.92
1200	Strong brown	4	7.5	9.6	19.3	2.01
1250	Moderate reddish brown	4	10.0	5.6	11.8	2.11

Remarks: No effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., building brick, floor brick at 1,200-1,250°C).

- LEGEND**
- INTERSTATE HIGHWAY
 - U.S. NUMBERED HIGHWAYS
 - VIRGINIA PRIMARY HIGHWAYS
 - RAILROADS
 - TRANSMISSION LINES
 - NATURAL GAS LINES
 - STATE BOUNDARY
 - COUNTY BOUNDARY
 - CORPORATE LIMITS
 - COUNTY SEAT
 - POWER SUBSTATION
 - STREAM GAGING STATION
 - DIRECTION OF AND AVERAGE FLOW IN MILLIONS OF GALLONS PER DAY (FLOWS OF LESS THAN 5 M.G.D. NOT SHOWN)
 - NAV. PROJ. AUTHORIZED NAVIGATION PROJECT AND CHANNEL DEPTH IN FEET
 - MAGISTERIAL DISTRICT LINE



PRINCE WILLIAM COUNTY
VIRGINIA



Figure 29.

SAMPLE: R-7244

COUNTY: Prince William

Date: April, 1978—Tuscaloosa Research Center

Locality: N4,217,930 E300,100 (Zone 18). Quantico 7.5-minute quadrangle. Roadcut, 1.8 miles (2.9 km) northeast of Dumfries on the north side of State Road 635 approximately 1.0 mile (1.6 km) by road southeast of its intersection with U. S. Highway 1.

Description of Outcrop: Yellowish-gray and pale-olive-brown plastic to slightly silty clay in a 225-foot (69-m) roadcut with a maximum height of 6 feet (2 m). Some dusky-yellow and reddish iron-oxide stain is on some of the clay. Minor amounts of quartz are in the clay; there are some rootlets. Material is covered by about one foot of sandy overburden.

Formation/(Age): Patuxent Formation (Cretaceous)

Sampled Interval: Representative channel sample across 4 feet (1 m) of clay.

Raw Properties:

Working properties: plastic
 Water of plasticity: 32.0%
 Drying shrinkage: 7.5%
 Dry strength: good
 pH: 4.9

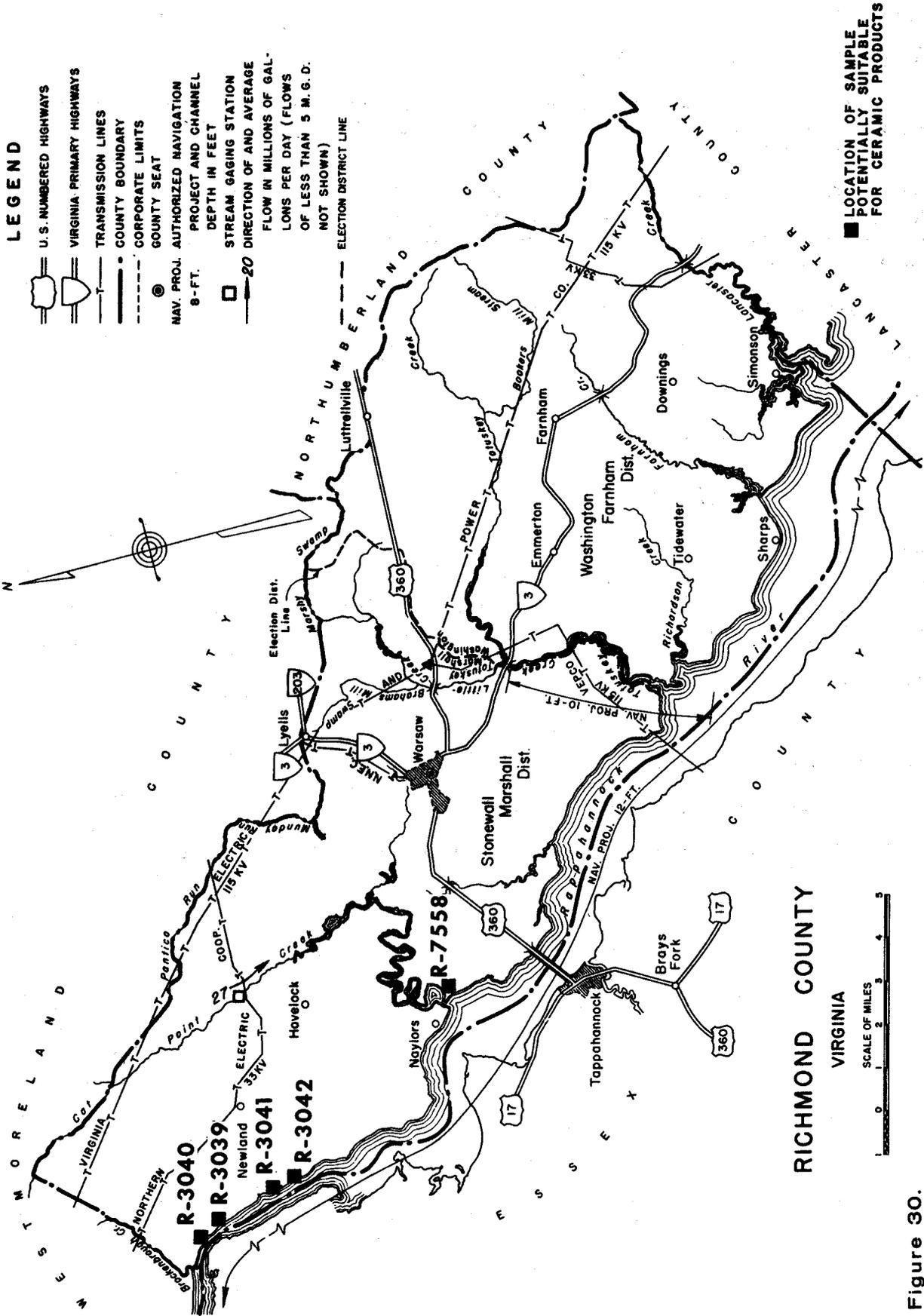
Slow Firing Test:

Temp. °C	Color	Hard- ness	%Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	4	7.5	8.9	17.6	1.97
1050	Moderate orange	4	10.0	7.6	15.3	2.02
1100	Grayish reddish orange	5	10.0	4.9	10.4	2.13
1150	Strong brown	5	12.5	3.0	6.6	2.20
1200	—	—	Melted	—	—	—
1250	—	—	—	—	—	—

Remarks: No effervescence with HCl.

Preliminary Bloating Test: Negative

Potential Use: Structural clay products (e.g., building brick at 1,000°-1,100°C).



SAMPLE: R-3039

COUNTY: Richmond

Date: July, 1966—Tuscaloosa Research Center*Locality:* N4,215,400 E331,250 (Zone 18). Champlain 7.5-minute quadrangle. Southern end of Fones Cliffs, 1.6 miles (2.6 km) west-southwest of Singerly, about 500 feet (152 m) north of Carters Wharf on the Rappahannock River.*Description of Outcrop:* Sixteen-foot diatomaceous zone that grades from white diatomaceous material at the top to yellowish-gray mudstone at the bottom of the zone. Below the mudstone is a 3- to 4-foot (1-m) zone of greenish-sand which is near the high-tide stand of the Rappahannock River. The diatomaceous zone is overlain by a 10- to 12-foot (3- to 4-m) bed of white to yellowish-gray, very fine-grained sand.*Formation/(Age):* Calvert Formation (Miocene)*Sampled Interval:* Composite sample from 16-foot (5-m) diatomaceous zone.*Raw Properties:*

Working properties: moderate plasticity
 Water of plasticity: 56.2%
 Drying shrinkage: 5.0%
 Dry strength: fair
 pH: 4.4

Slow Firing Test:

Temp. °F	Color	Hard- ness	%Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1800	Tan	2	7.5	44.4	49.3	1.11
1900	Tan	2	7.5	40.4	47.7	1.18
2000	Tan	3	10.0	32.7	43.0	1.30
2100	Light brown	4	20.0	16.0	27.4	1.71
2200	Gray	5	20.0	12.5	22.1	1.77
2300	Gray	6	22.5	10.8	19.5	1.81

Remarks: Poor decolorizer, high absorbency but slakes in water and oil, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Inert filler

SAMPLE: R-3040

COUNTY: Richmond

Date: July, 1966—Tuscaloosa Research Center*Locality:* N4,216,000 E330,660 (Zone 18). Champlain 7.5-minute quadrangle. Near center of Fones Cliffs, 1.85 miles (3.08 km) west of Singerly about 1800 feet (549 m) north of Carters Wharf on the Rappahannock River.*Description of Outcrop:* Eighteen feet (5.5 km) of gray to olive diatomaceous sediments; white when dry.*Formation/(Age):* Calvert Formation (Miocene)*Sampled Interval:* Grab sample (?) taken 12 feet (4 m) above high-tide line.*Raw Properties:*

Working properties: low plasticity
 Water of plasticity: 55.7%
 Drying shrinkage: 2.5%
 Dry strength: low
 pH: 4.3

Slow Firing Test:

Temp. °F	Color	Hard- ness	%Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1800	Tan	1	7.5	40.5	48.2	1.19
1900	Tan	1	10.0	38.7	47.2	1.22
2000	Tan	3	15.0	29.4	40.8	1.39
2100	Light brown	4	20.0	17.2	29.1	1.69
2200	Gray	5	25.0	8.4	16.3	1.94
2300	Gray	5	25.0	7.4	14.4	1.95

Remarks: Fair absorbency but slakes in water and oil, poor decolorizer although slightly improved by activation, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Inert filler

SAMPLE: R-3041

COUNTY: Richmond

Date: July, 1966 — Tuscaloosa Research Center*Locality:* N4,212,730 E332,150 (Zone 18). Champlain 7.5-minute quadrangle. On the east bank of the Rappahannock River, 1.85 miles (3.08 km) southwest of Oak Row, 0.3 mile (0.5 km) south of the inlet of Indian Peter Swamp Creek (Garlands Creek).*Description of Outcrop:* Sixteen-foot (5 m) zone of brown to white diatomaceous sediments above brown to yellowish-gray mudstone and fine-grained sand mottled with yellow clay.*Formation/(Age):* Calvert Formation (Miocene)*Sampled Interval:* Grab sample (?) 14 feet (4 m) above the high-tide line.*Raw Properties:*

Working properties: low plasticity
 Water of plasticity: 60.0%
 Drying shrinkage: 0.0%
 Dry strength: low
 pH: 3.1

Slow Firing Test:

Temp. °F	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1800	Tan	1	7.5	47.1	44.2	1.10
1900	Tan	1	7.5	42.3	48.2	1.14
2000	Tan	1	15.0	30.8	41.3	1.34
2100	Light brown	2	20.0	15.9	27.0	1.70
2200	Gray	3	25.0	3.8	7.6	2.00
2300	—	—	Expanded	—	—	—

Remarks: High absorbency but slakes in water and oil, poor decolorizer, but slightly improved by activation, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Inert filler

SAMPLE: R-3042

COUNTY: Richmond

Date: July, 1966—Tuscaloosa Research Center*Locality:* N4,212,050 E332,240 (Zone 18). Champlain 7.5-minute quadrangle. On the east bank of the Rappahannock River, 2.1 miles (3.4 km) southwest of Oak Row, 0.75 mile (1.21 km) south of the inlet of Indian Peter Swamp Creek (Garlands Creek).*Description of Outcrop:* Sixteen-foot (5 m) zone of brown to white diatomaceous sediments above brown to yellowish gray mudstone and fine-grained sand mottled with yellow clay.*Formation/(Age):* Calvert Formation (Miocene)*Sampled Interval:* Grab sample (?) 16 feet (5 m) above the high-tide line.*Raw Properties:*

Working properties: low plasticity
 Water of plasticity: 63.1%
 Drying shrinkage: 2.5%
 Dry strength: low
 pH: 4.8

Slow Firing Test:

Temp. °F	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1800	Tan	1	5.0	52.1	52.1	1.00
1900	Tan	2	5.0	48.5	50.4	1.04
2000	Tan	3	5.0	43.5	48.7	1.12
2100	Tan	4	10.0	42.3	48.6	1.15
2200	Buff	5	12.5	35.6	44.1	1.24
2300	Buff	6	12.5	29.8	39.9	1.34

Remarks: High absorbency but slakes in water and oil, poor decolorizer, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Inert filler

SAMPLE: R-7558

COUNTY: Richmond

Date: July, 1980 – Tuscaloosa Research Center*Locality:* N4,203,910 E337,430 (Zone 18). Tappahannock 7.5-minute quadrangle. River bank, 0.9 mile (1.4 km) southeast of Naylor's Beach, just off the west side of State Road 634 approximately 3.0 miles (4.8 km) by road west of its intersection with State Road 624.*Description of Outcrop:* Yellowish-gray and grayish-orange plastic clay in a riverbank with a maximum height of 3 feet (1 m). There is some light-brown silty clay. A layer of sand is below the clay.*Formation/(Age):* (Pleistocene)*Sampled Interval:* Composite of a channel and auger sample across 2.5 feet (0.8 m) of clay.*Raw Properties:*

Working properties: short
 Water of plasticity: 18.1%
 Drying shrinkage: 5.0%
 Dry strength: fair
 pH: 4.7

Slow Firing Test:

Temp. °C	Color	Hard- ness	%Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Pale orange yellow	3	5.0	17.2	31.6	1.84
1050	Moderate orange yellow	3	5.0	17.1	31.5	1.85
1100	Moderate orange yellow	3	5.0	16.2	30.0	1.85
1150	Moderate orange	4	5.0	15.1	28.4	1.87
1200	Moderate orange	5	7.5	13.9	26.5	1.90
1250	Light yellowish brown	6	7.5	13.4	25.5	1.91

Remarks: No effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., building brick structural tile at 1,150°-1,250°C).

