MISSISSIPPI
STATE GEOLOGICAL SURVEY

WILLIAM CLIFFORD MORSE, Ph. D.
Director

BULLETIN 54

PONTOTOC COUNTY MINERAL RESOURCES

GEOLOGY

By

RICHARD RANDALL PRIDDY, Ph.D.

TESTS

By

THOMAS EDWIN McCUTCHEON, B. S., Cer. Engr.

UNIVERSITY, MISSISSIPPI

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Prepared in cooperation with the Pontotoc County citizens and the WPA as a report on O. P. 65-1-62-137

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MISSISSIPPI GEOLOGICAL SURVEY

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LETTER OF TRANSMITTAL

Office of the Mississippi Geological Survey
University, Mississippi
May 20, 1943

To His Excellency,
Governor Paul Burney Johnson, Chairman, and
Members of the Geological Commission

Gentlemen:

Herewith is Bulletin 54, Pontotoc County Mineral Resources, Geology by Richard Randall Priddy, Ph.D., and Tests by Thomas Edwin McCutcheon, B.S. Cer. Engr., which is published as a fulfillment in part of the Mississippi State Geological Survey's pledge to secure, as heretofore, WPA Federal aid, not in the form of money but rather in the form of labor supply.

As in all other county surveys, attention was directed first to the stratigraphic succession of the geologic formations and their distribution—a procedure, now that many counties have been surveyed, that will enable the State Geological Survey readily to survey the gaps between these counties.

Pontotoc County is one of the few counties that has the distinction of mining and processing within its limits its own raw mineral resources; the Mississippi Minerals Company mines the important Benonite (clay) bed discovered near the County Seat of Pontotoc by Fredric Francis Mellen and manufactures it into bonding clay for molding sand under the trade name of "Dixie Bond," for which purpose it is said to be superior to any Bentonite for certain applications.

Pontotoc County also has the distinction of having the largest deposits of known Bauxite in the State—deposits that were surveyed and tested in 1922-23 by William Clifford Morse and Paul Franklin Morse, father and late son. At the request of the late Director of the State Geological Survey, Dr. E. N. Lowe, the results of these investigations were prepared in 1923 by Paul Franklin Morse, Assistant State Geologist in 1921, for publication as Bulletin 19, The Bauxite deposits of Mississippi. Due to the dire need of aluminum especially in the manufacture of airplanes in the present emergency, it now seems that the Government or a Government subsidized corporation may after all these years utilize these medium to low grade bauxite ores. Attempts were made by the present county survey to extend the known limits of these bauxite deposits by drilling some 38 test holes; and the geologic map of the Midway-Wilcox contact line as well as all the records of all the test holes were, in advance of the present publication, placed at the disposal of the men of the U. S. Geological Survey-Bureau of Mines in their attempt to extend the known limits of the deposits.

Although the shallow Cretaceous beds having a thickness of only 1800 to 2000 feet beneath the town of Pontotoc probably are fresh water-bearing and, consequently, have little likelihood of containing oil in the small structure 2 miles east of the town, nevertheless the possibility of this surface structure reflecting a similar structure in the deeper Paleozoic beds that might have served as an oil trap, while so much of the oil was escaping northeastward in Tishomingo County as described in Bulletin 23, Paleozoic rocks, by William Clifford Morse, must always be kept in mind. Oil is not only important, it is a vital mineral in the prosecution of the War.

Although the tests of the clays of Pontotoc County fail to show clays of as high quality as the surface exposures would seem to indicate, nevertheless they do show clays of certain beds or certain areas to be of special value, but in every instance the clays should be fully tested at the specific location and for the exact use for which it is desired. The tests of some of the buff burning (dense bodied) clays of the Fearn Springs formation have excellent possibilities in the field of ceramic products where resistance to thermal shock is important—as a bond clay for spark plugs, high tension insulators, electrical porcelain, chemical porcelain, crucibles, gas and electric grids, and oven ware. Other types of ware not requiring a perfectly white body such as cream dinner ware, sanitary ware, art pottery, and faience are products requiring such a clay. Buff burning (open bodied) clays of the Fearn Springs formation are especially suited for making high-grade buff face brick, facing tile in glazed and natural finishes, building block, faience, buff flower pots, flue lining, chimney blocks, garden pottery, as well as stoneware, art pottery, floor tile, roofing tile, and earthen ware.

Strangely enough, only a single sample (N 199 2-3) of a kaolinitic slightly bauxitic clay is of high quality—alumina 40.70 percent and iron 1.29 percent. The washed clay has possibilities as a filler in rubber, paper, oil cloth, linoleum; the crude clay, for the production of alumina and alumina salts by processes now in development.

As in all other county surveys, the civic and other organizations and the individual citizens lent their support to the prosecution of the survey. Senator Grady Cook, the genial editor of the Pontotoc Progress, was ever ready to assist in any part of the cooperative undertaking. Mr. Ivan L. Greene, Manager of the local plant, and Mr. N. J. Dunbeck, Vice President of the Eastern Clay Products Inc., Eifort, Ohio, lent every encouragement and especially supported the local civic organizations. To all these the Director of the Mississippi Geological Survey wishes to express his appreciation.

Very sincerely yours,

William Clifford Morse,
State Geologist and Director

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GEOLOGY

RICHARD RANDALL PRIDDY, Ph.D.

INTRODUCTION

Pontotoc County lies in northeast Mississippi (Figure 1). It is bounded on the north by Union County, on the east by Lee County, on the south by Chickasaw and Calhoun Counties, and on the west

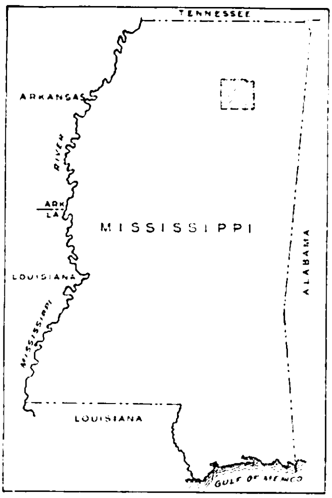

Figure 1.—Pontotoc County.

by Calhoun and Lafayette Counties. It has an area of 494 square miles and had a population in 1940 of 22,904. The incorporated towns are Pontotoc, the county seat, which is situated just north-east of the center, Ecru near the Union County line, and Sherman in the extreme northeast corner, which have populations of 1,832, 601, and 449 respectively. Small villages mentioned in this report are Thaxton and Esperanza (Hurricane) in the northwest; Randolph, Robbs, Buckhorn, Springville, and Matthews in the southwest; Endville, Bankhead, and Longview in the northeast; and Algoma, Wallfield, Gershorm, Plymouth (Black Zion), Furrs, and Troy in the south and east.

