



COMMONWEALTH OF VIRGINIA
DEPARTMENT OF CONSERVATION
AND ECONOMIC DEVELOPMENT
DIVISION OF MINERAL RESOURCES

ANALYSES OF CLAY, SHALE,
AND RELATED MATERIALS—
SOUTHERN COUNTIES

PALMER C. SWEET

In Cooperation with U. S. Bureau of Mines

MINERAL RESOURCES REPORT 12

VIRGINIA DIVISION OF MINERAL RESOURCES

James L. Calver

Commissioner of Mineral Resources and State Geologist

CHARLOTTESVILLE, VIRGINIA

1973



Plant of Hercules Incorporated, Snowden, Virginia. Hampton Slate is utilized as raw material in the manufacture of lightweight aggregate. (Photograph courtesy of Hercules Incorporated.)



Plant of Hercules Incorporated, Snowden, Virginia. Hampton Slate is utilized as raw material in the manufacture of lightweight aggregate. (Photograph courtesy of Hercules Incorporated.)



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RICHMOND
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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, P. C., 1973. Analyses of clay, shale, and related materials—southern counties: Virginia Division of Mineral Resources. Mineral Resources Report 12. 183 p.

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ANALSES OF CLAY, SHALE, AND RELATED MATERIALS—SOUTHERN COUNTIES

By

PALMER C. SWEET

ABSTRACT

This report contains the results of tests and determinations of properties required to evaluate the potential ceramic and nonceramic uses of 101 samples of clay, shale and related materials that were collected in 22 counties in southern Virginia. Tests indicate that 93 samples are potentially suitable for use in one or more structural clay products, porous clay products, and pottery products, or in the white-ware and refractories industries, or for lightweight aggregate. Three of these samples were also found to have possible nonceramic applications. The present report, which includes approximately 27 percent of the total land area in Virginia, is the fifth in a series and completes presentation of data for the initial testing program in the State.

INTRODUCTION

This report is the fifth in a series of Mineral Resources Reports that contain field and laboratory data obtained in a statewide program of testing nonmetallic raw materials for their potential ceramic and nonceramic uses. The present report contains information on 22 counties in southern Virginia (Figure 1); these counties include approximately 27 percent of the total land area in Virginia. Of a total of 101 samples of clay, shale, and related materials that were collected, 93 were found to be potentially suitable for various uses in face and decorative brick, sewer pipe, tile, flower pots, stoneware bodies, earthenware, and artware and for lightweight aggregate; samples were also potentially suitable for use in the whiteware industry, in the refractories industry as super-duty firebrick and low-duty refractories such as flue pipe, as a plastic, nonplastic or flux-type nonplastic component, and as a filler insulating material, paper filler, and foundry soil. With the publication of this report, the initial program of statewide reconnaissance and evaluation of clay materials has been completed.

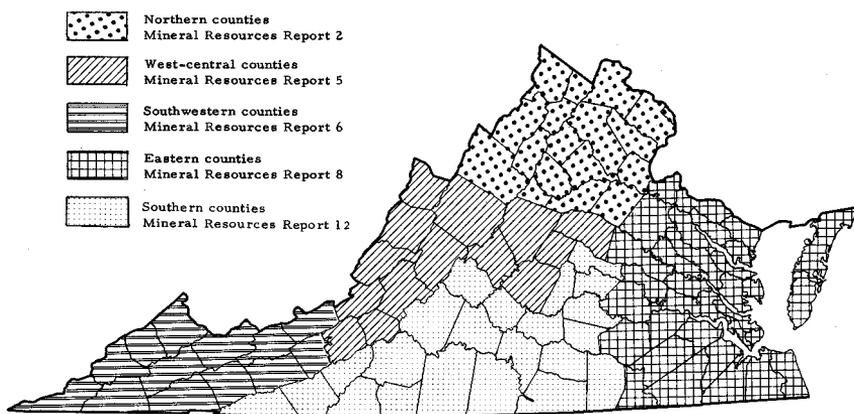


Figure 1. Areas of investigation.

Data for other areas are available in previous reports of the series, Mineral Resources Reports 2, 5, 6, and 8 of the Virginia Division of Mineral Resources.

Since November 1957 the Virginia Division of Mineral Resources and the U. S. Bureau of Mines have had a cooperative agreement to promote effective coordination of activities for exploration and evaluation of clays and similar materials for ceramic and nonceramic uses. The Division of Mineral Resources plans and conducts the field investigations, sampling, and correlation of field and laboratory data, and transmits the samples to the U. S. Bureau of Mines. Under the agreement, the responsibility of the U. S. Bureau of Mines is to make the appropriate tests and determinations of properties required to evaluate the potential uses of the submitted materials. Samples collected during the early part of the investigation, which was begun in February 1968, were tested at the Tuscaloosa Metallurgy Research Laboratory, Tuscaloosa, Alabama, under the direction of Miles E. Tyrrell; from early 1969 through November 1970, the samples were tested by Morse Laboratories, Sacramento, California. In this report, 20 samples were tested at the Tuscaloosa Laboratory, and 81 samples were tested at Morse Laboratories. The test data for these 101 samples are arranged by county and the potential uses are summarized at the beginning of each county discussion. The specifications of the various ceramic materials and the criteria generally used by both the Tuscaloosa Laboratory and Morse Laboratories in making the evaluations are listed in Appendices I-VI. Information on testing procedures for clay materials may be found in the "Syllabus of Clay Testing," Bulletin 565 of the U. S. Bureau of Mines, and in "Analyses of Clay, Shale,

and Related Materials—Northern Counties,” Mineral Resources Report 2 of the Virginia Division of Mineral Resources.

Materials sampled include residual clays from weathered rocks in the Piedmont and Blue Ridge provinces, and shales, slates and phyllites. Eight samples (R-3458, R-3544, R-3554, R-3663, R-3667, R-3668, R-3671, and R-4068) consist of Triassic sedimentary rocks in the Piedmont province and residual clays derived from those rocks. Samples were collected primarily from exposures in roadcuts; several samples were taken in active and inactive pits or quarries. The roadcuts from which most of the samples were collected do not provide sufficient exposures to determine total thickness or extent of the sampled materials. Descriptions of sample localities in the report indicate only the exposed thickness or height of material. Localities for which the test data indicate potential uses should be thoroughly investigated to determine whether adequate raw materials are available for commercial operations.

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

ACKNOWLEDGEMENTS

The writer wishes to thank the many persons who contributed information and assistance during the field investigation, the laboratory determinations, and the preparation of the manuscript. Stanley S. Johnson of the Division collected samples from Goochland County and, with D. C. Le Van, collected some of the samples from Cumberland County. Curtis D. Edgerton of the Eastern Field Operation Center, U. S. Bureau of Mines, Pittsburgh, provided information regarding the laboratories, their testing procedures and the criteria used in evaluating samples. Acknowledgement is made to the employees of the U. S. Bureau of Mines, who provided technical interpretation and analyses of the samples. Base maps used for plotting locations within individual counties were furnished by the Division of State Planning and Community Affairs.

SAMPLE DESCRIPTIONS
CHARACTERISTICS
AND EVALUATIONS

AMELIA COUNTY

Samples were collected from four localities in Amelia County. Testing by the Tuscaloosa Laboratory indicates the following potential uses for the raw material:

| <u>Sample</u> | <u>Formation or Age</u> | <u>Potential Use</u> |
|---------------|-------------------------|----------------------------------|
| R-3474 | Residual clay | Component in face-brick mixtures |
| R-3477 | Residual clay | Component in face-brick mixtures |
| R-3481 | Residual clay | Face brick |
| R-3482 | Residual clay | Component in face-brick mixtures |

SAMPLE: R-3474

County: Amelia

Locality: Roadcut, 0.6 mile west of Lodore, on the south side of State Road 616 approximately 0.6 mile by road west of its intersection with State Road 636.

Description: Yellow-orange plastic, micaceous clay, mottled with red, green and gray clay, is present in a roadcut 800 feet long, and has a maximum exposed thickness of 5 feet.

Formation or Age: Residual clay

Sampled Interval: Representative channel sample in the highest part of the exposure.

Raw Properties:

Water of plasticity: 29.0%

Working properties: moderate plasticity

Drying shrinkage: 5.0%

Dry strength: fair

Drying defects: none

pH: 5.6

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Abs. | % Appar. Porosity | Bulk Dens. gm/cc |
|--------------|-----------|---------------|----------------------|-----------|----------------------|---------------------|
| 1800 | Tan | 2 | 7.5 | 27.5 | 43.2 | 1.57 |
| 1900 | Tan | 2 | 7.5 | 26.9 | 43.0 | 1.60 |
| 2000 | Tan | 2 | 7.5 | 25.2 | 41.3 | 1.64 |
| 2100 | Lt. brown | 3 | 10.0 | 19.1 | 34.4 | 1.80 |
| 2200 | Brown | 4 | 10.0 | 18.3 | 33.1 | 1.81 |
| 2300 | Dk. brown | 5 | 12.5 | 16.8 | 30.9 | 1.84 |

Other tests and remarks: No effervescence with HCl; high absorption at all firing temperatures.

Bloating Test: Negative

Potential Use: Component in face-brick mixtures.

SAMPLE: R-3477

County: Amelia

Locality: Roadcut, 1.8 miles north of Mannboro, on the south side of State Road 659 at its intersection with State Road 612.

Description: Yellow-orange sandy and plastic clay, mottled with red and gray clay, is present in a roadcut 300 feet long, and has a maximum exposed thickness of 3 feet. Four feet of additional clay was indicated by augering to that depth at the base of the exposure. The clay becomes gritty with minor feldspar at the bottom of the auger hole.

Formation or Age: Residual clay

Sampled Interval: Composite of two representative channel samples in the highest part of the exposure, approximately 35 feet apart, and 4 feet of augered clay.

Raw Properties:

| | |
|----------------------------|---|
| Water of plasticity: 24.5% | Working properties: moderate plasticity |
| Drying shrinkage: 5.0% | Dry strength: fair |
| Drying defects: none | pH: 5.2 |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Abs. | Bulk Dens. gm/cc | % Appar. Porosity |
|--------------|-----------|---------------|----------------------|-----------|---------------------|----------------------|
| 1800 | Tan | 3 | 5.0 | 22.4 | 37.0 | 1.65 |
| 1900 | Tan | 4 | 5.0 | 22.5 | 37.4 | 1.66 |
| 2000 | Tan | 4 | 7.5 | 20.4 | 34.7 | 1.70 |
| 2100 | Lt. brown | 4 | 7.5 | 16.1 | 29.1 | 1.81 |
| 2200 | Lt. brown | 5 | 10.0 | 15.0 | 27.3 | 1.82 |
| 2300 | Brown | 5 | 10.0 | 14.8 | 27.1 | 1.83 |

Other tests and remarks: No effervescence with HC1; high absorption at all firing temperatures.

Bloating Test: Negative

Potential Use: Component in face-brick mixtures.

SAMPLE: R-3481

County: Amelia

Locality: Roadcut, 2.55 miles northeast of Rodophil, on the southeast side of State Road 616 at its intersection with State Road 644.

Description: Yellow and red, micaceous clay is present in a roadcut 525 feet long, and has a maximum exposed thickness of 3 feet. One and one-half feet of more micaceous clay was indicated by augering to that depth at the base of the exposure.

Formation or Age: Residual clay

Sampled Interval: Composite of two representative channel samples in the highest part of the exposure, approximately 245 feet apart, and 1.5 feet of augered clay.

Raw Properties:

| | |
|----------------------------|---|
| Water of plasticity: 32.9% | Working properties: moderate plasticity |
| Drying shrinkage: 5.0% | Dry strength: fair |
| Drying defects: none | pH: 5.4 |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Abs. | % Appar. Porosity | Bulk Dens. gm/cc |
|--------------|-----------|---------------|----------------------|-----------|----------------------|---------------------|
| 1800 | Tan | 2 | 7.5 | 28.1 | 43.6 | 1.55 |
| 1900 | Tan | 3 | 10.0 | 27.2 | 43.0 | 1.58 |
| 2000 | Tan | 4 | 10.0 | 19.7 | 34.5 | 1.75 |
| 2100 | Brown | 5 | 12.5 | 13.2 | 25.3 | 1.92 |
| 2200 | Brown | 6 | 15.0 | 12.2 | 24.0 | 1.97 |
| 2300 | Dk. brown | 6 | 17.5 | 11.0 | 22.1 | 2.01 |

Other tests and remarks: No effervescence with HCl; should fire to "MW" face brick specifications at about 2100°F; poor color.

Bloating Test: Negative

Potential Use: Face brick.

SAMPLE: R-3482

County: Amelia

Locality: Roadcut, 1.0 mile southeast of Jetersville, on the southwest side of State Road 640 approximately 0.1 mile by road southeast of its intersection with State Road 691.

Description: Yellow, plastic clay, variegated with red and gray clay, is present in a roadcut 525 feet long, and has a maximum exposed thickness of 6 feet. Four feet of additional clay was indicated by augering to that depth at the base of the exposure. The augered clay contains more grit, is less plastic and becomes lighter in color with increasing depth.

Formation or Age: Residual clay

Sampled Interval: Composite of two representative channel samples in the highest part of the exposure, approximately 300 feet apart, and 4 feet of augered clay.

Raw Properties:

Water of plasticity: 20.5%

Drying shrinkage: 5.0%

Drying defects: none

Working properties: low plasticity

Dry strength: fair

pH: 5.1

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Abs. | % Appar. Porosity | Bulk Dens. gm/cc |
|--------------|------------|---------------|----------------------|-----------|----------------------|---------------------|
| 1800 | Tan | 2 | 5.0 | 20.4 | 34.9 | 1.71 |
| 1900 | Tan | 2 | 5.0 | 20.2 | 35.1 | 1.74 |
| 2000 | Tan | 3 | 5.0 | 19.3 | 33.6 | 1.74 |
| 2100 | Lt. brown | 4 | 5.0 | 15.7 | 28.4 | 1.81 |
| 2200 | Lt. brown | 5 | 5.0 | 15.1 | 27.6 | 1.83 |
| 2300 | Gray brown | 5 | 5.0 | 16.7 | 29.4 | 1.76 |

Other tests and remarks: No effervescence with HCl; high absorption at all firing temperatures.

Bloating Test: Negative

Potential Use: Component in face-brick mixtures.

AMHERST COUNTY

Samples were collected from ten localities in Amherst County. Testing by Morse Laboratories indicates the following potential uses for the raw material:

| <u>Sample</u> | <u>Formation or Age</u> | <u>Potential Use</u> |
|---------------|-------------------------|---|
| R-3530 | Residual clay | Most porous clay products including drain tile and flower pots; in most structural clay products and in stoneware |
| R-3531 | Residual clay | Most porous clay products |
| R-3532 | Residual clay | Brick and tile |
| R-3533 | Residual clay | Most structural clay products except sewer pipe |
| R-3534 | Residual clay | Most structural clay products except sewer pipe |
| R-3535 | Paleozoic (?) | Nonplastic component in most structural clay products, including sewer pipe |
| R-3861 | Hampton Formation | Nonplastic component in brick, tile, and related structural clay products |
| R-4114 | Residual clay | Refractories industry |
| R-4124 | Paleozoic (?) | Component in most structural clay products, including sewer pipe |
| R-4362 | Hampton Formation | Lightweight aggregate (current use); brick and tile |

SAMPLE: R-3530

County: Amherst

Locality: Roadcut (Figure 2), 1.35 miles north of Stapleton, on the southeast side of State Road 622 approximately 1.45 miles by road northeast of its intersection with State Road 624.

Description: Red-orange, plastic clay, mottled with some yellow clay, is present in a roadcut about 800 feet long, and has a maximum exposed thickness of 7 feet. Some quartz fragments and minor magnetite are present in the clay. Four additional feet of micaceous and silty yellow-brown, plastic clay was indicated by augering to that depth at the base of the exposure.

Formation or Age: Residual clay

Sampled Interval: Composite of two representative channel samples in the highest part of the exposure, approximately 300 feet apart, and 4 feet of augered clay.

Raw Properties:

Water of plasticity: 39.3%

Drying shrinkage: 5.0%

Drying properties: good

pH: 5.8

Plasticity: excellent

Workability: excellent

Dry strength: 199.9 psi

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|------------------|---------------|----------------------|-----------------|---------------------|
| 2000 | Buff | 3 | 8.5 | 25.2 | 1.59 |
| 2100 | Lt. orange-brown | 4 | 11.0 | 23.9 | 1.64 |
| 2200 | Med. brown | 6 | 13.5 | 17.8 | 1.84 |
| 2300 | Med. brown | 7+ | 13.8 | 16.4 | 1.90 |

Other tests and remarks: Extrudes well; L.O.I. 9.9%; excellent color range; the addition of a natural flux is suggested to reduce maturing temperature and absorption.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 2000 | 107.9 | 35.2 |
| 2100 | 115.5 | 28.4 |
| 2200 | 115.5 | 21.0 |
| 2300 | 137.3 | 11.9 |

Potential Use: Probable as sole component in most porous clay products including drain tile and flower pots. Possible in most structural clay products; would consider for the stoneware industry.

SAMPLE: R-3531

County: Amherst

Locality: Roadcut, 2.35 miles northeast of Pleasant View, on the west side of State Road 610 at its intersection with State Road 636 leading northwest.

Description: Red, plastic clay, mottled in places with yellow and gray clay, is present in a roadcut 300 feet long, and has a maximum exposed thickness of 9 feet. Four feet of additional red, plastic clay was indicated by augering to that depth at the base of the exposure. Quartz fragments are present in the exposure and augered clay.

Formation or Age: Residual clay

Sampled Interval: Composite of two representative channel samples in the highest part of the exposure, approximately 90 feet apart, and 4 feet of augered clay.

Raw Properties:

| | |
|----------------------------|-------------------------|
| Water of plasticity: 33.4% | Plasticity: fair |
| Drying shrinkage: 6.3% | Workability: fair |
| Drying properties: fair | Dry strength: 138.6 psi |
| pH: 5.7 | |

Slow Firing Tests:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|--------------|---------------|----------------------|-----------------|---------------------|
| 2000 | Orange-brown | 3 | 8.8 | 24.0 | 1.69 |
| 2100 | Brown-orange | 4½ | 9.0 | 22.5 | 1.74 |
| 2200 | Med. brown | 5 | 11.0 | 20.3 | 1.80 |
| 2300 | Brown-red | 6 | 10.8 | 18.7 | 1.86 |

Other tests and remarks: Poor extrusion; L.O.I. 8.9%; slight checking during drying process; gritty texture and sticky; excellent color range; surface checking at all temperatures.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 2000 | 112.3 | 31.5 |
| 2100 | 133.5 | 27.6 |
| 2200 | 139.1 | 14.8 |
| 2300 | 146.6 | 10.8 |

Potential Use: Possible in most porous clay products.

SAMPLE: R-3532

County: Amherst

Locality: Roadcut, 1.75 miles southwest of Pedlar Mills, on the east side of State Road 647 approximately 0.15 mile by road northeast of its intersection with State Road 649.

Description: Orange, slightly plastic clay, which is gritty with quartz and feldspar fragments, is present in a roadcut 525 feet long, and has a maximum exposed thickness of 8 feet.

Formation or Age: Residual clay

Sampled Interval: Composite of two representative channel samples in the highest part of the exposure.

Raw Properties:

| | |
|----------------------------|-------------------------|
| Water of plasticity: 40.8% | Plasticity: poor |
| Drying shrinkage: 7.5% | Workability: poor |
| Drying properties: good | Dry strength: excellent |
| pH: 5.9 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|--------------|---------------|----------------------|-----------------|---------------------|
| 2000 | Orange-brown | 3 | 11.0 | 23.0 | 1.71 |
| 2100 | Brown-orange | 4½ | 15.0 | 20.5 | 1.78 |
| 2200 | Med. brown | 6 | 17.5 | 24.8 | 1.98 |
| 2300 | Brown-red | 7 | 17.5 | 14.4 | 2.02 |

Other tests and remarks: Poor extrusion; L.O.I. 10.9%; sticky; surface checking at all temperatures; good color range. The addition of nonplastic clay is suggested to reduce the sticky quality and relieve surface checking.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 2000 | 105.5 | 31.4 |
| 2100 | 119.2 | 29.1 |
| 2200 | 151.6 | 8.2 |
| 2300 | 158.5 | 7.6 |

Potential Use: Possible in brick and tile.

SAMPLE: R-3533

County: Amherst

Locality: Roadcut, 1.6 miles west of Amherst, on the south side of State Road 643 approximately 1.4 miles by road northwest of its intersection with U. S. Highway 29.

Description: Red-orange and orange, hard, plastic clay, variegated with yellow and gray clay, is present in a roadcut 525 feet long, and has a maximum exposed thickness of 6.5 feet. Minor mica and a quartz are present in the clay in the eastern part of the exposure. Two feet of additional red-orange, plastic clay, variegated with yellow and gray clay, was indicated by augering to that depth at the base of the exposure.

Formation or Age: Residual clay

Sampled Interval: Composite of two representative channel samples in the highest part of the exposure and 2 feet of augered clay.

Raw Properties:

| | |
|----------------------------|-------------------------|
| Water of plasticity: 45.4% | Plasticity: good |
| Drying shrinkage: 7.5% | Workability: good |
| Drying properties: good | Dry strength: 141.8 psi |
| pH: 5.9 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|------------------|---------------|----------------------|-----------------|---------------------|
| 2000 | Lt. orange-brown | 3 | 11.0 | 31.0 | 1.51 |
| 2100 | Orange-brown | 4 | 12.8 | 27.4 | 1.58 |
| 2200 | Med. brown | 7 | 20.3 | 14.2 | 2.00 |
| 2300 | Med. brown | 7+ | 18.8 | 14.4 | 1.96 |

Other tests and remarks: Poor extrusion; L.O.I. 12.4%; sticky; surface checking at 2100, 2200, and 2300°F. The addition of nonplastic clay is suggested to reduce the sticky quality and relieve surface checking.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 2000 | 93.0 | 36.4 |
| 2100 | 113.6 | 33.5 |
| 2200 | 150.4 | 9.9 |
| 2300 | 151.6 | 7.6 |

Potential Use: Possible in most structural clay products except sewer pipe.

SAMPLE: R-3534

County: Amherst

Locality: Roadcut, 4.7 miles west of Clifford, on the east side of State Road 778 approximately 0.1 mile by road north of its intersection with State Road 610.

Description: Red-orange, plastic clay is present in a roadcut 300 feet long, and has a maximum exposed thickness of 6 feet. Three feet of additional orange clay was indicated by augering to that depth at the base of the exposure.

Formation or Age: Residual clay

Sampled Interval: Composite of two representative channel samples in the highest part of the exposure, approximately 75 feet apart, and 3 feet of augered clay.

Raw Properties:

| | |
|----------------------------|-------------------------|
| Water of plasticity: 38.9% | Plasticity: fair |
| Drying shrinkage: 7.0% | Workability: fair |
| Drying properties: good | Dry strength: 154.7 psi |
| pH: 5.7 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|------------------|---------------|----------------------|-----------------|---------------------|
| 2000 | Lt. orange-brown | 6 | 11.0 | 25.0 | 1.66 |
| 2100 | Orange-brown | 6 | 12.5 | 21.7 | 1.74 |
| 2200 | Med. brown | 7+ | 18.3 | 13.4 | 2.04 |
| 2300 | Lt. red-brown | 7+ | 18.5 | 11.6 | 2.11 |

Other tests and remarks: Poor extrusion; L.O.I. 11.7%; sticky; surface checking at all temperatures. The addition of a nonplastic clay is suggested to reduce the sticky quality and relieve surface checking.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 2000 | 106.7 | 32.9 |
| 2100 | 137.3 | 21.6 |
| 2200 | 155.4 | 7.6 |
| 2300 | 177.2 | 7.5 |

Potential Use: Possible in most structural clay products except sewer pipe.

SAMPLE: R-3535

County: Amherst

Locality: Roadcut (Figure 3), 2.7 miles northwest of Riverville, on the north side of State Road 600 approximately 0.5 mile by road northwest of its intersection with State Road 601.

Description: Red, yellow, brown, and green, crinkled and contorted phyllite is present in a roadcut 360 feet long, and has a maximum exposed height of 15 feet. The phyllite, which is iron-oxide stained in places, contains some small quartz veins.

Formation or Age: Paleozoic (?)

Sampled Interval: Composite of grab samples believed representative of material in exposure.

Raw Properties:

| | |
|----------------------------|--------------------|
| Water of plasticity: 24.0% | Plasticity: none |
| Drying shrinkage: 1.3% | Workability: none |
| Drying properties: good | Dry strength: poor |
| pH: 6.2 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|-------------------|---------------|----------------------|-----------------|---------------------|
| 2000 | Med. orange-brown | 1 | 1.5 | 27.8 | 1.51 |
| 2100 | Dk. orange | 1 | 1.5 | 25.2 | 1.59 |
| 2200 | Lt. red-brown | 4 | 4.5 | 17.1 | 1.81 |
| 2300 | Med. red-brown | 7 | 7.8 | 13.0 | 1.97 |

Other tests and remarks: Nonextrudable; L.O.I. 9.4%; a large quantity of mica present; very powdery when dry. The addition of a better bonding clay is suggested to improve the dry strength, lower the maturing point, and reduce absorption.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 2000 | 132.3 | 14.7 |
| 2100 | 170.4 | 10.5 |
| 2200 | 151.0 | 2.6 |
| 2300 | 157.9 | 2.6 |

Potential Use: Probable as a nonplastic component in most structural clay products, including sewer pipe.



Figure 2. Residual clay (Sample R-3530) on the southeast side of State Road 622 approximately 1.45 miles by road northeast of its intersection with State Road 624.

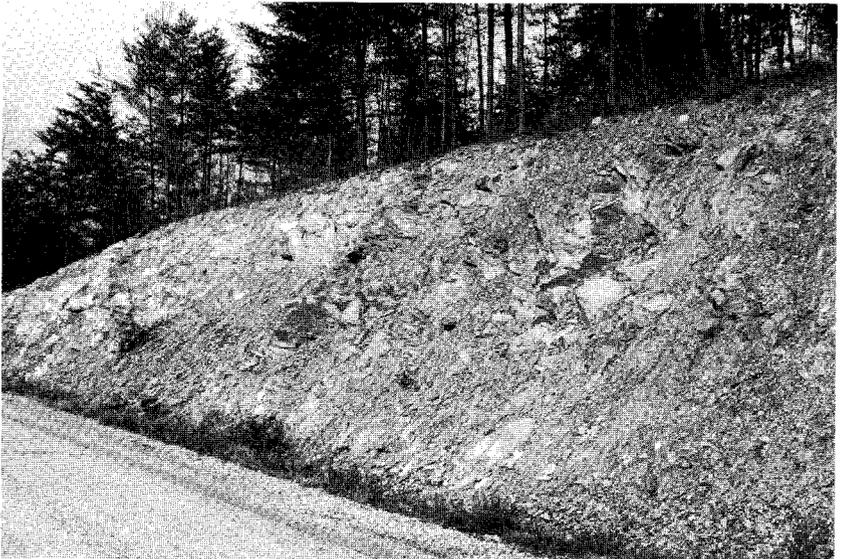


Figure 3. Phyllite of Paleozoic(?) age (Sample R-3535) on the north side of State Road 600 approximately 0.5 mile by road northwest of its intersection with State Road 601.



Figure 2. Residual clay (Sample R-3530) on the southeast side of State Road 622 approximately 1.45 miles by road northeast of its intersection with State Road 624.

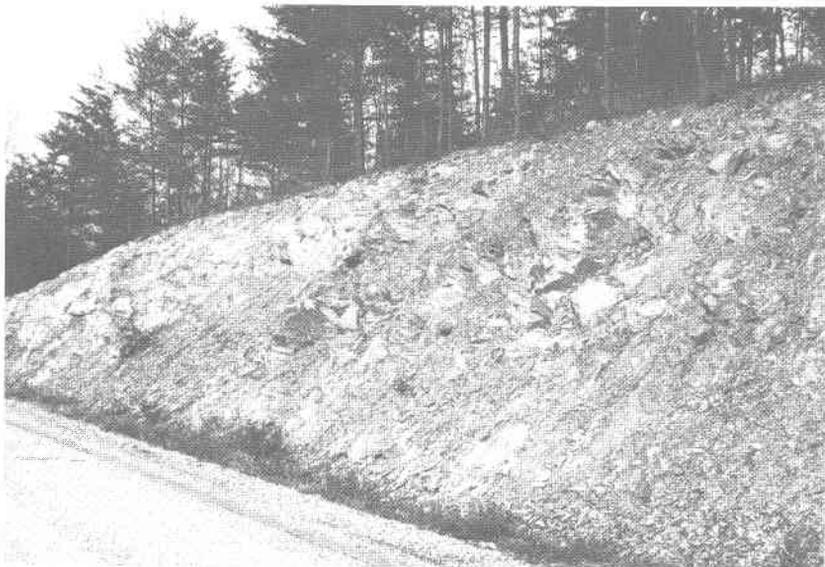


Figure 3. Phyllite of Paleozoic(?) age (Sample R-3535) on the north side of State Road 600 approximately 0.5 mile by road northwest of its intersection with State Road 601.

SAMPLE: R-3861

County: Amherst

Locality: Excavation, 2.7 miles northeast of Snowden on the property of Hercules Inc., .15 mile east of the old Rocky Row Run road approximately 3.4 miles by road northeast of its intersection with State Highway 130.

Description: Dark gray, semilustrous, thin-bedded slate with a smooth cleavage is present in a recent excavation site. The slate, which is folded in places, weathers to a rust-brown and lighter gray.

Formation or Age: Hampton Formation

Sampled Interval: Composite of grab samples believed representative of weathered and unweathered material in excavation.

Raw Properties:

| | |
|----------------------------|---------------------------------|
| Water of plasticity: 23.5% | Plasticity: poor |
| Drying shrinkage: 3.9% | Workability: short-fine texture |
| Drying properties: good | Dry strength: 85 psi |
| pH: 7.4 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|----------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Med. tan | 2 | 4.2 | 18.9 | 1.74 |
| 2000 | Lt. red-brown | 3 | 5.5 | 14.9 | 1.90 |
| 2100 | Med. brown | 7 | 12.2 | 6.7 | 2.21 |
| 2200 | Med. red-brown | 7+ | 15.1 | 2.6 | 2.43 |

Other tests and remarks: Poor extrusion; CaCO₃ test negative; L.O.I. 5.2%; no defects; the addition of a more plastic clay is suggested to increase dry strength and improve the workability.