SAMPLE: R-6942

COUNTY: Rockbridge

Date: May, 1977 — Tuscaloosa Research Center*Locality:* N4,201,130 E641,960 (Zone 17). Goshen 7.5-minute quadrangle. Roadcut, 3.6 miles (5.8 km) north of Rockbridge Baths, on the west side of State Road 602 approximately 0.15 mile (0.24 km) by road north of its intersection with State Road 724.*Description of Outcrop:* About 40 feet (12-m) of pale-to dark-yellowish-orange and dark-yellowish-brown slightly folded shale, with some reddish to dark-gray iron-oxide stain on bedding surfaces in a 400-foot (122-m) roadcut. The shale, which is soft and lightweight, strikes N18°E and dips 56°SE. About two feet (1 m) of soil overburden covers the weathered shale.*Formation/(Age):* Martinsburg Formation (Ordovician)*Sampled Interval:* Composite of representative samples taken across 40 feet (12-m) of weathered shale.*Raw Properties:*

Working properties:	short
Water of plasticity:	32.9%
Drying shrinkage:	0.0%
Dry strength:	good
pH:	5.7

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	2.5	30.3	45.7	1.51
1050	Moderate orange	3	5.0	26.3	41.7	1.59
1100	Brownish orange	3	10.0	15.3	29.0	1.89
1150	Brownish orange	4	12.5	12.1	24.2	1.99
1200	Mod. reddish brown	4	12.5	4.9	10.9	2.22
1250	—	—	Melted	—	—	—

Remarks: High shrinkage, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Marginal for structural clay products (e.g., building brick at 1,150°-1,200°C).

SAMPLE: R-7163

COUNTY: Rockbridge

Date: September, 1977 — Tuscaloosa Research Center*Locality:* N4,194,180 E627,500 (Zone 17). Millboro 7.5-minute quadrangle. Roadcut, 2.5 miles (4.0 km) southeast of California, on the northeast side of State Road 629 approximately 2.0 miles (3.2 km) by road north of its intersection with U. S. Highway 60.*Description of Outcrop:* About 275 feet (84-m) of pale-to dark-yellowish-orange and pale-to moderate-reddish-brown, weathered shale and plastic clay in a 600-foot (183-m) roadcut with a maximum height of 10 feet (3 m). The weathered shale strikes N24°E and has an average dip 64°SE. Some dark-brown to black stain (iron oxide?) is along fracture planes. Yellow-gray shale chips cover much of the roadcut.*Formation/(Age):* Martinsburg Formation (Ordovician)*Sampled Interval:* Composite of representative samples each taken across 275 feet (84 m) of weathered shale and clay.*Raw Properties:*

Working properties: plastic
 Water of plasticity: 39.3%
 Drying shrinkage: 5.0%
 Dry strength: good
 pH: 6.2

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	7.5	24.7	40.4	1.64
1050	Moderate orange	3	10.0	16.9	31.4	1.86
1100	Brownish orange	4	15.0	4.1	9.5	2.14
1150	Strong brown	5	17.5	1.1	2.3	2.31
1200	Strong brown	6	17.5	0.5	1.3	2.43
1250	Moderate reddish brown	7	17.5	0.3	0.7	2.46

Remarks: High shrinkage at maturity (1,100°-1,250°C), no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Plastic component in brick.

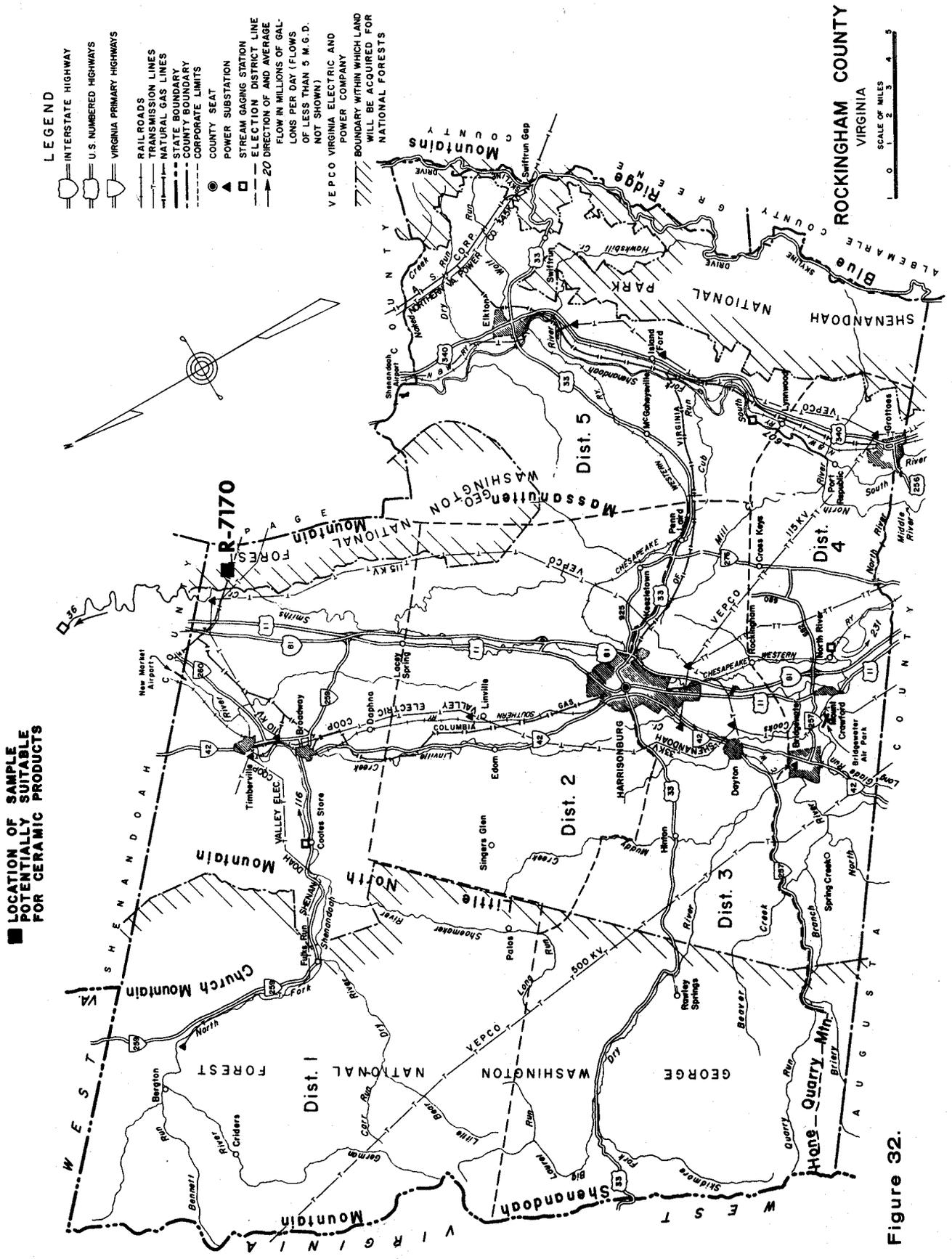


Figure 32.

SAMPLE: R-7170

COUNTY: Rockingham

Date: October, 1977 — Tuscaloosa Research Center*Locality:* N4,273,980 E702,680 (Zone 17). Tenth Legion 7.5-minute quadrangle. Cave-fill material, 3.4 miles (5.4 km) northeast of Tenth Legion, about 2.0 miles (3.2 km) off the east-southeast side of U. S. Highway 11 in Endless Caverns.*Description of Outcrop:* About 5.5 feet (1.7 m) of moderate-yellow-brown to moderate-brown and moderate-to dark-reddish-brown, very plastic, layered clay in a channel off the main cave tunnel. The channel contains a cave-fill of residual material from the Beekmantown Formation that is about 100 feet (30 m) long and 10 feet (3 m) wide. Additional clay material along the main cave tunnel is layered, slightly sandy to very plastic, grayish-orange to dark-yellowish-orange. Minor iron-oxide or manganese(?) stains some of the clay.*Formation/(Age):* Residual clay from Beekmantown Formation (Ordovician)*Sampled Interval:* Composite of representative samples taken from several localities of clay material in the caverns.*Raw Properties:*

Working properties: plastic
 Water of plasticity: 21.7%
 Drying shrinkage: 5.0%
 Dry strength: good
 pH: 7.3

Slow Firing Test:

Temp. °C	Color	Hard- ness	%Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	5.0	17.7	32.1	1.81
1050	Moderate orange	3	5.0	16.1	29.6	1.83
1100	Brownish orange	4	7.5	12.7	24.6	1.94
1150	Strong brown	4	7.5	9.6	19.4	2.02
1200	Strong brown	5	10.0	8.4	17.4	2.06
1250	Grayish reddish brown	6	10.0	2.2	4.8	2.21

Remarks: Good firing range, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., building brick at 1,100°-1,250°C).

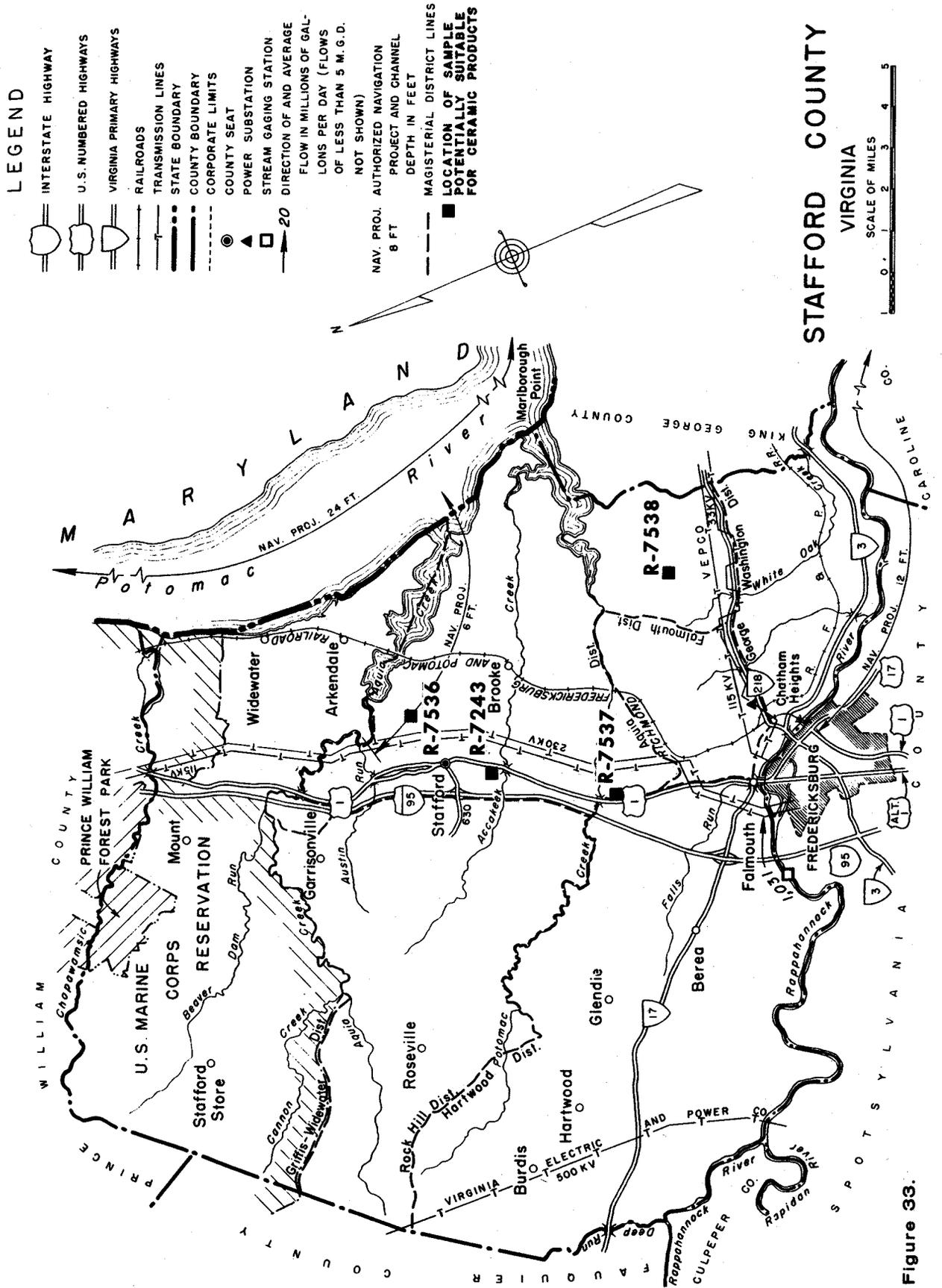


Figure 33.

SAMPLE: R-7243

COUNTY: Stafford

Date: April, 1978—Tuscaloosa Research Center

Locality: N4,253,360 E228,810 (Zone 18). Stafford 7.5-minute quadrangle. Roadcut, 1.25 miles (2.01 km) south-southwest of Stafford, on the west-northwest side of U. S. Highway 1 approximately 0.25 mile (0.40 km) by road northeast of its crossing over Accokeek Creek.

Description of Outcrop: White, very light-gray and light-greenish-gray to medium-gray blocky plastic to silty clay in a 100-foot (30-m) roadcut with a maximum height of 6 feet (2 m). The clay contains some light-brown, and pale-reddish-brown to moderate-reddish-brown iron-oxide stain and clay mottles. Material near the base of the unit is predominantly medium-gray and sandy. Clay is underlain by about 6 feet (2 m) of medium- to light-gray, fine-grained sand. Material has a northwest-southeast strike and a northeast dip. Clay is covered by about 2 feet (1 m) of loamy overburden.

Formation/(Age): Calvert Formation (Miocene)

Sampled Interval: Representative channel sample across 4 feet (1 m) of clay.

Raw Properties:

Working properties: plastic
 Water of plasticity: 31.8%
 Drying shrinkage: 2.5%
 Dry strength: good
 pH: 5.8

Slow Firing Test:

Temp. °C	Color	Hard- ness	%Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	2.5	27.5	42.0	1.53
1050	Moderate orange	3	5.0	26.1	40.9	1.57
1100	Moderate orange	3	7.5	20.2	34.7	1.72
1150	Brownish orange	3	10.0	12.4	24.1	1.94
1200	Brownish orange	4	12.5	10.5	21.0	2.00
1250	Moderate reddish brown	6	15.0	2.8	6.3	2.27

Remarks: Abrupt vitrification between 1,200°-1,250°C, very short firing range.

Analyses: (Virginia Division of Mineral Resources)

<i>Chemical:</i>	
SiO ₂	66.92
Al ₂ O ₃	17.86
Fe ₂ O ₃	3.17
CaO	0.07
MgO	0.44
Na ₂ O	0.13
K ₂ O	1.72
TiO ₂	1.40
MnO	0.02
P ₂ O ₅	0.16
LOF	8.09

Preliminary Bloating Test: Negative

Potential Use: Marginal for structural clay products (e.g., building brick at 1,200°C).