PHYSIOGRAPHY

Pontotoc County is crossed from north to south by four alternately rugged and gently undulating physiographic belts, which are, from west to east, North-Central Hills, Flatwoods, Pontotoc Ridge, and Black Prairie.

The North-Central Hills extend from the Bluff Hills, bordering the Yazoo delta, into the west tier of townships (Range 1 East). In Pontotoc County and in adjacent parts of Lafayette County, the belt is underlain by sands, silts, and clays of the Fearn Springs and Ackerman formations of the lower Wilcox series. The higher ridges have elevations of 425 to 550 feet above sea level, 50 to 150 feet above narrow stream valleys in the Wilcox strata or above the broad terraces where the streams have cut into the underlying Porters Creek clays (Plate 1). Some of the Wilcox-capped hills near the east edge of the belt are held up by bedded bauxite or by bauxitic clay of the Betheden residuum of the upper Midway series.

In Pontotoc County, the Flatwoods belt comprises nearly all of the townships in Range 2 East and extends west along some of the stream bottoms into the North-Central Hills area of Range 1 East, and in some places into the hill section of adjacent Lafayette County. The belt is underlain by the dark-colored Porters Creek clay, whose beds offer nearly uniform resistance to weathering and, consequently, produce wide stream terraces and broad low rounded hills, the terraces having elevations of 275 to 400 feet and the hills, elevations of 350 to 500 feet. Comparatively, the belt is more low-lying than the hill belts to the west and to the east.

A rugged belt, the Pontotoc Ridge, comprises most of the townships in Range 3 East and extends into adjacent parts of Ranges 2 and 4 East (Plate 1). The hills are actually roughly parallel north-south cuesta ridges, produced by the differential weathering of west-dipping alternate beds of impure sands, chalks, and limestones of the Ripley, Prairie Bluff, and Clayton formations. Clayton sands and Ripley limestones cap steep east-facing cuestas overlooking assymetrical valleys whose floors are on relatively resistant Ripley limestone and whose gently sloping east walls are weathered Prairie Bluff or Ripley chalk. The most eastern of the cuestas is held up by the lower Ripley limestone. Its dip slope is produced from the Selma-Ripley transitional clay, and the broad valley floor to the east is in the Selma formation which underlies the Black Prairie belt. The ridges have elevations of 450 to 550 feet above sea level, 75 to 125 feet above the narrow valleys in the Ripley strata, or 100 to 150 feet above the broad valleys in the Selma chalk.

The Black Prairie, the most eastern of the physiographic belts (Plate 1), extends from Lee County on the east into the east tier of townships (Range 4 East) of Pontotoc County. This belt is underlain by the Selma chalk, whose clayey phase weathers black, as typically developed to the southeast in a broad gently rolling region from Okolona south to West Point. However, in Pontotoc County, are only two small areas of Black Prairie; one, a low irregular divide (NE. 1/4, T.10 S., R.4 E.) near Furrs; and the other, a gently undulating prairie (E. 1/2, T.11 S., R.4 E.) near the Lee County line east of Troy. The rest of the belt is underlain by purer chalk which has produced broad but low undulating hills and wide terraces which are occupied by many small meandering creeks (Plate 1). The highlands have elevations of 300 to 450 feet above sea level, 25 to 50 feet above the bottomlands.

Pontotoc County lies in four major drainage basins: the Tallahatchie, the Tombigbee, Schooner, and the Yocona.

CULTURE AND INDUSTRY

Two modern highways intersect at Pontotoc, east-west Mississippi Highway 6 and north-south Mississippi Highway 15. Pontotoc is connected with Okolona to the southeast, and Springville and Toccopola to the southwest by the partly improved State Highways 41 and 9, respectively. Fully one-half of the county maintained roads are graveled. The Gulf, Mobile, and Ohio, the only railroad serving the county, closely parallels Mississippi Highway 15.

The chief industry is farming and the chief crop is cotton, but milk production is rapidly replacing cotton as a source of ready cash. Some lumber is being cut to supply local planing mills at Pontotoc and Ecru, and numerous temporary mills are cutting immature timber to meet national defense demands.

Pontotoc County has lately benefited from the mining of bentonitic clay which was discovered by Mellen in 1936.[1] The bentonite crops out beneath a massive limestone along valley walls four miles northeast of the county seat. There the limestone and overlying chalk are stripped away, and the bentonite trucked to a grinding plant at the west edge of Pontotoc, operated by the Mississippi Minerals Company. In west Pontotoc, brick has been made for many years from colluvial material derived from the Clayton formation. Although never worked, deposits of bauxite and bauxitic clay have been prospected and are under lease in the west part of the county, on hilltops situated at or near the contact of the Porters Creek and Ackerman formations (Plate 1). Most of the better known deposits were described by Morse[2] in 1923, and more recent discoveries are cited in a later part of the present report.

STRATIGRAPHY AND AREAL GEOLOGY

The strata in Pontotoc County are the upper Cretaceous (Gulf) series of the Mesozoic group and the Midway (Paleocene) and Wilcox (Eocene) series of the Cenezoic group. Upper Cretaceous units are the Selma, Ripley, and Prairie Bluff formations; Midway units are the Clayton and Porters Creek formations and the Betheden residuum; and Wilcox units are the Fearn Springs and Ackerman formations. In Pontotoc County, the Owl Creek formation, which overlies or merges into the Prairie Bluff in Union and Tippah Counties to the north,[3] is recognized by its fossils and not by its lithology. Since the Owl Creek, Betheden, and Fearn Springs are relatively thin or are developed but locally, they have been omitted from the geologic map (Plate 1).