Potential Use: Possible as a nonplastic component in brick, tile, and related structural clay products.

SAMPLE: R-4114

County: Amherst

Locality: Excavation, 1.5 miles southeast of Lowesville, on the east side of the company road of the Dominion Stone Plant, Inc., approximately 0.7 mile by road northeast of its intersection with State Road 665.

Description: Kaolin clay, partly iron-oxide stained in places and containing minor quartz fragments, is present in an excavation 35 feet long, and has a maximum exposed thickness of 6 feet.

Formation or Age: Residual clay

Sampled Interval: Representative channel sample in the highest part of the exposure.

Raw Properties:

| | |
|----------------------------|--------------------------|
| Water of plasticity: 41.3% | Plasticity: none |
| Drying shrinkage: 1.0% | Workability: none-gritty |
| Drying properties: good | Dry strength: poor |
| pH: 6.0 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|-------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Cream-white | 1 | 1.0 | 46.4 | 1.13 |
| 2000 | White | 1 | 1.0 | 36.6 | 1.20 |
| 2100 | White | 1 | 5.0 | 35.0 | 1.26 |
| 2200 | White | 1 | 5.0 | 33.3 | 1.27 |

Other tests and remarks: Not extrudable (compressed); CaCO₃ test negative; L.O.I. 7.6%; no defects. Two pyrometric cone equivalent tests are suggested. First test should be run on the material; silica should then be washed from the material and a pyrometric cone equivalent test run on the remainder.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 140.4 | 24.4 |
| 2000 | 125.4 | 26.5 |
| 2100 | 122.3 | 30.1 |
| 2200 | 124.2 | 24.0 |

Potential Use: Possible in the refractories industry.

SAMPLE: R-4124

County: Amherst

Locality: Roadcut, 0.8 mile west of Galts Mill, on the south side of State Road 622 approximately 1.05 miles by road west of its intersection with State Road 648.

Description: Reddish to gray-green, contorted phyllite that is iron-oxide stained in places is present in a roadcut 165 feet long, and has a maximum exposed height of 5 feet; quartz veins occur in the eastern end of the exposure. The phyllite has a strike of approximately N.44°E. and an almost vertical dip.

Formation or Age: Paleozoic (?)

Sampled Interval: Composite of grab samples believed representative of material in exposure.

Raw Properties:

Water of plasticity: 23.9%

Plasticity: poor

Drying shrinkage: 3.0%

Workability: poor-gritty

Drying properties: good

Dry strength: 31 psi

pH: 6.5

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Med. tan | 2 | 1.0 | 29.2 | 1.46 |
| 2000 | Lt. brown | 3 | 4.0 | 17.6 | 1.70 |
| 2100 | Med. brown | 7 | 6.0 | 10.0 | 1.89 |
| 2200 | Med. brown | 7+ | 8.5 | 8.3 | 2.03 |

Other tests and remarks: Fair extrusion; CaCO₃ test negative; L.O.I. 5.1%; no defects; the addition of a more plastic clay is suggested to improve the workability and dry strength.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 152.2 | 7.7 |
| 2000 | 151.0 | 6.7 |
| 2100 | 151.0 | 4.6 |
| 2200 | 152.9 | 5.1 |

Potential Use: Probable as a component in most structural clay products, including sewer pipe.

SAMPLE: R-4362

County: Amherst

Locality: Quarry area of Hercules Inc., 2.9 miles northeast of Snowden, 0.35 mile east of the old Rocky Row Run road approximately 3.6 miles by road northeast of its intersection with State Highway 130.

Description: Dark bluish-gray, semi-lustrous, slightly folded slate is present in this excavation on the mountainside. The slate is mined for use as raw material for the manufacture of lightweight aggregate.

Formation or Age: Hampton Formation

Sampled Interval: Composite of grab samples believed representative of unweathered material in excavation.

Raw Properties:

| | |
|----------------------------|-----------------------------|
| Water of plasticity: 19.3% | Plasticity: excellent |
| Drying shrinkage: 1.4% | Workability: excellent-fine |
| Drying properties: good | Dry strength: 29 psi |
| pH: 7.0 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Lt. brown | 2 | 3.5 | 18.1 | 1.72 |
| 2000 | Lt. brown | 3 | 4.0 | 12.9 | 1.91 |
| 2100 | Med. brown | 6 | 6.0 | 8.1 | 2.08 |
| 2200 | Red-brown | 7+ | 7.5 | 7.5 | 2.10 |

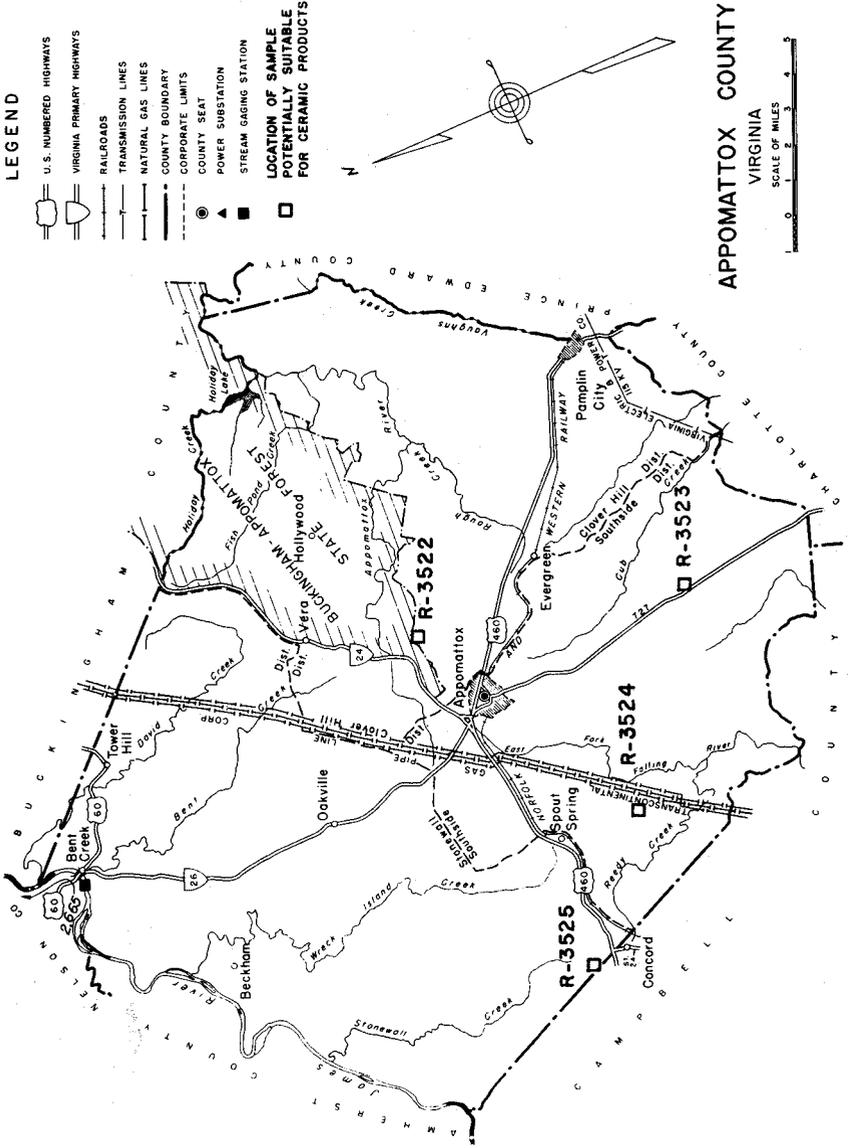
Other tests and remarks: Fair extrusion; CaCO₃ test negative; L.O.I. 5.3%; no defects. The addition of a low-firing filler is suggested to reduce the firing range.

Potential Use: Brick and tile.

Bloating Test: (Performed at the Tuscaloosa Laboratory)

| Temp. ° F | Weight Lb./ft. ³ | % Absorption | Remarks |
|--------------|--------------------------------|-----------------|---------------------|
| 1800 | 136.5 | 6.8 | No expansion |
| 1900 | 121.4 | 8.3 | Laminar expansion |
| 2000 | 106.5 | 4.9 | Laminar expansion |
| 2100 | 82.7 | 7.2 | Laminar expansion |
| 2200 | 69.5 | 7.2 | Good pore structure |

Potential Use: Should produce lightweight aggregate in the range 50-55 lb./ft.³ (loose pour weight) at 2150°-2200°F.



Location Map of Appomattox County

APPOMATTOX COUNTY

Samples were collected from four localities in Appomattox County. Testing by Morse Laboratories indicates the following potential uses for the raw material:

| <u>Sample</u> | <u>Formation or Age</u> | <u>Potential Use</u> |
|---------------|-------------------------|---|
| R-3522 | Residual clay | Brick and tile |
| R-3523 | Residual clay | Most porous clay products, such as drain tile; stoneware bodies |
| R-3524 | Residual clay | Brick and tile |
| R-3525 | Residual clay | Brick and tile |

SAMPLE: R-3522

County: Appomattox

Locality: Roadcut, 2.9 miles northeast of Appomattox, on the south-east side of State Road 631 approximately 0.3 mile by road north-east of its intersection with State Road 627.

Description: Red, plastic clay, mottled in places with yellow clay, is present in a roadcut 785 feet long, and has a maximum exposed thickness of 5 feet. Four feet of additional red clay, which becomes less plastic and contains some quartz fragments with increasing depth, was indicated by augering to that depth at the base of the exposure.

Formation or Age: Residual clay

Sampled Interval: Composite of two representative channel samples in the highest part of the exposure, approximately 50 feet apart, and 4 feet of augered clay.

Raw Properties:

Water of plasticity: 47.9%

Plasticity: excellent

Drying shrinkage: 11.3%

Workability: excellent

Drying properties: good

Dry strength: 406.2 psi

pH: 5.8

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|------------------|---------------|----------------------|-----------------|---------------------|
| 2000 | Lt. orange-brown | 4 | 15.0 | 26.0 | 1.61 |
| 2100 | Orange-brown | 5 | 16.5 | 22.8 | 1.71 |
| 2200 | Med. brown | 7 | 21.3 | 11.9 | 2.10 |
| 2300 | Lt. red-brown | 7+ | 21.5 | 11.9 | 2.10 |

Other tests and remarks: Extrudes well; L.O.I. 12.9%; good color range; slight surface checking at 2200°F; the addition of a non-plastic material would reduce the shrinkage.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 2000 | 117.9 | 36.5 |
| 2100 | 119.2 | 34.7 |
| 2200 | 125.4 | 22.5 |
| 2300 | 133.5 | 21.3 |

Potential Use: Possible in brick and tile.

SAMPLE: R-3523

County: Appomattox

Locality: Roadcut (Figure 4), 4.4 miles southwest of Evergreen, on the east side of State Road 727 approximately 0.45 mile by road north of its intersection with State Road 644.

Description: Red-orange, plastic clay, which contains some quartz pebbles and variegated red, yellow and gray clay, is present in a roadcut 300 feet long, and has a maximum exposed thickness of 6 feet. Two feet of additional yellow-gray, gritty clay was indicated by augering to that depth at the base of the exposure.

Formation or Age: Residual clay

Sampled Interval: Composite of two representative channel samples in the highest part of the exposure, approximately 15 feet apart, and 2 feet of augered clay.

Raw Properties:

| | |
|----------------------------|-------------------------|
| Water of plasticity: 39.6% | Plasticity: excellent |
| Drying shrinkage: 6.8% | Workability: excellent |
| Drying properties: good | Dry strength: 223.2 psi |
| pH: 5.7 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|--------------|---------------|----------------------|-----------------|---------------------|
| 2000 | Buff | 3 | 8.3 | 27.2 | 1.50 |
| 2100 | Med. orange | 4 | 10.0 | 25.0 | 1.60 |
| 2200 | Orange-brown | 5 | 12.5 | 20.5 | 1.69 |
| 2300 | Dk. orange | 6½ | 13.3 | 19.5 | 1.74 |

Other tests and remarks: Extrudes well; L.O.I. 8.2%; excellent color range.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 2000 | 111.1 | 33.7 |
| 2100 | 111.1 | 28.7 |
| 2200 | 117.9 | 17.6 |
| 2300 | 119.2 | 16.5 |

Potential Use: Possible in most porous clay products, such as drain tile; possible in stoneware bodies.



Figure 4. Residual clay (Sample R-3523) on the east side of State Road 727 approximately 0.45 mile by road north of its intersection with State Road 644.



Figure 4. Residual clay (Sample R-3523) on the east side of State Road 727 approximately 0.45 mile by road north of its intersection with State Road 644.

SAMPLE: R-3524

County: Appomattox

Locality: Roadcut, 2.4 miles south of Spout Spring, on the northeast side of State Road 648 approximately 2.55 miles by road south of its intersection with U. S. Highway 460.

Description: Red, plastic clay is present in a roadcut 400 feet long, and has a maximum exposed thickness of four feet. Four feet of additional red clay was indicated by augering to that depth at the base of the exposure.

Formation or Age: Residual clay

Sampled Interval: Composite of two representative channel samples in the highest part of the exposure and 4 feet of augered clay.

Raw Properties:

| | |
|----------------------------|-------------------------|
| Water of plasticity: 49.1% | Plasticity: excellent |
| Drying shrinkage: 8.8% | Workability: excellent |
| Drying properties: good | Dry strength: 201.1 psi |
| pH: 5.8 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|------------------|---------------|----------------------|-----------------|---------------------|
| 2000 | Orange-brown | 4 | 15.0 | 26.5 | 1.65 |
| 2100 | Lt. orange-brown | 5 | 15.0 | 25.0 | 1.72 |
| 2200 | Med. brown | 7+ | 23.8 | 7.9 | 2.35 |
| 2300 | Med. red-brown | 7+ | 23.3 | 8.0 | 2.33 |

Other tests and remarks: Extrudes well; L.O.I. 13.2%; surface checking at 2100, 2200, and 2300°F; the addition of a non-plastic grog is suggested to reduce shrinkage and surface checking.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 2000 | 109.8 | 33.9 |
| 2100 | 108.6 | 32.2 |
| 2200 | 127.3 | 15.9 |
| 2300 | 172.8 | 4.7 |

Potential Use: Possible in brick and tile.

SAMPLE: R-3525

County: Appomattox

Locality: Roadcut, 1.2 miles north of Concord, on the southwest side of State Road 609 approximately 200 feet northwest of its intersection with State Road 608.

Description: Red-orange, slightly plastic clay that contains some quartz fragments is present in a roadcut 425 feet long, and has a maximum exposed thickness of 5 feet. Four feet of additional, red-orange clay, which becomes lighter in color with depth, was indicated by augering to that depth at the base of the exposure.

Formation or Age: Residual clay

Sampled Interval: Composite of two representative channel samples in the highest part of the exposure, approximately 50 feet apart, and 4 feet of augered clay.

Raw Properties:

| | |
|----------------------------|-------------------------|
| Water of plasticity: 53.4% | Plasticity: good |
| Drying shrinkage: 8.8% | Workability: good |
| Drying properties: good | Dry strength: 300.8 psi |
| pH: 5.9 | |

Slow Firing Test:

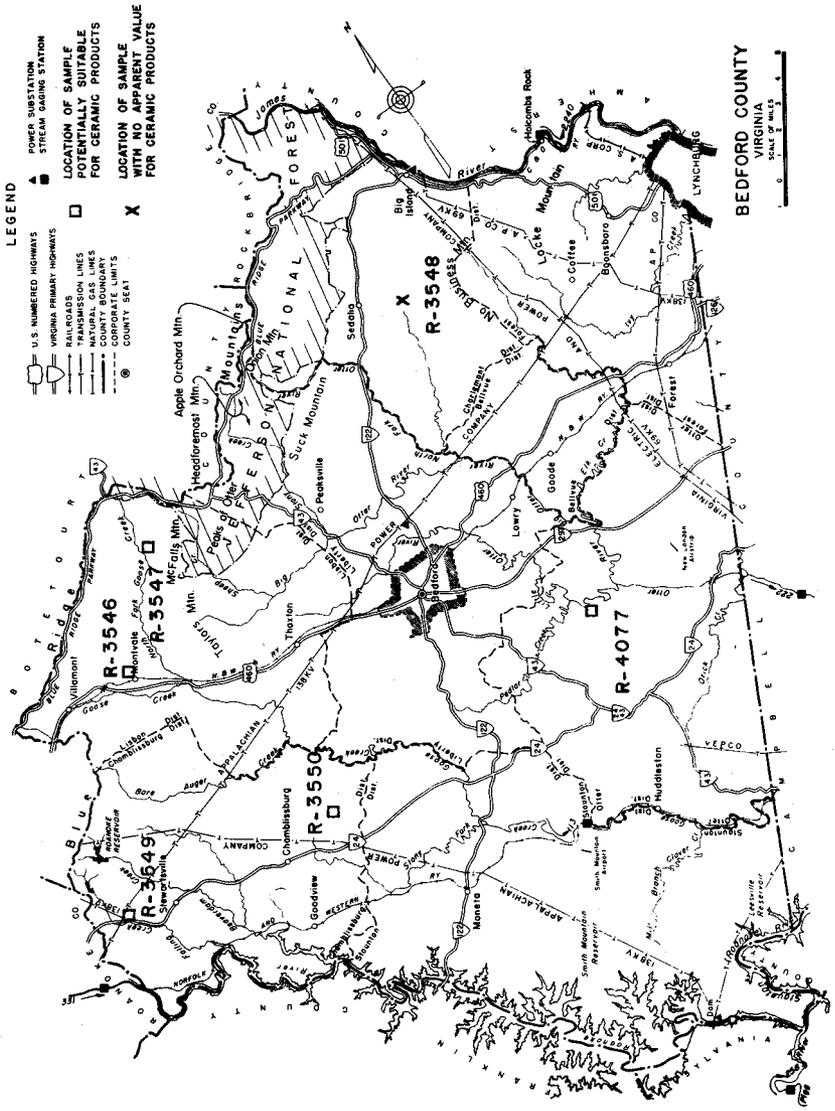
| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|------------------|---------------|----------------------|-----------------|---------------------|
| 2000 | Lt. brown | 3 | 14.3 | 30.9 | 2.94 |
| 2100 | Lt. orange-brown | 4 | 14.8 | 28.1 | 3.20 |
| 2200 | Med. brown | 6½ | 21.0 | 15.6 | 2.00 |
| 2300 | Red-brown | 7+ | 24.0 | 12.3 | 2.10 |

Other tests and remarks: Good to fair extrusion; L.O.I. 14.8%; surface checking at 2200 and 2300°F; the addition of a non-plastic grog is suggested to reduce the shrinkage and surface checking.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 2000 | 105.5 | 33.5 |
| 2100 | 111.1 | 36.2 |
| 2200 | 125.4 | 17.8 |
| 2300 | 151.6 | 9.5 |

Potential Use: Possible in brick and tile.



Location Map of Bedford County

BEDFORD COUNTY

Samples were collected from six localities in Bedford County. Testing by Morse Laboratories indicates the following potential uses for the raw material:

| <u>Sample</u> | <u>Formation or Age</u> | <u>Potential Use</u> |
|---------------|-------------------------|---|
| R-3546 | Rome Formation | Face and decorative brick; in most structural clay products, including sewer pipe |
| R-3547 | Rome Formation | Face and decorative brick; in most structural clay products, including sewer pipe |
| R-3548 | Residual clay | None in structural clay products |
| R-3549 | Paleozoic (?) | Most structural clay products; sewer pipe* |
| R-3550 | Residual clay | Nonplastic component in brick and tile |
| R-4077 | Residual clay | Nonplastic component in the white-ware industry and for low duty refractories |

*If dry strength is improved.

SAMPLE: R-3546

County: Bedford

Locality: Roadcut (Figure 5), 0.3 mile north of Montvale, on the west side of State Road 617 approximately 0.1 mile by road north of its intersection with State Road 695.

Description: Red, maroon, yellow, and gray-green shale with some fine-grained red sandstone is present in a roadcut 1320 feet long, and has a maximum exposed height of 10 feet. The shale has a strike of approximately N.58°E. and a dip of approximately 30° SE.

Formation or Age: Rome Formation

Sampled Interval: Composite of grab samples believed representative of material in exposure.

Raw Properties:

| | |
|----------------------------|-------------------------|
| Water of plasticity: 24.6% | Plasticity: fair |
| Drying shrinkage: 2.5% | Workability: fair |
| Drying properties: good | Dry strength: 100.5 psi |
| pH: 8.2 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|-------------------|---------------|----------------------|-----------------|---------------------|
| 2000 | Med. orange-brown | 3 | 6.5 | 19.2 | 1.68 |
| 2100 | Dk. orange | 4 | 7.0 | 19.0 | 1.71 |
| 2200 | Dk. brown | 7+ | — | 6.8 | 1.93 |
| 2300 | Dk. brown | 7+ | 9.0 | 0.7 | 1.96 |

Other tests and remarks: Fair to poor extrusion; L.O.I. 4.6%; excellent color range; beads appear on the surface at 2200°F and the surface shines at 2300°F. The addition of a better bonding clay would improve the dry strength.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 2000 | 99.2 | 25.3 |
| 2100 | 118.6 | 6.8 |
| 2200 | 176.0 | 4.8 |
| 2300 | — | — |

Potential Use: Probable as the sole component in face and decorative brick; possible in most structural clay products, including sewer pipe.

SAMPLE: R-3547

County: Bedford

Locality: Roadcut (Figure 6), 5.25 miles northeast of Montvale, on the southeast side of State Road 695 approximately 0.4 mile by road northeast of its intersection with State Road 680 leading southeast.

Description: Maroon, yellow, and light-gray shale with some thin interbeds of sandstone is present in a roadcut 530 feet long, and has a maximum exposed height of 25 feet. The shale, which is iron-oxide stained in places, has a strike of approximately N.50°E. and a dip of approximately 52° SE.

Formation or Age: Rome Formation

Sampled Interval: Composite of grab samples believed representative of material in exposure.

Raw Properties:

| | |
|----------------------------|------------------------|
| Water of plasticity: 24.1% | Plasticity: fair |
| Drying shrinkage: 3.3% | Workability: fair |
| Drying properties: good | Dry strength: 75.6 psi |
| pH: 7.5 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|---------------|---------------|----------------------|-----------------|---------------------|
| 2000 | Lt. red-brown | 3 | 6.3 | 18.4 | 1.69 |
| 2100 | Red-brown | 4 | 6.8 | 18.5 | 1.69 |
| 2200 | Dk. brown | 7+ | 11.3 | 6.0 | 2.08 |
| 2300 | Dk. brown | 7+ | 10.5 | 0.7 | 2.04 |

Other tests and remarks: Fair to poor extrusion; L.O.I. 3.8%; excellent color range; beads appear on the surface at 2200°F and the surface shines at 2300°F. The addition of a better bonding clay would improve the dry strength.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 2000 | 134.8 | 14.4 |
| 2100 | 132.3 | 5.8 |
| 2200 | 98.6 | 5.3 |
| 2300 | — | — |

Potential Use: Probable as sole component in face and decorative brick; possible in most structural clay products, including sewer pipe.



Figure 5. Rome Formation (Sample R-3546) on the west side of State Road 617 approximately 0.1 mile by road north of its intersection with State Road 695.



Figure 6. Rome Formation (Sample R-3547) on the southeast side of State Road 695 approximately 0.4 mile by road northeast of its intersection with State Road 680 leading southeast.

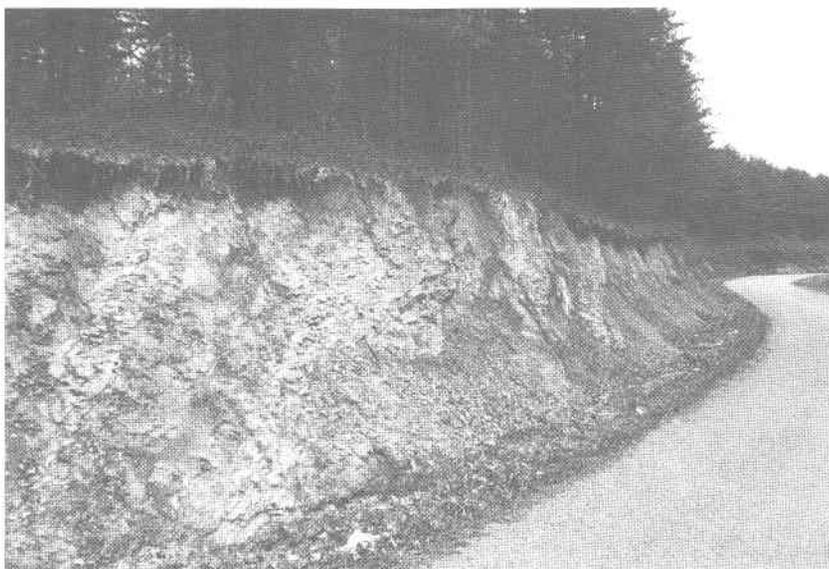


Figure 5. Rome Formation (Sample R-3546) on the west side of State Road 617 approximately 0.1 mile by road north of its intersection with State Road 695.



Figure 6. Rome Formation (Sample R-3547) on the southeast side of State Road 695 approximately 0.4 mile by road northeast of its intersection with State Road 680 leading southeast.

SAMPLE: R-3548

County: Bedford

Locality: Roadcut, 1.7 miles southeast of Sedalia, on the south side of State Road 638 approximately 0.1 mile by road northwest of its intersection with State Road 637 leading northeast.

Description: Red-orange, plastic clay is present in a roadcut 170 feet long, and has a maximum exposed thickness of 6 feet.

Formation or Age: Residual clay

Sampled Interval: Representative channel sample in the highest part of the exposure.

Raw Properties:

| | |
|----------------------------|-----------------------|
| Water of plasticity: 25.5% | Plasticity: poor |
| Drying shrinkage: 9.6% | Workability: short |
| Drying properties: fair | Dry strength: 164 psi |
| pH: 5.2 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|----------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Brown-orange | 3 | 14.2 | 22.9 | 1.81 |
| 2000 | Lt. red-brown | 5 | 18.5 | 15.0 | 2.14 |
| 2100 | Lt. red-brown | 7 | 21.5 | 9.4 | 2.41 |
| 2200 | Med. red-brown | 7 | 22.8 | 8.5 | 2.47 |

Other tests and remarks: Extrudes poorly (short); CaCO₃ test positive; L.O.I. 28.1%; cracking and slight warping.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 91.7 | 30.7 |
| 2000 | 99.2 | 28.6 |
| 2100 | 109.2 | 25.7 |
| 2200 | 119.8 | 17.9 |

Potential Use: None in structural clay products.

SAMPLE: R-3549

County: Bedford

Locality: Roadcut, 1.9 miles west of Stewartsville, on the northeast side of State Highway 24 approximately 0.5 mile by road southeast of its intersection with State Road 635 leading south.

Description: Red, brown, and light-green, contorted phyllite, slightly stained by iron oxide, is present in a roadcut 525 feet long, and has a maximum exposed height of 20 feet.

Formation or Age: Paleozoic (?)

Sampled Interval: Composite of grab samples believed representative of material in exposure.

Raw Properties:

Water of plasticity: 16.4%
Drying shrinkage: 2.0%
Drying properties: good
pH: 6.7

Plasticity: poor
Workability: short-medium
grit texture
Dry strength: 23 psi

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|------------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Lt. orange-brown | 2 | 2.5 | 17.1 | 1.78 |
| 2000 | Orange-brown | 3 | 2.5 | 15.5 | 1.85 |
| 2100 | Lt. red-brown | 7+ | 5.0 | 8.6 | 2.12 |
| 2200 | Orange-red | 7+ | 5.8 | 7.7 | 2.11 |

Other tests and remarks: Poor extrusion; L.O.I. 3.9%; excellent color range. The addition of a better bonding clay would increase the dry strength and improve the plasticity and workability.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 139.1 | 3.6 |
| 2000 | 149.8 | 3.6 |
| 2100 | 117.3 | 2.6 |
| 2200 | 113.6 | 3.1 |

Potential Use: Possible in most structural clay products, including sewer pipe if the dry strength is improved.

SAMPLE: R-3550

County: Bedford

Locality: Roadcut, 2.7 miles east of Chamblissburg, on the north side of State Road 746 approximately 0.2 mile by road east of its intersection with State Road 684.

Description: Red-orange, plastic clay, mottled in places with yellow and gray clay, is present in a roadcut 225 feet long, and has a maximum exposed thickness of 6 feet. Partly weathered granite is exposed in the roadcut.

Formation or Age: Residual clay

Sampled Interval: Representative channel sample of clay in the highest part of the exposure.

Raw Properties:

| | |
|--|-----------------------------------|
| Water of plasticity: 31.1% | Plasticity: good |
| Drying shrinkage: 8.0% | Workability: good-slightly gritty |
| Drying properties: fair-surface cracking | Dry strength: 320 psi |
| pH: 4.6 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|---------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Orange-brown | 1½ | 10.5 | 23.2 | 1.69 |
| 2000 | Brown-orange | 2 | 11.5 | 19.5 | 1.80 |
| 2100 | Dk. orange | 2 | 14.0 | 14.8 | 1.94 |
| 2200 | Lt. red-brown | 2 | 14.0 | 13.1 | 2.00 |

Other tests and remarks: Excellent extrusion; CaCO₃ test negative; L.O.I. 11.1%; surface cracking noted on all fired tiles; the addition of a more plastic material is suggested.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 113.6 | 23.6 |
| 2000 | 113.6 | 22.0 |
| 2100 | 113.6 | 21.0 |
| 2200 | 113.6 | 17.1 |

Potential Use: Possible as a nonplastic component in brick and tile.

SAMPLE: R-4077

County: Bedford

Locality: Abandoned feldspar mine, 6.45 miles south-southwest of Goode, 300 feet off the southeast side of State Road 714 approximately 0.45 mile by road southeast of its intersection with State Road 715, leading north.

Description: Kaolin clay, clear quartz, and muscovite are present in a weathered pegmatite. The exposure is about 40 feet wide and has a maximum height of 10 feet.