SAMPLE: R-7536

COUNTY: Stafford

Date: March, 1980—Tuscaloosa Research Center*Locality:* N4,255,890 E292,120 (Zone 18). Stafford 7.5-minute quadrangle. Roadcut, 1.5 miles (2.4 km) east of Stafford, on the north side of State Road 687 approximately 0.3 mile (0.5 km) by road northeast of its intersection with road 1301.*Description of Outcrop:* Light-gray, yellowish-gray, very pale-to pale-yellowish-orange plastic clay, with light-to dark-yellowish-orange and moderate-reddish-brown plastic clay mottles in a 225-foot (69-m) roadcut with a maximum height of 4.5 feet (1.4 m). Material grades from dark-yellowish-orange at the top to a light gray at the base. Augered material is yellowish and slightly silty in places, but is plastic.*Formation/(Age):* (Cretaceous)*Sampled Interval:* Composite of two channel samples taken about 35 feet (11 m) apart, each across 4 + feet (1 + m) of clay, plus 18 inches (46 cm) of augered material from the base of the exposure.*Raw Properties:*

Working properties:	plastic
Water of plasticity:	23.0%
Drying shrinkage:	5.0%
Dry strength:	good
pH:	4.0

Slow Firing Test:

Temp. °C	Color	Hard- ness	%Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	5.0	19.9	35.0	1.76
1050	Moderate orange	3	7.5	16.7	30.8	1.85
1100	Moderate orange	3	10.0	14.7	28.0	1.90
1150	Deep orange	4	10.0	12.3	24.4	1.97
1200	Brownish orange	5	10.0	11.1	22.3	2.01
1250	Strong brown	5	10.0	9.9	20.3	2.06

Remarks: No effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., building brick at 1,150°-1,250°C).

SAMPLE: R-7537

COUNTY: Stafford

Date: March, 1980 — Tuscaloosa Research Center*Locality:* N4,249,000 E285,460 (Zone 18). Fredericksburg 7.5-minute quadrangle. Hillside about 3 miles (5 km) north of Falmouth, about 600 feet (183 m) off the east side of U. S. Highway 1, 0.2 mile (0.3 km) by road north of its intersection with State Road 627, leading west.*Description of Outcrop:* Very light-gray, light-olive-gray, and yellowish-gray plastic clay in a 300-foot (91-m) hillside cut with a maximum height of 10 feet (3 m). Clay is mottled with grayish-orange, dark-yellow-orange and moderate-red plastic clay, and covered with yellowish-orange sandy clay with rounded quartz cobbles. The clay overlies light-gray and bleached silty clay.*Formation/(Age):* (Cretaceous)*Sampled Interval:* Representative channel sample across 5 feet (2 m) of clay.*Raw Properties:*

Working properties: plastic
 Water of plasticity: 27.4%
 Drying shrinkage: 5.0%
 Dry strength: good
 pH: 3.9

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	5.0	22.3	37.9	1.70
1050	Moderate orange	3	5.0	22.1	37.7	1.70
1100	Moderate orange	3	7.5	20.9	36.5	1.74
1150	Moderate orange	3	10.0	16.5	31.2	1.97
1200	Brownish orange	4	12.5	10.7	22.4	2.01
1250	Light brown	5	12.5	9.3	20.0	2.06

Remarks: Slightly high shrinkage; no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., building brick at 1,200°-1,250°C).

SAMPLE: R-7538

COUNTY: Stafford

Date: March, 1980 — Tuscaloosa Research Center*Locality:* N4,243,720 E292,060 (Zone 18). Fredericksburg 7.5-minute quadrangle. Roadcut 1.3 miles (2.1 km) north of White Oak on the north side of State Road 604 approximately 0.5 mile (0.8 km) by road west-southwest of its intersection with State Road 603.*Description of Outcrop:* Very light-gray, light-olive-gray and grayish-orange to dark-yellowish-orange plastic clay in a 300-foot roadcut with a maximum height of 8 feet (2 m); dark-yellowish-orange stain is along joint surfaces in the clay. Material underlies about 3 feet (1 m) of yellowish-orange sandy material and overlies light-gray sandy material that contains very little clay.*Formation/(Age):* (Cretaceous)*Sampled Interval:* Representative channel sample across 3 feet (1 m) of clay.*Raw Properties:*

Working properties:	plastic
Water of plasticity:	28.2%
Drying shrinkage:	5.0%
Dry strength:	good
pH:	4.0

Slow Firing Test:

<i>Temp.</i> °C	<i>Color</i>	<i>Hard-</i> <i>ness</i>	<i>% Lin.</i> <i>Shk.</i>	<i>%</i> <i>Abs.</i>	<i>%</i> <i>Appar. Poros.</i>	<i>Bulk Dens.</i> <i>gm/cc</i>
1000	Moderate orange	3	5.0	22.5	38.0	1.69
1050	Moderate orange	3	7.5	21.3	36.8	1.73
1100	Moderate orange	3	10.0	19.3	34.6	1.79
1150	Moderate orange	3	10.0	16.3	30.4	1.87
1200	Brownish orange	4	10.0	14.3	27.4	1.92
1250	Strong brown	5	12.5	12.0	23.9	1.99

Remarks: Slightly high shrinkage at 1,250°C, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., building brick at 1,200°-1,250°C).

SAMPLE: R-7378

COUNTY: Suffolk (City of)

Date: December, 1978 — Tuscaloosa Research Center*Locality:* N4,051,770 E357,850 (Zone 18). Corapeake 7.5-minute quadrangle. Roadcut, 1.1 miles (1.8 km) south of Cypress Chapel, on the west side of State Road 642 (White Marsh Road) approximately 0.55 mile (0.86 km) by road north of its intersection with State Highway 32.*Description of Outcrop:* Dark-yellowish-orange silty clay in a 200-foot (61-m) roadcut with a maximum height of 5 feet (2 m). Dark-yellowish-orange silty clay is mottled with very sandy, light-gray clay and red clay. Clay is covered by 1.5 feet (0.5 m) of dark-brown silty overburden.*Formation/(Age):* (Pleistocene)*Sampled Interval:* Representative channel sample across 3 feet (1 m) of clay.*Raw Properties:*

Working properties: plastic
 Water of plasticity: 19.7%
 Drying shrinkage: 2.5%
 Dry strength: good
 pH: 6.5

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	5.0	19.9	34.5	1.73
1050	Moderate orange	3	7.5	18.1	32.1	1.76
1100	Strong orange	3	7.5	18.0	31.9	1.77
1150	Moderate orange	3	7.5	17.9	31.5	1.78
1200	Brownish orange	3	7.5	17.6	31.4	1.78
1250	Grayish reddish orange	3	7.5	16.5	29.5	1.78

Remarks: Too soft, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Not suitable for structural clay products.

SAMPLE: R-7379

COUNTY: Suffolk (City of)

Date: December, 1978—Tuscaloosa Research Center*Locality:* N4,052,740 E357,760 (Zone 18). Corapeake 7.5-minute quadrangle. Cut and auger hole, 0.5 mile (0.8 km) south of Cypress Chapel, at the east side of State Road 642 (White Marsh Road) at a approximately 0.5 mile (0.8 km) by road south of its intersection with State Road 675 (Cypress Chapel Road).*Description of Outcrop:* Very light-gray to light-gray silty clay with yellowish-gray clay mottles from a cut and auger hole at the east edge of the road. The top 10 inches (25 cm) of road cover were not sampled.*Formation/(Age):* (Pleistocene)*Sampled Interval:* Representative channel sample in 1-foot hole; 2.5 feet (1 m) of additional clay was traversed by augering in the bottom of the hole.*Raw Properties:*

Working properties: short
 Water of plasticity: 17.4%
 Drying shrinkage: 2.5%
 Dry strength: fair
 pH: 6.7

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Light yellow orange	3	2.5	18.8	33.3	1.77
1050	Light yellow orange	3	5.0	18.2	32.4	1.78
1100	Light yellow orange	3	5.0	17.6	31.8	1.80
1150	Light yellow orange	3	5.0	17.4	31.5	1.80
1200	Pale orange yellow	3	5.0	16.4	29.5	1.81
1250	Pale yellow	3	5.0	16.4	29.5	1.82

Remarks: Too soft, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Not suitable for structural clay products.

SAMPLE: R-7405

COUNTY: Suffolk (City of)

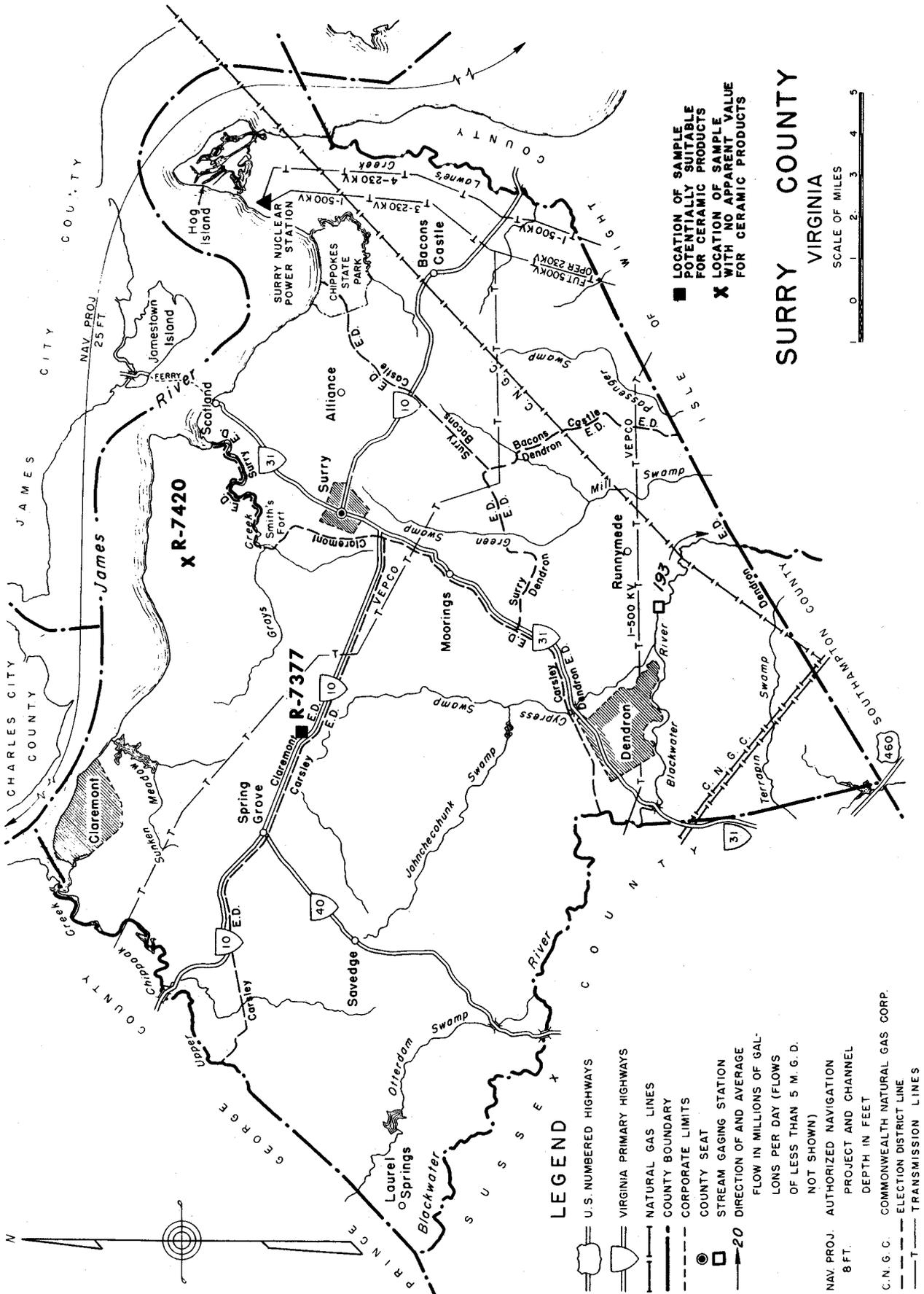
Date: March, 1979 — Tuscaloosa Research Center*Locality:* N4,086,680 E367,700 (Zone 18). Newport News 7.5-minute quadrangle. River bluff at Eclipse, about halfway between Pike Point and Barrel Point.*Description of Outcrop:* Olive-gray to dark-greenish-gray, silty clay with some dark-yellowish-orange clay mot-
tles near the top of the exposure in a 12-foot (4-m) river bank. Material is sandy throughout the exposure.*Formation/(Age):* (Pleistocene)*Sampled Interval:* Channel sample across 4 feet (1 m) of clay.*Raw Properties:*

Working properties:	No Bond
Water of plasticity:	—
Drying shrinkage:	—
Dry strength:	—
pH:	5.7

Slow Firing Test: Material failed to form cohesive mass when tested.

Remarks: No effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Not suitable for structural clay products.



■ LOCATION OF SAMPLE
 POTENTIALLY SUITABLE
 FOR CERAMIC PRODUCTS
 X LOCATION OF SAMPLE
 WITH NO APPARENT VALUE
 FOR CERAMIC PRODUCTS

SURRY COUNTY
VIRGINIA

SCALE OF MILES
0 1 2 3 4 5

LEGEND

- U.S. NUMBERED HIGHWAYS
- VIRGINIA PRIMARY HIGHWAYS
- NATURAL GAS LINES
- COUNTY BOUNDARY
- CORPORATE LIMITS
- COUNTY SEAT
- STREAM GAGING STATION
- DIRECTION OF AND AVERAGE FLOW IN MILLIONS OF GALLONS PER DAY (FLOWS OF LESS THAN 5 M.G.D. NOT SHOWN)
- NAV. PROJ. AUTHORIZED NAVIGATION 8 FT.
- PROJECT AND CHANNEL DEPTH IN FEET
- C.N.G.C. COMMONWEALTH NATURAL GAS CORP.
- ELECTION DISTRICT LINE
- TRANSMISSION LINES

Figure 35.