The following table indicates the grouping and relative ages of the Pontotoc County geologic units and their lithologic subdivisions:

Generalized Section of Exposed Formations In Pontotoc County

Group	System and (Series)	Formation	Member or Phase	Character and thickness in feet
Cenezoic	Eocene (Wilcox)	Ackerman	Upper	Sands, buff micaceous cross-bedded; lower part exposed in Pontotoc County; probably 300 feet in thickness in Lafayette County 25-50
			Middle	Light-colored silts, carbonaceous clays, silty or re-worked lignites, flaky lignitic clays 75-100
			Lower	Sands, buff micaceous cross-bedded; basal coarse sands and gravel or contorted beds of silts, sands and clay breccia 75-125
		Unconformity		
		Fearn Springs		Continental light or dark clays, silts, and sands; carbonaceous and lignitic in mid-portion; re-worked bentonite or bentonitic clay at several horizons; freshwater molluscs near top 0-75
		Unconformity		
	Paleocene (Midway)	Porters Creek	Betheden residuum	Weathered silts, silty sands, kaolinitic clays, bauxitic clays, and bedded bauxite 0-50
			Upper	Greenish-black micaceous silt lenses (Naheola of Mellen) and subordinate lenses of black clay and gray clayey silt 100-250
			Middle	Black montmorillonitic clay and subordinate lenses of gray micaceous silty clay or greenish-black micaceous silt 150-200
			Lower	Gray or greenish-buff calcareous, glauconitic coarse sands interbedded with greenish-buff waxy clays, greenish-black micaceous silts, and dark-colored montmorillonitic clays 30-50
		Clayton		Medium to coarse glauconitic sands; weathered brick-red; sandy fossiliferous limestone at several horizons; base marked by re-worked shells replaced by clay 50-90
	Unconformity			
Mesozoic	Cretaceous (Gulf)	Prairie Bluff	Upper	Sand, silty light-buff lenses of fossiliferous silty chalk (Owl Creek facies) 5-35
			Middle	Clay, greenish-buff chalky very fossiliferous 20-35
			Lower	Chalk, silty gray-blue fairly fossiliferous; zone of phosphatic molds at base 10-35
		Unconformity		
		Ripley	Upper Unconformity	Limestone, sandy very fossiliferous 0-20
			Middle	Sand, massive micaceous unfossiliferous; overlain by thin chalky limestone lenses and bentonitic clay 0-75
				Fossiliferous limestone lenses underlain by unfossiliferous sands and silty lignites 0-50
				Lenses of marl, chalky silt, and slightly glauconitic sands 0-50
			Lower	Lenses of very fossiliferous chalk and chalky limestone in micaceous sand 30-50
			Lower (transitional) Clay	Clay, dark-gray jointed limy; assemblage of dwarf molluscs 40-50
		Selma	Upper	Chalk, silty blue-black micaceous; weathers gray; fairly fossiliferous 25-50
			Lower	Chalk, slightly silty gray-blue; local clayey phases produce "black prairies"; lenses of nearly pure chalk cap bald hills 100-150

SELMA FORMATION

The name Selma was suggested in 1894 by Smith, Johnson, and Langdon[4] to succeed the descriptive term "Rotten limestone" which had been proposed by Winchell in 1847[5] for the cresentic Cretaceous chalk belt which crosses Alabama and northeast Mississippi and dies out to the north in Tennessee. In the more southern part of the outcrop belt in Mississippi, the chalk is nearly homogenous; but in the north area, the lower section is split by tongues of chalky clay and sand. The Pontotoc section of the Black Prairie belt is underlain

Figure 2.—Quarry face of massive chalk in the lower phase of the Selma formation, north side, Mississippi Highway 6 in Lee County, 1.2 miles east of Pontotoc County line. November 26, 1941.

by 125 to 225 feet of the purer upper division, all in the *Exogyra cancellata* zone of Stephenson and Monroe.[6] Two phases of the Selma are recognized in Pontotoc County, a lower slightly silty gray-blue chalk (Figure 2), 100 to 150 feet in thickness, and an upper very silty bluish-black micaceous chalk, 25 to 50 feet in thickness.

LOWER PHASE, SELMA CHALK

The lower phase is comprised of clayey, very silty, or nearly pure chalk lenses. The clayey lenses weather to dark-colored soils of the typical black prairie type which are developed in an irregular area (E. 1/2, T.10 S., R.4 E.) near Furrs and between the Lee County line and Troy (E. 1/2, T.11 S., R.4 E.). Test hole N161 (SW. 1/4, SE. 1/4, SE. 1/4, Sec. 14, T.10 S., R.4 E.) two miles south-southeast of Furrs encountered an interval of this clayey chalk 21.0 feet in thickness and entered silty chalk. Except for Exogyra and Gryphaea of normal size, the fossils in the clayey beds are dwarfed individuals of common Ostrea, Anomia, and Paranomia species. A mile to the west, the overlying purer chalk crops out along the east valley wall of Bob Miller Creek, where N159 (NE. 1/4, NW. 1/4, NE. 1/4, Sec. 22, T.10 S., R.4 E.) tested the beds to a depth of 30.9 feet. Here, barren hillsides are littered with several species of Gryphaea, Exogyra, Ostrea, Anomia, and Paranomia, all of normal size. A mile to the north, gullies on the east wall of the creek have exposed chalky strata rich in *Ostrea plumosa* and *Belemnitella americana,* in addition to the common genera at the above locality. The same chalk beds, lower strata of the purer chalk and lenses of clayey chalk, crop out in the rugged area (SE. 1/4, T.9 S., R.4 E.) south and southwest of Chesterville and in the region of low undulating hills (NE. 1/4, T.10 S., R.4 E.) south of Furrs. Mississippi Highway 6 crosses the outcrop belt of the lower phase from the Lee County line to Furrs and then traverses the broad valley of Muddy Creek which is underlain by strata near the top of the very silty upper phase of the Selma.