Formation or Age: Residual clay

Sampled Interval: Composite of representative channel sample of clay in the highest part of the exposure and grab samples along the entire width.

Raw Properties:

| | |
|----------------------------|--------------------------|
| Water of plasticity: 25.2% | Plasticity: none |
| Drying shrinkage: 1.5% | Workability: none—gritty |
| Drying properties: good | Dry strength: poor |
| pH: 7.0 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|-------|---------------|----------------------|-----------------|---------------------|
| 1900 | White | 1 | 3.0 | 20.6 | 1.49 |
| 2000 | White | 1 | 3.0 | 24.6 | 1.46 |
| 2100 | White | 1 | 3.0 | 21.2 | 1.50 |
| 2200 | White | 1 | 3.5 | 20.0 | 1.49 |

Other tests and remarks: Not extrudable (compressed); CaCO_3 test negativé; L.O.I. 3.4%; no defects; for the pyrometric cone equivalent test performed at the Tuscaloosa Metallurgy Research Laboratory, the clay was heated to 1,431°C.

Pyrometric Cone Equivalent: 15

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 174.1 | 20.0 |
| 2000 | 170.4 | 20.4 |
| 2100 | 166.0 | 23.7 |
| 2200 | 151.6 | 21.6 |

Potential Use: Possible as a nonplastic component in the whiteware industry; on the basis of the pyrometric cone equivalent test, the clay qualifies for at least low-duty refractories.

BRUNSWICK COUNTY

Samples were collected from seven localities in Brunswick County. Testing by Morse Laboratories indicates the following potential uses for the raw material:

| <u>Sample</u> | <u>Formation or Age</u> | <u>Potential Use</u> |
|---------------|-------------------------|--|
| R-4100 | Paleozoic (?) | Component in most structural clay products, including sewer pipe |
| R-4101 | Residual clay | Brick and tile |
| R-4102 | Residual clay | Component in brick and tile |
| R-4103 | Paleozoic (?) | Component in brick and tile |
| R-4363 | Paleozoic (?) | Brick (current use) and tile |
| R-4364 | Residual clay | Brick (current use); refractories industry |
| R-4365 | Residual clay | Previously used in manufacture of brick; refractories industry |

SAMPLE: R-4100

County: Brunswick

Locality: Roadcut, 2.1 miles northeast of Brunswick on the property of Union Camp Corporation, on the southwest side of a company road in Block 429 approximately 1.5 miles by road north of its intersection with State Road 611.

Description: Pale reddish-brown and moderate reddish-brown to grayish-orange and light-gray, weathered, fissile phyllite is present in a roadcut ditch 180 feet long, and has a maximum exposed height of 3 feet. The material has an observed height of about 6 feet from its outcrop in the southeast end to its outcrop in the northwest end of the exposure. The phyllite, which contains iron-oxide staining in places, has a strike of approximately N.25° E. and a northwest dip.

Formation or Age: Paleozoic (?)

Sampled Interval: Composite of grab samples believed representative of material in exposure.

Raw Properties:

Water of plasticity: 20.5%
Drying shrinkage: 2.0%
Drying properties: good
pH: 6.5

Plasticity: poor
Workability: poor-gritty
Dry strength: 33 psi

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|------------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Buff | 2 | 2.0 | 21.7 | 1.63 |
| 2000 | Buff | 2 | 2.0 | 17.6 | 1.74 |
| 2100 | Lt. orange-brown | 7+ | 5.0 | 14.1 | 1.86 |
| 2200 | Red-brown | 7+ | 8.0 | 9.4 | 2.01 |

Other tests and remarks: Good extrusion (though compresses); CaCO₃ test negative; L.O.I. 5.7%; no defects. The addition of a more plastic material is suggested to improve the workability and dry strength.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 152.9 | 13.3 |
| 2000 | 152.9 | 8.7 |
| 2100 | 152.2 | 7.7 |
| 2200 | 152.2 | 2.6 |

Potential Use: Probable as a component in most structural clay products, including sewer pipe.

SAMPLE: R-4101

County: Brunswick

Locality: Roadcut, 4.15 miles west of Dolphin, on the west side of State Road 743 approximately 0.9 mile by road northwest of its intersection with State Road 642.

Description: Dark reddish-brown to moderate reddish-brown, plastic clay, is present in the northwest end of a roadcut 225 feet long, and has a maximum exposed thickness of 7.5 feet. In the southeast end of the roadcut this clay contains yellowish-orange and light-gray clay mottlings.

Formation or Age: Residual clay

Sampled Interval: Composite of two representative channel samples in the highest part of the exposure, approximately 60 feet apart.

Raw Properties:

| | |
|----------------------------|------------------------|
| Water of plasticity: 51.0% | Plasticity: poor |
| Drying shrinkage: 14.0% | Workability: poor-fine |
| Drying properties: good | Dry strength: 335 psi |
| pH: 5.5 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|-----------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Med. red-orange | 4 | 19.0 | 27.9 | 1.56 |
| 2000 | Brown-orange | 5 | 21.0 | 21.8 | 1.74 |
| 2100 | Brown-orange | 7+ | 26.0 | 12.4 | 2.12 |
| 2200 | Dk. orange | 7+ | 28.0 | 5.7 | 2.32 |

Other tests and remarks: Excellent extrusion; CaCO₃ test negative; L.O.I. 19.1%; slight surface cracking on 2100°F tile. The addition of a filler clay is suggested to reduce the total shrinkage and to improve the workability.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 132.9 | 34.1 |
| 2000 | 132.9 | 34.1 |
| 2100 | 133.5 | 33.9 |
| 2200 | 118.6 | 17.0 |

Potential Use: Possible in brick and tile.

SAMPLE: R-4102

County: Brunswick

Locality: Roadcut, 1.4 miles northeast of Adsit on the property of Union Camp Corporation, on the north side of a company road in Block 402 approximately 0.4 mile by road west of its intersection with State Road 633.

Description: Light-brown and dark yellowish-orange to pale yellowish-orange, slightly gritty, plastic clay is present in a roadcut 110 feet long, and has a maximum exposed thickness of 3.5 feet. The clay contains some small quartz fragments.

Formation or Age: Residual clay

Sampled Interval: Composite of two representative channel samples in the highest part of the exposure.

Raw Properties:

| | |
|----------------------------|------------------------|
| Water of plasticity: 38.2% | Plasticity: fair |
| Drying shrinkage: 12.0% | Workability: fair-fine |
| Drying properties: good | Dry strength: 846 psi |
| pH: 5.5 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|--------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Med. orange | 5 | 18.0 | 20.6 | 1.74 |
| 2000 | Brown-orange | 7+ | 22.0 | 6.5 | 2.14 |
| 2100 | Orange-brown | 7+ | 23.0 | 2.1 | 2.24 |
| 2200 | Red-brown | 7+ | 24.0 | 2.1 | 2.24 |

Other tests and remarks: Excellent extrusion; CaCO₃ test negative; L.O.I. 22.9%; no defects. The addition of a nonplastic grog is suggested to reduce the total shrinkage.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 136.7 | 29.1 |
| 2000 | 135.4 | 20.7 |
| 2100 | 135.4 | 20.7 |
| 2200 | 156.6 | 10.8 |

Potential Use: Probable as a component in brick and tile.

SAMPLE: R-4103

County: Brunswick

Locality: Roadcut, 1.55 miles northeast of Lawrenceville, on the north side of State Road 606 approximately 0.75 mile by road northeast of its intersection with U. S. Highway 58.

Description: Dark yellowish-orange to grayish-orange and pale-blue, weathered phyllite is present in a roadcut 255 feet long and has a maximum exposed height of 8 feet. The iron-oxide stained phyllite has a strike of approximately N.55°W. and a dip of about 37° SW.

Formation or Age: Paleozoic (?)

Sampled Interval: Composite of grab samples believed representative of material in exposure.

Raw Properties:

| | |
|----------------------------|--------------------------|
| Water of plasticity: 21.9% | Plasticity: poor |
| Drying shrinkage: 2.0% | Workability: poor-gritty |
| Drying properties: good | Dry strength: 68 psi |
| pH: 6.0 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|------------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Buff | 2 | 2.0 | 29.9 | 1.46 |
| 2000 | Lt. orange-brown | 2 | 2.0 | 21.6 | 1.60 |
| 2100 | Lt. red-brown | 6 | 6.0 | 16.4 | 1.72 |
| 2200 | Lt. red-brown | 7+ | 7.0 | 11.9 | 1.88 |

Other tests and remarks: Fair extrusion; CaCO₃ test negative; L.O.I. 9.6%; no defects. The addition of a more plastic clay is suggested to improve the workability and the dry strength.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 151.0 | 10.8 |
| 2000 | 149.8 | 13.0 |
| 2100 | 147.3 | 11.6 |
| 2200 | 147.9 | 8.4 |

Potential Use: Possible as a component in brick and tile.

SAMPLE: R-4363

County: Brunswick

Locality: Schist pit of Brick and Tile Corporation of Lawrenceville, 2.65 miles south of Lawrenceville, off the west side of State Road 715 approximately 0.7 mile by road south of its intersection with State Road 685.

Description: Red clay and greenish-gray and red to reddish-brown weathered and unweathered schist, which are iron-oxide stained to varying degrees, are present throughout the entire pit. The material is mined for use as a raw material for the manufacture of brick.

Formation or Age: Paleozoic (?)

Sampled Interval: Composite of grab samples believed representative of material in pit.

Raw Properties:

| | |
|----------------------------|-----------------------------|
| Water of plasticity: 25.5% | Plasticity: excellent |
| Drying shrinkage: 3.1% | Workability: excellent-fine |
| Drying properties: good | Dry strength: 74 psi |
| pH: 5.0 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|--------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Orange-brown | 1 | 3.0 | 24.6 | 1.53 |
| 2000 | Orange-brown | 4 | 6.0 | 22.1 | 1.62 |
| 2100 | Red-brown | 5 | 8.0 | 15.6 | 1.75 |
| 2200 | Dk. orange | 7 | 9.0 | 15.1 | 1.76 |

Other tests and remarks: Good extrusion; CaCO₃ test negative; L.O.I. 11.1%; no defects. The addition of a low-firing filler is suggested to reduce the firing range.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 145.4 | 19.9 |
| 2000 | 147.9 | 19.5 |
| 2100 | 166.0 | 16.7 |
| 2200 | 167.9 | 13.8 |

Potential Use: Brick (current use); possible in tile.

SAMPLE: R-4364

County: Brunswick

Locality: Excavation on the property of Brick and Tile Corporation of Lawrenceville, 3.6 miles east of Lawrenceville, on the southeast side of State Road 606 approximately 0.7 mile by road southwest of its intersection with U. S. Highway 58.

Description: Moderate yellowish-brown to dark yellowish-orange and very pale-orange to white, micaceous, plastic clay is present in the pit and has a maximum exposed thickness of 10 feet. This excavation has subsequently been developed as a source of raw material for the manufacture of brick.

Formation or Age: Residual clay

Sampled Interval: Representative channel sample in the highest part of the exposure.

Raw Properties:

| | |
|----------------------------|--------------------------|
| Water of plasticity: 29.3% | Plasticity: fair |
| Drying shrinkage: 6.8% | Workability: fair-gritty |
| Drying properties: good | Dry strength: 88 psi |
| pH: 5.0 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Lt. tan | 2 | 9.0 | 27.2 | 1.48 |
| 2000 | Lt. yellow | 4 | 9.0 | 21.0 | 1.51 |
| 2100 | Lt. yellow | 6 | 10.0 | 16.0 | 1.95 |
| 2200 | Lt. yellow | 7 | 10.0 | 16.2 | 1.67 |

Other tests and remarks: Excellent extrusion; CaCO₃ test negative; L.O.I. 12.7%; no defects; for the pyrometric cone equivalent test performed by the Tuscaloosa Metallurgy Research Laboratory, the clay was heated to 1,654°C.

Pyrometric Cone Equivalent: 29

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 141.6 | 28.6 |
| 2000 | 141.6 | 28.6 |
| 2100 | 125.4 | 30.9 |
| 2200 | 121.1 | 18.3 |

Potential Use: Brick (current use); on the basis of the pyrometric cone equivalent test, the clay qualifies for at least medium-duty refractories.

SAMPLE: R-4365

County: Brunswick

Locality: Clay pit of Brick and Tile Corporation of Lawrenceville, 2.3 miles northeast of Lawrenceville, on the northwest side of State Road 606 approximately 0.95 mile by road northeast of its intersection with State Road 727.

Description: Pale yellowish-orange to moderate-orange and white, plastic clay with some small fragments of quartz is present in the clay pit. The clay has been mined for use in the manufacture of brick.

Formation or Age: Residual clay

Sampled Interval: Composite of grab samples believed representative of material in clay pit.

Raw Properties:

Water of plasticity: 21.8%

Plasticity: fair

Drying shrinkage: 3.2%

Workability: fair-gritty

Drying properties: good

Dry strength: 50 psi

pH: 5.0

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|---------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Lt. yellow | 2 | 2.0 | 23.3 | 1.55 |
| 2000 | Lt. cream-tan | 2 | 3.0 | 35.3 | 1.60 |
| 2100 | Lt. cream-tan | 4 | 4.0 | 17.2 | 1.69 |
| 2200 | Lt. cream-tan | 5 | 4.0 | 20.5 | 1.62 |

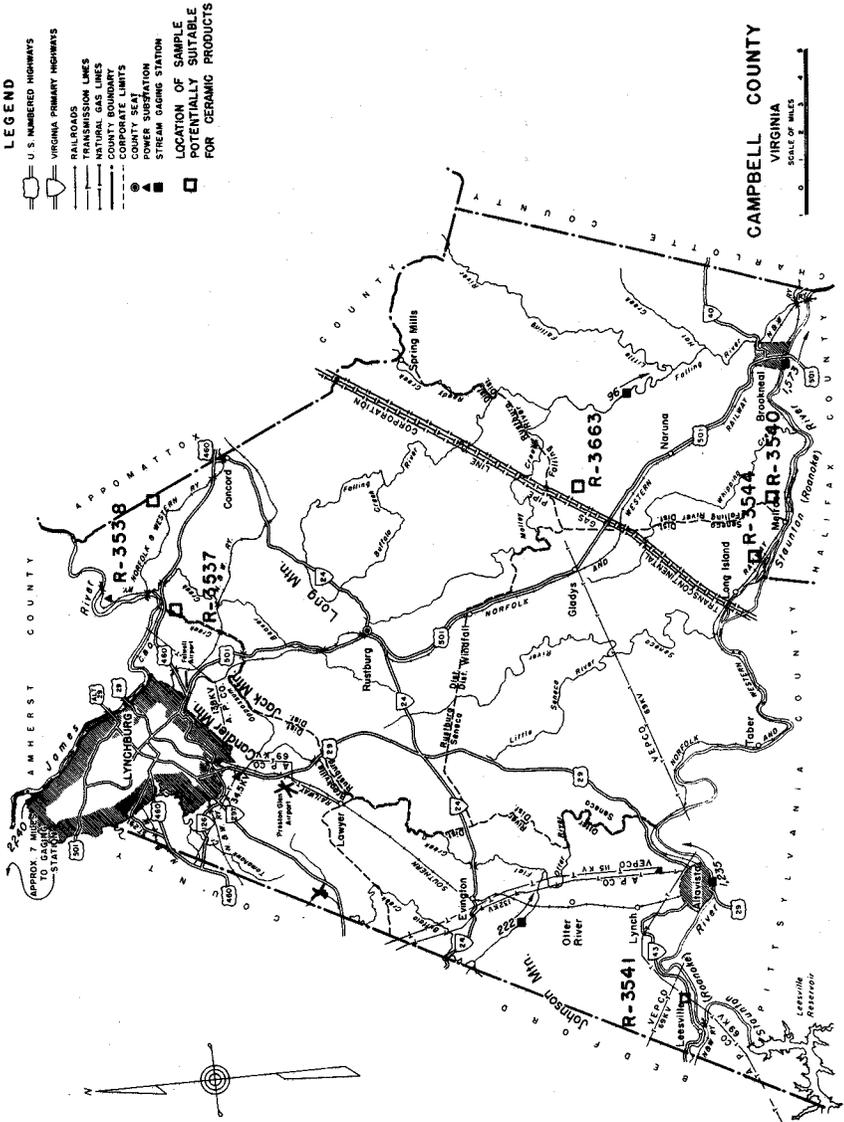
Other tests and remarks: Excellent extrusion; CaCO₃ test negative; L.O.I. 5.0%; no defects; for the pyrometric cone equivalent test performed at the Tuscaloosa Metallurgy Research Laboratory, the clay was heated to 1,549°C.

Pyrometric Cone Equivalent: 20

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 141.6 | 30.2 |
| 2000 | 125.4 | 30.4 |
| 2100 | 126.0 | 29.7 |
| 2200 | 125.4 | 11.0 |

Potential Use: Previously used for the manufacture of brick. On the basis of the pyrometric cone equivalent test, the clay qualifies for at least low-duty refractories.



Location Map of Campbell County

CAMPBELL COUNTY

Samples were collected from six localities in Campbell County. Testing by Morse Laboratories indicates the following potential uses for the raw material:

| <u>Sample</u> | <u>Formation or Age</u> | <u>Potential Use</u> |
|---------------|-------------------------|--|
| R-3537 | Joshua schist | Previously used in the manufacture of lightweight aggregate; most structural clay products, including sewer pipe |
| R-3538 | Palezoic (?) | Nonplastic component in most structural clay products, including sewer pipe |
| R-3540 | Residual clay | Brick and tile |
| R-3541 | Residual clay | Most porous clay products, brick and tile, and related structural clay products, stoneware bodies |
| R-3544 | Residual clay | Brick and tile, most porous clay products, stoneware bodies |
| R-3663 | Residual clay | Most structural clay products, except sewer pipe |

SAMPLE: R-3537

County: Campbell

Locality: Abandoned quarry, 6.2 miles east of Lynchburg, at the end of a gravel access road on the southwest side of U. S. Highway 460 approximately 0.55 mile by road west of its intersection with State Road 726.

Description: Blue-gray, hard, fine-grained schist, which contains some gray calcareous veins, is present in the walls of the abandoned quarry. The material was formerly mined as a raw material for the manufacture of lightweight aggregate.

Formation of Age: Joshua schist

Sampled Interval: Composite of grab samples believed representative of material in quarry.

Raw Properties:

Water of plasticity: 18.9%

Plasticity: poor

Drying shrinkage: 0.3%

Workability: poor

Drying properties: good

Dry strength: poor

pH: 6.5

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|------------------|---------------|----------------------|-----------------|---------------------|
| 2000 | Lt. orange-brown | 1 | 0.8 | 19.6 | 1.73 |
| 2100 | Buff | 3 | 0.8 | 19.3 | 1.73 |
| 2200 | Med. brown | 7+ | 5.0 | 9.8 | 2.01 |
| 2300 | Med. brown | 7+ | 5.0 | 5.7 | 2.09 |

Other tests and remarks: Non-extrudable; L.O.I. 4.9%; mealy texture; gritty. The addition of a bonding clay is suggested to improve the plasticity and dry strength.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 2000 | 131.7 | 8.9 |
| 2100 | 139.1 | 8.9 |
| 2200 | 144.1 | 2.6 |
| 2300 | 92.4 | 5.8 |

Potential Use: Previously used for the manufacture of lightweight aggregate; possible in most structural clay products, including sewer pipe.

SAMPLE: R-3538

County: Campbell

Locality: Roadcut, 3.2 miles northwest of Concord, on the northeast side of State Road 609 approximately 0.2 mile by road northwest of its intersection with State Road 607.

Description: Gray to greenish-gray, fissile, semilustrous phyllite is present in a roadcut 1050 feet long, and has a maximum exposed height of 6.5 feet. The phyllite, which weathers to a light-tan color, is interbedded with minor garnet-mica schist and contains some small quartz veins.

Formation or Age: Paleozoic (?)

Sampled Interval: Composite of grab samples believed representative of weathered and unweathered phyllite and schist.

Raw Properties:

| | |
|----------------------------|--------------------|
| Water of plasticity: 22.8% | Plasticity: none |
| Drying shrinkage: 0.0% | Workability: none |
| Drying properties: good | Dry strength: poor |
| pH: 6.5 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|------------------|---------------|----------------------|-----------------|---------------------|
| 2000 | Lt. orange-brown | 1 | 0.3 | 26.9 | 1.50 |
| 2100 | Lt. red-brown | 1 | 0.3 | 25.0 | 1.58 |
| 2200 | Lt. red-brown | 3+ | 4.5 | 17.1 | 1.80 |
| 2300 | Lt. red-brown | 7 | 6.0 | 12.6 | 1.99 |

Other tests and remarks: Non-extrudable; L.O.I. 4.9%; large quantity of mica present; very powdery when dry. The addition of a better bonding clay is suggested to improve the dry strength, lower the maturing point, and reduce absorption.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 2000 | 132.9 | 12.6 |
| 2100 | 157.9 | 11.1 |
| 2200 | 157.9 | 3.2 |
| 2300 | 157.2 | 2.1 |

Potential Use: Probable as a nonplastic component in most structural clay products, including sewer pipe.

SAMPLE: R-3540

County: Campbell

Locality: Roadcut, 4.1 miles southwest of Naruna, on the northeast side of State Road 614 approximately 0.4 mile by road southeast of its intersection with State Road 634.

Description: Red-orange, compact, plastic clay, variegated with yellow and gray plastic clay, is present in a roadcut 275 feet long, and has a maximum exposed thickness of 6 feet. Quartz and feldspar fragments are present in the exposure.

Formation or Age: Residual clay

Sampled Interval: Composite of two representative channel samples in the highest part of the exposure, approximately 60 feet apart.

Raw Properties:

Water of plasticity: 36.1%

Plasticity: good

Drying shrinkage: 7.8%

Workability: good

Drying properties: good

Dry strength: 252.9 psi

pH: 6.8

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|---------------|---------------|----------------------|-----------------|---------------------|
| 2000 | Buff | 4 | 11.5 | 23.1 | 1.61 |
| 2100 | Med. orange | 5 | 13.8 | 20.2 | 1.70 |
| 2200 | Med. brown | 7 | 17.8 | 11.1 | 2.00 |
| 2300 | Lt. red-brown | 7+ | 18.5 | 10.3 | 2.02 |

Other tests and remarks: Extrudes well; L.O.I. 16.6%; the addition of a nonplastic grog is suggested to improve the shrinkage and absorption.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 2000 | 94.2 | 22.9 |
| 2100 | 130.4 | 25.0 |
| 2200 | 126.0 | 17.1 |
| 2300 | 142.9 | 8.1 |

Potential Use: Possible in brick and tile.

SAMPLE: R-3541

County: Campbell

Locality: Roadcut (Figure 7), 1.4 miles east of Leesville, on the north side of State Highway 43 approximately 1.35 miles by road east of its intersection with State Road 682.

Description: Yellow-brown, compact, plastic clay containing some quartz fragments is present in a roadcut 180 feet long, and has a maximum exposed thickness of 8 feet.

Formation or Age: Residual clay

Sampled Interval: Composite of two representative channel samples in the highest part of the exposure, approximately 60 feet apart.

Raw Properties:

| | |
|----------------------------|-------------------------|
| Water of plasticity: 31.7% | Plasticity: excellent |
| Drying shrinkage: 7.0% | Workability: excellent |
| Drying properties: good | Dry strength: 289.7 psi |
| pH: 8.3 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|------------------|---------------|----------------------|-----------------|---------------------|
| 2000 | Lt. orange-brown | 3 | 8.5 | 20.8 | 1.71 |
| 2100 | Orange-brown | 5 | 11.3 | 19.8 | 1.77 |
| 2200 | Med. brown | 6 | 13.8 | 17.7 | 1.80 |
| 2300 | Lt. red-brown | 7 | 11.8 | 14.9 | 1.89 |

Other tests and remarks: Extrudes well; L.O.I. 9.9%; excellent color range.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 2000 | 98.6 | 34.1 |
| 2100 | 121.1 | 18.1 |
| 2200 | 136.7 | 16.1 |
| 2300 | 134.2 | 12.2 |

Potential Use: Probable as sole component in most porous clay products. Possible in brick, tile and related structural clay products; would consider for use in stoneware bodies.

SAMPLE: R-3544

County: Campbell

Locality: Roadcut (Figure 8), 1.5 miles southeast of Long Island, on the south side of State Road 614 approximately 0.1 mile by road southeast of its intersection with State Road 627.

Description: Dark to red-brown, plastic clay, mottled with some light gray clay, is present in a long roadcut, and has a maximum exposed thickness of 15 feet. The clay is derived from sedimentary rocks of Triassic age.

Formation or Age: Residual clay

Sampled Interval: Representative channel sample in the highest part of the exposure.

Raw Properties:

| | |
|----------------------------|-------------------------|
| Water of plasticity: 35.5% | Plasticity: fair |
| Drying shrinkage: 5.5% | Workability: fair |
| Drying properties: good | Dry strength: 148.7 psi |
| pH: 6.1 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|------------------|---------------|----------------------|-----------------|---------------------|
| 2000 | Lt. orange-brown | 3 | 8.5 | 21.5 | 1.64 |
| 2100 | Orange-brown | 5 | 9.0 | 19.5 | 1.71 |
| 2200 | Med. brown | 6 | 13.3 | 13.1 | 1.91 |
| 2300 | Red-brown | 7 | 13.8 | 12.3 | 1.94 |

Other tests and remarks: Fair to poor extrusion; L.O.I. 7.8%; excellent color range. The addition of better bonding materials would reduce the maturing point and absorption.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 2000 | 94.8 | 26.9 |
| 2100 | 126.7 | 11.6 |
| 2200 | 133.5 | 10.0 |
| 2300 | 133.5 | 7.8 |

Potential Use: Possible in most porous clay products. Would consider for use in stoneware bodies and possibly in brick and tile.



Figure 7. Residual clay (Sample R-3541) on the north side of State Highway 43 approximately 1.35 miles by road east of its intersection with State Road 682.



Figure 8. Residual clay (Sample R-3544) on the south side of State Road 614 approximately 0.1 mile by road southeast of its intersection with State Road 627.



Figure 7. Residual clay (Sample R-3541) on the north side of State Highway 43 approximately 1.35 miles by road east of its intersection with State Road 682.



Figure 8. Residual clay (Sample R-3544) on the south side of State Road 614 approximately 0.1 mile by road southeast of its intersection with State Road 627.

SAMPLE: R-3663

County: Campbell

Locality: Roadcut, 2.9 miles east of Gladys, on the northwest side of State Road 651 approximately 1.3 miles by road south of its intersection with State Road 652.

Description: Chocolate-brown, plastic clay is present in a roadcut 450 feet long, and has a maximum exposed thickness of 4.5 feet. Three feet of additional light-brown, increasingly sandy clay was indicated by augering to that depth at the base of the exposure. The clay is derived from sedimentary rocks of Triassic age.

Formation or Age: Residual clay

Sampled Interval: Composite of two representative channel samples in the highest part of the exposure, approximately 230 feet apart, and 3 feet of augered clay.

Raw Properties:

Water of plasticity: 36.3%

Plasticity: good

Drying shrinkage: 7.8%

Workability: smooth, fine texture

Drying properties: good

Dry strength: 200 psi

pH: 6.6

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|------------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Lt. orange-brown | 3½ | 8.0 | 23.1 | 1.68 |
| 2000 | Orange-brown | 5 | 9.8 | 23.1 | 1.68 |
| 2100 | Lt. red-brown | 7+ | 15.0 | 13.4 | 1.98 |
| 2200 | Orange-red | 7+ | 15.0 | 11.9 | 2.03 |

Other tests and remarks: Good extrusion; L.O.I. 8.8%; good color range. Total shrinkage and absorption could be reduced by the addition of a nonplastic grog.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 93.0 | 24.2 |
| 2000 | 98.6 | 22.8 |
| 2100 | 117.9 | 13.3 |
| 2200 | 116.7 | 12.4 |

Potential Use: Probable in most structural clay products, except sewer pipe.

CARROLL COUNTY

Samples were collected from three localities in Carroll County. Testing by Morse Laboratories indicates the following potential uses for the raw material:

| <u>Sample</u> | <u>Formation or Age</u> | <u>Potential Use</u> |
|---------------|-------------------------|--|
| R-4073 | Lynchburg Formation | Flux-type nonplastic component in brick and tile |
| R-4076 | Chilhowee Group | Brick and tile; sewer pipe |
| R-4094 | Lynchburg Formation | Component in most structural clay products, including sewer pipe |

SAMPLE: R-4073

County: Carroll

Locality: Roadcut, 2.7 miles east-southeast of Buck, on the northwest side of State Road 740 approximately 0.15 mile by road southwest of its intersection with State Road 741.

Description: Steel-gray to grayish-blue, highly contorted phyllite is present in a roadcut 525 feet long, and has a maximum exposed height of 6 feet. The phyllite, which is iron-oxide stained in places, contains small quartz veins in parts of the roadcut. The foliation of the phyllite has a strike of approximately N.58°E. and a dip of approximately 64° SE.

Formation or Age: Lynchburg Formation

Sampled Interval: Composite of grab samples believed representative of material in exposure.

Raw Properties:

Water of plasticity: 23.5%
Drying shrinkage: 1.9%
Drying properties: good
pH: 6.3

Plasticity: poor
Workability: poor-fatty
Dry strength: poor

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|------------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Buff | poor bond | 0.0 | 28.9 | 1.46 |
| 2000 | Lt. orange-brown | poor bond | 2.5 | 24.3 | 1.60 |
| 2100 | Red-brown | 1½ | 4.2 | 20.3 | 1.70 |
| 2200 | Med. brown | 4 | 8.5 | 9.7 | 1.93 |

Other tests and remarks: Not extrudable; CaCO₃ test negative; L.O.I. 7.7%; bloating indicated on 1900°F tile.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 146.0 | 11.2 |
| 2000 | 145.4 | 10.2 |
| 2100 | 144.1 | 9.7 |
| 2200 | 129.2 | 9.1 |

Potential Use: Possible as a flux-type nonplastic component in brick and tile.

SAMPLE: R-4076

County: Carroll

Locality: Roadcut, 4.35 miles west of Bylesby, on the east side of State Road 738 approximately 0.25 mile by road north of its intersection with State Road 602.