SAMPLE: R-7377

COUNTY: Surry

Date: December, 1978—Tuscaloosa Research Center*Locality:* N4,112,950 E328,580 (Zone 18). Claremont 7.5-minute quadrangle. Roadcut, 2.65 miles (4.27 km) southeast of Spring Grove on the northeast side of State Highway 10 approximately 1.65 miles (2.66 km) by road northwest of its intersection with Forest Road 362.*Description of Outcrop:* Pale-yellowish-orange to dark-yellowish-orange plastic clay in a 230-foot (70-m) roadcut with a maximum height of 4.5 feet (1.4 m). The dark-yellowish-orange clay is mottled with silty pinkish-gray, light-gray and some red clay. Two feet of additional clay that becomes more silty with depth were augered at the base of the exposure. Clay is covered by 1.5 feet (0.5 m) of yellow sandy overburden.*Formation/(Age):* (Pleistocene)*Sampled Interval:* Representative channel sample across 3 feet (1 m) of clay in the eastern part of the exposure and 2 feet (1 m) of augered clay.*Raw Properties:*

Working properties:	plastic
Water of plasticity:	27.3%
Drying shrinkage:	5.0%
Dry strength:	good
pH:	6.4

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	7.5	20.3	35.6	1.75
1050	Moderate orange	3	10.0	17.3	31.4	1.82
1100	Moderate orange	3	10.0	15.2	28.6	1.88
1150	Brownish orange	3	10.0	13.3	25.6	1.92
1200	Strong brown	4	10.0	11.3	22.5	1.99
1250	Moderate reddish brown	5	10.0	7.8	16.2	2.08

Remarks: No effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., building brick at 1,200°-1,250°C).

SAMPLE: R-7420

COUNTY: Surry

Date: March, 1979—Tuscaloosa Research Center*Locality:* N4,117,330 E335,220 (Zone 18). Surry 7.5-minute quadrangle. Roadcut, 3.75 miles (6.04 km) northwest of Surry, on the east side of State Road 618 approximately 400 feet (122 m) by road south of its intersection with State Road 610.*Description of Outcrop:* Grayish-yellow and dark-yellowish-orange plastic clay in a 200-foot (61-m) roadcut with a maximum height of 5 feet (2 m). The clay is mottled with pale-reddish-brown and contains progressively more light-gray plastic clay toward the base of the exposure. Overburden consists of about one foot of silty clay.*Formation/(Age):* St. Marys Formation (Miocene)*Sampled Interval:* Representative channel sample across 4 feet (1 m) of clay.*Raw Properties:*

Working properties: plastic
 Water of plasticity: 26.7%
 Drying shrinkage: 5.0%
 Dry strength: good
 pH: 6.4

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	5.0	20.1	34.6	1.72
1050	Moderate orange	3	5.0	19.8	34.2	1.72
1100	Moderate orange	3	5.0	19.4	33.3	1.73
1150	Moderate orange	3	5.0	19.4	33.8	1.74
1200	Moderate orange	3	5.0	18.1	31.7	1.75
1250	Grayish reddish orange	3	5.0	18.0	31.2	1.75

Remarks: Too soft, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Not suitable for structural clay products.

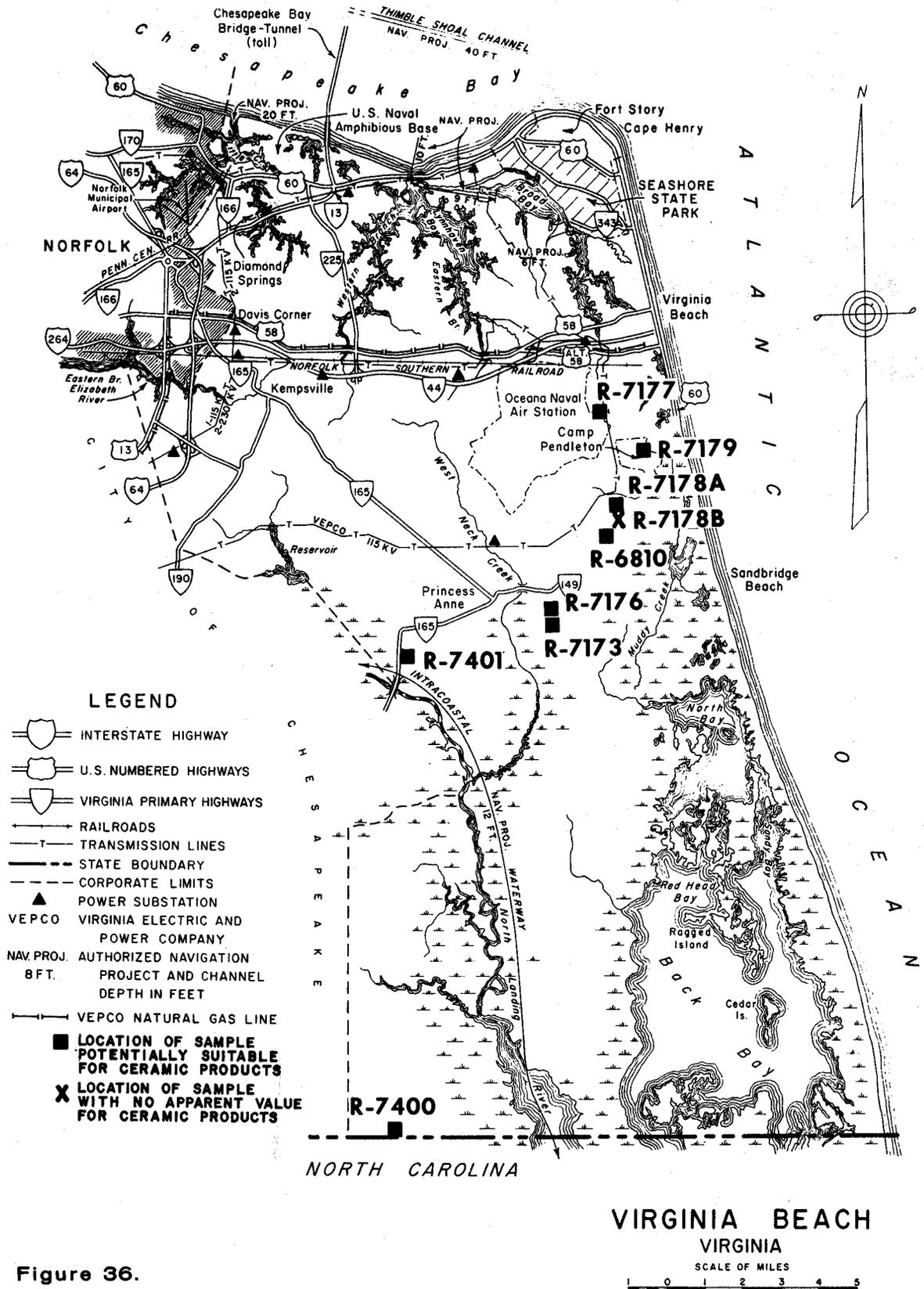


Figure 36.

SAMPLE: R-6810

COUNTY: Virginia Beach (City of)

Date: January, 1977 — Tuscaloosa Research Center

Locality: N4,069,640 E410,940 (Zone 18). Virginia Beach 7.5-minute quadrangle. Pit of Baillio Sand Company, Inc., 1.1 miles (1.8 km) south of Dam Neck Corner, approximately 0.2 mile (0.3 km) from the south side of Culver Lane, 0.6 mile (1.0 km) by road southeast of its intersection with State Road 615 (Oceana Blvd.).

Description of Outcrop: Light- to medium-light-gray, in places micaceous, silty clay with 2 thin intervals of fine to very fine, grayish clay-coated quartz sand. Some plant fragments are in the clay, which is in the mud-flat part of the upper member of the Sand Bridge Formation. When wet the clay is bluish-gray, very compact and plastic; Oaks and Coch (1973) report that it thickens to about 10 feet (3 m) to the W-SW, near middle (?) of the old tidal flat. Fine-medium, slightly ferruginous, cross-bedded sand is below the silty clay exposure.

Formation/(Age): Sand Bridge Formation (Pleistocene)

Sampled Interval: Representative channel sample across 3 feet (1 m) of clay.

Raw Properties:

Working properties: plastic
 Water of plasticity: 24.3%
 Drying shrinkage: 5.0%
 Dry strength: good
 pH: 6.8

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	4	7.5	15.5	28.3	1.83
1050	Light reddish brown	5	10.0	5.7	12.1	2.13
1100	Moderate reddish brown	6.5	12.5	1.5	3.3	2.19
1150	—	—	Melted	—	—	—
1200	—	—	—	—	—	—
1250	—	—	—	—	—	—

Remarks: Short firing range, no effervescence with HCl.

Preliminary Bloating Test: Positive*Bloating Test:*

Temp. °C	% Abs.	Bulk Dens. gm/cc (lb.ft. ³)	Remarks
1050	21.7	1.64 (102.3)	No expansion
1100	14.8	1.32 (82.4)	Slight expansion
1150	12.5	1.29 (80.5)	Good pore structure
1200	9.8	.89 (55.5)	—

Potential Use: Marginal for use in structural clay products and for use as lightweight aggregate.

SAMPLE: R-7173

COUNTY: Virginia Beach (City of)

Date: December, 1977 — Tuscaloosa Research Center*Locality:* N4,066,610 E407,820 (Zone 18). Pleasant Ridge 7.5-minute quadrangle. Pit of Little Creek Sand and Gravel Corp., 1.5 miles (2.4 km) northwest of Pungo, approximately 0.15 mile (0.24 km) off the west side of the Seaboard Road, 1.25 miles (2.01 km) by road northwest of its intersection with Princess Anne Road.*Description of Outcrop:* Very light-gray to medium-dark-gray, plastic, silty clay, sparingly micaceous in places is in the west bank of pit. About 10 inches (25 cm) of very fine, grayish clay-coated sand is in the lower part of the 5-foot (1.5-m) bed. Some yellowish-brown and dark-yellowish-orange, oxidized material is in the lower part of the unit; some plant fragments and rootlets are in the top part of the clay. The lower foot or so is much more sticky and plastic than the upper 3-4 feet, which is more silty and sandy. The clay material dips west-northwest at a low angle in this area and probably thickens to a total thickness of about 12 feet (4 m).*Formation (Age):* Sand Bridge Formation (Pleistocene)*Sampled Interval:* Representative channel sample taken across approximately 8.0 feet (2.4 m) of clay in the west bank of the pit.*Raw Properties:*

Working properties:	plastic
Water of plasticity:	22.1%
Drying shrinkage:	2.5%
Dry strength:	good
pH:	4.4

Slow Firing Test:

Temp. °C	Color	Hard- ness	%Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	5.0	18.0	31.9	1.77
1050	Moderate orange	3	5.0	16.9	30.4	1.80
1100	Moderate orange	3	7.5	12.1	23.3	1.92
1150	Brownish orange	4	10.0	10.5	20.6	1.97
1200	Grayish reddish orange	4	10.0	7.9	16.2	2.05
1250	Moderate reddish brown	4	10.0	3.2	7.0	2.21

Remarks: No effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (eg., building brick at 1,150°-1,250°C).

SAMPLE: R-7176

COUNTY: Virginia Beach (City of)

Date: December, 1977 — Tuscaloosa Research Center

Locality: N4,066,700 E407,830 (Zone 18). Pleasant Ridge 7.5-minute quadrangle. Pit of Little Creek Sand and Gravel Corp., 1.55 miles (2.50 km) northwest of Pungo, approximately 0.15 miles (0.24 km) off the west side of Seaboard Road, 1.25 miles (2.01 km) by road northwest of its intersection with Princess Anne Road.

Description of Outcrop: Very light-gray to medium-dark gray, and dark-grayish-blue plastic, silty clay, slightly micaceous in places, in the west bank of pit, about 350 feet (107 m) north of sample R-7173. Two 3-inch (7.6-cm) layers of very fine grayish-clay coated sand are near the middle of the 8-foot (2.4-m) clay exposure. Some very clean, white sand is below the clay, which is extremely sticky and plastic at the base of the exposure. Some yellowish-brown and yellowish-orange, oxidized material is near the lower part of the clay exposure. The clay material dips at a low angle west-northwest in this area and probably thickens in that direction to a total thickness of about 12-feet (4 m).

Formation/(Age): Sand Bridge Formation (Pleistocene)

Sampled Interval: Representative channel sample taken across approximately 8.0 feet (2.4 m) of clay in the west bank of the pit.

Raw Properties:

Working properties: plastic
 Water of plasticity: 18.2%
 Drying shrinkage: 2.5%
 Dry strength: good
 pH: 5.1

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	2.5	16.5	29.6	1.79
1050	Moderate orange	3	2.5	16.4	29.6	1.80
1100	Grayish reddish orange	3	5.0	11.5	22.2	1.93
1150	Strong brown	4	7.5	9.7	19.3	1.98
1200	Moderate reddish brown	4	10.0	5.0	10.7	2.15
1250	—	—	Melted	—	—	—

Remarks: No effervescence with HCl.

Preliminary Bloating Test: Negative

Potential Use: Structural clay products (e.g., building brick at 1,150°-1,200°C).

SAMPLE: R-7177

COUNTY: Virginia Beach (City of)

Date: December, 1977 — Tuscaloosa Research Center*Locality:* N4,074,710 E410,500 (Zone 18). Princess Anne 7.5-minute quadrangle. Old sand and gravel pit 1.1 miles (1.8 km) north of Macons Corner, approximately 0.2 mile (0.3 km) off the east side of Oceana Boulevard, 0.3 mile (0.5 km) by road south of Bells Avenue.*Description of Outcrop:* Light-olive-gray to medium-dark-gray, plastic clay in a bank near the west side of pit. Very light-gray and dark-yellowish-orange clay mottles are in the 3-foot (1-m) exposure. There is very plastic, dark-gray clay at the base of the exposure, where there are a few very coarse, rounded quartz grains. Overburden is about 6 inches (15 cm) thick.*Formation/(Age):* Sand Bridge Formation (Pleistocene)*Sampled Interval:* Composite of representative channel samples each taken across 3 feet (1 m) of clay about 50 feet (15 m) apart in the exposure.*Raw Properties:*

Working properties:	plastic
Water of plasticity:	16.6%
Drying shrinkage:	2.5%
Dry strength:	good
pH:	4.5

Slow Firing Test:

Temp. °C	Color	Hard- ness	%Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Pale orange yellow	3	2.5	16.8	30.1	1.79
1050	Pale orange yellow	3	2.5	16.2	29.2	1.80
1100	Moderate orange	3	2.5	14.8	27.1	1.83
1150	Moderate orange	3	2.5	13.6	25.3	1.86
1200	Light brown	3	2.5	12.1	23.0	1.90
1250	Light yellowish brown	4	5.0	8.3	16.7	2.00

Remarks: No effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., building brick at 1,250°C).