UPPER PHASE, SELMA CHALK

The upper very silty bluish-black micaceous phase of the Selma formation has a thickness of 25 to 50 feet. Because of its low resistance to weathering, exposures are confined to creek beds whose broad floodplains occupy virtually all of the normal outcrop belt. Strata showing at a few places in the banks and beds of Coonewah, Muddy, Bob Miller, and Chiwapa Creeks are blue-gray and massive, and are interbedded with thin discontinuous lenses of chalky, silty sand or very micaceous sand. The more silty and sandy portions of the upper phase yield, on weathering, warped beds of red-buff micaceous silty sand, such as those exposed in the steep bluff just east of the creek bridge on Mississippi Highway 6 (NW. corner, Sec. 9, T.10 S., R.4 E.). Here, several auger holes at increasing distances from the outcrop showed progressively less leaching until unweathered blue-black silty micaceous chalk was reached. The unaltered phase was encountered a mile to the northeast in the lower parts of N145 (SW. 1/4, NW. 1/4, SE. 1/4, Sec. 4, T.10 S., R.4 E.) and two miles north-northeast in N143 (SE. 1/4, NE. 1/4, NW. 1/4, Sec. 33, T.9 S., R.4 E.) which tested the overlying Selma-Ripley transitional clay.

RIPLEY FORMATION

The term Ripley was first applied to beds exposed near Ripley in Tippah County in 1860 by Hilgard[7] who referred them to the upper Cretaceous. Subsequently the uppermost of these beds was recognized as the Clayton of the Cenozoic by Harris.[8] The successively lower beds were divided into the Owl Creek, Prairie Bluff, and Ripley formations by Stephenson and Monroe.[9]

In Pontotoc County, the Selma formation grades through the transitional clay into the Ripley Formation, which is unconformably overlain by the Prairie Bluff formation. Although the maximum thickness of the Ripley is 250 to 275 feet, thicknesses of only 25 to 50 feet are recognized in small areas, the variation being partly accounted for by differences in deposition but chiefly by the erosion of 100 to 125 feet of beds in its mid-portion. The formation is dominantly well-bedded micaceous sand which contains lenses of silty chalk, chalky limestone, and sandy limestone at various horizons, and a single bed of bentonite which is capped by a massive limestone at the very top. Although most of the Ripley contains abundant marine fossils, a sandy zone in the mid-portion is unfossiliferous and has several locally developed beds of lignite, indicating continental deposition.

Since the Selma-Ripley transitional clay is easily recognizable and persistent, it has been mapped separately (Plate 1). The remainder of the Ripley is divided, on lithologic and paleontologic bases, into three phases: a lower zone of chalky limestone or sand lenses, 30 to 50 feet in thickness; a middle zone which is dominantly sand, 25 to 175 feet in thickness; and, locally, an upper zone consisting of a well-bedded sandy limestone which may attain a thickness of 20 feet.

TRANSITIONAL CLAY, RIPLEY FORMATION

A well-bedded marine sandy calcareous joint clay forms a transitional zone separating the upper silty phase of the Selma formation and the lowest chalky limestone of the Ripley formation. Its thickness is 40 to 50 feet in its outcrop area north of Mississippi Highway 6, but it thins and becomes less sandy to the south. Conant[10] assigns it a thickness of 50 feet in adjacent Union County and mentions 25 feet (probably the upper part) as being exposed in the southeast corner of Tippah County.[11] This zone is mapped as an individual unit (Plate 1).

The transitional clay, where exposed in fresh roadcuts, is greenish gray, fairly plastic, and poorly laminated. But on weathering, it turns successively greenish-buff, buff, and finally reddish-buff, a color change which aids in distinguishing it from those chalky clay lenses in the lower phase of the Selma formation which produce the Black Prairies to the east. Fragments of a small species of Ostrea and of other pelecypods are common near the base but decrease toward the top. Near the Union County line, the clay contains large irregular nodular concretions of hard limonite-coated chalk.

The outcrop belt of the transitional clay is very irregular and winding (Plate 1). Where it is capped by lower Ripley chalky limestone, it forms steep hillsides, but where it is unprotected it produces broad low rounded hills. The broad floodplains of several of the creeks near the west (downdip) edge of its outcrop belt completely hide the clay. Steep hillside exposures are common near the Union County line, west valley wall of Town Creek one mile west of Sherman (roadcut, NW. 1/4, NE. 1/4, Sec. 27, T.8 S., R.4 E.), where the clay has a thickness of 44.3 feet, and at the base of a hillside roadcut one-half mile east of Troy (west valley wall of Tallabinnela Creek NW. 1/4, NW. 1/4, Sec. 22, T.11 S., R.4 E.), in the southeast corner of the county, where a thickness of only 24.6 feet was measured in the test hole N178. Low rounded hills, composed entirely of the transitional clay, are crossed by Mississippi Highway 41, southeast of Troy (Secs. 34, and 27, T.11 S., R.4 E.); by the Woodland-Tupelo road (Secs. 1 and 2, T.11 S., R.4 E.); by the Endville-Sherman road in the northeast corner of the county, and by Mississippi Highway 6, west of Furrs (crossroads, N. 1/2, Sec. 9, T.10 S., R.4 E.). Holes N143 and N145, along the north-south road connecting Longview and Mississippi Highway 6, tested 21.0-foot and 39.8-foot intervals, respectively, of the lower clay beds.

LOWER ZONE, RIPLEY FORMATION

The lower zone of the Ripley formation is 30 to 50 feet in thickness. It consists of interfingered lenses of micaceous chalky sand and fairly fossiliferous silty chalk or chalky limestone. Whereas the sands produce gentle slopes or broad valleys, the limestones and chalks are more resistant and produce benches on hillsides or hold up knobby ridges. The sands weather red-buff, similar to those in the overlying middle Ripley zone, into which they grade, but the sandy limestones weather gray-white and form alternate projecting and receding ledges, which distinguish them from other exposures of like lithology in Pontotoc County.

Areas underlain by the sandy facies form the broad terrace of Bob Miller Creek two miles west of Furrs (Sec. 5, T.10 S., R.4 E.), the flat upper reaches of Coonewah Creek west of Endville (Secs. 5 and 8, T.9 S., R.4 E.), the broad bottomlands of Chiwapa Creek southwest of Plymouth (Secs. 20 and 21, T.10 S., R.4 E.), and the low divides between Sherman and Chesterville (NE. 1/4, T.9 S., R.4 E.). In contrast, the more resistant limestone lenses form steep valley walls or east facing cuestas along these and other creeks.