Description: Light-brown to pale yellowish-orange weathered shale, grayish-green unweathered shale, and some fine-grained, light reddish-brown sandstone are present in a roadcut 325 feet long, and have a maximum exposed height of 3 feet. The shale has a strike of approximately N.70°E. and an almost vertical dip.

Formation or Age: Chilhowee Group

Sampled Interval: Composite of grab samples believed representative of shale in exposure.

Raw Properties:

| | |
|----------------------------|--------------------------|
| Water of plasticity: 20.6% | Plasticity: good |
| Drying shrinkage: 4.0% | Workability: good-gritty |
| Drying properties: good | Dry strength: 80 psi |
| pH: 6.0 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|--------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Buff | 2 | 4.0 | 19.0 | 1.71 |
| 2000 | Orange-brown | 6 | 7.0 | 12.2 | 2.21 |
| 2100 | Brown-red | 7+ | 11.0 | 5.9 | 2.11 |
| 2200 | Brown-red | 7+ | 12.0 | 3.6 | 2.19 |

Other tests and remarks: Fair extrusion; CaCO₃ test negative; L.O.I. 9.5%; no defects.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 169.1 | 10.5 |
| 2000 | 169.1 | 6.8 |
| 2100 | 169.1 | 10.5 |
| 2200 | 169.1 | 2.6 |

Potential Use: Probable as sole component in brick and tile; possible in sewer pipe.

SAMPLE: R-4094

County: Carroll

Locality: Roadcut, 1.45 miles south of Sylvatus, on the northeast side of State Road 768 approximately 2.0 miles by road northwest of its intersection with State Road 771.

Description: Silver-gray to grayish-blue and green, highly contorted phyllite is present in a roadcut 325 feet long, and has a maximum exposed height of 5 feet. The phyllite is stained dark red-brown and rusty brown in places by iron oxide, and has a strike of approximately N.74°W. and a dip of approximately 60-65° SW.

Formation or Age: Lynchburg Formation

Sampled Interval: Composite of grab samples believed representative of material in the exposure.

Raw Properties:

Water of plasticity: 28.2%

Plasticity: poor

Drying shrinkage: 2.0%

Workability: poor-short, gritty

Drying properties: good,

Dry strength: poor

pH: 6.5

Slow Firing Test:

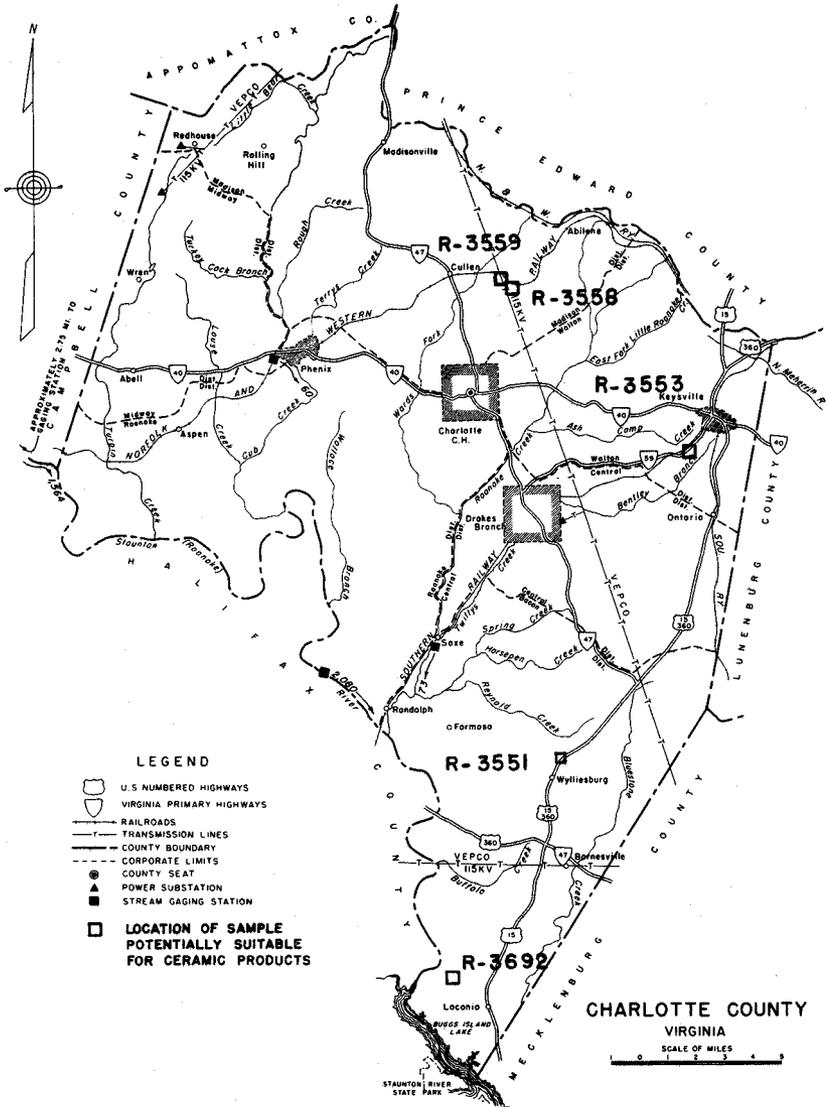
| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|---------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Buff | 2 | 2.0 | 29.3 | 1.44 |
| 2000 | Lt. brown | 3 | 3.5 | 17.9 | 1.65 |
| 2100 | Lt. red-brown | 7+ | 7.0 | 17.0 | 1.78 |
| 2200 | Med. brown | 7+ | 10.0 | 4.4 | 2.14 |

Other tests and remarks: Not extrudable (compresses); CaCO₃ test negative; L.O.I. 4.7%; no defects. The addition of a more plastic clay is suggested to improve the workability and dry strength.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 170.4 | 8.9 |
| 2000 | 170.4 | 9.4 |
| 2100 | 149.1 | 12.0 |
| 2200 | 147.3 | 13.8 |

Potential Use: Probable as a component in most structural clay products, including sewer pipe.



Location Map of Charlotte County

CHARLOTTE COUNTY

Samples were collected from five localities in Charlotte County. Testing by Morse Laboratories indicates the following potential use for the raw material:

| <u>Sample</u> | <u>Formation or Age</u> | <u>Potential Use</u> |
|---------------|-------------------------|--|
| R-3551 | Residual clay | Component in brick and tile |
| R-3553 | Residual clay | Nonplastic component in brick and tile |
| R-3558 | Residual clay | Brick and tile* |
| R-3559 | Residual clay | Brick and tile** |
| R-3692 | Aaron slate | Brick and tile |

*If water of plasticity, total shrinkage, and absorption are reduced.

**If water of plasticity and total shrinkage are reduced.

SAMPLE: R-3551

County: Charlotte

Locality: Roadside excavation, 0.8 mile northeast of Wyllyesburg, on northwest side of U. S. Highway 15 at its intersection with State Road 611.

Description: Sandy, yellow-brown clay, mottled with red and gray clay, is present in the excavation, and has a maximum exposed thickness of 8 feet.

Formation or Age: Residual clay

Sampled Interval: Representative channel sample in the highest part of the exposure.

Raw Properties:

| | |
|--|-------------------------|
| Water of plasticity: 45.3% | Plasticity: good-sticky |
| Drying shrinkage: 11.4% | Workability: good-fine |
| Drying properties: fair-surface cracking | Dry strength: 316 psi |
| pH: 4.3 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|------------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Med. orange | 1½ | 13.9 | 23.2 | 1.67 |
| 2000 | Lt. orange-brown | 2 | 17.0 | 20.0 | 1.76 |
| 2100 | Orange-brown | 2 | 19.5 | 12.1 | 1.98 |
| 2200 | Dk. orange-brown | 3 | 21.5 | 7.3 | 2.18 |

Other tests and remarks: Excellent extrusion; CaCO₃ test negative; L.O.I. 14.0%; surface cracking was noted on all fired tiles; the addition of a fill clay is suggested to improve the drying and firing properties.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 108.6 | 27.6 |
| 2000 | 99.2 | 25.7 |
| 2100 | 99.8 | 24.4 |
| 2200 | 134.8 | 16.8 |

Potential Use: Possible only as a component in brick and tile.

SAMPLE: R-3553

County: Charlotte

Locality: Railroad cut, 7.9 miles east of Charlotte Court House, off the northwest side of State Road 772 approximately 0.1 mile by road northeast of its intersection with State Highway 59.

Description: Yellow, red, and gray variegated, plastic clay, which contains some quartz fragments, is present in a long roadcut, and has a maximum exposed thickness of 8 feet.

Formation or Age: Residual clay

Sampled Interval: Representative channel sample in the highest part of the exposure.

Raw Properties:

| | |
|----------------------------|-----------------------|
| Water of plasticity: 31.0% | Plasticity: fair |
| Drying shrinkage: 7.6% | Workability: mealy |
| Drying properties: fair | Dry strength: 200 psi |
| pH: 5.0 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|---------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Orange-brown | 2 | 9.0 | 25.6 | 1.66 |
| 2000 | Med. brown | 2½ | 11.2 | 19.3 | 1.83 |
| 2100 | Lt. red-brown | 2½ | 12.2 | 17.4 | 1.92 |
| 2200 | Red-brown | 2½ | 12.4 | 17.1 | 1.92 |

Other tests and remarks: Fair extrusion (mealy); CaCO₃ test slightly positive; L.O.I. 11.4%; surface cracking during drying process; good color range. The addition of a more plastic clay is suggested to improve workability and dry strength and to reduce the absorption.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 103.6 | 25.8 |
| 2000 | 103.6 | 21.3 |
| 2100 | 124.8 | 11.1 |
| 2200 | 124.2 | 10.1 |

Potential Use: Possible as a nonplastic component in brick and tile.

SAMPLE: R-3558

County: Charlotte

Locality: Railroad cut, 2.1 miles east of Cullen, on the southeastern side of State Road 658 at its intersection with the Norfolk and Western Railway.

Description: Red-brown, yellow-green, and gray plastic clay is present in a railroad cut 475 feet long, and has a maximum exposed thickness of 8 feet. Some quartz fragments and manganese staining are present in the clay.

Formation or Age: Residual clay

Sampled Interval: Representative channel sample in the highest part of the exposure.

Raw Properties:

| | |
|----------------------------|-----------------------------------|
| Water of plasticity: 44.8% | Plasticity: excellent |
| Drying shrinkage: 9.5% | Workability: smooth, fine texture |
| Drying properties: good | Dry strength: 268 psi |
| pH: 6.6 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|--------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Brown-orange | 3 | 12.3 | 26.9 | 1.63 |
| 2000 | Red-orange | 5 | 12.5 | 26.9 | 1.60 |
| 2100 | Orange-brown | 6½ | 15.5 | 19.6 | 1.85 |
| 2200 | Dk. orange | 7 | 17.3 | 18.3 | 1.89 |

Other tests and remarks: Excellent extrusion; L.O.I. 12.8%; surface checking occurs between 2000° and 2200°F. The addition of a better bonding material and nonplastic grog would reduce the water of plasticity, total shrinkage and absorption.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1800 | 96.1 | 32.9 |
| 1900 | 98.0 | 26.6 |
| 2000 | 111.1 | 13.9 |
| 2100 | 125.4 | 10.5 |

Potential Use: None in structural clay products unless the water of plasticity, total shrinkage, and absorption are reduced; possible use then in brick and tile.

SAMPLE: R-3559

County: Charlotte

Locality: Railroad cut, 2.1 miles east of Cullen, on the northwest side of State Road 658 at its intersection with the Norfolk and Western Railway.

Description: Yellow-brown and gray, plastic clay, with some manganese staining, is present in a railroad cut 165 feet long, and has a maximum exposed thickness of 8 feet.

Formation or Age: Residual clay

Sampled Interval: Representative channel sample in the highest part of the exposure.

Raw Properties:

| | |
|----------------------------|-----------------------------------|
| Water of plasticity: 53.5% | Plasticity: excellent |
| Drying shrinkage: 13.3% | Workability: smooth, fine texture |
| Drying properties: good | Dry strength: 867 psi |
| pH: 6.7 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|--------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Orange-brown | 6 | 16.5 | 21.1 | 1.67 |
| 2000 | Orange-brown | 7 | 17.5 | 20.5 | 1.73 |
| 2100 | Orange-brown | 7+ | 22.5 | 9.0 | 2.12 |
| 2200 | Dk. orange | 7+ | 22.0 | 9.1 | 2.10 |

Other tests and remarks: Excellent extrusion; L.O.I. 15.5%; the addition of more open clay materials, such as fireclay and grog, would reduce the water of plasticity and total shrinkage.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 96.7 | 27.5 |
| 2000 | 89.2 | 28.4 |
| 2100 | 106.1 | 17.6 |
| 2200 | 105.5 | 16.6 |

Potential Use: Possible in brick and tile if the water of plasticity and total shrinkage are reduced.

SAMPLE: R-3692

County: Charlotte

Locality: Roadcut (Figure 9), 5.6 miles southwest of Barnesville, on the southeast side of State Road 632 approximately 1.6 miles by road southwest of its intersection with State Road 608.

Description: Olive-gray to dusky-blue and purple, tuffaceous slate, which weathers to a soft tan and orange gray, is present in a roadcut 170 feet long, and has a maximum exposed height of 7.5 feet. The slate has a strike of approximately N.25°E. and a dip of approximately 40° SE.

Formation or Age: Aaron slate

Sampled Interval: Composite of grab samples believed representative of material in exposure.

Raw Properties:

| | |
|----------------------------|-----------------------|
| Water of plasticity: 20.2% | Plasticity: poor |
| Drying shrinkage: 1.8% | Workability: short |
| Drying properties: good | Dry strength: 176 psi |
| pH: 6.8 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|---------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Orange-brown | 2 | 2.8 | 22.5 | 1.69 |
| 2000 | Lt. red-brown | 2½ | 4.6 | 16.9 | 1.85 |
| 2100 | Med. brown | 6 | 8.8 | 7.9 | 2.16 |
| 2200 | Med. brown | 7 | 11.2 | 2.6 | 2.38 |

Other tests and remarks: Fair extrusion (tends to force water and compress); CaCO₃ test slightly positive; L.O.I. 6.4%; slight cracking.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 146.6 | 8.5 |
| 2000 | 146.6 | 8.0 |
| 2100 | 146.6 | 4.8 |
| 2200 | 146.6 | 5.3 |

Potential Use: Possible in brick and tile.



Figure 9. Aaron slate (Sample R-3692) on the southeast side of State Road 632 approximately 1.6 miles by road southwest of its intersection with State Road 608.



Figure 9. Aaron slate (Sample R-3692) on the southeast side of State Road 632 approximately 1.6 miles by road southwest of its intersection with State Road 608.

CUMBERLAND COUNTY

Samples were collected from five localities in Cumberland County. Testing by Tuscaloosa Laboratory and Morse Laboratories (R-3545) indicates the following potential uses for the raw material:

| <u>Sample</u> | <u>Formation or Age</u> | <u>Potential Use</u> |
|---------------|-------------------------------------|----------------------------------|
| R-3458 | Residual clay and Triassic shale | Face brick |
| R-3459 | Residual clay | Component in face-brick mixtures |
| R-3460 | Residual clay | Component in face-brick mixtures |
| R-3461 | Residual clay | Component in face-brick mixtures |
| R-3545 | Residual clay | Most porous clay products |

SAMPLE: R-3458

County: Cumberland

Locality: Roadcut (Figure 10), 3.7 miles northwest of Farmville, on the northeast side of State Road 668 approximately 0.9 mile by road west of its intersection with State Road 635.

Description: Chocolate-red, gray-brown, orange, gray, and red-brown plastic, micaceous, silty clay and shale, mottled with some light green clay, are present in a long roadcut, and have a maximum exposed height of 6 feet. Some manganese staining is present along joint planes. The weathered shale has a strike of approximately N.50°E. and a dip of approximately 40° NW.

Formation or Age: Residual clay and Triassic shale

Sampled Interval: Composite of grab samples believed representative of material along 110 feet of the exposure.

Raw Properties:

| | |
|----------------------------|------------------------------------|
| Water of plasticity: 19.1% | Working properties: low plasticity |
| Drying shrinkage: 2.5% | Dry strength: fair |
| Drying defects: none | pH: 5.9 |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Abs. | % Appar. Porosity | Bulk Dens. gm/cc |
|--------------|-----------|---------------|----------------------|-----------|----------------------|---------------------|
| 1800 | Lt. brown | 2 | 5.0 | 18.2 | 32.6 | 1.79 |
| 1900 | Lt. brown | 2 | 5.0 | 18.2 | 32.7 | 1.80 |
| 2000 | Brown | 3 | 7.5 | 14.5 | 27.6 | 1.90 |
| 2100 | Brown | 4 | 7.5 | 11.3 | 22.6 | 2.00 |
| 2200 | Dk. brown | 5 | 10.0 | 8.4 | 17.5 | 2.08 |
| 2300 | Gray | 5 | 10.0 | 2.0 | 4.2 | 2.09 |

Other tests and remarks: No effervescence with HCl; should fire to "MW" face-brick specifications at about 2100°F; poor color.

Bloating Test: Negative

Potential Use: Face brick.



Figure 10. Residual clay and Triassic shale (Sample R-3458) on the northeast side of State Road 668 approximately 0.9 mile by road west of its intersection with State Road 635.



Figure 10. Residual clay and Triassic shale (Sample R-3458) on the northeast side of State Road 668 approximately 0.9 mile by road west of its intersection with State Road 635.

SAMPLE: R-3459

County: Cumberland

Locality: Roadcut, 2.4 miles northeast of Cumberland, on the north side of State Highway 13 approximately 1.0 mile by road west of its intersection with State Road 645.

Description: Orange-red micaceous, slightly silty clay, mottled with some yellow clay, is present in a roadcut 150 feet long, and has a maximum exposed thickness of 5 feet. Four feet of additional clay was indicated by augering to that depth at the base of the exposure.

Formation or Age: Residual clay

Sampled Interval: Composite of representative channel sample in the highest part of the exposure and 4 feet of augered clay.

Raw Properties:

Water of plasticity: 32.5%

Drying shrinkage: 5.0%

Drying defects: none

Working properties: moderate plasticity

Dry strength: fair

pH: 5.5

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Abs. | % Appar. Porosity | Bulk Dens. gm/cc |
|--------------|-----------|---------------|----------------------|-----------|----------------------|---------------------|
| 1800 | Red-brown | 2 | 7.5 | 29.8 | 45.9 | 1.54 |
| 1900 | Red-brown | 2 | 7.5 | 29.5 | 46.0 | 1.56 |
| 2000 | Lt. brown | 2 | 7.5 | 26.1 | 43.0 | 1.65 |
| 2100 | Brown | 4 | 10.0 | 21.4 | 37.9 | 1.77 |
| 2200 | Brown | 5 | 12.5 | 20.1 | 36.2 | 1.80 |
| 2300 | Dk. brown | 5 | 12.5 | 18.4 | 34.0 | 1.85 |

Other tests and remarks: No effervescence with HCl; high absorption at all firing temperatures.

Bloating Test: Negative

Potential Use: Component in face-brick mixtures.

SAMPLE: R-3460

County: Cumberland

Locality: Roadcut, 3.0 miles south of Cartersville, on the east side of State Road 616 just south of its intersection with State Road 607.

Description: Orange-red micaceous clay is present in a long roadcut, and has a maximum exposed thickness of 4.5 feet. Two and one-half feet of additional clay was indicated by augering to that depth at the base of the exposure.

Formation or Age: Residual clay

Sampled Interval: Composite of representative channel sample in the highest part of the exposure and 2½ feet of augered clay.

Raw Properties:

Water of plasticity: 32.3%

Drying shrinkage: 5.0%

Drying defects: none

pH: 5.6

Working properties: moderate plasticity

Dry strength: fair

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Abs. | % Appar. Porosity | Bulk Dens. gm/cc |
|--------------|-----------|---------------|----------------------|-----------|----------------------|---------------------|
| 1800 | Lt. brown | 2 | 5.0 | 30.5 | 46.1 | 1.51 |
| 1900 | Lt. brown | 2 | 5.0 | 30.0 | 45.9 | 1.53 |
| 2000 | Lt. brown | 3 | 7.5 | 27.2 | 43.2 | 1.59 |
| 2100 | Lt. brown | 4 | 7.5 | 22.2 | 38.0 | 1.71 |
| 2200 | Brown | 5 | 10.0 | 20.5 | 35.9 | 1.75 |
| 2300 | Dk. brown | 5 | 12.5 | 19.4 | 34.7 | 1.79 |

Other tests and remarks: No effervescence with HCl; high absorption at all firing temperatures.

Bloating Test: Negative

Potential Use: Component in face-brick mixtures.

SAMPLE: R-3461

County: Cumberland

Locality: Roadcut, 0.6 mile south of Columbia, on the west side of State Road 690 approximately 0.7 mile by road south of its intersection with State Highway 6.

Description: Orange-red plastic, slightly micaceous clay, mottled with some yellow clay is present in a long roadcut, and has a maximum exposed thickness of 9 feet. Three feet of additional clay was indicated by augering to that depth at the base of the exposure.

Formation or Age: Residual clay

Sampled Interval: Composite of representative channel sample in the highest part of the exposure and 3 feet of augered clay.

Raw Properties:

Water of plasticity: 33.7%

Drying shrinkage: 5.0%

Drying defects: none

Working properties: moderate plasticity

Dry strength: fair

pH: 5.0

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Abs. | % Appar. Porosity | Bulk Dens. gm/cc |
|--------------|-----------|---------------|----------------------|-----------|----------------------|---------------------|
| 1800 | Lt. brown | 2 | 7.5 | 32.3 | 48.1 | 1.49 |
| 1900 | Lt. brown | 2 | 7.5 | 32.1 | 48.5 | 1.51 |
| 2000 | Lt. brown | 3 | 10.0 | 29.4 | 46.2 | 1.57 |
| 2100 | Brown | 4 | 12.5 | 22.9 | 39.8 | 1.74 |
| 2200 | Brown | 5 | 12.5 | 21.4 | 38.3 | 1.79 |
| 2300 | Dk. brown | 5 | 12.5 | 18.2 | 34.6 | 1.90 |

Other tests and remarks: No effervescence with HCl; high absorption at all firing temperatures.

Bloating Test: Negative

Potential Use: Component in face-brick mixtures.

SAMPLE: R-3545

County: Cumberland

Locality: Roadcut, 0.3 mile northeast of Guinea Mills, on the southwest side of State Road 640 approximately 200 feet by road southeast of its intersection with State Highway 45.

Description: Yellow and brown, plastic clay, mottled with some red and gray clay, is present in a roadcut 200 feet long, and has a maximum exposed thickness of 6.5 feet. A thin buff-colored loam overlies the exposure, which contains a small vein of quartz.

Formation or Age: Residual clay

Sampled Interval: Composite of two representative channel samples in the highest part of the exposure.

Raw Properties:

| | |
|----------------------------|-------------------------|
| Water of plasticity: 42.5% | Plasticity: good |
| Drying shrinkage: 8.3% | Workability: good |
| Drying properties: good | Dry strength: 231.1 psi |
| pH: 6.3 | |

Slow Firing Test:

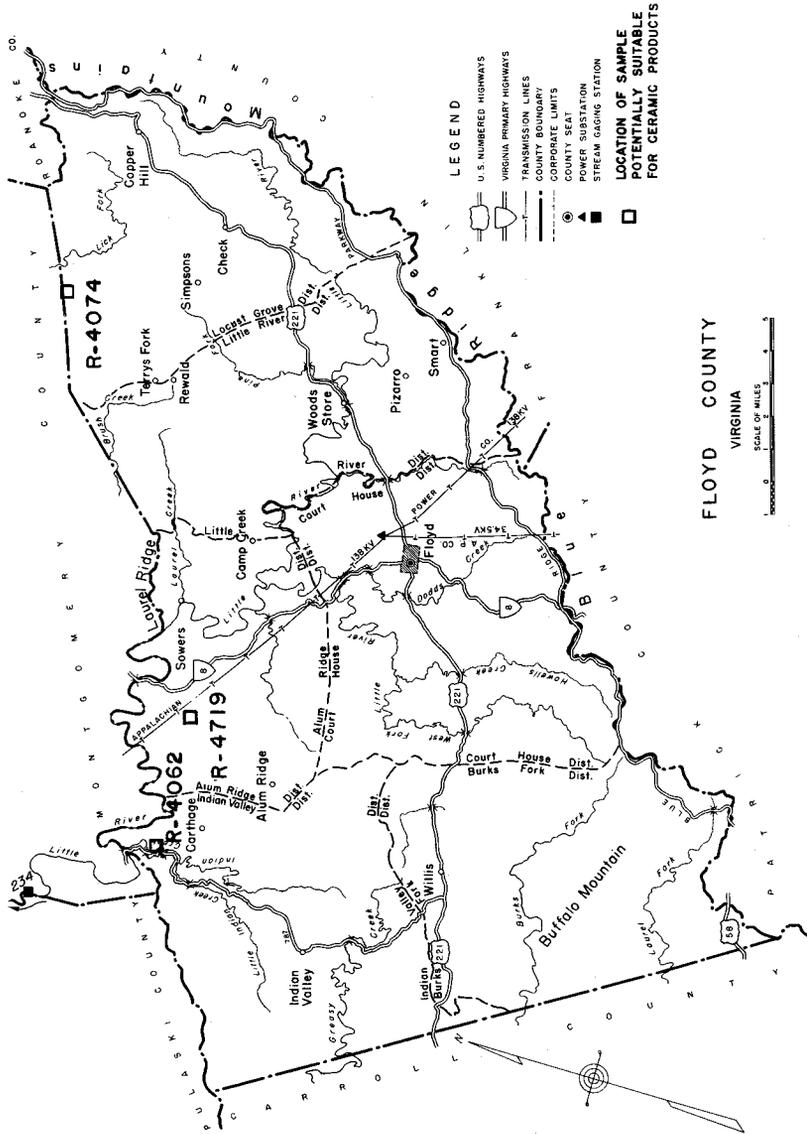
| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|------------------|---------------|----------------------|-----------------|---------------------|
| 2000 | Lt. orange-brown | 3 | 10.5 | 26.2 | 2.68 |
| 2100 | Med. orange | 4 | 13.8 | 23.4 | 2.68 |
| 2200 | Med. brown | 7 | 17.5 | 14.0 | 2.68 |
| 2300 | Red-brown | 7+ | 18.0 | 12.6 | 2.78 |

Other tests and remarks: Poor extrusion; L.O.I. 12.2%; sticky; surface checking at 2200 and 2300°F. The addition of nonplastic material is suggested to reduce shrinkage, relieve the sticky quality and eliminate surface checking.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 2000 | 126.7 | 24.0 |
| 2100 | 131.7 | 16.6 |
| 2200 | 132.9 | 14.1 |
| 2300 | 151.0 | 8.7 |

Potential Use: Possible in most porous clay products.



Location Map of Floyd County

FLOYD COUNTY

Samples were collected from three localities in Floyd County. Testing by Morse Laboratories indicates the following potential uses for the raw material:

| <u>Sample</u> | <u>Formation or Age</u> | <u>Potential Use</u> |
|---------------|--|--|
| R-4062 | Lower Cambrian | Nonplastic component in brick and tile |
| R-4074 | Rome Formation | Common brick; component in brick, tile, and porous clay products |
| R-4719 | Lynchburg Formation (Alum phyllite) | Nonplastic component in brick and tile |

SAMPLE: R-4062

County: Floyd

Locality: Roadcut, 5.5 miles north of Indian Valley, on the east side of State Road 787 approximately 0.1 mile by road north of its intersection with State Road 740 leading east.

Description: Gray, dusky yellow, buff, and brown weathered slate is present in a roadcut 200 feet long, and has a maximum exposed height of 11 feet. Residual material on the slate is pale brown to brown, loamy clay. The slate has a strike of approximately N.35°E. and a dip of approximately 50° SE.

Formation or Age: Lower Cambrian

Sampled Interval: Composite of grab samples believed representative of slate in exposure.

Raw Properties:

| | |
|----------------------------|-----------------------------------|
| Water of plasticity: 24.0% | Plasticity: poor |
| Drying shrinkage: 4.5% | Workability: short-medium texture |
| Drying properties: good | Dry strength: poor |
| pH: 6.7 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|------------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Lt. yellow-buff | 2 | 5.4 | 21.4 | 1.63 |
| 2000 | Buff | 2½ | 7.3 | 18.8 | 1.73 |
| 2100 | Lt. orange-brown | 6 | 8.4 | 11.0 | 1.95 |
| 2200 | Brown-red | 7+ | 13.7 | 4.8 | 2.25 |

Other tests and remarks: Nonextrudable; CaCO₃ test slightly positive; L.O.I. 5.4%; no defects. The addition of a more plastic clay is suggested to increase the dry strength and improve the workability.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 117.9 | 6.9 |
| 2000 | 131.7 | 7.9 |
| 2100 | 138.5 | 4.8 |
| 2200 | 149.1 | 3.1 |

Potential Use: Possible as a nonplastic component in brick and tile.

SAMPLE: R-4074

County: Floyd

Locality: Roadcut, 5.45 miles west of Copper Hill, on the Floyd-Montgomery County line, on the north side of State Road 790 approximately 0.25 mile by road south of its intersection with State Road 637.

Description: Light olive-gray and maroon shale is present in a roadcut 100 feet long, and has a maximum exposed height of 3.5 feet. The light olive-gray shale is visible along strike across the road for another 100 feet. The shale has a strike of approximately N.20°E. and a dip of approximately 70° SE.

Formation or Age: Rome Formation

Sampled Interval: Composite of grab samples believed representative of material in exposure.

Raw Properties:

| | |
|----------------------------|--------------------------|
| Water of plasticity: 13.5% | Plasticity: fair |
| Drying shrinkage: 1.8% | Workability: fair-gritty |
| Drying properties: good | Dry strength: 109 psi |
| pH: 6.1 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|--------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Orange-brown | 2½ | 4.0 | 9.2 | 2.06 |
| 2000 | Orange-brown | 4 | 5.5 | 7.4 | 2.13 |
| 2100 | Red-brown | 5 | 7.9 | 4.6 | 2.26 |
| 2200 | Dk. brown | 4 | -0.2 | 1.2 | 1.52 |

Other tests and remarks: Good extrusion; CaCO₃ test negative; L.O.I. 5.3%; bloating noted with 2200°F tile; short firing range; the addition of a more plastic clay is suggested to improve the workability and fired hardness.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 171.0 | 2.1 |
| 2000 | 132.3 | 2.1 |
| 2100 | 149.1 | 1.6 |
| 2200 | 118.6 | 4.7 |

Potential Use: Possible for common brick; probable as a component in brick, tile, and porous clay products.