SAMPLE: R-7178-A

COUNTY: Virginia Beach (City of)

Date: December, 1977 — Tuscaloosa Research Center*Locality:* N4,070,280 E412,060 (Zone 18). Virginia Beach 7.5-minute quadrangle. Ditch, 1.05 miles (1.69 km) southeast of Dam Neck Corner, about 100-feet (30 m) off the southwest side of Old Dam Neck Road, 1.05 mile (1.69 km) by road southeast of its intersection with Oceana Boulevard.*Description of Outcrop:* Dark-yellowish-brown to dusky-yellowish-brown to brownish-black, plastic, mealy clay in a 4.5-foot (1.4-m) exposure. The top foot is a light dusky-yellowish-brown with a thin zone of light-gray plastic clay. Most of the clay is very sticky, contains rootlets and is mottled in places with a yellowish-brown to yellowish-orange clay and some light-gray clay. The material is exposed for a distance of at least 500 feet (153 m). There is some organic material and virtually no overburden. The basal foot of exposed clay is extremely plastic and sticky, very light-gray to medium-gray to olive-gray and contains some plastic yellowish-brown and light-yellowish-orange mottles. One foot of this material is exposed and 3 feet (1 m) were augered. Mottles decrease towards the base of the augered hole. Clay at bottom of the auger hole is slightly silty and contains minor mica.*Formation/(Age):* Sand Bridge Formation (Pleistocene)*Sampled Interval:* Representative channel sample across 4.5 feet (1.4 m) of clay.*Raw Properties:*

Working properties:	plastic
Water of plasticity:	26.4%
Drying shrinkage:	5.0%
Dry strength:	good
pH:	4.7

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Pale orange yellow	3	5.0	16.8	29.8	1.78
1050	Pale orange yellow	3	7.5	15.7	28.3	1.81
1100	Moderate orange	4	10.0	9.3	18.3	1.97
1150	Moderate orange	4	10.0	7.8	15.8	2.02
1200	Grayish reddish orange	5	10.0	4.0	8.6	2.15
1250	Light grayish reddish brown	5	10.0	0.2	0.4	2.26

Remarks: No effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., building brick at 1,100°-1,200°C).

SAMPLE: R-7178-B

COUNTY: Virginia Beach (City of)

Date: December, 1977 — Tuscaloosa Research Center

Locality: N4,070,280 E412,060 (Zone 18). Virginia Beach 7.5-minute quadrangle. Ditch, 1.05 miles (1.69 km) southeast of Dam Neck Corner about 100 feet (30 m) off the southwest side of Old Dam Neck Road, 1.05 miles (1.69 km) by road southeast of its intersection with Oceana Boulevard.

Description of Outcrop: Dark-yellowish-brown to dusky-yellowish-brown to brownish-black, plastic, mealy clay in a 4.5-foot (1.4-m) deep ditch. The top foot of the exposure contains a light-dusky-yellowish-brown clay with a thin interval of light-gray plastic clay. Most of the clay is very sticky, contains rootlets and is mottled in places with a yellowish-brown to yellowish-orange clay and some light-gray clay. The material is exposed for a distance of at least 500 feet (152 m). There is some organic material and virtually no overburden. The basal foot of exposed clay is extremely plastic and sticky, very light-gray to medium-gray to olive-gray clay with some plastic yellowish-brown and light-yellowish-orange mottles. One foot of this material is exposed and another 3 feet (1 m) were augered. Mottles decrease towards the base of the augered hole. Clay at the bottom of the auger hole is slightly silty and contains minor mica.

Formation/(Age): Sand Bridge Formation (Pleistocene)

Sampled Interval: Composite of a channel sample across 1 foot (0.3 m) of clay and 3 feet (1 m) of augered clay.

Raw Properties:

Working properties: plastic
 Water of plasticity: 31.4%
 Drying shrinkage: 7.5%
 Dry strength: good
 pH: 4.4

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Strong orange	3	7.5	13.5	25.2	1.87
1050	Moderate orange	3	10.0	10.5	20.5	1.96
1100	Grayish reddish orange	4	10.0	0.9	2.2	2.32
1150	Strong brown	5	15.0	0.6	1.5	2.33
1200	—	—	Melted	—	—	—
1250	—	—	—	—	—	—

Remarks: Abrupt vitrification between 1,050° — 1,100°C, no effervescence with HCl.

Preliminary Bloating Test: Negative

Potential Use: Not suitable for structural clay product.

SAMPLE: R-7179

COUNTY: Virginia Beach (City of)

Date: December, 1977 — Tuscaloosa Research Center*Locality:* N4,073,470 E412,130 (Zone 18). Virginia Beach 7.5-minute quadrangle. Ditch, 1.5 miles (2.4 km) northeast of Dam Neck Corner, on the east side of Prosperity Road, 0.40 mile (0.73 km) by road south of its intersection with Birdneck Circle.*Description of Outcrop:* Medium-gray to medium-dark-gray to olive-gray, plastic clay mottled in places with minor white silty clay and small amounts of yellowish-orange plastic clay in 0.15 mile (0.24 km) ditch, with a maximum height of 2.5 feet (1 m). The top 8 inches (20 cm) of clay, which is covered by about 3 inches (8 cm) of overburden, is light-olive-gray and slightly silty. Near the base of the exposure, there is more medium-gray plastic clay and in the auger hole, the clay contains less yellowish-orange plastic clay mottles. One foot into the auger hole, there is an increase in very fine sand; the sand fraction decreases towards the base of the auger hole. There is some organic material.*Formation/(Age):* (Pleistocene)*Raw Properties:*

Working properties:	plastic
Water of plasticity:	20.4%
Drying shrinkage:	5.0%
Dry strength:	good
pH:	5.1

Slow Firing Test:

<i>Temp.</i> °C	<i>Color</i>	<i>Hard- ness</i>	<i>% Lin. Shk.</i>	<i>% Abs.</i>	<i>% Appar. Poros.</i>	<i>Bulk Dens. gm/cc</i>
1000	Light orange yellow	3	5.0	17.1	30.6	1.79
1050	Light orange yellow	3	5.0	16.9	30.3	1.79
1100	Moderate orange	3	5.0	14.7	27.2	1.85
1150	Moderate orange	3	5.0	13.7	25.7	1.87
1200	Moderate orange	2	7.5	11.8	22.7	1.92
1250	Moderate yellowish pink	4	7.5	10.1	19.8	1.96

Remarks: No effervescence with HCl.

Analyses: (Virginia Division of Mineral Resources)

<i>Chemical:</i>		<i>Mineralogy:</i>
SiO ₂	76.61	Chlorite
Al ₂ O ₃	12.04	Quartz
Fe ₂ O ₃	2.27	Feldspar
CaO	0.15	Halloysite
MgO	0.38	Illite
Na ₂ O	0.70	
K ₂ O	1.17	
TiO ₂	1.03	
MnO	0.01	
P ₂ O ₅	0.00	
LOF	5.62	

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., building brick at 1,250°C).

SAMPLE: R-7400

COUNTY: Virginia Beach (City of)

Date: March, 1979—Tuscaloosa Research Center*Locality:* N4,045,430 E403,920 (Zone 18). Creeds 7.5-minute quadrangle. Roadcut, 1.4 miles (2.2 km) south of Vine, on the east side of Blackwater Road approximately 210 feet (64 m) by road south of its intersection with Reads Road.*Description of Outcrop:* Light-gray and light-olive-gray plastic clay with some dark-yellowish-orange clay mot- tles in a roadcut with a maximum height of 3 feet (1 m). Clay becomes sandy towards the bottom of the auger hole. Overburden consists of several inches of dark-brownish-gray, mealy material.*Formation/(Age):* (Pleistocene)*Sampled Interval:* Channel sample across 2.5 feet (0.8 m) of clay and 1 foot (0.3 m) of augered clay.*Raw Properties:*

Working properties:	plastic
Water of plasticity:	23.8%
Drying shrinkage:	5.0%
Dry strength:	good
pH:	6.4

Slow Firing Test:

<i>Temp.</i> °C	<i>Color</i>	<i>Hard- ness</i>	<i>%Lin. Shk.</i>	<i>% Abs.</i>	<i>% Appar. Poros.</i>	<i>Bulk Dens. gm/cc</i>
1000	Yellowish white	3	5.0	19.8	34.0	1.72
1050	Yellowish white	3	5.0	17.4	30.9	1.78
1100	Light orange yellow	3	5.0	16.5	29.9	1.81
1150	Moderate orange yellow	3	7.5	14.5	26.7	1.85
1200	Light yellowish brown	4	7.5	11.2	21.7	1.93
1250	Grayish yellow	5	10.0	8.2	16.7	2.03

Remarks: No effervescence with HCl.

Analyses: (Virginia Division of Mineral Resources)

<i>Chemical:</i>		<i>Mineralogy:</i>
SiO ₂	72.62	Quartz
Al ₂ O ₃	14.41	Chlorite
Fe ₂ O ₃	2.00	Feldspar
CaO	0.25	Illite
MgO	0.55	
Na ₂ O	0.72	
K ₂ O	1.70	
TiO ₂	0.94	
MnO	0.02	
P ₂ O ₅	0.04	
LOF	6.75	

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., structural tile, building brick at 1,200°-1,250°C).

SAMPLE: R-7401

COUNTY: Virginia Beach (City of)

Date: March, 1979—Tuscaloosa Research Center*Locality:* N4,065,580 E401,860 (Zone 18). Pleasant Ridge 7.5-minute quadrangle. Ditchcut, 2.55 miles (4.11 km) southwest of Princess Anne on the east side of North Landing Road approximately 570 feet (174 m) by road south of its intersection with Indian River Road.*Description of Outcrop:* Light-gray to yellowish-gray and medium-gray plastic clay with some dark-yellowish-orange clay mottles in a ditch. Clay becomes slightly sandy at the bottom of the auger hole. Thin silty overburden covers the clay.*Formation/(Age):* (Pleistocene)*Sampled Interval:* Channel sample across 2 feet (0.6 m) of clay and 2 feet (0.6 m) of augered clay.*Raw Properties:*

Working properties:	short
Water of plasticity:	16.8%
Drying shrinkage:	2.5%
Dry strength:	fair
pH:	7.2

Slow Firing Test:

Temp. °C	Color	Hard- ness	%Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Pale orange yellow	2	2.5	17.1	30.3	1.77
1050	Moderate orange yellow	3	2.5	16.0	28.6	1.79
1100	Moderate orange	3	2.5	14.4	26.3	1.83
1150	Moderate orange	3	5.0	11.6	22.1	1.90
1200	Light brown	4	5.0	6.7	13.5	2.03
1250	Light grayish brown	4	7.5	3.1	6.6	2.15

Remarks: No effervescence with HCl.

Analyses: (Virginia Division of Mineral Resources)

<i>Chemical:</i>		<i>Mineralogy:</i>
SiO ₂	80.84	Feldspar
Al ₂ O ₃	9.54	Quartz
Fe ₂ O ₃	1.26	Chlorite
CaO	0.63	Halloysite
MgO	0.33	Illite
Na ₂ O	1.34	
K ₂ O	1.45	
TiO ₂	0.83	
MnO	0.01	
P ₂ O ₅	0.00	
LOF	3.75	

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., structural tile, building brick at 1,200°-1,250°C).

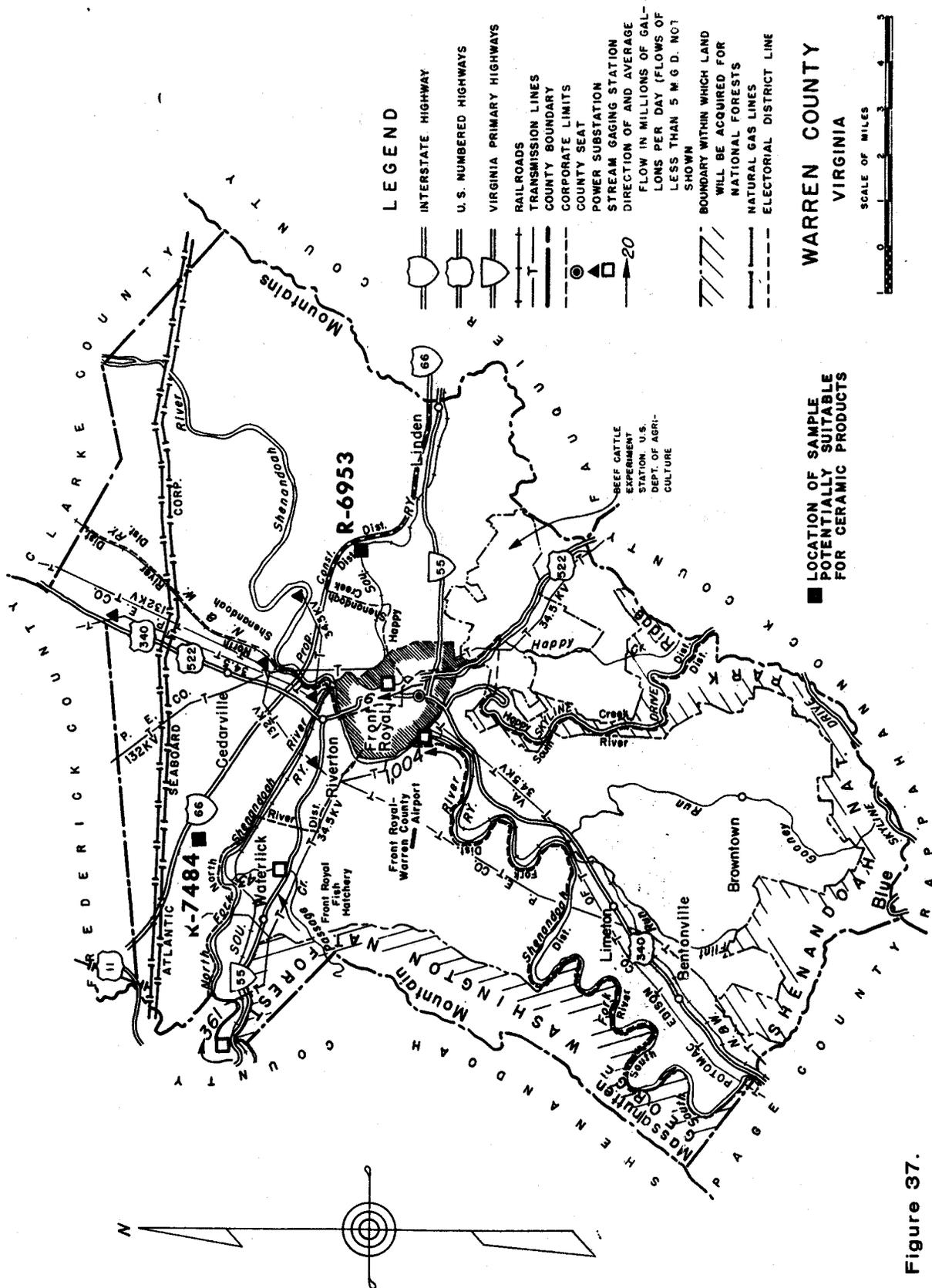


Figure 37.