Some of the best exposures of the lower Ripley limestone are in the vicinity of Troy, in the southeast part of the county. Just east of that village, the steep west valley wall of Tallabinnela Creek exposes alternate ledges of sandy limestone and hard silty chalk 48.9 feet in thickness. Here, N178, drilled to a depth of 62.8 feet, tested the lower 21.9-foot interval of the limy facies, above the Selma-Ripley transitional clay. This section is very fossiliferous and provided a long list of forms which were collected and identified by Stephenson and Monroe[12], and which bear a close resemblance to Wade's[13] Coon Creek facies of the Ripley formation. In this investigation, a larger number of species has been identified, an assemblage which appears characteristic of all lower Ripley limestones in Pontotoc County.

Fossils From the Lower Ripley Limestone, West Valley Wall of Tallabinnela Creek (NE. Corner, Sec. 21, T.11 S., R.4 E.), 0.3 to 0.5 mile East of Troy

Pelecypoda
- Inoceramus species
- Liopistha protexta (Conrad)
- Tenea species
- Lima (2 species)
- Ostrea tecticosta Gabb
- Gryphaea mutabilis Morton
- Exogyra costata Say

Scaphopoda
- Dentalium species

Gastropoda
- Turritella trilira Conrad
- Turritella species
- Liopeplum species
- Pinna species
- Polinices species

Anomia argentaria Morton
Paranomia scabra (Morton)
Pecten mississippiensis Conrad
Cardium stantoni Wade
Cardium kummeli Weller
Cyprimeria alta Conrad
Pholadomya occidentalis Morton

Echinodermata
Linthia variabilis Slocum
Hemiaster slocumi Lambert
Hemiaster ungula (Morton)

Cephalopoda
Baculites tippaensis Conrad
Belemnitella americana (Morton)

Arthropoda
Crab claws and body parts

Vertebrata
Sharks teeth

Two miles south, the chalky limestone holds up a long ridge which is traversed by Mississippi Highway 41, and a mile west of Troy the same beds form the bases of the steep valley walls of Owl Creek. Two miles north of the village, an east-west road (Secs. 3 and 4, T.11 S., R.4 E.) crosses a series of north-south narrow ridges composed of transitional clay and capped by lower Ripley very fossiliferous sandy limestone, which has an aggregate thickness of 44 feet. One mile east, a large Ripley outlier in Section 2 is held up by the same strata.

East of Pontotoc, fossiliferous lower Ripley limestones are exposed in the bed and at the base of the west valley wall of Bob Miller Creek (Secs. 23, 24, 25, and 36, T.9 S., R.3 E., and Sec. 6, T.10 S., R.4 E.) for a distance of two miles both upstream and downstream from Mississippi Highway 6. Two miles updip, to the northeast of the creek bridge, very fossiliferous strata cap the north end of a narrow north-south divide (N. 1/2, Sec. 33, T.9 S., R.4 E.), where a recent roadcut furnished numerous casts of the interior of Cardium, Turritella, Cyprimeria, Anomia, and Crassatella, in addition to well preserved *Exogyra costata, Linthia variabilis, Belemnitella americana,* and *Baculites tippaensis.* To the northwest, cuts in a road on the steep west valley wall of Muddy Creek (SE. 1/4, Sec. 19, T.9 S., R.4 E.), a mile west of Longview, expose a section of fairly fossiliferous sandy limestone and hard chalk of the lower Ripley, 44.6 feet in thickness. Similar strata are exposed half-way up the steep southwest valley wall of Coonewah Creek (S. 1/2, Sec. 9, T.9 S., R.4 E.), a mile south of Endville.

MIDDLE ZONE, RIPLEY FORMATION

Strata of the middle zone of the Ripley formation conformably overlie the lower zone and are unconformably overlain by the upper Ripley limestone, or by the Prairie Bluff formation where the limestone has been eroded. The middle zone is comprised chiefly of well-bedded micaceous sand, 50 to 150 feet in thickness, which contains lenses of chalky silts or marls and slightly glauconitic sands in the lower one-third; and sandy limestone lenses, underlain at places by

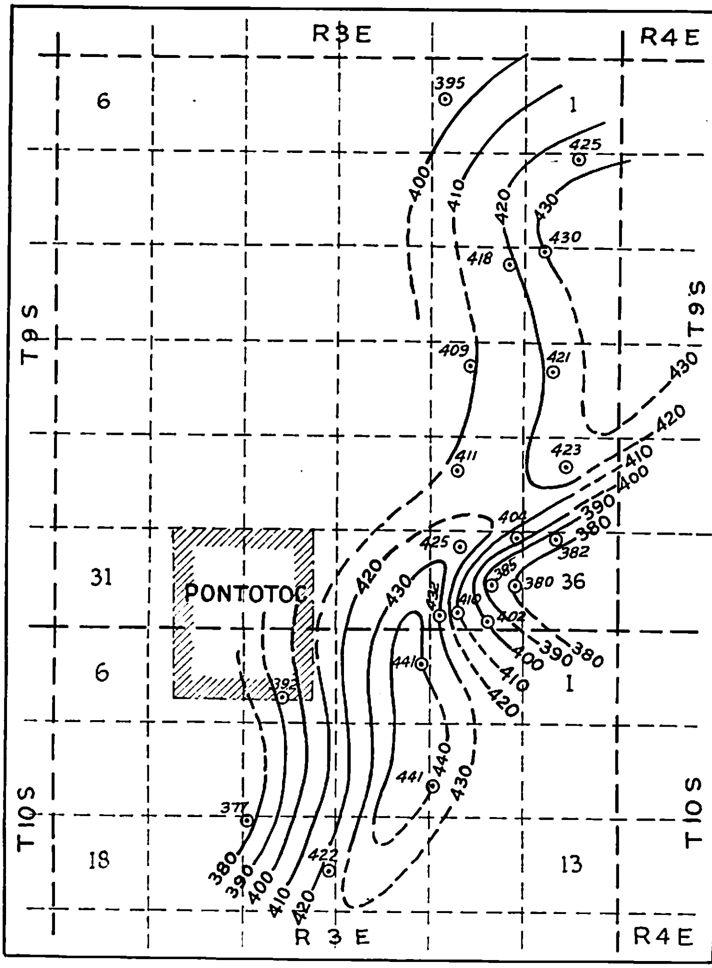

Figure 3.—Structure of area east of Pontotoc—Contoured on the base of the upper Ripley.