SAMPLE: R-4719

County: Floyd

Locality: Roadcut, 3.2 miles north of Alum Ridge, on the northwest side of State Road 750 approximately 0.2 mile by road north of its intersection with State Road 658.

Description: Silvery-gray to steel-gray, fine-grained, chlorite phyllite is present in a roadcut 200 feet long, and has a maximum exposed height of 8 feet. The phyllite contains scattered limonite in places and weathers pale olive to light olive-brown near the top of the exposure. The foliation of the phyllite has a strike of approximately N.45°E. and a dip of approximately 40-45° SE.

Formation or Age: Lynchburg Formation (Alum phyllite)

Sampled Interval: Composite of grab samples believed representative of material in exposure.

Raw Properties:

| | |
|----------------------------|---------------------------------|
| Water of plasticity: 29.3% | Plasticity: none |
| Drying shrinkage: 4.6% | Workability: short-fine texture |
| Drying properties: good | Dry strength: poor |
| pH: 7.1 | |

Slow Firing Test:

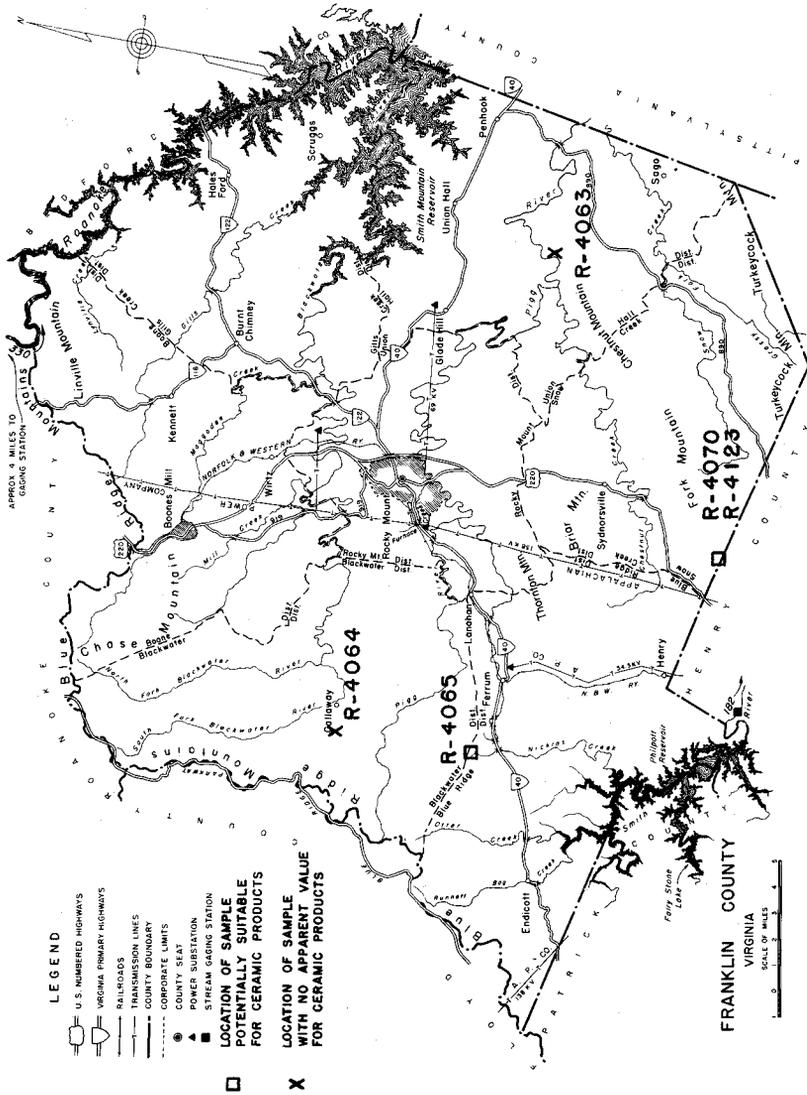
| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|--------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Orange-brown | poor bond | 5.2 | 31.2 | 1.44 |
| 2000 | Dk. orange | 1 | 7.0 | 28.0 | 1.53 |
| 2100 | Orange-red | 2½ | 8.8 | 18.0 | 1.80 |
| 2200 | Brown-red | 7 | 14.3 | 9.2 | 2.17 |

Other tests and remarks: Non-extrudable; CaCO₃ test slightly positive; L.O.I. 7.0%; no defects; the addition of a more plastic clay is suggested to increase the dry strength and improve workability.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 148.2 | 6.3 |
| 2000 | 148.2 | 6.8 |
| 2100 | 146.0 | 6.4 |
| 2200 | 106.7 | 9.6 |

Possible Use: Possible nonplastic component in brick and tile.



Location Map of Franklin County

FRANKLIN COUNTY

Samples were collected from four localities in Franklin County. Testing by Morse Laboratories indicates the following potential uses for the raw material:

| <u>Sample</u> | <u>Formation or Age</u> | <u>Potential Use</u> |
|---------------|-------------------------|---|
| R-4063 | Paleozoic (?) | None in structural clay products |
| R-4064 | Residual clay | None in structural clay products |
| R-4065 | Residual clay | A combination of this clay and slate (R-3861) from Amherst County or phyllite (R-4719) from Floyd County has a possibility in dry-press brick or tile |
| R-4070 | Residual clay | Component in whitewares, and in production of super-duty firebrick; paper filler, and paper coater (with beneficiation) |
| R-4123 | Residual clay | Refractories; and as a filler insulating material |

SAMPLE: R-4063

County: Franklin

Locality: Roadcut, 5.1 miles northwest of Sago, on the northeast side of State Road 646 approximately 0.7 mile by road west of its intersection with State Road 673 leading north.

Description: Silvery to steel-gray and greenish-gray phyllite is present in a roadcut 385 feet long, and has a maximum exposed height of 15 feet. The phyllite is iron-oxide stained in places and tends to be more crinkled in the eastern part of the roadcut. The foliation of the phyllite has a strike of approximately N.35°E. and a south-east dip.

Formation or Age: Paleozoic (?)

Sampled Interval: Composite of grab samples believed representative of material in exposure.

Raw Properties:

Water of plasticity: 20.6% Plasticity: none
 Drying shrinkage: 3.8% Workability: short-medium texture
 Drying properties: good Dry strength: poor
 pH: 6.8

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|---------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Lt. red-brown | poor bond | 4.0 | 25.2 | 1.61 |
| 2000 | Dk. orange | 1½ | 4.4 | 24.0 | 1.64 |
| 2100 | Brown-red | 2½ | 7.2 | 18.9 | 1.80 |
| 2200 | Brown-red | 5 | 7.9 | 12.9 | 2.01 |

Other tests and remarks: Non-extrudable; CaCO₃ test moderately positive; L.O.I. 5.5%; no defects.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 148.2 | 6.8 |
| 2000 | 149.1 | 7.3 |
| 2100 | 147.3 | 4.8 |
| 2200 | 149.1 | 4.2 |

Potential Use: None in structural clay products.

SAMPLE: R-4064

County: Franklin

Locality: Roadcut, 0.9 mile west of Callaway, on the north side of State Road 642 approximately 0.7 mile by road west of its intersection with State Road 602 leading northwest.

Description: Moderate reddish-brown, plastic clay is present in a roadcut 525 feet long, and has a maximum exposed thickness of 5.5 feet. Small quartz fragments are scattered throughout the clay.

Formation or Age: Residual clay

Sampled Interval: Composite of two representative channel samples in the highest part of the exposure, approximately 45 feet apart.

Raw Properties:

| | |
|----------------------------|---------------------------|
| Water of plasticity: 32.9% | Plasticity: poor |
| Drying shrinkage: 7.6% | Workability: short-medium |
| Drying properties: good | texture-sticky |
| pH: 6.3 | Dry strength: 244 psi |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|---------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Brown-orange | 4½ | 11.0 | 23.7 | 1.73 |
| 2000 | Orange-red | 5 | 16.1 | 14.9 | 2.04 |
| 2100 | Lt. red-brown | 6 | 16.7 | 12.0 | 2.13 |
| 2200 | Brown-red | 7 | 16.8 | 12.1 | 2.15 |

Other tests and remarks: Fair extrusion; CaCO₃ test negative; L.O.I. 15.2%; surface cracking.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 112.9 | 28.2 |
| 2000 | 108.6 | 24.7 |
| 2100 | 134.2 | 13.3 |
| 2200 | 142.3 | 13.3 |

Potential Use: None in structural clay products.

SAMPLE: R-4065

County: Franklin

Locality: Roadcut, 3.0 miles west of Ferrum, on the northwest side of State Road 752 approximately 0.75 mile by road southwest of its intersection with State Road 648.

Description: Pale reddish-brown to moderate reddish-brown, plastic, gritty clay is present in a roadcut 675 feet long, and has a maximum exposed thickness of 6 feet. Muscovite occurs in the clay in the lower part of the northeast section of the roadcut; in the southwest section, the clay is more plastic and only slightly micaceous.

Formation or Age: Residual clay

Sampled Interval: Composite of two representative channel samples in the highest part of the exposure, approximately 100 feet apart.

Raw Properties:

| | |
|----------------------------|--------------------------------|
| Water of plasticity: 42.0% | Plasticity: fair |
| Drying shrinkage: 9.1% | Workability: fair-fine texture |
| Drying properties: good | Dry strength: 285 psi |
| pH: 6.1 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|------------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Lt. orange-brown | 2½ | 12.4 | 26.0 | 1.70 |
| 2000 | Lt. red-brown | 3 | 13.3 | 23.3 | 1.78 |
| 2100 | Orange-brown | 5 | 17.2 | 17.5 | 1.98 |
| 2200 | Dk. orange | 7 | 19.1 | 14.6 | 2.10 |

Other tests and remarks: Fair extrusion; CaCO₃ test moderately positive; L.O.I. 16.5%.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 93.6 | 28.5 |
| 2000 | 97.3 | 32.0 |
| 2100 | 107.9 | 26.6 |
| 2200 | 107.9 | 22.5 |

Potential Use: None in structural clay products; a combination of this clay and either the slate (R-3861) from Amherst County or the phyllite (R-4719) from Floyd County has a possibility in dry-press brick or tile.

SAMPLES: R-4070 and R-4123

County: Franklin

Locality: Roadcut, 5.7 miles south of Sydnorsville, on the west side of State Road 608 approximately 0.1 mile by road north of its intersection with State Road 609.

Description: Kaolinitic saprolite, which is probably a residuum formed on alaskite and pegmatite dikes, is present in a roadcut 180 feet long, and has a maximum exposed thickness of 15 feet. Quartz veins and sericite, biotite, and minor magnetite occur in the saprolite with the kaolinite.

Formation or Age: Residual clay

R-4070

Sampled Interval: Select sample of the kaolin portion of the saprolite.

Raw Properties:

Water of plasticity: 55.0%

Plasticity: fair

Drying shrinkage: 5.5%

Workability: semi-plastic;

Drying properties: good

fine-sticky

pH: 4.8

Dry strength: good

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|--------------------------|---------------|----------------------|-----------------|---------------------|
| 2100 | Gray-white | 1 | 6.8 | 40.2 | 1.18 |
| 2200 | Gray-white | 2½ | 9.4 | 30.6 | 1.34 |
| 2300 | Lt. yellow Gray-white | 4 | 14.6 | 18.6 | 1.59 |
| 2400 | Lt. yellow-white | 5½ | 15.9 | 9.0 | 1.85 |
| 2500 | Lt. yellow-white | 7 | 16.6 | 4.7 | 1.93 |
| 2600 | Lt. yellow-white | 7+ | 20.1 | 3.4 | 1.98 |
| 2700 | Lt. gray-white | 7+ | 17.0 | 1.1 | 2.07 |
| 2800 | Lt. yellow-white | 7+ | 16.8 | 0.0 | 2.17 |

Other tests and remarks: CaCO₃ test slightly positive; L.O.I. 13.3%; kaolin material is sufficiently bright for use as a paper filler.

Pyrometric Cone Equivalent: 34+

Potential Use: Suitable as a component in whitewares and in the production of super-duty firebrick. Probable as a filler in paper and other products and possible that future beneficiation would result in a kaolin that would meet paper-coater specifications.

R-4123

Sampled Interval: Composite of grab samples believed representative of material in the exposure.

Raw Properties:

| | |
|----------------------------|--------------------------|
| Water of plasticity: 32.3% | Plasticity: none |
| Drying shrinkage: 2.0% | Workability: none-gritty |
| Drying properties: good | Dry strength: poor |
| pH: 6.0 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|-------|---------------|----------------------|-----------------|---------------------|
| 1900 | White | 1 | 0.0 | 35.3 | 1.27 |
| 2000 | White | 1 | 2.0 | 28.8 | 1.31 |
| 2100 | White | 1 | 1.0 | 27.0 | 1.36 |
| 2200 | White | 1 | 1.0 | 26.5 | 1.34 |

Other tests and remarks: Not extrudable (compressed); CaCO₃ test negative; L.O.I. 4.9%; no defects; for the pyrometric cone equivalent test performed at the Tuscaloosa Metallurgy Research Laboratory, the clay was heated to 1549°C.

Pyrometric Cone Equivalent: 20

Potential Use: Possible as a filler-insulating material; on the basis of the pyrometric cone equivalent test, the clay qualifies for at least low-duty refractories.

GOOCHLAND COUNTY

Samples were collected from four localities in Goochland County. Testing by the Tuscaloosa Laboratory indicates the following potential uses for the raw material:

| <u>Sample</u> | <u>Formation or Age</u> | <u>Potential Use</u> |
|---------------|-----------------------------|----------------------------------|
| R-3462 | Residual clay | Component in face-brick mixtures |
| R-3463 | Residual clay | Component in face-brick mixtures |
| R-3464 | Residual clay | Component in face-brick mixtures |
| R-3465 | Residual clay and saprolite | Face brick |

SAMPLE: R-3462

County: Goochland

Locality: Roadcut, 2.0 miles northeast of Tabscott, on the northeast side of U. S. Highway 250 approximately 0.4 mile by road northwest of its intersection with State Road 605.

Description: Deep orange-red plastic, slightly micaceous clay, and some yellow-orange, red, and white clay are present in a roadcut 275 feet long, and have a maximum exposed thickness of 7 feet. Quartz fragments occur in the clay in parts of the roadcut. Four feet of additional clay was indicated by augering to that depth at the base of the exposure.

Formation or Age: Residual clay

Sampled Interval: Composite of representative channel sample in the highest part of the exposure and 4 feet of augered clay.

Raw Properties:

| | |
|----------------------------|-------------------------------------|
| Water of plasticity: 36.7% | Working properties: high plasticity |
| Drying shrinkage: 7.5% | Dry strength: good |
| Drying defects: none | pH: 4.9 |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Abs. | % Appar. Porosity | Bulk Dens. gm/cc |
|--------------|---------------|---------------|----------------------|-----------|----------------------|---------------------|
| 1800 | Lt. red-brown | 2 | 10.0 | 30.3 | 48.1 | 1.59 |
| 1900 | Lt. red-brown | 2 | 12.5 | 29.6 | 47.7 | 1.61 |
| 2000 | Lt. brown | 3 | 12.5 | 26.2 | 44.5 | 1.70 |
| 2100 | Lt. brown | 4 | 15.0 | 18.7 | 36.3 | 1.94 |
| 2200 | Brown | 5 | 17.5 | 15.6 | 32.1 | 2.06 |
| 2300 | Dk. brown | 5 | 17.5 | 13.8 | 29.5 | 2.14 |

Other tests and remarks: No effervescence with HCl; high firing shrinkage.

Bloating Test: Negative

Potential Use: Component in face-brick mixtures.

SAMPLE: R-3463

County: Goochland

Locality: Roadcut, 1.0 mile northeast of Hadensville, on the southwest side of U. S. Highway 250 approximately 0.7 mile by road southeast of its intersection with State Road 629.

Description: Mottled gray, red, orange, white, and yellow sandy clay is present in a roadcut 300 feet long, and has a maximum exposed thickness of 6 feet. Partly weathered feldspar and quartz fragments are present in the clay in parts of the roadcut. Three feet of additional gritty clay was indicated by augering to that depth at the base of the exposure.

Formation or Age: Residual clay

Sampled Interval: Composite of representative channel sample in the highest part of the exposure and 3 feet of augered clay.

Raw Properties:

Water of plasticity: 32.2%

Drying shrinkage: 5.0%

Drying defects: none

Working properties: moderate plasticity

Dry strength: fair

pH: 5.0

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Abs. | % Appar. Porosity | Bulk Dens. gm/cc |
|--------------|-----------|---------------|----------------------|-----------|----------------------|---------------------|
| 1800 | Lt. brown | 2 | 7.5 | 46.6 | 56.4 | 1.21 |
| 1900 | Lt. brown | 2 | 7.5 | 38.8 | 52.0 | 1.34 |
| 2000 | Lt. brown | 3 | 7.5 | 37.8 | 51.0 | 1.35 |
| 2100 | Lt. brown | 4 | 10.0 | 36.7 | 50.6 | 1.38 |
| 2200 | Brown | 4 | 12.5 | 34.3 | 48.4 | 1.41 |
| 2300 | Brown | 4 | 12.5 | 34.0 | 48.3 | 1.42 |

Other tests and remarks: No effervescence with HCl; high absorption at all firing temperatures.

Bloating Test: Negative

Potential Use: Component in face-brick mixtures.

SAMPLE: R-3464

County: Goochland

Locality: Roadcut, 0.5 mile southeast of Sandy Hook, on the northeast side of U. S. Highway 522 approximately 0.3 mile by road northwest of its intersection with State Road 607.

Description: Orange-red sandy clay is present in a roadcut 1050 feet long, and has a maximum exposed thickness of 7 feet.

Formation or Age: Residual clay

Sampled Interval: Composite of three representative channel samples in the highest part of the exposure, approximately 40 feet apart.

Raw Properties:

Water of plasticity: 26.2%

Drying shrinkage: 5.0%

Drying defects: none

Working properties: moderate plasticity

Dry strength: fair

pH: 5.3

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Abs. | % Appar. Porosity | Bulk Dens. gm/cc |
|--------------|-----------|---------------|----------------------|-----------|----------------------|---------------------|
| 1800 | Tan | 2 | 5.0 | 20.8 | 36.6 | 1.76 |
| 1900 | Tan | 2 | 5.0 | 19.5 | 35.1 | 1.80 |
| 2000 | Tan | 3 | 7.5 | 19.0 | 34.6 | 1.82 |
| 2100 | Lt. brown | 4 | 7.5 | 16.9 | 31.8 | 1.88 |
| 2200 | Brown | 5 | 10.0 | 15.5 | 29.8 | 1.92 |
| 2300 | Dk. brown | 6 | 10.0 | 15.0 | 29.0 | 1.93 |

Other tests and remarks: No effervescence with HCl; high absorption at all firing temperatures.

Bloating Test: Negative

Potential Use: Component in face-brick mixtures.

SAMPLE: R-3465

County: Goochland

Locality: Roadcut, 0.6 mile northeast of Sandy Hook, on the southeast side of U. S. Highway 522 approximately 0.9 mile by road southwest of its intersection with State Road 634.

Description: Variegated red, cream, white, and orange, micaceous, slightly sandy clay is present in a roadcut 300 feet long, and has a maximum exposed thickness of 9 feet. Excellent relict folds are displayed.

Formation or Age: Residual clay and saprolite

Sampled Interval: Representative channel sample in the highest part of the exposure.

Raw Properties:

Water of plasticity: 29.9%
Drying shrinkage: 5.0%
Drying defects: none

Working properties: moderate
plasticity
Dry strength: fair
pH: 4.8

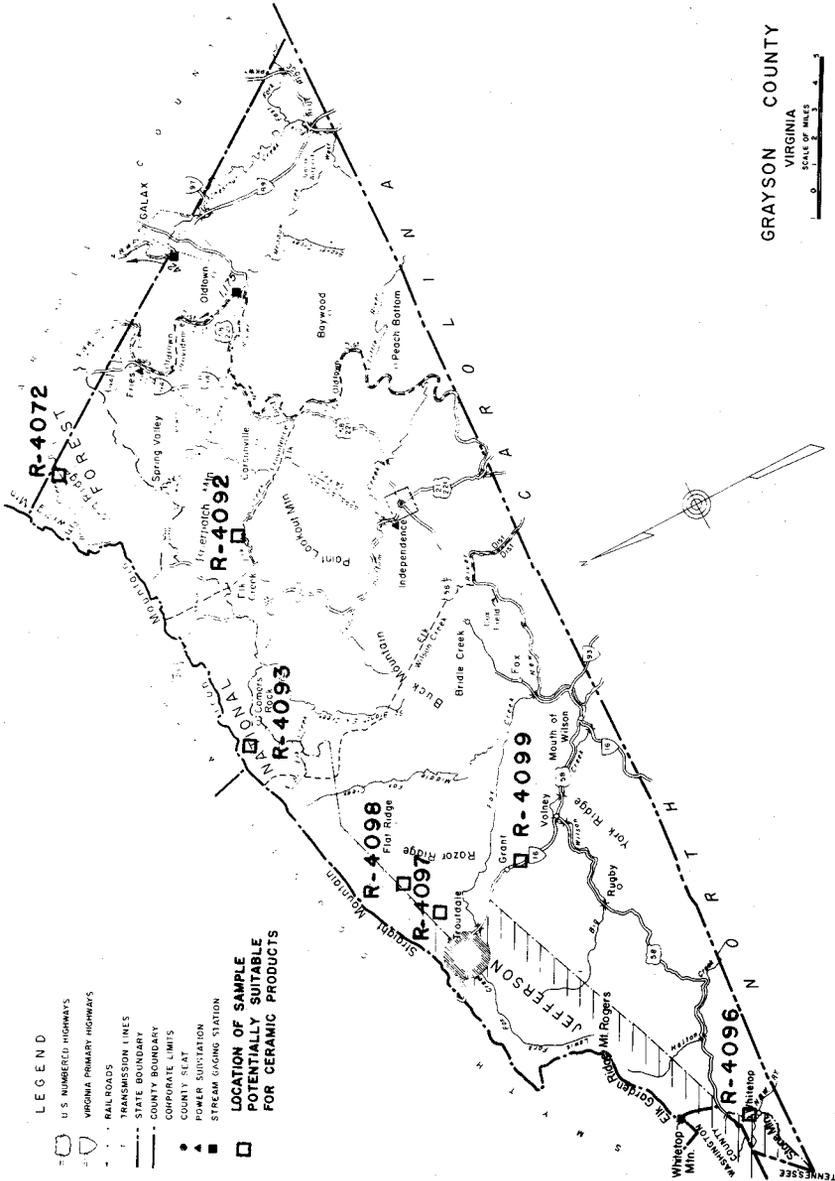
Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Abs. | % Appar. Porosity | Bulk Dens. gm/cc |
|--------------|----------|---------------|----------------------|-----------|----------------------|---------------------|
| 1800 | Tan | 2 | 5.0 | 20.8 | 36.0 | 1.73 |
| 1900 | Tan | 2 | 5.0 | 20.6 | 36.1 | 1.75 |
| 2000 | Tan | 3 | 5.0 | 14.0 | 27.6 | 1.97 |
| 2100 | Tan | 4 | 7.5 | 8.4 | 18.5 | 2.20 |
| 2200 | Lt. gray | 4 | 10.0 | 5.7 | 13.3 | 2.34 |
| 2300 | Lt. gray | 4 | 10.0 | 5.8 | 13.5 | 2.34 |

Other tests and remarks: No effervescence with HCl; should fire to "SW" face brick specifications at about 2100°F.

Bloating Test: Negative

Potential Use: Face brick.



Location Map of Grayson County

GRAYSON COUNTY

Samples were collected from seven localities in Grayson County. Testing by Morse Laboratories indicates the following potential uses for the raw material:

| <u>Sample</u> | <u>Formation or Age</u> | <u>Potential Use</u> |
|---------------|-------------------------|---|
| R-4072 | Hampton Formation | Brick and tile |
| R-4092 | Residual clay | Brick and tile |
| R-4093 | Residual clay | Component in brick and tile |
| R-4096 | Paleozoic (?) | Structural clay products, including sewer pipe |
| R-4097 | Chilhowee Group | Brick and tile |
| R-4098 | Residual clay | Brick and tile |
| R-4099 | Residual clay | Domestic stoneware industry; low-duty refractories, including flue pipe |

SAMPLE: R-4072

County: Grayson

Locality: Roadcut, 3.6 miles northeast of Spring Valley, on the north side of State Road 602 approximately 3.1 miles by road east of its intersection with State Road 653.

Description: Weathered, pale reddish-brown and light maroon to buff and bluish-gray to gray, hard, banded shale is present in a roadcut 260 feet long, and has a maximum exposed height of 11 feet. The shale, which contains some iron-oxide staining, has a strike of approximately N.65°E. and a dip of approximately 62° SE.

Formation or Age: Hampton Formation

Sampled Interval: Composite of grab samples believed representative of material in exposure.

Raw Properties:

| | |
|----------------------------|--------------------------|
| Water of plasticity: 24.9% | Plasticity: fair |
| Drying shrinkage: 3.9% | Workability: fair-gritty |
| Drying properties: good | Dry strength: 108 psi |
| pH: 6.2 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|------------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Buff | 1 | 4.0 | 21.2 | 1.66 |
| 2000 | Lt. orange-brown | 2 | 6.5 | 15.4 | 1.83 |
| 2100 | Red-brown | 3 | 8.0 | 10.7 | 1.99 |
| 2200 | Dk. red-brown | 5½ | 11.8 | 4.5 | 2.26 |

Other tests and remarks: Fair extrusion (compresses); CaCO₃ test negative; L.O.I. 6.7%; no defects in fired tiles; the use of a more plastic material is suggested to improve the workability and fired hardness.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 147.3 | 10.6 |
| 2000 | 167.9 | 11.2 |
| 2100 | 167.9 | 9.0 |
| 2200 | 167.9 | 5.8 |

Potential Use: Possible in brick and tile.

SAMPLE: R-4092

County: Grayson

Locality: Roadcut, 3.35 miles east of Elk Creek, on the west side of State Road 654 approximately 0.4 mile by road south of its intersection with State Road 660.

Description: Dark reddish-brown and dark yellowish-orange to grayish-orange plastic clay is present in a roadcut 790 feet long, and has a maximum exposed thickness of 8.5 feet. The clay is slightly sandy near the center and toward the base of the roadcut, where a partly weathered gneiss is exposed; minor iron-oxide staining is also present in parts of the exposure.

Formation or Age: Residual clay

Sampled Interval: Composite of four channel samples in the highest part of the exposure.

Raw Properties:

| | |
|----------------------------|--------------------------|
| Water of plasticity: 37.1% | Plasticity: good |
| Drying shrinkage: 13.0% | Workability: good-gritty |
| Drying properties: good | Dry strength: 922 psi |
| pH: 6.5 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|---------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Orange-brown | 5 | 16.0 | 15.2 | 1.88 |
| 2000 | Red-brown | 7+ | 19.0 | 9.6 | 2.08 |
| 2100 | Brown-red | 7+ | 19.0 | 8.6 | 2.10 |
| 2200 | Dk. red-brown | 7+ | 23.0 | 1.0 | 2.40 |

Other tests and remarks: Excellent extrusion; CaCO₃ test negative; L.O.I. 16.3%, no defects. The addition of a nonplastic grog is suggested to reduce total shrinkage.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 156.6 | 25.0 |
| 2000 | 136.7 | 21.1 |
| 2100 | 135.4 | 24.7 |
| 2200 | 154.1 | 9.8 |

Potential Use: Probable in brick and tile.

SAMPLE: R-4093

County: Grayson

Locality: Roadcut, 1.0 mile northwest of Comers Rock, on the west side of State Road 672 approximately 1.4 miles by road northwest of its intersection with State Road 658.

Description: Grayish-red to dark reddish-brown plastic clay and bits of grayish-red and pale yellowish-orange shale are present in a roadcut 110 feet long, and have a maximum exposed thickness of 5.5 feet. Minor red siliceous fragments are present in the northern end of the roadcut.

Formation or Age: Residual clay

Sampled Interval: Representative channel sample in the highest part of the exposure.

Raw Properties:

| | |
|----------------------------|--------------------------|
| Water of plasticity: 33.2% | Plasticity: good |
| Drying shrinkage: 10.3% | Workability: good-gritty |
| Drying properties: good | Dry strength: 283 psi |
| pH: 6.0 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|------------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Lt. orange-brown | 3 | 13.0 | 20.9 | 1.83 |
| 2000 | Dk. tan | 4 | 17.0 | 13.2 | 2.07 |
| 2100 | Med. brown | 7+ | 18.0 | 11.3 | 2.17 |
| 2200 | Med. brown | 7+ | 21.0 | 7.9 | 2.33 |

Other tests and remarks: Excellent extrusion; CaCO₃ test negative; L.O.I. 14.6%; slight surface cracking on fired tile at 2100°F. The addition of a nonplastic material is suggested to reduce surface cracking and total fired shrinkage.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 137.9 | 29.9 |
| 2000 | 137.9 | 24.3 |
| 2100 | 135.4 | 20.1 |
| 2200 | 138.5 | 16.3 |

Potential Use: Possible as a component in brick and tile.

SAMPLE: R-4096

County: Grayson

Locality: Roadcut, 0.25 mile north of Whitetop, on the east side of State Road 726 approximately 0.35 mile by road north of its intersection with State Road 755.

Description: Pale yellowish-brown, yellowish-gray, and grayish-orange weathered phyllite and very pale orange, crumbly, very soft phyllite are present in a roadcut 270 feet long, and have a maximum exposed height of 7 feet. Broken fragments in the exposures are rust-colored to purplish-brown due to iron-oxide staining. The phyllite has a strike of approximately N.55°E. and a southeast dip.

Formation or Age: Paleozoic (?)

Sampled Interval: Composite of grab samples believed representative of material in exposure.