SAMPLE: R-6953

COUNTY: Warren

Date: June, 1977 — Tuscaloosa Research Center

Locality: N4,313,150 E748,530 (Zone 17). Front Royal 7.5-minute quadrangle. Roadcut, 3.3 miles (5.3 km) east of Front Royal, on the south side of State Road 647 approximately 0.15 mile (0.24 km) by road west of proposed Interstate Highway 66 and 0.2 mile (0.3 km) east by State Road 647 of tracks of the Southern Railway.

Description of Outcrop: About 10 + feet (3 m) of very pale-orange and pale- and dark-yellowish-orange to moderate-reddish-brown plastic clay in a 450-foot (137-m) roadcut with a maximum height of about 30 feet (9 m). The clay is slightly silty in the lower part of the top half of the sampled section. Clay is extremely plastic at the top and bottom of the exposure. Overburden consists of two feet (1 m) of pale-yellowish-orange material.

Formation/(Age): Residual clay on Rome Formation (Cambrian)

Sampled Interval: Representative channel samples across 10 + feet (3 m) of clay in the bare, western part of the roadcut.

Raw Properties:

Working properties: plastic
 Water of plasticity: 28.8%
 Drying shrinkage: 2.5%
 Dry strength: good
 pH: 5.0

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	5.0	20.2	36.6	1.81
1050	Moderate orange	3	7.5	18.5	34.1	1.85
1100	Brownish orange	3	12.5	11.8	24.5	2.08
1150	Strong brown	3	12.5	11.4	23.7	2.08
1200	Grayish reddish orange	4	12.5	8.8	19.2	2.19
1250	Mod. reddish brown	5	12.5	4.2	9.8	2.35

Remarks: High shrinkage, no effervescence with HCl.

Preliminary Bloating Test: Negative

Potential Use: Marginal for structural clay products (e.g., building brick at 1,200°-1,250°C).

SAMPLE: R-7484

COUNTY: Warren

Date: July, 1979—Tuscaloosa Research Center*Locality:* N4,319,070 E737,960 (Zone 17). Strasburg 7.5-minute quadrangle. Roadcut, 2.4 miles (3.8 km) north of Buckton, on the west side of State Road 637 approximately 0.05 mile (0.08 km) by road north of its intersection with State Road 626.*Description of Outcrop:* Yellowish-gray to light-olive-gray shale in a 110-foot (34-m) roadcut with a maximum height of 7 feet (2 m). Some of the shale (about 3 inches) (8 cm) has disintegrated into a plastic, very light-gray clay. There is a thin siltstone near the top of the exposure; some grayish-orange and dark-gray iron-oxide stain is on bedding surfaces. The shale strikes N35°E and dips 70°SE.*Formation/(Age):* Martinsburg Formation (Ordovician)*Sampled Interval:* Representative sample taken across 7.5 feet (2 m) of shale and clay.*Raw Properties:*

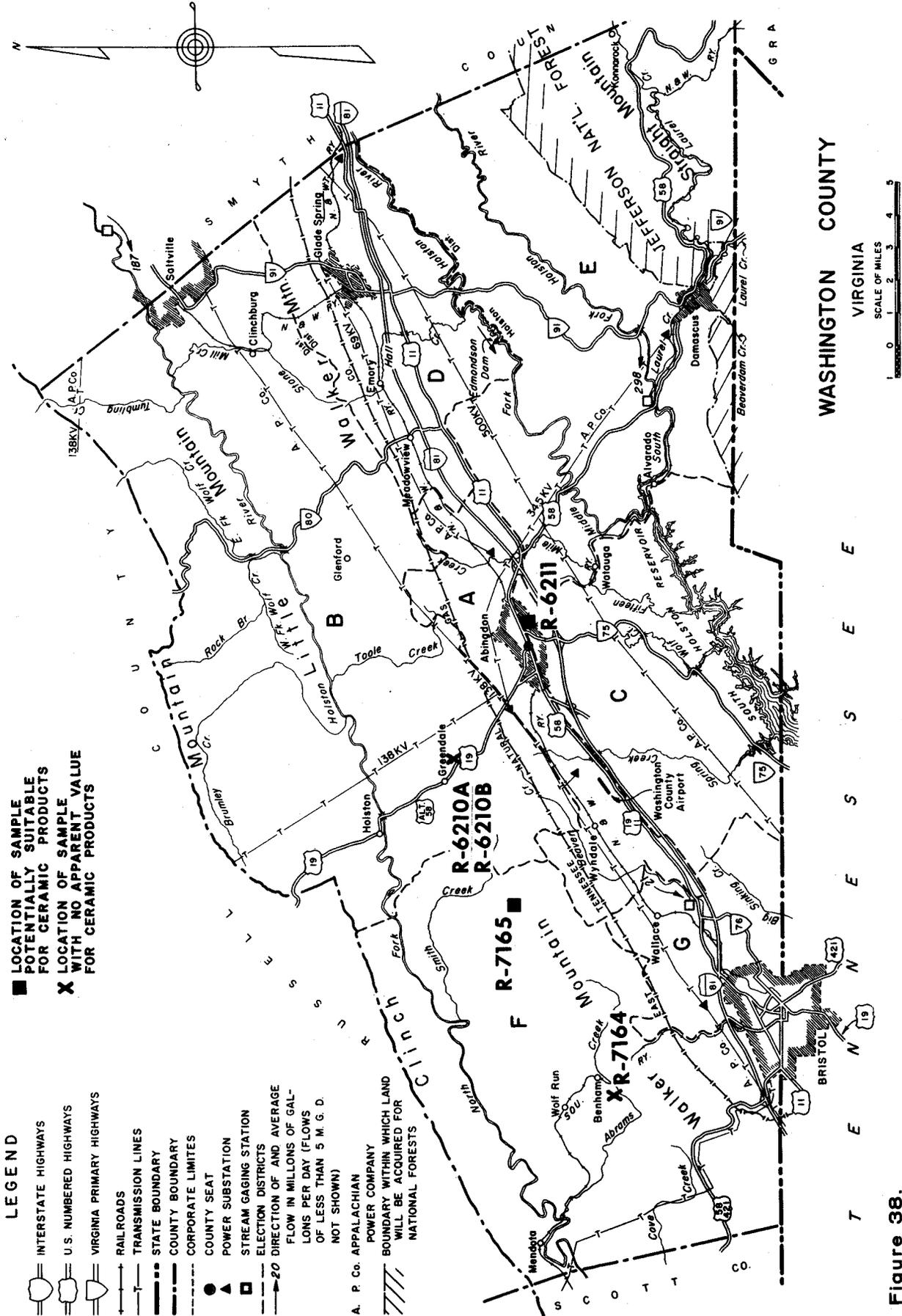
Working properties: short
 Water of plasticity: 16.4%
 Drying shrinkage: 2.5%
 Dry strength: fair
 pH: 8.2

Slow Firing Test:

Temp. °C	Color	Hard- ness	%Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	5.0	14.0	27.0	1.93
1050	Grayish reddish orange	3	5.0	10.9	22.1	2.03
1100	Grayish reddish orange	4	7.5	6.1	13.4	2.18
1150	Moderate reddish brown	4	7.5	3.7	8.2	2.23
1200	—	—	Melted	—	—	—
1250	—	—	—	—	—	—

Remarks: Presence of carbonates could cause problems, slight effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., building brick, floor brick at 1,100°-1,150°C).



SAMPLE: R-6210-A and 6210-B

COUNTY: Washington

Date: August, 1975—Tuscaloosa Research Center*Locality:* N4,066,650 E406,610 (Zone 17). Wyndale 7.5-minute quadrangle. Roadcut, 0.4 mile (0.6 km) southeast of Greendale, on the north side of U. S. Highway 58 approximately 0.2 mile (0.3 km) by road southeast of its intersection with State Road 775.*Description of Outcrop:* Light, well-indurated gray shale.

R-6210-A

Sampled Interval: Representative composite sample across 40 feet (12 m) of shale.*Raw Properties:*

Working properties:	short
Water of plasticity:	14.8%
Drying defects:	none
Drying shrinkage:	5.0%
Dry strength:	fair
pH:	8.3

Slow Firing Test:

Temp. °F	Color	Hard- ness	%Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1800	Brownish orange	2	5.0	17.2	30.7	1.79
1900	—	—	(Expanded)	—	—	—
2000	—	—	—	—	—	—

Remarks: May be limy, slight effervescence with HCl.

Preliminary Bloating Test: Positive*Bloating Test:* (Particle size—3/4" lumps, crushing characteristics—platy, retention time—15 minutes).

Temp. °F	% Abs.	Bulk Dens. gm/cc (lb./ft ³)		Remarks
1800	—	—	—	Platy
1900	13.6	1.73	108.0	No expansion
2000	11.4	1.79	111.7	No expansion
2100	10.3	1.50	93.6	No expansion
2200	9.0	1.17	73.0	Partial melting
2300	—	—	—	—

Comments: May be limy, mixture of clays.

Potential Use: Not suitable for use as lightweight aggregate.

R-6210-B

Sampled Interval: Representative composite sample across 50 feet (15 m) of shale; sample below R-6210-A.

Raw Properties:

Working properties:	short
Water of plasticity:	14.2%
Drying defects:	none
Drying shrinkage:	5.0%
Dry strength:	fair
pH:	8.3

Slow Firing Test:

Temp. °F	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1800	Light brown	2	5.0	13.3	25.8	1.93
1900	Brownish orange	2	5.0	12.8	25.0	1.96
2000	—	—	(Expanded)	—	—	—
2100	—	—	—	—	—	—

Remarks: May be limy; slight effervescence with HCl.

Preliminary Bloating Test: Positive

Bloating Test: (Particle size — 3/4" lumps, crushing characteristics — platy, retention time — 15 minutes).

Temp. °F	% Abs.	Bulk Dens. gm/cc (lb./ft. ³)		Remarks
1800	—	—	—	Platy
1900	—	—	—	Platy
2000	6.9	1.98	123.6	No expansion
2100	10.4	1.18	73.6	Partial expansion
2200	11.6	0.80	49.9	Melted
2300	—	—	—	—

Comments: May be limy, mixture of clays.

Potential Use: Not suitable for use as lightweight aggregate.

SAMPLE: R-6211

COUNTY: Washington

Date: September, 1976—Tuscaloosa Research Center*Locality:* N4,062,880 E413,220 (Zone 17). Abingdon 7.5-minute quadrangle. Along Town Creek near the Norfolk and Western Railway crossing for Greenspring Road, near the site of Blacks Fort, Abingdon, Virginia.*Description of Outcrop:* Light-olive-gray to dark-yellowish-brown clay.*Formation/(Age):* Residuum on Chepultepec Formation*Sampled Interval:* Grab sample (?)**Raw Properties:**

Working properties: plastic
 Water of plasticity: 22.0%
 Drying shrinkage: 2.5%
 Dry strength: good
 pH: 6.9

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	5.0	22.4	37.4	1.67
1050	Brownish orange	4	5.0	17.9	31.8	1.78
1100	Strong brown	5	5.0	13.7	25.7	1.89
1150	Moderate brown	7	10.0	7.5	15.3	2.03
1200	Moderate brown	7	10.0	5.6	11.6	2.07
1250	—	—	Melted	—	—	—

Remarks: Abrupt vitrification at 1,200°C, may be limy, slight effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., facing brick) 1,100°C-1,200°C.

SAMPLE: R-7164

COUNTY: Washington

Date: September, 1977 – Tuscaloosa Research Center*Locality:* N4,058,440 E390,090 (Zone 17). Wallace 7.5-minute quadrangle. Roadcut, 1.0 mile (1.6 km) southwest of Benham, on the west side of State Road 700 approximately 0.2 mile (0.3 km) by road northeast of its intersection with State Road 641.*Description of Outcrop:* About 5 feet (1.5 m) of pale-red to grayish-red, maroon and yellowish-gray to light-olive-gray and grayish-green and dark-yellowish-orange silty shale in a 250-foot (76-m) roadcut with a maximum height of 12 feet (4 m). Shale contains some small ripple marks. Some carbonate is in the top of the exposure, but was not sampled. Shale strikes N19°E and dips 26°SE. Some of the material contains a small amount of siltstone.*Formation/(Age):* Pumpkin Valley (Cambrian)*Sampled Interval:* Composite of representative samples taken across 5 feet (1.5 m) of shale.*Raw Properties:*

Working properties:	—
Water of plasticity:	—
Drying shrinkage:	—
Dry strength:	—
pH:	6.4

Slow Firing Test: Material failed to form cohesive mass when tested.

Remarks: No effervescence with HCl.

Preliminary Bloating Test: Negative

SAMPLE: R-7165

COUNTY: Washington

Date: September, 1977 — Tuscaloosa Research Center*Locality:* N4,063,310 E398,830 (Zone 17). Wallace 7.5-minute quadrangle. Roadside excavation 0.45 mile (0.72 km) east of Rocktown on the northeast side of State Road 625 approximately 1.8 miles (2.9 km) by road north of its intersection with State Road 633.*Description of Outcrop:* About 50 feet (15 m) of predominantly thin-bedded light-olive-gray to greenish-gray, indurated, fissile shale in a roadside excavation. Brownish-gray to black iron-oxide stain is on some joint and fracture surfaces. Shale strikes N66°E and dips 25°SE. Two prominent joints have attitudes N4°W, 85°W and N55°E, 63°NW. Many weathered angular fragments were on the exposure. Some small brachiopods are in the shale, which becomes conglomeratic and dolomitic down-section.*Formation/(Age):* Nolichucky Formation (Cambrian)*Sampled Interval:* Composite of representative samples taken across 50 feet (15 m) of shale.*Raw Properties:*

Working properties:	short
Water of plasticity:	19.6%
Drying shrinkage:	2.5%
Dry strength:	fair
pH:	6.3

Slow Firing Test:

Temp. °C	Color	Hard- ness	%Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Light yellowish pink	3	2.5	16.9	30.0	1.77
1050	Moderate yellowish pink	3	2.5	15.3	27.7	1.80
1100	Moderate orange	3	5.0	10.7	20.3	1.92
1150	Moderate brown	4	7.5	6.2	12.1	1.97
1200	—	—	Melted	—	—	—

Remarks: Short firing range, abrupt vitrification between 1,150°-1,200°C, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Marginal for structural clay products (e.g., building brick at 1,150°C).