unfossiliferous sands and thin lignitic strata, in the mid-portion. The upper one-half of the middle zone is well-bedded fine to medium unfossiliferous sand which is capped by a chalky limestone and a bed of bentonitic clay. However, the full thickness of the zone is accounted for in only limited areas (E. 1/2, T.9 S., R.3 E.) northeast of Pontotoc, in the area underlain by the bentonite. Elsewhere, the bentonite and older beds are eroded, at places to within 50 feet of the base of the zone, so that the very fossiliferous upper Ripley limestone may rest on strata of any given horizon in the upper two-thirds of the division, accounting for the great variation in its thickness. The magnitude of the unconformity is partly reflected by a reverse (east) dip (Figure 3) of 50 feet per mile which was recognized by the relative elevations of basal upper Ripley beds (S. 1/2, Sec. 35, T.9 S., R.3 E.), 2 miles east of Pontotoc, adjacent to Mississippi Highway 6.

The only strata of the entire middle Ripley zone to escape erosion in Pontotoc County are the chalky silt or marl lenses and the slightly glauconitic sands which are concentrated near its base. These beds crop out to best advantage along a north-south road 2 miles southwest of Chesterville; near the top of the steep west wall of Muddy Creek (SE. 1/4, Sec. 19, T.9 S., R.4 E.), 1 mile west of Longview, and at both roadforks in Troy (Secs. 16 and 21, T.11 S., R.4 E.). They have also been tested by 16 auger holes, among them N48 and N65 (E. 1/2, SE. 1/4, NW. 1/4, Sec. 19, T.10 S., R.4 E. and NW. 1/4, SE. 1/4, SW. 1/4, Sec. 19, T.9 S., R.4 E., respectively).

In the south one-half of the outcrop belt, lenses of very sandy limestone have a position in the mid-portion of the zone. A sparingly fossiliferous lens is exposed in a roadcut 400 feet southwest of the intersection of a local road and Mississippi Highway 41 (N. 1/2, SE. 1/4, SW. 1/4, Sec. 26, T.10 S., R.3 E.), about 6 miles southeast of Pontotoc. The same lens was uncovered during the construction of a new bridge (Cen., NW. 1/4 NE. 1/4, Sec. 2, T.11 S., R.3 E.), 1.5 miles to the south; and 2.2 miles farther south, it was penetrated in a recently dug water well (SW. corner, Sec. 12, T.11 S., R.3 E.). Along Highway 41, 3 miles southeast of Pontotoc, a highly calcareous sandstone containing an abundance of Exogyra is exposed beneath a bridge over the middle prong of Chiwapa Creek (E. 1/2, NE. 1/4, SW. 1/4, Sec. 15, T.10 S., R.3 E.).

The lignites and the unfossiliferous sands, indicating the continental origin of some of the middle Ripley strata, lie just below these sandy limestone lenses. A "smut" is the only suggestion of lignite 4 miles southeast of Pontotoc (Sec. 18, T.10 S., R.4 E) where it was once dug for local use, and drilling failed to uncover it 3 miles west of Troy (Sec. 13, T.11 S., R.3 E.) where it had also been mined.

However, thin lenses of bedded lignite and thicker beds of re-worked lignite have been found 2 miles to the north in deep valleys on the J. S. Astin property (NW. 1/4, NE. 1/4, Sec. 12, T.11 S., R.3 E.). Here, hand auger tests showed thicknesses of 1.7 and 2.1 feet of low grade lignite, respectively.

The fine to medium cross-bedded sands in the upper one-half of the middle zone are unfossiliferous, similar to the McNairy sand facies recognized by Stephenson[14] in Tippah County to the north. These sands have a thickness of 25 to 60 feet in the area of narrow divides between Bankhead and Longview (SW. 1/4, T.9 S., R.4 E.), in the "Dozier hills" between Longview and Endville (NW. 1/4, T.9 S., R.4 E.), and in the broad hills traversed by Mississippi Highway 41 from Troy half-way to Pontotoc. In other parts of the normal outcrop belt, the sands are much thinner, due to present topographic position and to extensive erosion before upper Ripley deposition. In weathered roadcuts, all of these sands appear non-calcareous, but auger tests N43, 46, 53, and 61 show limy beds at depth. In the general area of these tests (NE. 1/4, T.10 S., R.3 E.), gully washes in the unfossiliferous sands show several beds of re-worked bentonitic clay, having thicknesses of 0.1 to 0.5 feet. The clays are best exposed along a secondary road (W. 1/2, NE. 1/4, SW. 1/4, Sec. 6, T.10 S., R.4 E.) at the top of the west valley wall of Bob Miller Creek.

The chalky fairly fossiliferous limestone beds, capping the unfossiliferous sands, crop out in a limited area northeast of Pontotoc, in the east one-half of T.9 S., R.3 E. In most of the area, they are directly overlain by bentonitic clay, or by the upper Ripley very fossiliferous limestone where the bentonite has been eroded. Both limestones are exposed in a narrow valley (SE. 1/4, NE. 1/4, NE. 1/4, Sec. 14, T.9 S., R.3 E.).

BENTONITIC CLAY, RIPLEY FORMATION

The bedded bentonitic clay has been assigned a position "in or slightly above a horizon of siliceous limestone of the Ripley formation."[15] The thicker bedded deposits are now being mined by the Mississippi Minerals Company from pits (NW. 1/4, Sec. 23, T.9 S., R.3 E.) along valley walls (Figure 4), four miles northeast of Pontotoc. According to previous investigations by core drilling and according to 27 test holes drilled in the course of this survey, the bentonitic clay appears to underlie parts of Sections 13, 14, 23, 24, 25, and 26, T.9 S., R.3 E. In nine of the holes, the clay averages 3.2

feet; and in the pit, it has a thickness of 1.2 to 8.2 feet. Test N44, near the southeast end of the excavation (SE. 1/4, NE. 1/4, NW. 1/4, Sec. 23, T.9 S., R.3 E.), showed a workable bed 7.0 feet in thickness. In the upper part, the clay is dark-bluish-gray, slightly silty, and slightly limy; but it grades downward into buff, less silty, less limy clay which directly overlies gray-white sandy chalk. Inasmuch as weathered material increases with depth and the base is marked by coarse sand, it appears that the chalk-bentonite contact is unconformable.