Raw Properties:

Water of plasticity: 18.9%

Plasticity: good

Drying shrinkage: 3.9%

Workability: good-gritty

Drying properties: good

Dry strength: 33 psi

pH: 8.0

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|----------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Buff | 3½ | 5.0 | 19.7 | 1.69 |
| 2000 | Orange-brown | 6 | 8.0 | 11.3 | 1.91 |
| 2100 | Brown-red | 7+ | 11.0 | 4.3 | 2.20 |
| 2200 | Med. red-brown | 7+ | 14.0 | 0.0 | 2.32 |

Other tests and remarks: Good extrusion; CaCO₃ test negative; L.O.I. 10.7%; no defects; the addition of a more plastic material is suggested to improve the dry strength.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 149.8 | 7.8 |
| 2000 | 149.1 | 7.3 |
| 2100 | 147.9 | 7.4 |
| 2200 | 149.8 | 5.2 |

Potential Use: Probable in most structural clay products, including sewer pipe.

SAMPLE: R-4097

County: Grayson

Locality: Roadcut, 1.9 miles east of Troutdale, on the east side of State Road 603 approximately 0.85 mile by road north of its intersection with State Road 732.

Description: Reddish-purple and pale purple to very light gray shale is present in a long roadcut, and has a maximum exposed height of 7 feet. The shale is stained and banded by iron oxide in places, and has a strike of approximately N.12°E. and a northwest dip. Some fine-grained sandstone occurs in the southwestern part of the exposure.

Formation or Age: Chilhowee Group

Sampled Interval: Composite of grab samples believed representative of shale in exposure.

Raw Properties:

| | |
|----------------------------|--------------------------|
| Water of plasticity: 29.5% | Plasticity: fair |
| Drying shrinkage: 3.0% | Workability: fair-gritty |
| Drying properties: good | Dry strength: 70 psi |
| pH: 7.5 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|--------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Buff | 2 | 6.0 | 22.1 | 1.60 |
| 2000 | Yellow-brown | 6 | 10.0 | 10.7 | 1.96 |
| 2100 | Red-brown | 7+ | 18.0 | 0.0 | 2.39 |
| 2200 | Dk. brown | 7+ | 10.0 | 1.5 | 1.89 |

Other tests and remarks: Excellent extrusion; CaCO₃ test negative; L.O.I. 5.9%; bloating was indicated on 2200°F tile. The addition of a nonplastic grog is suggested to reduce the total shrinkage.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 170.4 | 12.6 |
| 2000 | 149.1 | 7.3 |
| 2100 | 149.1 | 2.6 |
| 2200 | 147.3 | 1.1 |

Potential Use: Probable in brick and tile.

Rotary Kiln Test: Performed at the IIT Research Institute, Chicago, Illinois.

RAW MATERIAL

Screen Analysis:

| <u>Sizes</u> | <u>Percent Retained</u> | |
|------------------|-------------------------|---|
| -3/4" + 1/2" | 39.13 | |
| -1/2" + 3/8" | 16.18 | Comments: fragments mostly elongated — tabular; +3/4" is 12.48% of total shale crushed. |
| -3/8" + 4 mesh | 15.25 | |
| -4 mesh + 8 mesh | 7.92 | |
| -8 mesh | 21.51 | |
| Total | 99.99 | |

Firing Data:

Size range of feed: -3/4" + 8 mesh

Bloating temperature: N/A

Pour weight of feed: 62.5 pcf

Logging temperature (nodules sticking together): 2400°F

FIRED MATERIAL

Comments: Considerable logging without bloating. Feed end 500°F. Maximum hot zone temperature 2450°F. Quick-fire test showed some bloating.

The rotary-kiln data presented for this sample are based on laboratory tests that are preliminary in nature and will not suffice for plant or process design.

SAMPLE: R-4098

County: Grayson

Locality: Roadcut, 2.55 miles northwest of Flat Ridge, on the north-northwest side of State Road 603 approximately 1.05 miles by road west-southwest of its intersection with State Road 601.

Description: Pale reddish-purple, plastic clay, mottled in places with some grayish-orange clay, is present in a roadcut 130 feet long, and has a maximum exposed thickness of 5 feet. A slightly sandy, iron-oxide stained shale lies below the clay in the exposure.

Formation or Age: Residual clay

Sampled Interval: Composite of two representative channel samples in the highest part of the exposure.

Raw Properties:

| | |
|----------------------------|------------------------|
| Water of plasticity: 29.8% | Plasticity: fair |
| Drying shrinkage: 6.0% | Workability: fair-fine |
| Drying properties: good | Dry strength: — |
| pH: 6.0 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|------------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Lt. orange-brown | 2 | 7.0 | 20.9 | 1.68 |
| 2000 | Lt. orange-brown | 5 | 9.0 | 15.7 | 1.79 |
| 2100 | Orange-brown | 7 | 11.0 | 11.0 | 1.98 |
| 2200 | Red-brown | 7+ | 14.0 | 5.5 | 2.15 |

Other tests and remarks: Good extrusion; CaCO₃ test negative; L.O.I. 6.7%; no defects.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 144.8 | 24.2 |
| 2000 | 128.5 | 19.5 |
| 2100 | 129.8 | 9.6 |
| 2200 | 129.2 | 12.4 |

Potential Use: Probable in brick and tile.

SAMPLE: R-4099

County: Grayson

Locality: Roadcut, 0.6 mile south of Grant, on the southeast side of State Road 737 approximately 0.25 mile by road northeast of its intersection with State Highway 16.

Description: Pale yellowish-brown to pale yellowish-orange clay and some light gray plastic clay, containing fragments of quartz and partly weathered feldspar, are present in a roadcut 260 feet long, and have a maximum exposed thickness of 5 feet. The upper 2 feet of clay is less plastic and slightly more gritty than that in the lower part of the exposure. Three feet of additional light-gray clay, mottled in places with some yellow to reddish-orange clay, was indicated by augering to that depth at the base of the exposure. The clay becomes almost white, less gritty, and more plastic towards the bottom of the auger hole.

Formation or Age: Residual clay

Sampled Interval: Composite of two representative channel samples in the highest part of the exposure and 3 feet of augered clay.

Raw Properties:

| | |
|----------------------------|--------------------------|
| Water of plasticity: 35.5% | Plasticity: fair |
| Drying shrinkage: 9.0% | Workability: fair-gritty |
| Drying properties: good | Dry strength: 411 psi |
| pH: 6.0 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|-------------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Lt. orange-buff | 3½ | 11.0 | 23.8 | 1.54 |
| 2000 | Lt. tan | 4 | 13.0 | 18.9 | 1.72 |
| 2100 | Lt. orange-yellow | 7 | 17.0 | 11.2 | 1.91 |
| 2200 | Lt. orange-brown | 7+ | 17.0 | 9.5 | 1.98 |

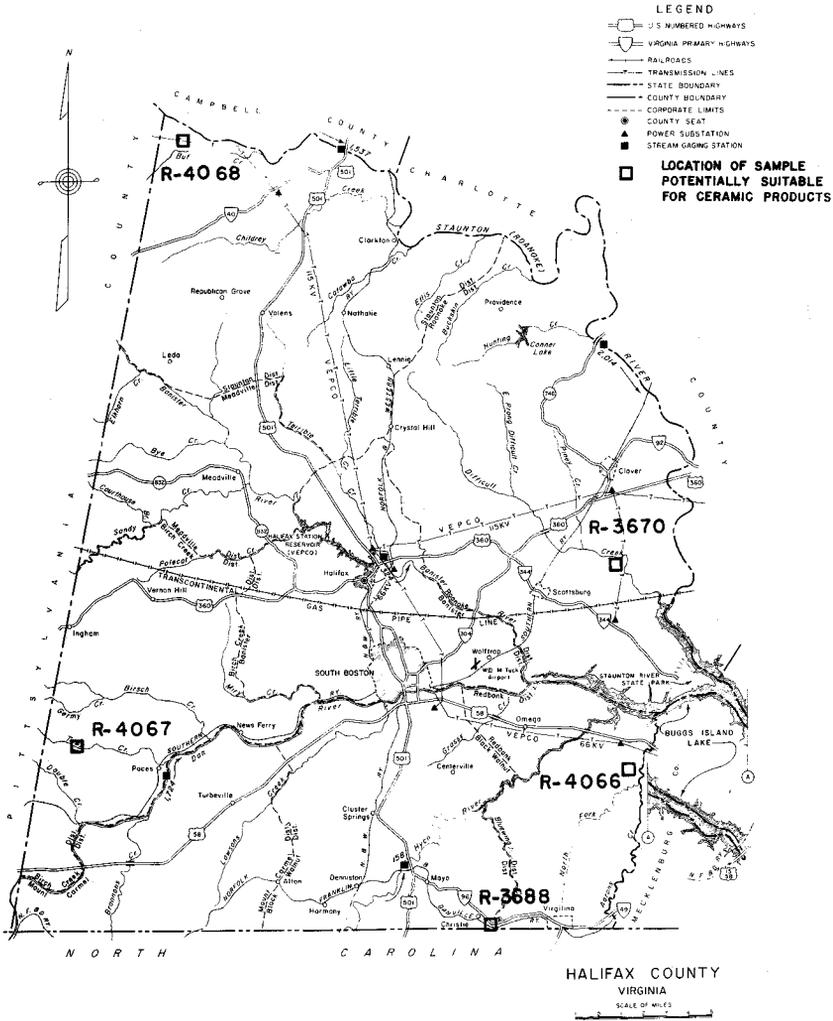
Other tests and remarks: Good extrusion; CaCO₃ test negative; L.O.I. 13.3%; no defects; for the pyrometric cone equivalent test performed at the Tuscaloosa Metallurgy Research Laboratory, the clay was heated to 1,549°C.

Pyrometric Cone Equivalent: 20

Bloating Test:

| <u>Temp.</u> <u>° F</u> | <u>Weight</u> <u>Lb./ft.³</u> | <u>%</u> <u>Absorption</u> |
|----------------------------|---|-------------------------------|
| 1900 | 141.0 | 23.2 |
| 2000 | 141.6 | 22.5 |
| 2100 | 141.0 | 18.8 |
| 2200 | 141.0 | 9.9 |

Potential Use: Probable in the domestic stoneware industry; on the basis of the pyrometric cone equivalent test, the clay qualifies for at least low-duty refractories, including flue pipe.



Location Map of Halifax County

HALIFAX COUNTY

Samples were collected from five localities in Halifax County. Testing by Morse Laboratories indicates the following potential uses for the raw material:

| <u>Sample</u> | <u>Formation or Age</u> | <u>Potential Use</u> |
|---------------|----------------------------------|--|
| R-3670 | Paleozoic | Brick and tile, drain tile, flower pots; domestic earthenware and stoneware industries |
| R-3688 | Aaron slate | Component in most structural clay products, including sewer pipe; component in face brick* |
| R-4066 | Aaron slate | Brick and tile, flower pots; domestic earthenware and artware industries |
| R-4067 | Residual clay | Brick and tile |
| R-4068 | Residual clay and Triassic shale | Brick and tile |

*If color is acceptable to the industry.

SAMPLE: R-3670

County: Halifax

Locality: Roadcut, 3.9 miles south of Clover, on the southeast side of State Road 720 approximately 1.3 miles by road south of its intersection with State Road 721.

Description: Slightly sandy, iron-stained, moderate yellowish-brown and yellowish-gray to pale yellowish-brown shale and light gray clay, which is mottled with yellowish-brown clay in the top part of the exposure, are present in a roadcut 800 feet long, and have a maximum exposed height of 5.5 feet. Four feet of additional yellow-brown and yellowish-gray shale and clay were indicated by augering to that depth at the base of the exposure; the shale becomes more iron-oxide stained towards the bottom of the auger hole.

Formation or Age: Paleozoic

Sampled Interval: Composite of two representative channel samples in the highest part of the exposure, 4 feet of augered clay and shale and grab samples believed representative of shale.

Raw Properties:

| | |
|----------------------------|-----------------------------------|
| Water of plasticity: 32.0% | Plasticity: excellent |
| Drying shrinkage: 4.5% | Workability: smooth, fine texture |
| Drying properties: good | Dry strength: 382 psi |
| pH: 6.7 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|------------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Lt. orange-brown | 3 | 4.8 | 21.8 | 1.62 |
| 2000 | Orange-brown | 3 | 5.3 | 20.9 | 1.65 |
| 2100 | Orange-brown | 6½ | 8.0 | 15.7 | 1.84 |
| 2200 | Dk. orange | 7 | 8.5 | 14.4 | 1.86 |

Other tests and remarks: Good extrusion; L.O.I. 4.9%; good color range.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 109.7 | 14.1 |
| 2000 | 115.5 | 11.4 |
| 2100 | 114.8 | 10.3 |
| 2200 | 127.3 | 6.5 |

Potential Use: Probable in brick, tile, and most porous clay products such as drain tile and flower pottery. Possible in the domestic earthenware and stoneware industries.

SAMPLE: R-3688

County: Halifax

Locality: Roadcut, 3.0 miles west of Virgilina, on the south side of State Highway 96 approximately 0.5 mile by road southeast of its intersection with State Road 862.

Description: Light olive-gray to grayish-orange and yellowish-gray to grayish-purple, tuffaceous, partly weathered, schistose slate is present in a roadcut 225 feet long, and has a maximum exposed height of 14 feet. Several feet of tan clay occur above the slate. The slate has a strike of approximately N.5°E. and a dip of 25-30° SE.

Formation or Age: Aaron slate

Sampled Interval: Composite of grab samples believed representative of slate in exposure.

Raw Properties:

| | |
|----------------------------|-----------------------|
| Water of plasticity: 21.0% | Plasticity: poor |
| Drying shrinkage: 1.5% | Workability: short |
| Drying properties: fair | Dry strength: 103 psi |
| pH: 6.1 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|---------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Orange-brown | 1 | 1.8 | 23.0 | 1.66 |
| 2000 | Lt. red-brown | 2 | 3.9 | 19.3 | 1.79 |
| 2100 | Med. brown | 6½ | 8.9 | 7.8 | 2.15 |
| 2200 | Med. brown | 7 | 11.3 | 1.3 | 2.44 |

Other tests and remarks: Fair extrusion (mealy); CaCO₃ test negative; L.O.I. 5.5%; the addition of a more plastic material is suggested to improve plasticity, workability and dry strength.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 148.5 | 5.8 |
| 2000 | 149.1 | 5.2 |
| 2100 | 148.5 | 2.1 |
| 2200 | 148.5 | 2.6 |

Potential Use: Probable as a component in most structural clay products, including sewer pipe. Possible as a component in face brick if the color is acceptable to the industry.

SAMPLE: R-4066

County: Halifax

Locality: Roadcut, 5.0 miles east of Omega, on the west side of State Road 632 approximately 0.3 mile by road northeast of its intersection with State Road 601.

Description: Very pale-orange to dark yellowish-orange, plastic clay and a very light-gray to pale-olive, partly iron-oxide stained weathered slate are present in a roadcut 300 feet long, and have a maximum exposed height of 5 feet. The slate becomes more distinct towards the base of the exposure and has a strike of approximately N.20°E. and a southeast dip.

Formation or Age: Aaron slate

Sampled Interval: Composite of three representative channel samples in the highest part of the exposure and composite of grab samples believed representative of slate.

Raw Properties:

| | |
|----------------------------|--------------------------------|
| Water of plasticity: 31.1% | Plasticity: good |
| Drying shrinkage: 8.3% | Workability: good-fine texture |
| Drying properties: good | Dry strength: 434 psi |
| pH: 5.9 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|---------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Tan-orange | 3 | 10.4 | 17.1 | 1.81 |
| 2000 | Red-orange | 4 | 13.1 | 11.2 | 1.98 |
| 2100 | Lt. red-brown | 5½ | 14.5 | 8.1 | 2.10 |
| 2200 | Orange-red | 6½ | 14.6 | 6.5 | 2.16 |

Other tests and remarks: Extrudes well; CaCO₃ test negative; L.O.I. 9.7%; no defects; excellent color range.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 118.6 | 15.8 |
| 2000 | 116.1 | 15.6 |
| 2100 | 136.0 | 10.8 |
| 2200 | 154.1 | 7.6 |

Potential Use: Probable for brick and tile; probable for porous clay products such as flower pots; possible in the domestic earthenware and artware industries.

SAMPLE: R-4067

County: Halifax

Locality: Roadcut, 3.8 miles west of Paces, on the west side of State Road 688 approximately 1.0 mile by road northeast of its intersection with State Road 658.

Description: Very light-gray to pale-olive clay and very pale-orange to dark yellowish-orange, plastic, slightly micaceous clay are present in a roadcut 275 feet long, and have a maximum exposed thickness of 5 feet. Moderate-red to pale reddish-brown clay mottlings are present near the middle of the exposure; pale-olive clay becomes increasingly sandy near the bottom of the exposure with small quartz fragments. Two feet of additional pale-olive to dark yellowish-orange, sandy clay was indicated by augering to that depth at the base of the exposure.

Formation or Age: Residual clay

Sampled Interval: Composite of two representative channel samples in the highest part of the exposure and 2 feet of augered clay.

Raw Properties:

| | |
|----------------------------|---------------------------------|
| Water of plasticity: 36.0% | Plasticity: good |
| Drying shrinkage: 8.1% | Workability: good, fine texture |
| Drying properties: good | Dry strength: 710 psi |
| pH: 5.8 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|--------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Orange-brown | 4 | 11.5 | 22.7 | 1.69 |
| 2000 | Red-orange | 5 | 12.0 | 18.2 | 1.83 |
| 2100 | Brown-orange | 6 | 15.8 | 12.8 | 1.85 |
| 2200 | Dk. orange | 7 | 16.0 | 10.0 | 2.08 |

Other tests and remarks: Good extrusion; CaCO₃ test negative; L.O.I. 13.9%; good color range; no defects. The addition of a nonplastic grog is suggested to decrease total shrinkage and possibly reduce absorption.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 99.2 | 24.6 |
| 2000 | 101.1 | 26.4 |
| 2100 | 110.4 | 19.8 |
| 2200 | 137.3 | 15.3 |

Potential Use: Probable in brick and tile.

SAMPLE: R-4068

County: Halifax

Locality: Roadcut, 7.0 miles north of Republican Grove, on the south-east side of State Road 640 approximately 0.25 mile by road southwest of its intersection with State Road 639.

Description: Grayish-red and moderate reddish-brown to dark reddish-brown shale and clay are present in a roadcut 165 feet long, and have a maximum exposed height of 5 feet. The shale has a strike of approximately N.25°E. and a dip of approximately 35° NW.

Formation or Age: Residual clay and Triassic shale

Sampled Interval: Composite of three representative channel samples in the highest part of the exposure, approximately 20 feet apart.

Raw Properties:

| | |
|----------------------------|---------------------------------|
| Water of plasticity: 22.5% | Plasticity: fair |
| Drying shrinkage: 4.2% | Workability: fair, fine texture |
| Drying properties: good | Dry strength: 221 psi |
| pH: 5.8 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|----------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Orange-brown | 2½ | 6.7 | 14.3 | 1.88 |
| 2000 | Dk. orange | 4 | 9.5 | 8.8 | 2.08 |
| 2100 | Lt. red-brown | 7+ | 13.1 | 3.4 | 2.39 |
| 2200 | Med. red-brown | 7+ | 14.3 | 0.0 | 2.51 |

Other tests and remarks: Fair extrusion; CaCO₃ test moderately positive; L.O.I. 8.5%; no defects.

Bloating Test:

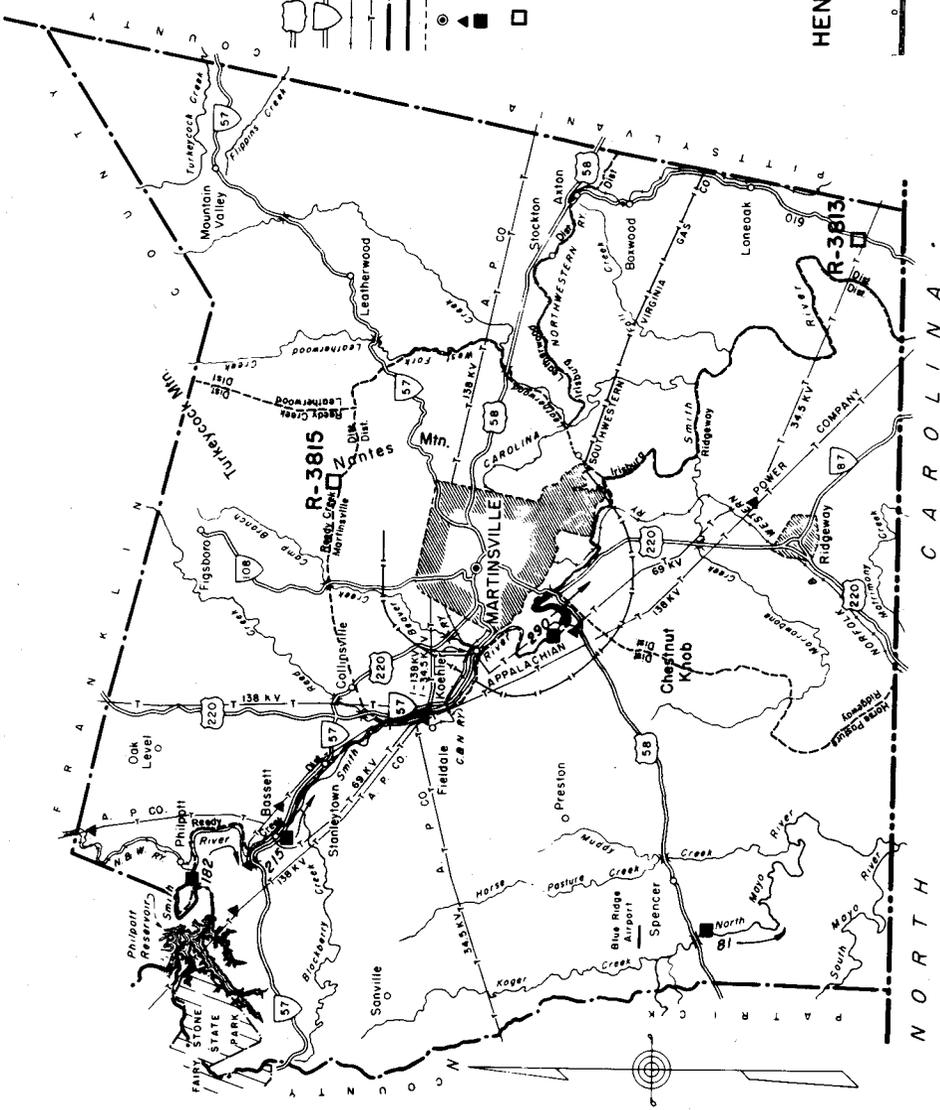
| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 130.4 | 9.6 |
| 2000 | 130.4 | 10.1 |
| 2100 | 167.2 | 1.6 |
| 2200 | 167.2 | 1.1 |

Potential Use: Probable in brick and tile.

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

HENRY COUNTY
VIRGINIA

SCALE OF MILES



Location Map of Henry County

HENRY COUNTY

Samples were collected from two localities in Henry County. Testing by Morse Laboratories indicates the following potential uses for the raw material:

| <u>Sample</u> | <u>Formation or Age</u> | <u>Potential Use</u> |
|---------------|-------------------------|--|
| R-3813 | Residual clay | Nonplastic component in brick and tile |
| R-3815 | Residual clay | Nonplastic component in brick and tile |

SAMPLE: R-3813

County: Henry

Locality: Roadcut, 2.8 miles southwest of Loneoak, on the northwest side of State Road 610 approximately 0.1 mile by road north-northeast of its intersection with State Road 622.

Description: Dark yellowish-orange to moderate-brown, plastic, micaceous clay is present in a roadcut 225 feet long, and has a maximum exposed thickness of 6 feet. Towards the base of the exposure the clay becomes lighter brown and increasingly micaceous. Three and one-half feet of additional light- to moderate-brown, micaceous clay was indicated by augering to that depth at the base of the exposure; only a small amount of mica is present in clay at the base of the auger hole.

Formation or Age: Residual clay

Sampled Interval: Composite of two representative channel samples in the highest part of the exposure, approximately 60 feet apart, and 3½ feet of augered clay.

Raw Properties:

Water of plasticity: 23.6%

Plasticity: fair

Drying shrinkage: 6.5%

Workability: mealy

Drying properties: good

Dry strength: 340 psi

pH: 5.0

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|---------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Orange-brown | 2½ | 9.3 | 23.2 | 1.68 |
| 2000 | Brown-orange | 3½ | 11.8 | 16.2 | 1.89 |
| 2100 | Lt. red-brown | 6 | 14.0 | 12.3 | 2.03 |
| 2200 | Orange-red | 7 | 14.2 | 12.0 | 2.05 |

Other tests and remarks: Extrudes well; CaCO₃ test positive; L.O.I. 19.9%; slightly sticky.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 100.5 | 27.7 |
| 2000 | 100.5 | 23.2 |
| 2100 | 110.4 | 14.7 |
| 2200 | 110.4 | 14.1 |

Potential Use: Possible as a nonplastic component in brick and tile.

SAMPLE: R-3815

County: Henry

Locality: Roadcut, 4.0 miles northeast of Martinsville, on the north side of State Road 663 approximately 0.1 mile by road southwest of its intersection with State Road 658.

Description: Pale to moderate reddish-brown, hard, plastic clay that contains quartz fragments is present in a roadcut 270 feet long, and has a maximum exposed thickness of 5.5 feet. Four feet of additional lighter brown, slightly micaceous clay was indicated by augering to that depth at the base of the exposure.

Formation or Age: Residual clay

Sampled Interval: Composite of two representative channel samples in the highest part of the exposure, approximately 45 feet apart, and 4 feet of augered clay.

Raw Properties:

| | |
|-----------------------------------|-----------------------|
| Water of plasticity: 37.2% | Plasticity: fair |
| Drying shrinkage: 7.9% | Workability: mealy |
| Drying properties: fair, cracking | Dry strength: 241 psi |
| pH: 5.1 | |

Slow Firing Test:

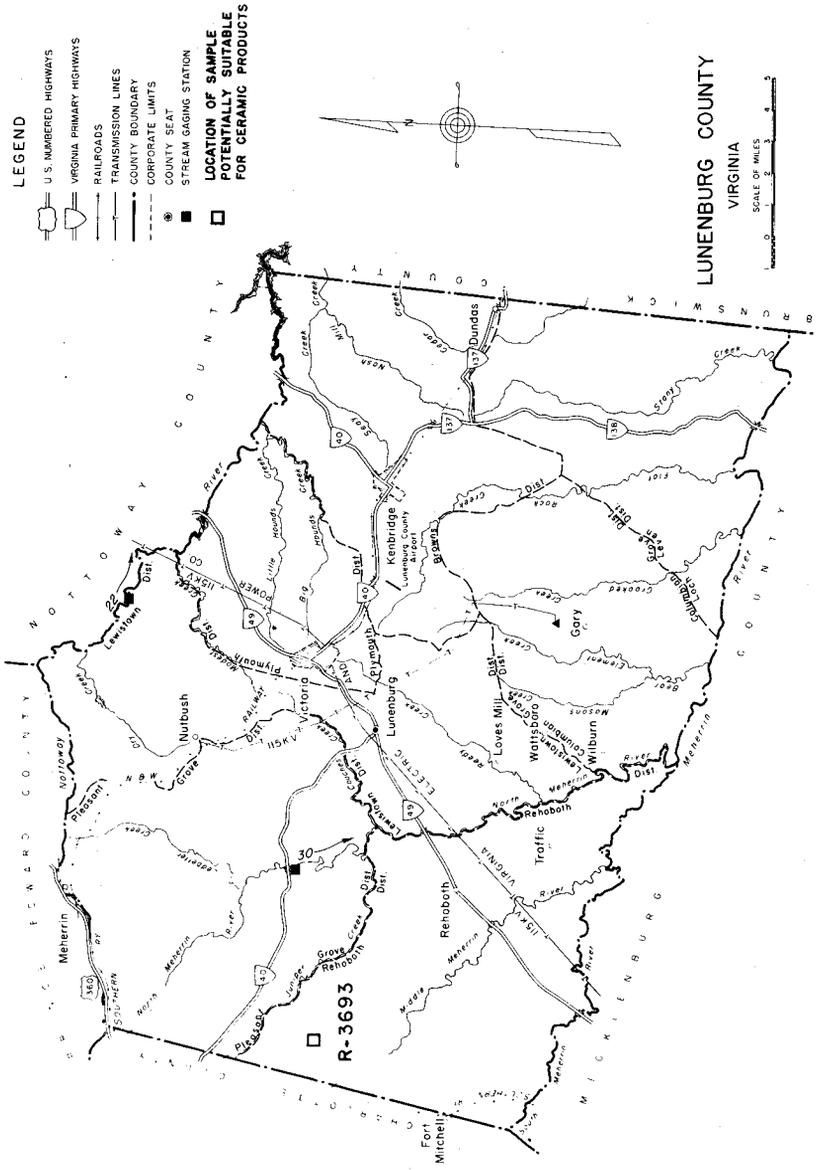
| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|---------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Orange-brown | 2 | 10.5 | 26.8 | 1.67 |
| 2000 | Lt. red-brown | 2 | 11.9 | 24.3 | 1.74 |
| 2100 | Lt. red-brown | 4 | 13.0 | 19.8 | 1.88 |
| 2200 | Orange-red | 5½ | 15.2 | 18.2 | 1.93 |

Other tests and remarks: Fair extrusion (mealy); CaCO₃ test slightly positive; L.O.I. 13.6; surface cracking.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 101.1 | 26.4 |
| 2000 | 99.8 | 27.8 |
| 2100 | 110.4 | 24.3 |
| 2200 | 110.4 | 24.3 |

Potential Use: Possible as a nonplastic component in brick and tile.



Location Map of Lunenburg County

LUNENBURG COUNTY

A sample was collected from one locality in Lunenburg County. Testing by Morse Laboratories indicates the following potential use for the raw material:

| <u>Sample</u> | <u>Formation or Age</u> | <u>Potential Use</u> |
|---------------|-------------------------|--|
| R-3693 | Residual clay | Brick, tile, and porous clay products* |

*If hardness is improved.

SAMPLE: R-3693

County: Lunenburg

Locality: Roadcut, 6.5 miles northwest of Rehoboth, on the southwest side of State Road 688 approximately 0.1 mile by road southeast of its intersection with State Road 622.