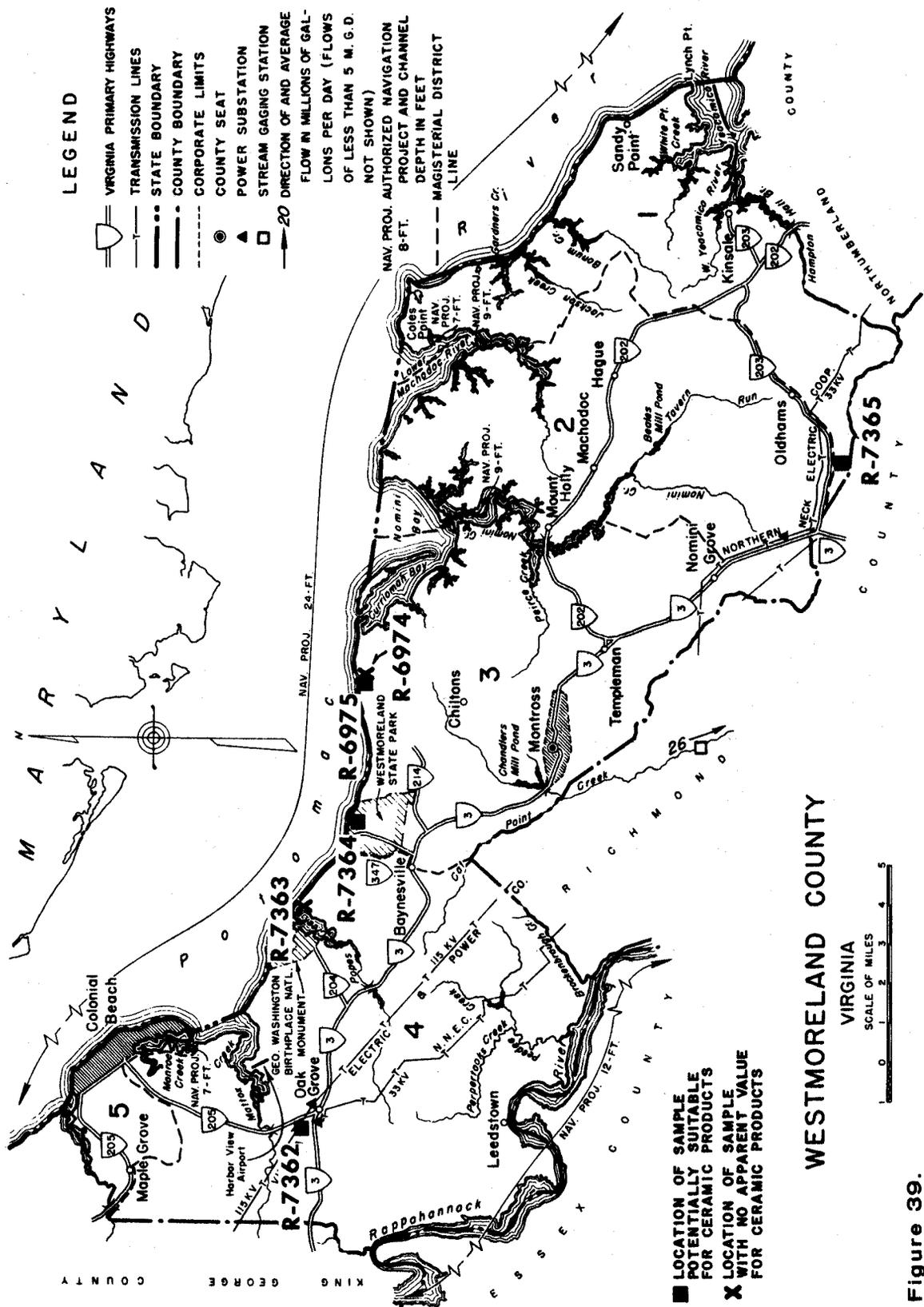


Figure 39.

SAMPLE: R-6974

COUNTY: Westmoreland

Date: June, 1977 — Tuscaloosa Research Center*Locality:* N4,225,770 E342,560 (Zone 18). Stratford Hall 7.5-minute quadrangle. (3.7 km) northeast of Stratford Hall, in the eastern end of Nomini Cliffs on the south bank of the Potomac River, 0.1 mile (0.2 km) north-northwest of the intersection of Independence Drive (Local Road 1601) with Bishop Drive.*Description of Outcrop:* Exposure in the base of the river bluff consists of 35 + feet (11 + m) of light-olive-gray to grayish-olive and dark-greenish-gray, diatom-bearing clay and mudstone. Weathered diatomaceous material is yellowish-gray to very-light-gray. Some material is slightly silty. Dark-yellowish-orange, iron-oxide stain is on the clay.*Formation/(Age):* Calvert Formation (Miocene)*Sampled Interval:* Representative samples taken across approximately 35 feet (11 m) of clay.*Raw Properties:*

Working properties: short
 Water of plasticity: 30.6%
 Drying shrinkage: 5.0%
 Dry strength: good
 pH: 2.8

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	2	5.0	25.0	38.8	1.55
1050	Moderate orange	2	5.0	24.3	38.0	1.57
1100	Brownish orange	3	7.5	18.0	30.9	1.69
1150	Strong brown	3	7.5	18.0	30.5	1.72
1200	—	—	Melted	—	—	—
1250	—	—	—	—	—	—

Remarks: Abrupt vitrification between 1,150°-1,200°C, too soft, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Not suitable for structural clay products.

SAMPLE: R-6975

COUNTY: Westmoreland

Date: June, 1977 - Tuscaloosa Research Center

Locality: N4,225,730 E342,560 (Zone 18). Stratford Hall 7.5-minute quadrangle. River bluff, 2.3 miles (3.7 km) northeast of Stratford Hall, in the eastern end of Nomini Cliffs on the south bank of the Potomac River, 0.05 mile (0.08 km) north-northeast of the intersection of Independence Drive (Local Road 1601) with Bishop Drive.

Description of Outcrop: Exposure of 4 feet (1 m) of very pale-orange and yellowish-gray plastic clay mottled with pale- and dark-yellowish-brown, plastic clay near the top of river bluff. Clay is overlain by about 15 feet (5 m) of yellowish-orange sand and silty clay with pebbles. Dark-yellowish-orange soil is over most of this material. Rootlets are in the clay.

Formation/(Age): St. Marys Formation (Miocene)

Sampled Interval: Representative channel sample taken across 4 feet (1 m) of clay.

Raw Properties:

Working properties: plastic
 Water of plasticity: 20.4%
 Drying shrinkage: 5.0%
 Dry strength: good
 pH: 4.1

Slow Firing Test:

Temp. °C	Color	Hard ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	5.0	17.7	31.6	1.78
1050	Moderate orange	3	5.0	17.0	30.8	1.82
1100	Moderate orange	3	7.5	14.1	26.4	1.88
1150	Moderate orange	3	7.5	13.6	25.6	1.88
1200	Moderate orange	4	7.5	12.4	23.8	1.92
1250	Light reddish brown	5	10.0	6.1	13.0	2.15

Remarks: No effervescence with HCl.

Preliminary Bloating Test: Negative

Potential Use: Structural clay products (e.g., building brick at 1,200°-1,250°C).

SAMPLE: R-7362

COUNTY: Westmoreland

Date: December, 1978 — Tuscaloosa Research Center*Locality:* N4,228,340 E324,780 (Zone 18). Rollins Fork 7.5-minute quadrangle. Roadcut 3.3 miles (5.3 km) east of Rollins Fork, on the west-southwest side of State Hwy. 205 approximately 0.25 mile (0.40 km) by road northwest of its intersection with State Road 638.*Description of Outcrop:* Very pale-orange to dark-yellowish-orange and moderate-yellowish-brown plastic clay mottled with moderate-reddish-brown and dark-grayish-pink silty clay in a 350-foot (107-m) roadcut with a maximum height of 6 feet (2 m). Material becomes increasingly sandy toward the base of the exposure.*Formation/(Age):* (Pleistocene)*Sampled Interval:* Representative channel sample across 5 feet (2 m) of clay.*Raw Properties:*

Working properties: plastic
 Water of plasticity: 31.9%
 Drying shrinkage: 2.5%
 Dry strength: good
 pH: 5.5

Slow Firing Test:

Temp. °C	Color	Hard- ness	%Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	5.0	21.1	36.7	1.74
1050	Moderate orange	3	7.5	19.0	33.8	1.78
1100	Brownish orange	3	7.5	17.1	31.3	1.83
1150	Strong brown	3	7.5	16.0	29.7	1.86
1200	Strong brown	4	7.5	14.8	27.6	1.87
1250	Moderate reddish brown	5	10.0	14.0	26.4	1.88

Remarks: Possible use in the soft mud process, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., building brick at 1,200°-1,250°C).

SAMPLE: R-7363

COUNTY: Westmoreland

Date: December, 1978—Tuscaloosa Research Center*Locality:* N4,228,260 E33,540 (Zone 18). Colonial Beach South 7.5-minute quadrangle. River cliff, 3.0 miles (4.8 km) northwest of Baynesville on the south bank of the Potomac River, about 750 feet (229 m) southeast from the end of State Road 624.*Description of Outcrop:* Light-olive-gray to olive-gray with some medium-dark-gray, very plastic clay in river cliff with maximum height of 15 feet (5 m). Clay is overlain with sand and gravel. Some of the clay is stained dark-yellowish-orange by iron oxide. There is some carbonaceous material in the clay.*Formation/(Age):* Calvert Formation (Miocene)*Sampled Interval:* Representative channel sample across 5 feet (2 m) of clay at the base of the cliff.*Raw Properties:*

Working properties:	plastic
Water of plasticity:	21.2%
Drying shrinkage:	2.5%
Dry strength:	good
pH:	5.4

Slow Firing Test:

Temp. °C	Color	Hard- ness	%Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange yellow	3	5.0	20.5	35.7	1.74
1050	Moderate orange	3	5.0	18.7	33.3	1.78
1100	Grayish reddish orange	3	7.5	16.7	30.4	1.83
1150	Grayish reddish orange	3	7.5	14.0	26.5	1.89
1200	Moderate reddish brown	3	7.5	11.0	21.6	1.96
1250	Light grayish reddish brown	3	7.5	8.1	16.4	2.02

Remarks: Too soft, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Not suitable for structural clay products.

SAMPLE: R-7364

COUNTY: Westmoreland

Date: December, 1978—Tuscaloosa Research Center*Locality:* N4,226,210 E336,570 (Zone 18). Stratford Hall 7.5-minute quadrangle. River bluff, 2.0 miles (3.2 km) north of Lerty, near the middle of the Horsehead Cliffs, on the south bank of the Potomac River and about 750-feet (229 m) east of the trail down the cliff behind the park restaurant.*Description of Outcrop:* Medium-light-gray and grayish-orange very plastic clay mottled with dark-yellowish-orange, light-reddish-brown and moderate-brown plastic clay near the middle of the 150-foot (46-m) high Horsehead Cliffs. Diatomaceous material is above and below the exposure.*Formation/(Age):* Calvert Formation (Miocene)*Sampled Interval:* Representative channel sample across 4 feet (1 m) of clay.*Raw Properties:*

Working properties:	plastic
Water of plasticity:	32.3%
Drying shrinkage:	5.0%
Dry strength:	good
pH:	4.8

Slow Firing Test:

Temp. °C	Color	Hard- ness	%Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate yellowish pink	3	10.0	18.5	33.3	1.80
1050	Moderate orange	4	12.5	10.7	21.6	2.02
1100	Grayish reddish orange	5	15.0	4.6	10.1	2.21
1150	Moderate reddish brown	5	15.0	1.0	2.3	2.30
1200	—	—	Melted	—	—	—
1250	—	—	—	—	—	—

Remarks: High shrinkage, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., building brick at 1,050°-1,100°C).

SAMPLE: R-7365

COUNTY: Westmoreland

Date: December, 1978—Tuscaloosa Research Center*Locality:* N4,205,280 E350,640 (Zone 18). Haynesville 7.5-minute quadrangle. Roadcut, 0.55 mile (0.89 km) south of Threeway, on the east side of State Road 620 approximately 125 feet (38 m) by road northeast of the Westmoreland-Richmond county line.*Description of Outcrop:* Dark-yellowish-orange slightly silty clay with silty pale-yellowish-orange to plastic grayish-orange, plastic light-gray and moderate-reddish-brown silty clay mottles in a 300-foot (91-m) roadcut with a maximum height of 7 feet (2 m). Overburden is silty and yellowish-orange.*Formation/(Age):* (Pleistocene)*Sampled Interval:* Representative channel sample across the lower 5 feet (2 m) of clay.*Raw Properties:*

Working properties:	plastic
Water of plasticity:	20.5%
Drying shrinkage:	2.5%
Dry strength:	good
pH:	6.4

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Moderate orange	3	5.0	19.6	34.3	1.75
1050	Moderate orange	3	5.0	18.2	32.4	1.77
1100	Moderate orange	3	5.0	17.9	31.9	1.78
1150	Brownish orange	3	5.0	14.6	27.3	1.87
1200	Strong brown	4	7.5	13.6	25.5	1.88
1250	Grayish reddish orange	4	7.5	13.3	25.2	1.89

Remarks: Possible use in soft mud process, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., building brick at 1,200°-1,250°C).

SAMPLE: R-6699

COUNTY: Wise

Date: January, 1977 — Tuscaloosa Research Center*Locality:* N4,097,300 E361,580 (Zone 17). Pound 7.5-minute quadrangle. On the north side of Dotson Branch, 1.3 miles (2.1 km) northwest of Hurricane, east of the Wise County Sanitary Landfill.*Description of Outcrop:* Medium-gray underclay*Formation/(Age):* Wise Formation (Pennsylvanian)*Sampled Interval:* Representative channel sample across 2 feet (1 m) of exposure.*Raw Properties:*

Working properties: short
 Water of plasticity: 16.4%
 Drying shrinkage: 5.0%
 Dry strength: fair
 pH: 8.3

Slow Firing Test:

Temp. °C	Color	Hard- ness	% Lin. Shk.	% Abs.	% Appar. Poros.	Bulk Dens. gm/cc
1000	Pale orange yellow	3	5.0	15.3	28.5	1.86
1050	Pale orange yellow	3	5.0	13.8	26.4	1.90
1100	Moderate orange	4	10.0	11.2	22.3	1.99
1150	Dark yellow orange	6	10.0	4.1	9.0	2.20
1200	Lt. grayish reddish brown	7	10.0	1.0	2.2	2.19
1250	—	—	Melted	—	—	—

Remarks: Too soft below 1,100°C, no effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., building brick at 1,100°-1,150°C).