Figure 4.—Face of upper Ripley sandy limestone overlying bentonite, Mississippi Minerals Company pit (SE. 1/4, NE. 1/4, NW. 1/4, Sec. 23, T.9 S., R.3 E.), 4 miles northeast of Pontotoc. November 22, 1941.

When freshly cut, the bentonite is gray-blue or greenish-blue, massive, has a blocky to conchoidal fracture and a characteristic waxy feel, and sloughs but little when immersed in water. However, on brief exposure, large fragments crack along the laminae, and weather buff. Throughout the bed, but most abundant near the top, are several genera of thin-shelled dwarfed pelecypods, Cardium, Pectin, Ostrea, and Paranomia, and several species of low-spired gastropods.

Although the bedded bentonite is everywhere overlain by the upper Ripley limestone, 38 tests drilled through the limestone failed to encounter clay. Its absence beneath 90 percent of the upper Ripley exposures is explained by the extensive erosion which preceded upper Ripley deposition and which nearly everywhere cut out the bentonite, the underlying chalk, and a 50-foot to 100-foot interval of the subjacent beds. In contrast, a study of the elevations and of the nature of the middle Ripley-upper Ripley contact shows that the clay's preservation is due either to local downwarping before extensive erosion started, or to irregular deposition in narrow seaways which were isolated during the later stages of regional erosion. Evidences for both explanations are seen in the bentonite pit (Figure 4), where the upper Ripley limestone arches over the thicker beds of clay and sags where the clay is thinner.

MIDDLE RIPLEY-UPPER RIPLEY CONTACT

As stated, west dipping younger strata of the middle Ripley division, having thicknesses up to 100 feet, were locally eroded and a very fossiliferous (upper Ripley) limestone deposited on their beveled edges. The magnitude of the erosion in one area is illustrated by contours on the base of the limestone (Figure 3), which show a sharp east dip, two to three miles east of Pontotoc. Although the reversal is partly due to tilting, it must be partly accounted for by erosion preceding upper Ripley deposition.

The unconformity is fairly extensive, for Stephenson and Monroe[16] cite sections in Union County to the north and in Chickasaw County to the south, in all which younger middle Ripley beds are also cut out. If the erosion were proved regional, the upper Ripley limestone, which is overlain unconformably by the Prairie Bluff, could very well be considered a new formation.

UPPER ZONE, RIPLEY FORMATION

The upper zone of the Ripley formation comprises a well-bedded very fossiliferous sandy limestone. In some areas it is absent, but in others it attains a maximum thickness of 18.4 feet, a variation which is due partly to the uneven surfaces of the eroded middle Ripley beds upon which it was deposited and partly to extensive Ripley-Prairie Bluff erosion. The unit has been recognized by Conant in Union[17] and Tippah[18] Counties to the north, and by Stephenson and Monroe[19] in Pontotoc County and in adjacent parts of Chickasaw County to the south.

The limestone is best exposed above the bentonite in the pits of the Mississippi Minerals Company (NW. 1/4, Sec. 23, T.9 S., R.3 E.), 4 miles northeast of Pontotoc, where its thickness is 12.6 to 18.4 feet (Figure 4). Although the fossil assemblage is similar to that noted in the lower Ripley limestone near Troy, two abundant forms are characteristic, the echinoderm *Hardouinia subquadrata* which is locally called a "star rock," and the large cephalopod Sphenodiscus which is termed a "snail-disc." At the bentonite pit, the echinoderm is most plentiful 2.5 to 3.8 feet below the top of the section and the cephalopod, in the upper 1.5 feet.

Other exposures of the upper Ripley unit in the north part of the county are: along valley walls near the Union County line (NW. 1/4, SW. 1/4, Sec. 29, T.8 S., R.4 E.), where the limestone is frescoed and cavernous; at the heads of gullies (NE. 1/4, Sec. 12, T.9 S., R.3 E.), 7 miles northeast of Pontotoc; along valley walls overlying bentonite (S. 1/2, Sec. 24, T.9 S., R.3 E.) 4 miles northeast of Pontotoc; and on

Figure 5.—Ledge of weathered upper Ripley sandy limestone along road, west valley wall of a small creek (Cen., SW. 1/4, NW. 1/4, Sec. 13, T.11 S., R.3 E.), 3.5 miles west of Troy. November 28, 1941.

the upper and eastern slopes of "Bolton Hill" (N. 1/2, Sec. 25, T.9 S., R.3 E.) 2 1/2 miles east of Pontotoc, where reverse dips expose it for a distance of over 1 mile (Figure 3). At these localities both Hardouinia and Sphenodiscus are common, but in the south part of the outcrop belt, most of the Sphenodiscus bearing (upper) strata have been eroded, exposing only Hardouinia at the very top of cavernous ledges. South of Pontotoc, the limestone crops out in the bed and along the south bank of Chiwapa Creek just east of Mississippi Highway 15 (NW. 1/4, Sec. 16, T.10 S., R.3 E.); forms low rock ledges which cap hilltops 2 miles updip to the east (NE. 1/4, SW. 1/4, Sec. 22, T.10 S., R.3 E.); caps sand hills 5 miles to the south (NW. 1/4, SW. 1/4, Sec. 1, T.11 S., R.3 E.); and produces low benches (Figure 5) along valley walls (Secs. 13, 24, 25, 35, and 36, T.11 S., R.3 E.) near the Chickasaw County line.

RIPLEY-PRAIRIE BLUFF CONTACT

In addition to the erosion of the Sphenodiscus (upper) zone of the upper Ripley limestone in the south part of the county, the whole unit is cut out in several areas southeast of Pontotoc. Similarly, a section cited by Stephenson and Monroe[20] 3 miles west of Buena Vista in Chickasaw County shows Prairie Bluff resting on lower middle Ripley beds. They[21] have also pointed out further evidence of erosion in the form of a concentration of brown to black shiny and smooth phosphatic casts of the interior of small pelecypods and spired gastropods in the basal beds of the Prairie Bluff in this and in adjacent counties, comparable to phosphatic molds marking erosional unconformities at other horizons in Coastal Plain strata.