Description: Yellowish-brown, plastic clay, with variegated yellow-brown and yellowish-gray clay and moderate-red clay mottlings, is present in a roadcut 790 feet long, and has a maximum exposed thickness of 5.5 feet. Quartz veins are present in the clay, especially in the southeastern section. Three feet of gritty and increasingly sandy yellow-gray and pale yellowish-orange clay was indicated by augering to that depth at the base of the exposure.

Formation or Age: Residual clay

Sampled Interval: Composite of two representative channel samples in the highest part of the exposure and 3 feet of augered clay.

Raw Properties:

| | |
|----------------------------|-----------------------|
| Water of plasticity: 21.0% | Plasticity: good |
| Drying shrinkage: 5.9% | Workability: good |
| Drying properties: good | Dry strength: 311 psi |
| pH: 5.0 | |

Slow Firing Test:

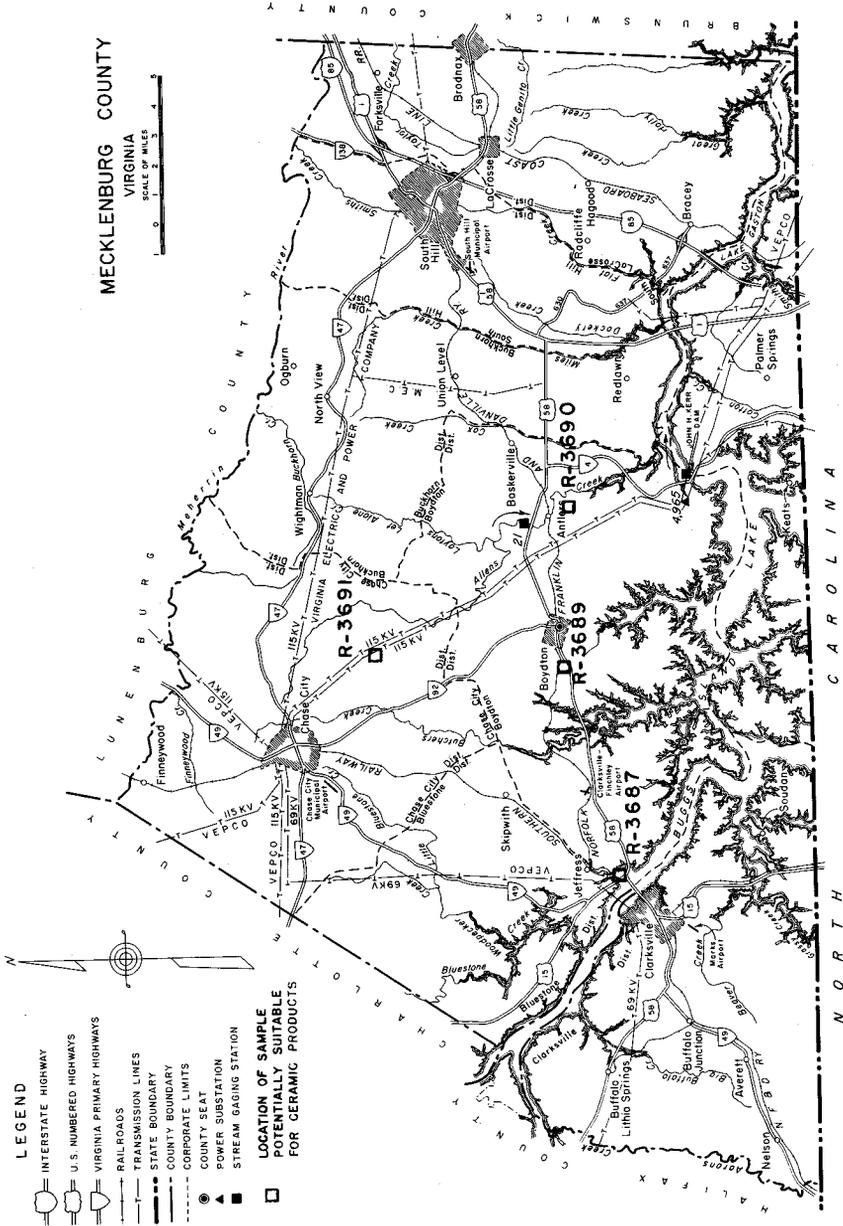
| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|--------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Buff | 1½ | 6.8 | 19.8 | 1.75 |
| 2000 | Orange-buff | 2 | 6.5 | 19.4 | 1.76 |
| 2100 | Buff-orange | 2½ | 7.0 | 17.5 | 1.83 |
| 2200 | Brown-orange | 3½ | 6.8 | 17.3 | 1.83 |

Other tests and remarks: Extrudes well; CaCO₃ test negative; L.O.I. 11.1%; good color range. The addition of a fluxing material is suggested to improve hardness and reduce total absorption.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 103.6 | 20.8 |
| 2000 | 103.0 | 22.0 |
| 2100 | 103.0 | 21.4 |
| 2200 | 103.0 | 20.3 |

Potential Use: Possible in brick, tile, and porous clay products if the hardness is improved.



Location Map of Mecklenburg County

MECKLENBURG COUNTY

Samples were collected from four localities in Mecklenburg County. Testing by Morse Laboratories indicates the following potential uses for the raw material:

| <u>Sample</u> | <u>Formation or Age</u> | <u>Potential Use</u> |
|---------------|-------------------------|--|
| R-3687 | Residual clay | Nonplastic component in brick and tile |
| R-3689 | Residual clay | Brick and tile* |
| R-3690 | Paleozoic (?) | Component in most structural clay products, including sewer pipe |
| R-3691 | Residual clay | Nonplastic component in brick and tile |

*If total shrinkage is reduced.

SAMPLE: R-3687

County: Mecklenburg

Locality: Excavation, 1.3 miles northeast of Clarksville, on the north-east side of U. S. Highway 15 approximately 0.1 mile by road northwest of its intersection with U. S. Highway 58.

Description: Moderate reddish-brown, plastic clay, mottled with some dark yellowish-orange clay, is present in a roadcut 900 feet long, and has a maximum exposed thickness of 12 feet. Several small quartz veins are present in the clay, which becomes less plastic and more silty near the base of the roadcut.

Formation or Age: Residual clay

Sampled Interval: Composite of two representative channel samples in the highest part of the exposure.

Raw Properties:

| | |
|----------------------------------|-----------------------|
| Water of plasticity: 40.2% | Plasticity: fair |
| Drying shrinkage: 9.0% | Workability: short |
| Drying properties: fair-cracking | Dry strength: 210 psi |
| pH: 5.0 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|---------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Red-brown | 2½ | 13.4 | 23.6 | 1.71 |
| 2000 | Orange-red | 5½ | 15.6 | 18.9 | 1.86 |
| 2100 | Lt. red-brown | 6½ | 20.6 | 9.4 | 2.26 |
| 2200 | Brown-red | 7+ | 21.0 | 8.6 | 2.28 |

Other tests and remarks: Extrudes well; CaCO₃ test slightly positive; L.O.I. 14.9%; surface cracking.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 99.8 | 27.3 |
| 2000 | 99.8 | 25.6 |
| 2100 | 120.4 | 14.4 |
| 2200 | 122.3 | 13.6 |

Potential Use: Possible as a nonplastic component in brick and tile.

SAMPLE: R-3689

County: Mecklenburg

Locality: Roadcut, 1.4 miles west of Boynton, on the east side of Road 9468 at its intersection with U. S. Highway 58.

Description: Moderate reddish-brown to dark reddish-brown clay, with dusky-yellow and yellowish-gray clay mottling, is present in a roadcut 165 feet long, and has a maximum exposed thickness of 5.5 feet. Three feet of additional reddish-brown clay, with greenish-yellow mottlings, was indicated by augering to that depth at the base of the exposure; the clay becomes lighter in color near the bottom of the auger hole.

Formation or Age: Residual clay

Sampled Interval: Composite of two representative channel samples in the highest part of the exposure, approximately 40 feet apart, and 3 feet of augered clay.

Raw Properties:

| | |
|----------------------------|-----------------------------|
| Water of plasticity: 26.6% | Plasticity: good |
| Drying shrinkage: 8.2% | Workability: slightly mealy |
| Drying properties: good | Dry strength: 415 psi |
| pH: 5.2 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|---------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Orange-brown | 2½ | 11.9 | 25.0 | 1.96 |
| 2000 | Brown-orange | 3½ | 15.0 | 18.3 | 1.88 |
| 2100 | Lt. red-brown | 5½ | 16.5 | 12.8 | 2.10 |
| 2200 | Orange-red | 6½ | 17.0 | 11.6 | 2.11 |

Other tests and remarks: Extrudes well; CaCO₃ test slightly positive; L.O.I. 23.7%. The addition of a nonplastic grog is suggested to reduce total shrinkage.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 91.1 | 31.4 |
| 2000 | 91.1 | 29.1 |
| 2100 | 98.0 | 28.9 |
| 2200 | 108.0 | 24.3 |

Potential Use: Possible as a main component in brick and tile if total shrinkage is reduced.

SAMPLE: R-3690

County: Mecklenburg

Locality: Roadcut, 3.8 miles east of Boydton, on the southeast side of State Road 678 approximately 1.5 miles by road south of its intersection with U. S. Highway 58.

Description: Light-yellow and a very pale-orange, dark yellowish-orange to grayish-brown and dark-purple, schistose, tuffaceous, weathered slate is present in a roadcut 165 feet long, and has a maximum exposed height of 8 feet. The slate has a north-south strike and a dip of approximately 15-20° to the east.

Formation or Age: Paleozoic (?)

Sampled Interval: Composite of grab samples believed representative of material in exposure.

Raw Properties:

| | |
|----------------------------|--------------------|
| Water of plasticity: 24.5% | Plasticity: fair |
| Drying shrinkage: 1.0% | Workability: short |
| Drying properties: fair | Dry strength: poor |
| pH: 6.3 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|---------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Buff | 1½ | 1.1 | 24.1 | 1.61 |
| 2000 | Orange-brown | 2 | 2.3 | 21.9 | 1.68 |
| 2100 | Lt. red-brown | 5½ | 7.0 | 13.7 | 1.95 |
| 2200 | Med. brown | 7 | 10.2 | 2.1 | 2.30 |

Other tests and remarks: Non-extrudable (forces water and compresses); CaCO₃ test negative; L.O.I. 2.9%; the addition of a more plastic clay is suggested to improve the workability and dry strength.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 136.7 | 7.1 |
| 2000 | 135.4 | 8.7 |
| 2100 | 136.0 | 7.1 |
| 2200 | 135.4 | 6.2 |

Potential Use: Possible as a component in most structural clay products, including sewer pipe.

SAMPLE: R-3691

County: Mecklenburg

Locality: Roadcut, 4.0 miles southeast of Chase City, on the south side of State Road 671 approximately 0.5 mile by road east of its intersection with State Road 679.

Description: Moderate reddish-brown, plastic clay, with variegated yellowish-gray, dusky-yellow and red clay, is present in a roadcut 270 feet long, and has a maximum exposed thickness of 7 feet. Three feet of additional dusky-yellow to pale-olive clay was indicated by augering to that depth at the base of the exposure.

Formation or Age: Residual clay

Sampled Interval: Composite of two representative channel samples in the highest part of the exposure, approximately 35 feet apart, and 3 feet of augered clay.

Raw Properties:

Water of plasticity: 27.7%

Plasticity: good

Drying shrinkage: 8.3%

Workability: slightly mealy

Drying properties: good

Dry strength: 365 psi

pH: 5.4

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|--------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Brown-orange | 3 | 12.1 | 23.6 | 1.69 |
| 2000 | Orange-brown | 3½ | 15.5 | 18.0 | 1.88 |
| 2100 | Med. brown | 5½ | 15.9 | 15.7 | 1.96 |
| 2200 | Orange-red | 6 | 16.0 | 13.8 | 2.06 |

Other tests and remarks: Extrudes well; CaCO₃ test slightly positive; L.O.I. 21.2%.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 96.7 | 29.2 |
| 2000 | 96.7 | 28.1 |
| 2100 | 107.3 | 22.1 |
| 2200 | 134.2 | 12.8 |

Potential Use: Possible as a nonplastic component in brick and tile.

NOTTOWAY COUNTY

Samples were collected from four localities in Nottoway County. Testing by the Tuscaloosa Laboratory (R-3484, R-3485) and Morse Laboratories (R-3487, R-3490) indicates the following potential uses for the raw material:

| <u>Sample</u> | <u>Formation or Age</u> | <u>Potential Use</u> |
|---------------|-------------------------|--|
| R-3484 | Residual clay | Component in face-brick mixtures |
| R-3485 | Residual clay | Face brick |
| R-3487 | Residual clay | Component in some structural clay products, such as brick and tile |
| R-3490 | Residual clay | In structural clay products, with bonding clays. |

SAMPLE: R-3484

County: Nottoway

Locality: Roadcut, 2.2 miles southwest of Burkeville, on the northwest side of State Road 624 approximately 0.9 mile by road northeast of its intersection with State Road 622.

Description: Red-orange, plastic clay, with variegated yellow and gray clay and yellow clay mottlings, is present in a roadcut 150 feet long, and has a maximum exposed thickness of 5 feet. Four feet of additional red-orange, micaceous clay was indicated by augering to that depth at the base of the exposure.

Formation or Age: Residual clay

Sampled Interval: Composite of two representative channel samples in the highest part of the exposure, approximately 70 feet apart, and 4 feet of augered clay.

Raw Properties:

Water of plasticity: 29.5%

Dry shrinkage: 5.0%

Drying defects: none

Working properties: moderate plasticity

Dry strength: fair

pH: 5.2

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Abs. | % Appar. Porosity | Bulk Dens. gm/cc |
|--------------|-----------|---------------|----------------------|-----------|----------------------|---------------------|
| 1800 | Tan | 2 | 5.0 | 27.2 | 42.4 | 1.56 |
| 1900 | Tan | 2 | 5.0 | 26.6 | 35.4 | 1.57 |
| 2000 | Tan | 3 | 5.0 | 24.4 | 39.5 | 1.62 |
| 2100 | Brown | 4 | 12.5 | 16.7 | 30.1 | 1.80 |
| 2200 | Brown | 5 | 12.5 | 15.4 | 28.1 | 1.83 |
| 2300 | Dk. brown | 5 | 12.5 | 16.0 | 29.1 | 1.82 |

Other tests and remarks: No effervescence with HCl; high absorption at all firing temperatures.

Bloating Test: Negative

Potential Use: Component in face-brick mixtures.

SAMPLE: R-3485

County: Nottoway

Locality: Roadcut (Figure 11), 1.8 miles northeast of The Falls, on the northeast side of State Road 600 at its intersection with State Road 604.

Description: Yellow, sandy, and plastic variegated red and gray clay is present in a roadcut 330 feet long, and has a maximum exposed thickness of 6 feet. A two-inch zone of partially weathered schist is present near the base of the exposure. Four feet of additional plastic, lighter gray and yellow clay was indicated by augering to that depth at the base of the exposure.

Formation or Age: Residual clay

Sampled Interval: Composite of representative channel sample in the highest part of the exposure and 4 feet of augered clay.

Raw Properties:

| | |
|----------------------------|------------------------------------|
| Water of plasticity: 24.3% | Working properties: low plasticity |
| Drying shrinkage: 5.0% | Dry strength: fair |
| Drying defects: none | pH: 5.3 |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Abs. | % Appar. Porosity | Bulk Dens. gm/cc |
|--------------|------------|---------------|----------------------|-----------|----------------------|---------------------|
| 1800 | Tan | 2 | 5.0 | 23.3 | 38.2 | 1.64 |
| 1900 | Tan | 3 | 5.0 | 23.3 | 38.2 | 1.64 |
| 2000 | Tan | 4 | 5.0 | 22.5 | 37.4 | 1.66 |
| 2100 | Lt. brown | 4 | 7.5 | 17.6 | 31.0 | 1.76 |
| 2200 | Lt. brown | 5 | 7.5 | 17.1 | 35.2 | 2.06 |
| 2300 | Gray-brown | 5 | 10.0 | 12.7 | 24.2 | 1.91 |

Other tests and remarks: No effervescence with HCl₁; should fire to "MW" face-brick specifications at about 2300°F; poor color.

Bloating Test: Negative

Potential Use: Face brick.



Figure 11. Residual clay (Sample 3485) on the northeast side of State Road 600 at its intersection with State Road 604.



Figure 11. Residual clay (Sample 3485) on the northeast side of State Road 600 at its intersection with State Road 604.

SAMPLE: R-3487

County: Nottoway

Locality: Roadcut, 5.1 miles northeast of Blackstone, on the west side of State Road 669 approximately 0.45 mile by road south of its intersection with State Road 605.

Description: Yellow, plastic clay, mottled in places with red clay, is present in a roadcut 150 feet long, and has a maximum exposed thickness of 2 feet. Four feet of additional light yellow and gray plastic clay was indicated by augering to that depth at the base of the exposure; the clay becomes slightly gritty at a depth of 3½ feet in the auger hole.

Formation or Age: Residual clay

Sampled Interval: Composite of two representative channel samples in the highest part of the exposure, approximately 30 feet apart, and 4 feet of augered clay.

Raw Properties:

Water of plasticity: 43.7%

Plasticity: good

Drying shrinkage: 9.3%

Workability: smooth, fine texture

Drying properties: good

Dry strength: 319 psi

pH: 6.4

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|--------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Orange-brown | 3 | 10.0 | 29.2 | 1.54 |
| 2000 | Orange-brown | 3 | 10.5 | 28.7 | 1.54 |
| 2100 | Orange-brown | 7 | 16.8 | 17.4 | 1.85 |
| 2200 | Dk. orange | 7 | 16.8 | 17.0 | 1.89 |

Other tests and remarks: Extruding properties excellent; L.O.I. 9.3%; surface checking occurs at 2100° and 2200°F; water of plasticity, absorption, and total shrinkage can be reduced by the addition of a bonding clay and nonplastic grog.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 98.0 | 26.7 |
| 2000 | 99.8 | 25.6 |
| 2100 | 122.3 | 11.9 |
| 2200 | 123.6 | 10.8 |

Potential Use: Possible component in some structural clay products, such as brick and tile.

SAMPLE: R-3490

County: Nottoway

Locality: Roadcut, 1.5 miles west of Crewe, on the west side of State Road 607 approximately 1.4 miles by road south of its intersection with U. S. Highway 460.

Description: Red-orange, sandy clay is present in a roadcut 525 feet long, has a maximum exposed thickness of 6 feet. The clay is mottled with yellow and gray clay in the top half of the exposure and variegated with slightly plastic gray clay in the bottom half. Four feet of additional red-orange clay, with some yellow and light gray clay, was indicated by augering to that depth at the base of the exposure. This clay is plastic in the first foot of the augered hole, but becomes increasingly gritty with quartz fragments towards the bottom of the hole.

Formation or Age: Residual clay

Sampled Interval: Composite of two representative channel samples in the highest part of the exposure, approximately 25 feet apart, and 4 feet of augered clay.

Raw Properties:

| | |
|----------------------------|-------------------------|
| Water of plasticity: 26.1% | Plasticity: good |
| Drying shrinkage: 5.5% | Workability: good |
| Drying properties: good | Dry strength: 132.8 psi |
| pH: 5.8 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|------------------|---------------|----------------------|-----------------|---------------------|
| 2000 | Lt. yellow, buff | 3 | 8.0 | 21.1 | 1.69 |
| 2100 | Lt. yellow, buff | 3 | 7.5 | 20.8 | 1.69 |
| 2200 | Lt. orange-brown | 3 | 6.5 | 19.4 | 1.74 |
| 2300 | Dk. orange | 3 | 6.7 | 18.8 | 1.76 |

Other tests and remarks: Extrudes well but has a gritty texture; L.O.I. 4.9%; good color range, soft.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 2000 | 126.7 | 22.9 |
| 2100 | 142.9 | 22.9 |
| 2200 | 142.9 | 13.7 |
| 2300 | 142.9 | 11.6 |

Potential Use: Possible with bonding clays in structural clay products.

PATRICK COUNTY

A sample was collected from one locality in Patrick County. Testing by Morse Laboratories indicates the following potential use for the raw material:

| <u>Sample</u> | <u>Formation or Age</u> | <u>Potential Use</u> |
|---------------|-------------------------|-----------------------------------|
| R-3814 | Paleozoic (?) | None in structural clay products. |

SAMPLE: R-3814

County: Patrick

Locality: Roadcut, 3.95 miles northeast of Patrick Springs, on the northwest side of State Road 680 approximately 0.4 mile by road northwest of its intersection with State Road 687.

Description: Pale-blue to grayish-blue sericite-chlorite phyllite is present in a roadcut 225 feet long, and has a maximum exposed height of 50 feet. The phyllite, which has a strike of approximately N.60°E., contains lenses of quartz, around which the phyllite has turned a dull yellow due to iron-oxide staining.

Formation or Age: Paleozoic (?)

Sampled Interval: Composite of grab samples believed representative of material in exposure.

Raw Properties:

| | |
|-----------------------------------|--------------------|
| Water of plasticity: 18.9% | Plasticity: poor |
| Drying shrinkage: 1.3% | Workability: short |
| Drying properties: fair, crumbles | Dry strength: poor |
| pH: 6.4 | |

Slow Firing Test:

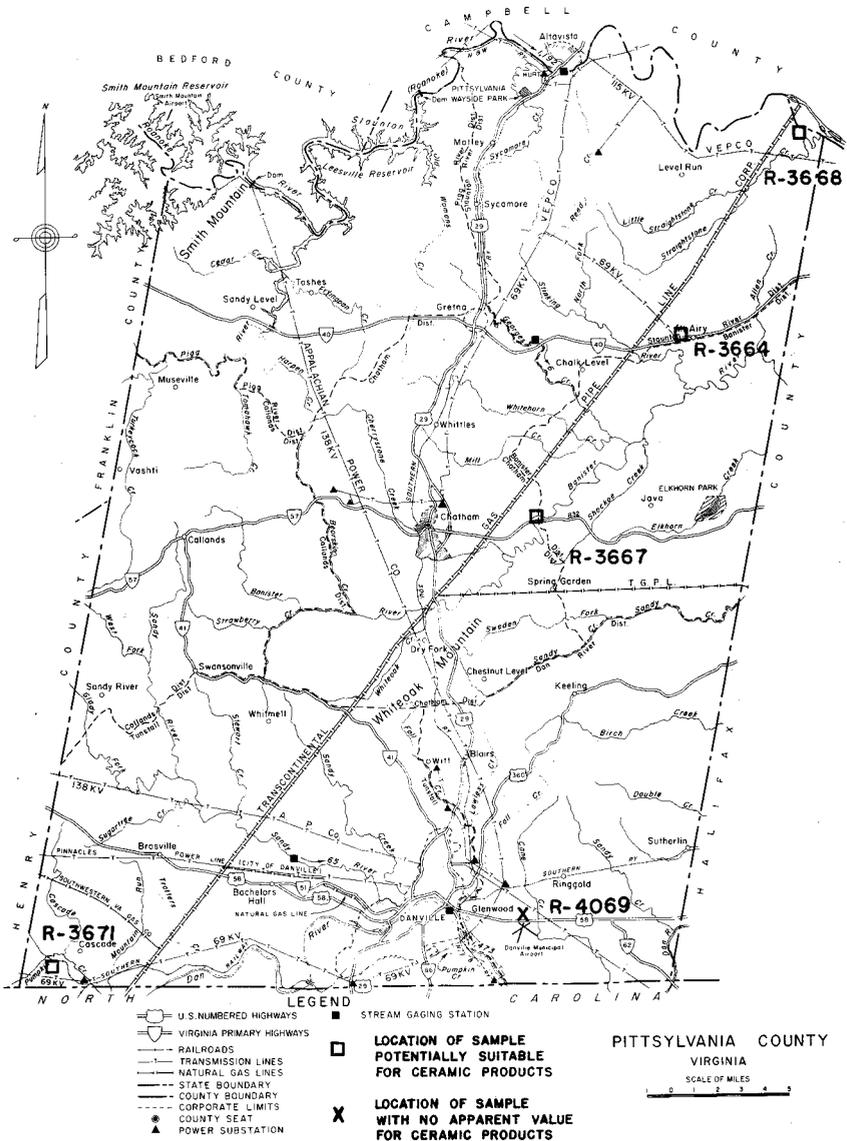
| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|----------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Yellow-brown | 1½ | 1.9 | 22.0 | 1.71 |
| 2000 | Gray-brown | 2 | 2.0 | 20.5 | 1.77 |
| 2100 | Dk. gray-brown | 2½ | 4.3 | 16.1 | 1.92 |
| 2200 | Gray-brown | 5½ | 5.5 | 12.3 | 2.06 |

Other tests and remarks: Non-extrudable (forces water and compresses); CaCO₃ test positive; L.O.I. 4.5%.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 150.4 | 4.7 |
| 2000 | 151.6 | 4.6 |
| 2100 | 150.4 | 3.6 |
| 2200 | 149.8 | 4.7 |

Potential Use: None in structural clay products.



Location Map of Pittsylvania County

PITTSYLVANIA COUNTY

Samples were collected from five localities in Pittsylvania County. Testing by Morse Laboratories indicates the following potential uses for the raw material.

| <u>Sample</u> | <u>Formation or Age</u> | <u>Potential Use</u> |
|---------------|----------------------------------|--|
| R-3664 | Residual clay | Brick, and tile* |
| R-3667 | Triassic | Component in most structural clay products, including sewer pipe; as foundry soil |
| R-3668 | Residual clay and Triassic shale | Most structural clay products; sewer pipe**; face or decorative brick if color is acceptable |
| R-3671 | Residual clay | Component in structural clay products, such as brick and tile |
| R-4069 | Residual clay | None in structural clay products |

*If water of plasticity and total shrinkage are reduced.

**If total shrinkage is reduced.

SAMPLE: R-3664

County: Pittsylvania

Locality: Roadcut, 0.6 mile northwest of Mt. Airy, on the northeast side of State Road 606, approximately 0.4 mile by road west of its intersection with State Road 640 leading north.

Description: Yellow, gritty, plastic clay, variegated with red and gray clay, is present in a roadcut 520 feet long, and has a maximum exposed thickness of 5.5 feet. Fragments of shale occur in the middle and lower parts of the roadcut. Two feet of additional yellow, plastic clay was indicated by augering to that depth at the base of the exposure.

Formation or Age: Residual clay

Sampled Interval: Composite of two representative channel samples in the highest part of the exposure, approximately 185 feet apart, and 2 feet of augered clay.

Raw Properties:

Water of plasticity: 47.2%

Plasticity: good

Drying shrinkage: 10.3%

Workability: smooth, fine texture

Drying properties: good

Dry strength: 333 psi

pH: 6.5

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|--------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Med. orange | 3½ | 11.8 | 26.0 | 1.60 |
| 2000 | Med. orange | 5 | 12.0 | 26.0 | 1.63 |
| 2100 | Brown-orange | 7+ | 17.5 | 13.3 | 1.98 |
| 2200 | Dk. orange | 7+ | 18.0 | 13.3 | 1.98 |

Other tests and remarks: Excellent extrusion; L.O.I. 9.3%; the addition of more open clay materials, such as fireclay and grog, would improve the water of plasticity, total shrinkage, and absorption.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 93.6 | 27.1 |
| 2000 | 96.1 | 26.6 |
| 2100 | 109.8 | 15.9 |
| 2200 | 122.9 | 13.7 |

Potential Use: Possible in brick and tile if the water of plasticity and total shrinkage are reduced.

SAMPLE: R-3667

County: Pittsylvania

Locality: Roadcut, 4.6 miles east of Chatham, on the southeast side of State Road 683 approximately 0.5 mile by road northeast of its intersection with State Road 692 leading northwest.

Description: Grayish-brown and grayish-red, ripple-marked, silty shale and some dusky brown, fine-grained sandstone are present in a roadcut 360 feet long, and have a maximum exposed height of 4.5 feet. The shale has a strike of approximately N.45°E. and a northwest dip.

Formation or Age: Triassic

Sampled Interval: Composite of grab samples believed representative of material in exposure.

Raw Properties:

| | |
|----------------------------|---|
| Water of plasticity: 22.8% | Plasticity: fair |
| Drying shrinkage: 2.3% | Workability: short, smooth, fine texture |
| Drying properties: good | |
| pH: 6.8 | Dry strength: poor |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|--------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Orange-brown | 1 | 2.3 | 24.0 | 1.60 |
| 2000 | Orange-brown | 1 | 2.3 | 24.2 | 1.60 |
| 2100 | Dk. brown | 7+ | 10.5 | 4.2 | 2.22 |
| 2200 | Dk. brown | 7+ | 11.8 | 1.4 | 2.29 |

Other tests and remarks: Non-extrudable; L.O.I. 1.9%; dry strength, plasticity, and workability could be improved by the addition of a better bonding material.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 151.6 | 3.6 |
| 2000 | 149.1 | 2.6 |
| 2100 | 122.3 | 3.1 |
| 2200 | 136.7 | 3.1 |

Potential Use: Possible as a component in most structural clay products, including sewer pipe; possible use as a foundry soil.

SAMPLE: R-3668

County: Pittsylvania

Locality: Roadcut (Figure 12), 5.5 miles east of Level Run, on the northwest side of State Road 761 at its intersection with State Road 602.

Description: Yellow, grayish-red and moderate reddish-brown weathered shale and clay are present in a roadcut 350 feet long, and have a maximum exposed height of 14 feet. The shale, which is covered by a dark yellowish-orange saprolite in the extreme northern end of the exposure, has a northeast strike and a northwest dip.

Formation or Age: Residual clay and Triassic shale

Sampled Interval: Representative channel sample of shale and clay in the highest part of the exposure.

Raw Properties:

Water of plasticity: 22.6%

Plasticity: good

Drying shrinkage: 4.5%

Workability: smooth, fine texture

Drying properties: good

Dry strength: 202 psi

pH: 6.9

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Med. brown | 3 | 5.0 | 17.5 | 1.79 |
| 2000 | Red-brown | 3½ | 6.0 | 15.4 | 1.86 |
| 2100 | Dk. brown | 7+ | 10.0 | 7.1 | 2.17 |
| 2200 | Brown-red | 7+ | 11.0 | 6.5 | 2.21 |

Other tests and remarks: Good extrusion; L.O.I. 4.7%; excellent color range.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 139.8 | 4.7 |
| 2000 | 149.1 | 2.6 |
| 2100 | 147.3 | 1.6 |
| 2200 | 141.6 | 3.2 |

Potential Use: Probable in most structural clay products, except sewer pipe; possible use in sewer pipe if the total shrinkage is reduced. Probable in face or decorative brick if the color is acceptable to the industry.