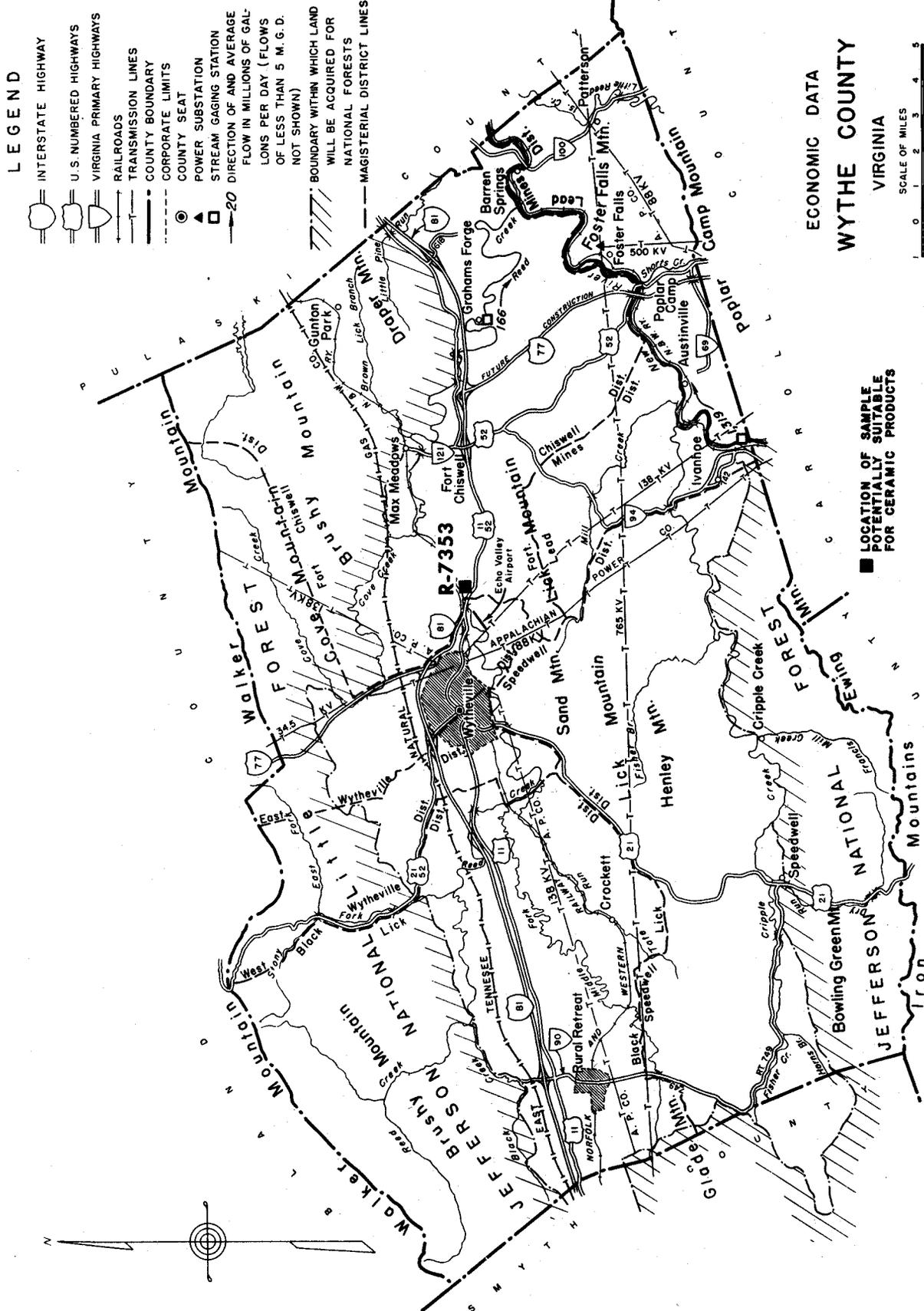


Figure 41.

SAMPLE: R-7353

COUNTY: Wythe

Date: September, 1978—Tuscaloosa Research Center*Locality:* Wytheville 7.5-minute quadrangle. From the settling pond of Silica Products Company, Division of Locher Silica Corporation, at the company plant on the north side of U. S. Highway 11, just east of the crossing of Reed Creek and about half a mile west of the intersection of State Road 649 east of Wytheville.*Description:* Yellowish-gray clay from the company settling pond.*Sampled Interval:* Grab sample (?)*Raw Properties:*

Working properties: plastic
 Water of plasticity: 17.9%
 Drying shrinkage: 2.5%
 Dry strength: good
 pH: 6.0

Slow Firing Test:

<i>Temp.</i> °C	<i>Color</i>	<i>Hard- ness</i>	<i>%Lin. Shk.</i>	<i>% Abs.</i>	<i>% Appar. Poros.</i>	<i>Bulk Dens. gm/cc</i>
1000	Moderate orange	3	2.5	21.0	37.4	1.77
1050	Moderate orange yellow	3	2.5	19.3	34.2	1.78
1100	Strong orange	3	5.0	19.1	34.0	1.78
1150	Moderate orange	4	5.0	15.5	29.4	1.90
1200	Moderate orange	4	5.0	14.4	27.6	1.92
1250	Pale orange yellow	5	5.0	13.3	25.8	1.93

Remarks: No effervescence with HCl.

Preliminary Bloating Test: Negative*Potential Use:* Structural clay products (e.g., building brick, structural tile at 1,150°-1,250°C); possibly in the soft-mud process.

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APPENDIX I
STRUCTURAL CLAY PRODUCTS¹

Product Raw Material	Fired Color	Description of Product	Uses
Common brick clays and shales	Reds to red-brown	Under-fired or off-color brick	Backing up masonry walls
Face-brick clays and shales	Creams, buffs, reds, browns (various scored, glazed, etc., finishes)	Uniform attractive colors, textured finishes	Facing walls
Decorative-brick clays and shales	Unusual colors, pinks, buffs, grays, etc.	Mottled and spotted	Facing walls and special applications, such as interior and exterior decorations
Hollow tile clays and shales	Not critical, usually reds, buffs, brown-reds	Rectangular, four holes	Back up for hollow wall construction
Wall tile clays and shales, talcs, etc.	White, buffs, etc., glazed to any color	Flat squares	Interior wall (facings, etc.)
Drain-tile clays and shales	Buffs to red-brown	Porous, circular shapes	Septic fields and water drainage around suburban housing developments
Roofing tile clays and shales	Buffs, reds, browns	Corrugated or channeled	Roofs
Floor-tile clays and shales (can be synthetic mixes)	Various colors	Vitrified, dense	Floors and patios
Chimney flue-tile clays and shales, low grade fire clays	Buffs, reds, and red-brown	Hollow cross sections, refractory	Lining of chimneys
Terra-cotta clays and shales, buff burning, 25-50% calcined material	Various	Variety of shapes and colors, hollow construction, glazed and unglazed	Facing walls, interior and exterior decoration
Electrical conduit clay and shales	Buffs, reds, and brown	Square sectional, vitrified	Conduit for underground electrical wiring
Sewer-pipe clays and shales	Reds, red-brown	Usually salt glazed, circular with flanged end	Sewer drainage
Lightweight-aggregate clays and shales	Light to dark colors	Expanded or bloated particles	Lightweight concretes, blocks, etc., for back up

¹from Sweet (1973).

APPENDIX II

CRITERIA USED IN EVALUATING MATERIAL FOR STRUCTURAL CLAY PRODUCTS¹

	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	(5-6)	(6)	(6)	(6)	(6)	(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, buffs, creams	Unusual colors, pinks, grays, etc.	Not critical usually red, brown-red, buffs	White, buffs, reds, creams	Buff to red-browns
Scumming	Slight	None	None	Slight	None	Slight

¹from Sweet (1973).

	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	(6)	(6)	(5)	(6)	(6)
Absorption %	0-10	0-20	0-20	8-25	0-8
Shrinkage %	0-8	0-8	0-8	0-8	0-8
Color	Buff, reds, browns	Reds, buffs, dark browns	Buff, red, and red-brown	Reds, buff, gray-buffs, off-whites	Reds, red-brown
Scumming	None	None	None	None	None

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

APPENDIX III

CRITERIA USED IN EVALUATING MATERIAL FOR LIGHTWEIGHT AGGREGATE¹

	Sintering process	Rotary kiln process
<i>Unfired properties</i>		
Drying characteristics	Not critical, water used to pelletize before firing	Dry readily and show only slight disintegration
Dry strength	Not critical	Strength must be sufficient for proper sizing when crushed for kiln feed
Crushing characteristics	Not critical except where particles tend to be thin and platy	- 8 mesh material should not exceed 20%*
<i>Fired properties</i>		
Firing range	Vitreous and glazes between 2200-2300°F	1800-2200 °F
Bloating range	Not critical	Minimum 100°F, 200° preferred
Weight	55 lb./ft. ³ (1/2" to No. 4)	55 lb./ft. ³ (1/2" to No. 4)
Expansion	Slight	Gradual weight decrease thru bloating range
% Absorption	0-6.0	0-18.0 at best bloating temperature
Color	Light red-grays preferred, although color not too critical	Light reds to light 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.

¹from Sweet (1973).

APPENDIX IV

FIRECLAY REFRACTORY BRICK CLASSIFIED ACCORDING TO CLASSES AND SUBDIVIDED INTO TYPES¹

Class	Type	Pyrometric Cone Equivalent, min	Pahe! Spalling Loss, max, per cent	Hot Load Subsidence, max, per cent	Reheat Shrinkage, max, per cent	Modulus of Rupture, min, psi (kgf/mm ²)	Other Test Requirements
FIRECLAY BRICK							
Super duty	Regular	33	8 at 3000 F (1649 C)	—	1.0 at 2910 F (1599 C)	600 (0.422)	—
	Spall resistant	33	4 at 3000 F (1649 C)	—	1.0 at 2910 F (1599 C)	600 (0.422)	—
	Slag resistant	33	—	—	—	1000 (0.703)	Bulk density, min, 140 lb/ft ³ (2243 kgm/m ³)
High duty	Regular	31 1/2	—	—	—	—	—
	Spall resistant	31 1/2	10 at 2910 F (1599 C)	—	—	500 (0.352)	—
	Slag resistant	31 1/2	—	—	—	1200 (0.844)	Bulk density, min, 137 lb/ft ³ (2194 kgm/m ³) or max porosity 15 per cent
Semi-silica	—	—	—	1.5 at 2460 F (1349C)	—	300 (0.211)	Silica content, min, 72 per cent
Medium duty	—	29	—	—	—	500 (0.352)	—
Low duty	—	15	—	—	—	600 (0.422)	—

¹from the 1972 Annual Book of ASTM Standards (ASTM Specification No. C27, Part 13, page 14), American Society for Testing and Materials

GLOSSARY

- Absorption (Abs.)**—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.
- Apparent porosity (Appar. Poros.)**—The ratio of the volume of open pores in a specimen to the bulk volume, usually expressed in percent.
- Bloating test**—A test to determine the ability of a ceramic material or product to expand when heated. Data on this test reported here are chiefly preliminary. The Results are repeated as "negative," meaning no bloating— or "positive."
- Bonding clay**—A clay of high plasticity and high dry strength used to bond nonplastic materials; it may or may not be refractory.
- Bulk density**—The weight of a solid per unit of exterior volume expressed in gm/cc or lb/ft.³
- Ceramic products**—Articles formed at least partly of clay materials and fired.
- Diatomaceous**—Containing microscopic plant shells composed of siliceous material.
- Drying characteristics**—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.
- 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 bricks are designated "NW", "MW", or "SW" to indicate suitability for use under negligible, mild, or severe weather conditions.
- Flux**—A substance that promotes fusion in a given ceramic mixture.
- Grog**—Ground up pieces of burned brick or clay, added to the raw clay mixture for the purpose of decreasing the shrinkage and density of the burned ware.
- Hardness**—The resistance to scratching or abrasion expressed verbally, or by Mohs scale of hardness as follows:
- Moh's scale
1. talc
 2. gypsum
 3. calcite
 4. fluorite
 5. apatite
 6. orthoclase feldspar
 7. quartz
- lb./ft.³—Pounds per cubic foot.
- Lightweight aggregate**—Aggregate produced by expanding, or bloating, of such materials as clay, shale, or slate which have been heated.
- Linear shrinkage**—The percent of linear contraction of a ceramic body, measured both after drying and after firing.
- Loss on ignition (L.O.F.)**—The loss in weight, expressed in percent, which results from heating a sample of material to a high temperature, after preliminary drying at a temperature just above the boiling point of water.
- Mealy**—A granular feel caused by lumpy, soft particles.
- Mineral filler**—An inert mineral substance added to certain manufactured products to impart desirable properties such as weight, wear resistance, and opacity.
- 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.
- Porous clay products**—Clay products capable of absorbing moisture, such as flower pots and garden pottery.
- 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 (PCE)**—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.
- Refractories**—Materials, usually non-metallic, used to withstand high temperature.
- Residual clay**—A clay deposit formed by the decay of rock in place.
- Shrinkage**—The reduction in size of ceramic material upon drying and firing.
- Slow firing test**—A test to determine the firing characteristics of ceramic raw material in which dried samples are fired in a kiln started at room temperature and raised to a maximum temperature over a period of hours. Samples removed at specific temperatures are evaluated for hardness, color, percent of total linear shrinkage, percent absorption, percent apparent porosity, and bulk density. (Morse Laboratories fired briquets together for two successive firing temperatures. The first set was removed as soon as the designated temperature was resumed until the second temperature was reached, after which the kiln was shut down and the second set of briquets was left in the kiln to cool.) Testing ends upon fusion of the sample material.
- Stoneware**—Fine-texture 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.
- Surface checking**—Fine cracks on a fired ceramic surface.
- Vitrification**—The continual reduction in porosity of a ceramic object or material as a result of firing.
- Water of plasticity**—The percent of water required to make a clay material plastic.
- Workability**—The consistency and moldability of plastic ceramic materials.