Figure 12. Residual clay and Triassic shale (Sample R-3668) on the northwest side of State Road 761 at its intersection with State Road 602.



Figure 12. Residual clay and Triassic shale (Sample R-3668) on the northwest side of State Road 761 at its intersection with State Road 602.

SAMPLE: R-3671

County: Pittsylvania

Locality: Roadcut, 1.4 miles southwest of Cascade, on the southeast side of State Road 622 at its intersection with State Road 856 leading south.

Description: Dark reddish-brown, hard, plastic clay and some reddish-brown shale are present in a roadcut 250 feet long, and have a maximum exposed thickness of 5.5 feet. Four feet of additional reddish-brown clay was indicated by augering to that depth at the base of the exposure. Fragments of partly weathered feldspar and muscovite are more abundant towards the bottom of the hole. The clay is derived from sedimentary rocks of Triassic age.

Formation or Age: Residual clay

Sampled Interval: Composite of two representative channel samples in the highest part of the exposure and 4 feet of augered clay.

Raw Properties:

| | |
|----------------------------|--|
| Water of plasticity: 44.1% | Plasticity: excellent |
| Drying Shrinkage: 8.0% | Workability: smooth, sticky, fine texture |
| Dry properties: good | Dry strength: 255 psi |
| pH: 6.6 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|------------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Lt. orange-brown | 6 | 12.8 | 15.3 | 1.85 |
| 2000 | Brown-orange | 7+ | 15.5 | 11.8 | 1.96 |
| 2100 | Lt. red-brown | 7+ | 20.0 | 1.8 | 1.83 |
| 2200 | Brown-red | 7+ | 21.0 | 1.8 | 1.83 |

Other tests and remarks: Excellent extrusion; L.O.I. 8.7%; excellent color range; total shrinkage could be reduced by the addition of a nonplastic grog. Quick-fire in a reducing atmosphere is suggested for possible use as an expanded light-weight aggregate.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 125.4 | 9.4 |
| 2000 | 140.4 | 4.4 |
| 2100 | 128.5 | 5.0 |
| 2200 | 98.6 | 3.4 |

Potential Use: Probable as a component in some structural clay products, such as brick and tile.

SAMPLE: R-4069

County: Pittsylvania

Locality: Roadcut, 2.4 miles southwest of Ringgold, on the north side of State Road 655 approximately 0.45 mile by road east of its intersection with State Road 729.

Description: Dark yellowish-orange, slightly sandy, plastic clay is present in the top 5 feet of a roadcut 250 feet long and 7 feet high. The clay is variegated with a yellowish-gray clay and a moderate red to pale reddish-brown clay in the middle of the exposure and contains light-brown clay mottlings in the top 2 feet. The bottom 2 feet of the roadcut contains primarily a moderate red, plastic clay variegated with a yellowish-gray and a very light gray clay.

Formation or Age: Residual clay

Sampled Interval: Composite of two representative channel samples in the highest part of the exposure, approximately 35 feet apart.

Raw Properties:

| | |
|----------------------------|---------------------------------|
| Water of plasticity: 33.5% | Plasticity: fair |
| Drying shrinkage: 7.7% | Workability: fair, fine texture |
| Drying properties: good | Dry strength: 400 psi |
| pH: 5.6 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|------------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Buff | 2½ | 9.8 | 25.2 | 1.66 |
| 2000 | Orange-brown | 3½ | 10.4 | 23.9 | 1.69 |
| 2100 | Lt. orange-brown | 5 | 12.6 | 17.5 | 1.87 |
| 2200 | Brown-orange | 5½ | 13.7 | 14.9 | 1.97 |

Other tests and remarks: Fair extrusion; CaCO₃ test slightly positive; L.O.I. 13.7%; surface cracking at 2100° and 2200°F.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 107.9 | 28.3 |
| 2000 | 98.0 | 32.4 |
| 2100 | 107.3 | 25.6 |
| 2200 | 120.4 | 17.8 |

Potential Use: None in structural clay products.

POWHATAN COUNTY

Samples were collected from six localities in Powhatan County. Testing by the Tuscaloosa Laboratory indicates the following potential uses for the raw material:

| <u>Sample</u> | <u>Formation or Age</u> | <u>Potential Use</u> |
|---------------|-----------------------------|----------------------------------|
| R-3467 | Residual clay | Component in face-brick mixtures |
| R-3468 | Residual clay | Component in face-brick mixtures |
| R-3469 | Residual clay | Component in face-brick mixtures |
| R-3470 | Residual clay | Component in face-brick mixtures |
| R-3471 | Residual clay | Face brick |
| R-3472 | Residual clay and saprolite | Component in face-brick mixtures |

SAMPLE: R-3467

County: Powhatan

Locality: Roadcut, 4.75 miles north of Powhatan, on the southeast side of U. S. Highway 522 approximately 0.1 mile by road southwest of its intersection with State Road 618.

Description: Red plastic clay is present in a roadcut 180 feet long, and has a maximum exposed thickness of 4 feet. Four feet of additional red, slightly sandy and micaceous plastic clay, mottled in places with yellow and gray clay, was indicated by augering to that depth at the base of the exposure.

Formation or Age: Residual clay

Sampled Interval: Composite of three representative channel samples in the highest part of the exposure, approximately 35 feet apart, and 4 feet of augered clay.

Raw Properties:

Water of plasticity: 34.8%
Drying shrinkage: 5.0%
Drying defects: none

Working properties: moderate
plasticity
Dry strength: fair
pH: 5.1

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Abs. | % Appar. Porosity | Bulk Dens. gm/cc |
|--------------|-----------|---------------|----------------------|-----------|----------------------|---------------------|
| 1800 | Tan | 2 | 7.5 | 40.1 | 52.9 | 1.32 |
| 1900 | Tan | 2 | 7.5 | 40.6 | 53.2 | 1.31 |
| 2000 | Tan | 3 | 7.5 | 37.7 | 51.3 | 1.36 |
| 2100 | Lt. brown | 4 | 12.5 | 32.2 | 47.0 | 1.46 |
| 2200 | Brown | 5 | 15.0 | 26.4 | 42.0 | 1.59 |
| 2300 | Dk. brown | 6 | 15.0 | 28.0 | 43.1 | 1.54 |

Other tests and remarks: No effervescence with HCl; high absorption at all firing temperatures.

Bloating Test: Negative

Potential Use: Component in face-brick mixtures.

SAMPLE: R-3468

County: Powhatan

Locality: Roadcut, 2.2 miles south of Trenholm, on the southeast side of State Road 630 approximately 1.6 miles by road northeast of its intersection with U. S. Highway 60.

Description: Orange plastic clay, mottled with minor amounts of yellow clay, is present in a long roadcut, and has a maximum exposed thickness of 4 feet. Four feet of additional orange clay, mottled with greater amounts of yellow clay, was indicated by augering to that depth at the base of the exposure. The augered clay becomes sandy, micaceous, and less plastic with depth.

Formation or Age: Residual clay

Sampled Interval: Composite of four representative channel samples in the highest part of the exposure approximately 45 feet apart, and 4 feet of augered clay.

Raw Properties:

Water of plasticity: 31.5%
Drying shrinkage: 5.0%
Drying defects: none

Working properties: moderate
plasticity
Dry strength: fair
pH: 5.4

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Abs. | % Appar. Porosity | Bulk Dens. gm/cc |
|--------------|-----------|---------------|----------------------|-----------|----------------------|---------------------|
| 1800 | Tan | 2 | 5.0 | 35.5 | 49.3 | 1.39 |
| 1900 | Tan | 2 | 7.5 | 32.8 | 47.6 | 1.45 |
| 2000 | Tan | 2 | 7.5 | 30.9 | 46.4 | 1.50 |
| 2100 | Lt. brown | 3 | 10.0 | 20.8 | 36.4 | 1.75 |
| 2200 | Brown | 4 | 12.5 | 20.5 | 35.5 | 1.73 |
| 2300 | Dk. brown | 5 | 12.5 | 20.2 | 35.1 | 1.74 |

Other tests and remarks: No effervescence with HCl; high absorption at all firing temperatures.

Bloating Test: Negative

Potential Use: Component in face-brick mixtures.

SAMPLE: R-3469

County: Powhatan

Locality: Roadcut, 0.95 mile west of Tobaccoville, on the south side of State Highway 13 approximately 0.2 mile by road east of its intersection with State Road 648.

Description: Red, sandy and micaceous clay, mottled in places with yellow and orange clay, is present in a roadcut 525 feet long, and has a maximum exposed thickness of 8 feet. A small pegmatite dike is present in the northeastern end of the roadcut.

Formation or Age: Residual clay

Sampled Interval: Composite of two representative channel samples in the highest part of the exposure, approximately 40 feet apart.

Raw Properties:

Water of plasticity: 32.9%

Drying shrinkage: 5.0%

Drying defects: none

Working properties: moderate plasticity

Dry strength: fair

pH: 5.3

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Abs. | % Appar. Porosity | Bulk Dens. gm/cc |
|--------------|-----------|---------------|----------------------|-----------|----------------------|---------------------|
| 1800 | Lt. brown | 2 | 7.5 | 32.8 | 46.6 | 1.42 |
| 1900 | Lt. brown | 2 | 7.5 | 31.5 | 45.7 | 1.45 |
| 2000 | Lt. brown | 2 | 7.5 | 29.6 | 44.1 | 1.49 |
| 2100 | Lt. brown | 3 | 10.0 | 24.2 | 39.0 | 1.61 |
| 2200 | Brown | 4 | 12.5 | 22.8 | 37.4 | 1.64 |
| 2300 | Brown | 4 | 12.5 | 21.5 | 35.5 | 1.65 |

Other tests and remarks: No effervescence with HCl; high absorption at all firing temperatures.

Bloating Test: Negative

Potential Use: Component in face-brick mixtures.

SAMPLE: R-3470

County: Powhatan

Locality: Roadcut, 1.6 miles north of Moseley, on the northwest side of State Road 634 approximately 1.2 miles by road northeast of its intersection with State Road 618.

Description: Red, slightly plastic clay, mottled with yellow clay, is present in a roadcut 800 feet long, and has a maximum exposed thickness of 6 feet. The clay becomes less plastic toward the bottom of the exposure; quartz fragments are present in the bottom 2 feet.

Formation or Age: Residual clay

Sampled Interval: Representative channel sample in the highest part of the exposure.

Raw Properties:

Water of plasticity: 29.0%

Drying shrinkage: 7.5%

Drying defects: none

Working properties: moderate plasticity

Dry strength: fair

pH: 5.1

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Abs. | % Appar. Porosity | Bulk Dens. gm/cc |
|--------------|------------|---------------|----------------------|-----------|----------------------|---------------------|
| 1800 | Tan | 2 | 7.5 | 28.0 | 43.4 | 1.55 |
| 1900 | Tan | 2 | 7.5 | 27.5 | 43.1 | 1.56 |
| 2000 | Tan | 2 | 7.5 | 26.1 | 41.8 | 1.60 |
| 2100 | Lt. brown | 3 | 10.0 | 22.0 | 37.4 | 1.70 |
| 2200 | Brown | 4 | 10.0 | 20.0 | 35.0 | 1.75 |
| 2300 | Gray-brown | 5 | 10.0 | 19.6 | 34.5 | 1.76 |

Other tests and remarks: No effervescence with HCl; high absorption at all firing temperatures.

Bloating Test: Negative

Potential Use: Component in face-brick mixtures.

SAMPLE: R-3471

County: Powhatan

Locality: Railroad cut, 0.5 mile south of Clayville, on the southeast side of State Road 622 approximately 1.1 miles by road north of its intersection with State Road 639.

Description: Yellow-orange plastic clay, mottled with gray, red and yellow clay, is present in a long railroad cut and in a small gully, and has a maximum exposed thickness of 8 feet.

Formation or Age: Residual clay

Sampled Interval: Composite of grab samples believed representative of material in the railroad cut and gully.

Raw Properties:

Water of plasticity: 27.7%

Drying shrinkage: 5.0%

Drying defects: none

Working properties: moderate plasticity

Dry strength: fair

pH: 4.8

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Abs. | % Appar. Porosity | Bulk Dens. gm/cc |
|--------------|------------|---------------|----------------------|-----------|----------------------|---------------------|
| 1800 | Tan | 2 | 5.0 | 27.0 | 43.2 | 1.60 |
| 1900 | Tan | 2 | 7.5 | 25.3 | 41.7 | 1.65 |
| 2000 | Tan | 3 | 7.5 | 22.7 | 39.0 | 1.72 |
| 2100 | Lt. brown | 4 | 12.5 | 17.6 | 32.9 | 1.87 |
| 2200 | Brown | 5 | 12.5 | 15.2 | 29.3 | 1.93 |
| 2300 | Gray-brown | 6 | 12.5 | 13.2 | 26.1 | 1.98 |

Other tests and remarks: No effervescence with HCl; should fire to "MW" face brick specifications at about 2300°F; poor color.

Bloating Test: Negative

Potential Use: Face brick.

SAMPLE: R-3472

County: Powhatan

Locality: Roadcut, 1.0 mile west of Subletts, on the southeast side of State Road 614 approximately 0.5 mile by road southwest of its intersection with State Road 711.

Description: Red, micaceous clay is present in a long roadcut, and has a maximum exposed thickness of 9 feet. The clay is mottled with green and yellow-orange clay and variegated with red, white, and green silty and micaceous clay in the southern part of the cut. Some relict structures are present. Four feet of additional red, micaceous and sandy clay was indicated by augering to that depth at the base of the exposure.

Formation or Age: Residual clay and saprolite

Sampled Interval: Composite of two representative channel samples, 4 and 5 feet long and 4 feet of augered clay.

Raw Properties:

Water of plasticity: 27.5%

Drying shrinkage: 5.0%

Drying defects: none

Working properties: moderate plasticity

Dry strength: fair

pH: 5.7

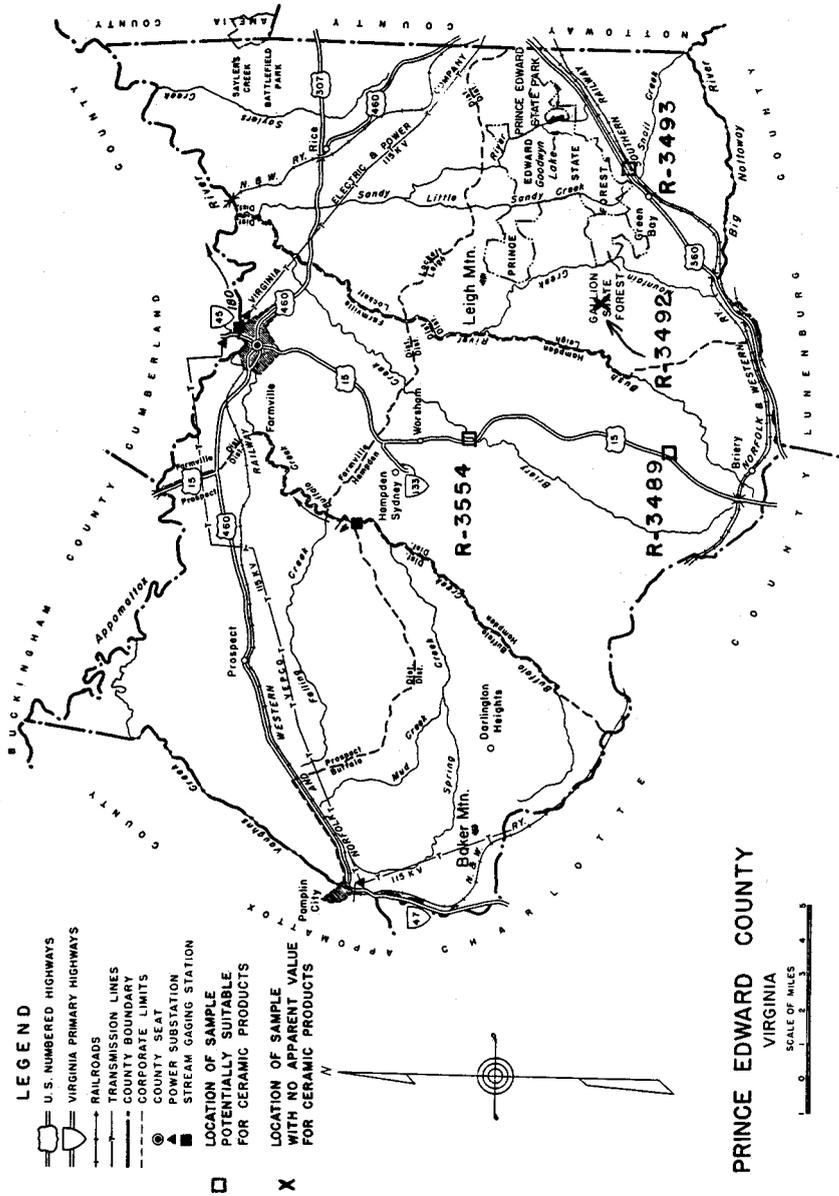
Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Abs. | % Appar. Porosity | Bulk Dens. gm/cc |
|--------------|-----------|---------------|----------------------|-----------|----------------------|---------------------|
| 1800 | Lt. brown | 2 | 5.0 | 31.7 | 46.3 | 1.46 |
| 1900 | Lt. brown | 2 | 5.0 | 28.9 | 43.9 | 1.52 |
| 2000 | Lt. brown | 3 | 5.0 | 25.8 | 40.8 | 1.58 |
| 2100 | Brown | 4 | 7.5 | 21.4 | 36.4 | 1.70 |
| 2200 | Dk. brown | 5 | 10.0 | 20.7 | 35.3 | 1.71 |
| 2300 | Dk brown | 6 | 10.0 | 17.2 | 30.6 | 1.78 |

Other tests and remarks: No effervescence with HCl; high absorption at all firing temperatures.

Bloating Test: Negative

Potential Use: Component in face-brick mixtures.



Location Map of Prince Edward County

PRINCE EDWARD COUNTY

Samples were collected from four localities in Prince Edward County. Testing by Morse Laboratories indicates the following potential uses for the raw material:

| <u>Sample</u> | <u>Formation or Age</u> | <u>Potential Use</u> |
|---------------|-------------------------|--|
| R-3489 | Residual clay | Nonplastic component |
| R-3492 | Residual clay | None in structural clay products |
| R-3493 | Residual clay | Brick and tile |
| R-3554 | Residual clay | Most structural clay products, including face or decorative brick; sewer pipe* |

*If total shrinkage is reduced.

SAMPLE: R-3489

County: Prince Edward

Locality: Roadcut, 2.5 miles north of Briery, on the north side of State Road 634 approximately 0.35 mile by road east of its intersection with U. S. Highway 15.

Description: Red, plastic clay, which is slightly gritty with quartz fragments and mottled with minor yellow and brown clay, is present in a roadcut 350 feet long, and has a maximum exposed thickness of 3 feet. Four feet of additional slightly silty plastic clay and lighter orange to dull-white clay was indicated by augering to that depth at the base of the exposure.

Formation or Age: Residual clay

Sampled Interval: Composite of representative channel sample in the highest part of the exposure and 4 feet of augered clay.

Raw Properties:

| | |
|----------------------------|-------------------------|
| Water of plasticity: 41.1% | Plasticity: good |
| Drying shrinkage: 9.8% | Workability: good |
| Drying properties: good | Dry strength: 358.3 psi |
| pH: 5.0 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Red-brown | 2 | 13.2 | 25.7 | 1.66 |
| 2000 | Orange-red | 5 | 15.1 | 20.6 | 1.79 |
| 2100 | Orange-red | 7 | 20.5 | 11.9 | 2.15 |
| 2200 | Orange-red | 7 | 20.4 | 10.0 | 2.27 |

Other tests and remarks: Fair extrusion (mealy); CaCO₃ test slightly positive; L.O.I. 16.3%; surface cracking.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 99.2 | 30.9 |
| 2000 | 90.5 | 32.2 |
| 2100 | 98.6 | 28.2 |
| 2200 | 97.3 | 25.0 |

Potential Use: Possible as a nonplastic component.

SAMPLE: R-3492

County: Prince Edward

Locality: Roadcut, 3.4 miles northwest of Green Bay, on the east side of State Road 628 approximately 1.4 miles by road north of its intersection with State Road 632.

Description: Yellow and red, plastic, micaceous clay, variegated with yellow, brown and gray clay, is present in a roadcut 525 feet long, and has a maximum exposed thickness of 5 feet. The clay contains quartz fragments and becomes less plastic towards the bottom of the exposure where the clay is increasingly micaceous.

Formation or Age: Residual clay

Sampled Interval: Composite of two representative channel samples in the highest part of the exposure, approximately 45 feet apart.

Raw Properties:

| | |
|----------------------------|-----------------------|
| Water of plasticity: 31.3% | Plasticity: fair |
| Drying shrinkage: 5.3% | Workability: short |
| Drying properties: fair | Dry strength: 223 psi |
| pH: 5.3 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|--------------|---------------|----------------------|-----------------|---------------------|
| 1900 | Orange-brown | 1 | 7.2 | 29.7 | 1.53 |
| 2000 | Brown-orange | 2 | 7.8 | 27.6 | 1.57 |
| 2100 | Orange-brown | 2½ | 9.2 | 23.1 | 1.69 |
| 2200 | Dk. orange | 3 | 10.8 | 21.2 | 1.76 |

Other tests and remarks: Fair extrusion (mealy); CaCO₃ test slightly positive; L.O.I. 13.0%.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 93.0 | 30.2 |
| 2000 | 92.4 | 29.9 |
| 2100 | 99.8 | 30.1 |
| 2200 | 100.5 | 29.9 |

Potential Use: None in structural clay products.

SAMPLE: R-3493

County: Prince Edward

Locality: Railroad cut, 1.1 miles northeast of Green Bay, off the southeast side of U. S. Highway 360 at its intersection with State Road 694.

Description: Red, plastic clay, mottled with yellow clay in the top half and containing minor amounts of partly weathered schists, is present in a roadcut 785 feet long, and has a maximum exposed thickness of 10 feet. Four feet of additional red, plastic clay, which becomes lighter in color and less plastic with depth, was indicated by augering to that depth at the base of the exposure.

Formation or Age: Residual clay

Sampled Interval: Composite of two representative channel samples in the highest part of the exposure, approximately 50 feet apart, and 4 feet of augered clay.

Raw Properties:

| | |
|----------------------------|-------------------------|
| Water of plasticity: 47.3% | Plasticity: excellent |
| Drying shrinkage: 10.0% | Workability: excellent |
| Drying properties: good | Dry strength: 156.5 psi |
| pH: 5.7 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|-------------------|---------------|----------------------|-----------------|---------------------|
| 2000 | Lt. orange-brown | 3 | 10.0 | 26.9 | 1.53 |
| 2100 | Buff | 4 | 10.0 | 26.9 | 1.55 |
| 2200 | Orange-brown | 5 | 16.5 | 20.6 | 1.73 |
| 2300 | Med. orange-brown | 6 | 18.6 | 19.6 | 1.76 |

Other tests and remarks: Extrudes well; L.O.I. 9.9%; good color range; nonplastic grog would probably lower the water of plasticity.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 2000 | 108.6 | 32.9 |
| 2100 | 107.9 | 27.5 |
| 2200 | 126.0 | 16.5 |
| 2300 | 131.7 | 13.1 |

Potential Use: Probable in brick and tile.

SAMPLE: R-3554

County: Prince Edward

Locality: Roadcut, 1.5 miles south of Worsham, on the east side of U. S. Highway 15 approximately 1.0 mile northwest of its intersection with State Road 630 leading southeast.

Description: Chocolate-red to red-brown plastic clay and bits of shale are present in a roadcut 135 feet long, and have a maximum exposed thickness of 9 feet. Some manganese staining is present. The clay is derived from sedimentary rocks of Triassic age.

Formation or Age: Residual clay

Sampled Interval: Representative channel sample in the highest part of the exposure.

Raw Properties:

| | |
|----------------------------|-----------------------------------|
| Water of plasticity: 28.6% | Plasticity: good |
| Drying shrinkage: 5.3% | Workability: smooth, fine texture |
| Drying properties: good | Dry strength: 306 psi |
| pH: 6.7 | |

Slow Firing Test:

| Temp. ° F | Color | Hard- ness | % Total Lin. Shk. | % Absorption | Bulk Dens. gm/cc |
|--------------|-----------|---------------|----------------------|-----------------|---------------------|
| 1900 | Lt. brown | 3 | 7.0 | 21.0 | 1.73 |
| 2000 | Red-brown | 5 | 7.8 | 18.4 | 1.79 |
| 2100 | Dk. brown | 7+ | 12.0 | 8.0 | 2.12 |
| 2200 | Brown-red | 7+ | 12.8 | 7.4 | 2.14 |

Other tests and remarks: Excellent extrusion; L.O.I. 7.3%; excellent color range. Total shrinkage can be reduced by the addition of a nonplastic grog.

Bloating Test:

| Temp. ° F | Weight Lb./ft. ³ | % Absorption |
|--------------|--------------------------------|-----------------|
| 1900 | 127.3 | 10.9 |
| 2000 | 127.3 | 8.2 |
| 2100 | 139.1 | 2.7 |
| 2200 | 152.2 | 1.1 |

Potential Use: Probable in most structural clay products, including face or decorative brick. Possible in sewer pipe if the total shrinkage is reduced.

APPENDIX I
STRUCTURAL CLAY PRODUCTS

| 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 |

APPENDIX II
CRITERIA USED IN EVALUATING MATERIAL FOR STRUCTURAL CLAY PRODUCTS

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

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

| | Roofing tile | Floor tile | Flue lining (Flue tile) | Architectural Terra-cotta | Sewer pipe |
|---------------------------|------------------------------------|------------------------------------|------------------------------------|------------------------------------|------------------------------------|
| <i>Unfired properties</i> | | | | | |
| Workability | Plastic to very plastic and smooth | Plastic to very plastic and smooth | Plastic to very plastic and smooth | Very plastic and smooth | Plastic to very plastic and smooth |
| Water of plasticity % | 15-35 | 15-35 | 15-40 | 18-35 | 15-35 |
| Green strength | | | | | |
| Wet | Average to high |
| Dry | Average to high |
| Drying characteristics | No warping or cracking |
| Drying shrinkage %* | 0-8 | 0-8 | 0-8 | Up to 8 | 0-8 |
| <i>Fired properties</i> | | | | | |
| Maturing temp. °F | 1800-2200 | 1800-2200 | 1800-2400 | 2000-2200 | 1800-2100 |
| Hardness | (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 | Bufs, reds, browns | Reds, buf's, dark browns | Bufs, 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
PRINCIPAL TYPES OF POTTERY

| | Fired colors | Uses |
|--|--|--|
| <i>Whiteware</i> | | |
| Mixes of white burning clays, feldspars, flint, etc. | White (colors obtained by glazes, body pigments, etc.) | Table ware, sanitary ware, porcelain, etc. |
| <i>Stoneware</i> | | |
| Gray to buff clays | Variety of colors, glazed and decorated | Kitchen ware, chemical stoneware, etc. |
| <i>Earthenware</i> | | |
| Red-buff burning clays | Red to buff, glazed and unglazed | Kitchen ware, garden-ware, etc. |
| <i>Artware</i> | | |
| Various clays | Variety of colors, glazes and decorations | Decoration |

APPENDIX IV
CRITERIA USED IN EVALUATING MATERIAL FOR POTTERY CLAYS

| | Stoneware | Earthenware | Artware |
|---------------------------|---|--|--|
| <i>Unfired properties</i> | | | |
| Workability | Highly plastic and smooth working | Highly plastic and smooth working | Very plastic and smooth working |
| Water of plasticity | Not critical | Not critical | Not critical |
| <i>Green strength</i> | | | |
| Wet and dry | Average | Average | Above average |
| Drying characteristics | Dry free from defects under controlled drying | Dry free from defects at normal drying rates | Dry free from defects at normal drying rates |
| % Drying shrinkage* | 3-12 | 3-8 | 0-15 |
| <i>Fired properties</i> | | | |
| Maturing temp. °F. | 1800-2500 | 1800-2300 | 1800-2100 |
| % Shrinkage* | 0-8 | 1-8 | 0-20 |
| % Absorption (unglazed) | 0-2 | 0-2 | Not critical |
| Colors | Whites, blues, yellows, etc. | Buff and grays | Variety |
| | | Reds, browns, and buff | |

*Total shrinkage of both green and fired properties should not exceed 12 percent except for artware.

APPENDIX V
CRITERIA USED IN EVALUATING MATERIAL FOR LIGHTWEIGHT AGGREGATE

| | 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.

APPENDIX VI
FIRECLAY REFRACTORY BRICK CLASSIFIED ACCORDING TO CLASSES AND SUBDIVIDED INTO TYPES

| Class | Type | Pyro-metric Cone Equivalent, min | Panel 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 | 31½ | — | — | — | — | — |
| | Spall resistant | 31½ | 10 at 2910 F (1599 C) | — | — | 500 (0.352) | — |
| | Slag resistant | 31½ | — | — | — | 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 (1349 C) | — | 300 (0.211) | Silica content, min, 72 per cent | |
| Medium duty | — | 29 | — | — | — | 500 (0.352) | — |
| Low duty | — | 15 | — | — | — | 600 (0.422) | — |

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

GLOSSARY

- absorption**—The relationship of the weight of water absorbed by a ceramic specimen to the weight of the specimen before immersion in water, expressed as a percent.
- apparent porosity**—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.
- 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
- 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 feet.

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.I.)—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.

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 materials 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 reached, then firing 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.)

stoneware—Fine-textured ceramic products, either vitreous or semivitreous, generally made from low-grade plastic fireclay.

structural clay products—Any of a class of load-bearing, ceramic building units.

surface checking—Fine cracks on a fired ceramic surface.

water of plasticity—The percent of water required to make a clay material plastic.

workability—The consistency and moldability of plastic ceramic materials.