Thus, local unconformities above and below the upper Ripley limestone would suggest raising that unit to the rank of a formation. However, the writer hesitates to name a new formation until more evidence is at hand to prove conclusively that both unconformities are regional.

PRAIRIE BLUFF FORMATION

The Prairie Bluff formation has a thickness of 65 to 75 feet in Pontotoc County, including near the top beds 5 to 35 feet in thickness of sandy silt, which contain Owl Creek fossils. According to Stephenson and Monroe,[22] the Owl Creek formation is distinct in Tippah and Union Counties to the north, but merges with the Prairie Bluff just south of Pontotoc. In this report the Owl Creek is mapped with the Prairie Bluff formation, which unconformably overlies the Ripley formation and in turn is unconformably overlain by the Clayton formation, Paleocene series.

The Prairie Bluff formation has three lithologic divisions in Pontotoc County: a lower moderately fossiliferous gray-blue silty chalk, a middle very fossiliferous greenish-buff chalky clay, and an upper sparingly fossiliferous gray-buff sandy silt, the Owl Creek. Each facies differs locally in thickness, due to differences in deposition in the case of the lower two zones and to erosion which has at places cut out all, or nearly all, of the Owl Creek beds—as illustrated in a composite record of test holes along Mississippi Highway 15 on the south valley wall of Chiwapa Creek, 2 miles south of Pontotoc. Here, the lower silty chalk facies, part of which is exposed in a roadcut at the base of the valley wall (Figure 6), has a thickness of 28.8 feet (samples 7 and 8). In contrast, the overlying clayey facies has a thickness of but 4.0 feet, and the Owl Creek sandy zone has a thickness of 33.5 feet (samples 4 and 5). The basal Clayton, 2.0 feet in Sample 3, contains clay replacements of shells which here mark the Cretaceous-Paleocene contact.

Figure 6.—Roadcut exposure of Prairie Bluff silty chalk and overlying Owl Creek sandy silts, Mississippi Highway 15, south valley wall of the middle prong of Chiwapa Creek (NW. corner, Sec. 16, T.10 S., R.3 E.), 2 miles south of Pontotoc. November 28, 1941.

COMPOSITE RECORD OF TEST HOLES N267, N268, N269, AND N270, ALONG MISSISSIPPI HIGHWAY 15, SOUTH VALLEY WALL OF CHIWAPA CREEK, 2 MILES SOUTH OF PONTOTOC (NE. 1/4, SEC. 17, T.10 S., R.3 E.)

No.	Depth	Thick.	Description of strata and designations of samples
			Clayton formation
1	23.3	23.3	Sand, very coarse dark-red
2	25.1	1.8	Sand, medium to coarse red-buff; weathered glauconite
3	27.1	2.0	Sand, medium to coarse brownish-buff slightly glauconitic; very thin siliceous shells at top; fragments of re-worked Prairie Bluff fossils preserved as clay replacements near base
			Prairie Bluff formation
4	38.7	11.6	Silt, yellow-buff fairly micaceous; laminae of light-gray silty clay at base
5	60.6	21.9	Sand, fine to medium yellow-buff slightly micaceous; slightly glauconitic; slightly limy light-gray nodules
6	64.6	4.0	Silt, clayey yellow-buff slightly micaceous slightly limy
7	65.4	0.8	Chalk, silty cream-colored
8	93.4	28.0	Chalk, silty blue-gray fairly micaceous; large fragments of Exogyra; *Linthia variabilis*
			Ripley formation
9	94.1	0.7	Limestone, sandy gray-white; fragment of *Hardouinia subquadrata*

LOWER DIVISION, PRAIRIE BLUFF FORMATION

The chalky lower division of the Prairie Bluff formation has a thickness of 10 to 35 feet. In the outcrop belt, it is easily identified by gray-white soils containing phosphatic molds of small molluscs and by rank growths of sweet clover, stunted cedar, and wild plum. The chalk is freshly exposed above the upper Ripley limestone at the bentonite pit (NW. 1/4, Sec. 23, T.9 S., R.3 E.), 4 miles northeast of Pontotoc, where two fossil zones are recognized as characteristic of the lower one-third of the unit. The basal zone, 2.5 feet in thickness, has an abundance of brown or black shiny and smooth phosphatic casts of the interior of small pelecypods and small gastropods; and the superjacent zone, 1.8 to 4.2 feet in thickness, contains a relative abundance of small cephalopods, among them Eutrephoceras and Scaphites species.

MIDDLE DIVISION, PRAIRIE BLUFF FORMATION

The clayey middle division of the Prairie Bluff formation has a thickness of 2 to 35 feet in Pontotoc County. In exposures, it is more readily recognized than the lower division, since the strata weather to non-calcareous light-greenish-gray waxy clays. These clays seem to resist further alteration, and consequently form broad rounded hills such as those east of Pontotoc, that extend N.30° E.—S.30° W. through the east one-third of T.9 S., R.3 E. and through the middle one-third of T.10 S., R.3 E. The best or most accessible exposures in this area are: both sides of Mississippi Highway 6 (Sec. 35, T.9 S., R.3 E.) 2 miles east of Pontotoc; gullies and roadcuts at the south edge of the town (S. 1/2, Sec. 4, T.10 S., R.3 E.); cuts along a north-south road (NE. 1/4, Sec. 3, T.10 S., R.3 E.), 2 miles to the southeast; cuts of a new road (N. 1/2, Sec. 13, T.9 S., R.3 E.), 5 miles northeast of Pontotoc; and at the roadfork at Campground Church (SW. 1/4, NW. 1/4, Sec. 27, T.10 S., R.3 E.). Although these exposures are very fossiliferous, only *Baculites columna* and tooth sockets and clavicles of Mosasaurs seem to be distinctive of the middle zone.

UPPER DIVISION, PRAIRIE BLUFF FORMATION

The sandy upper division of the Prairie Bluff formation, the Owl Creek facies, has a maxmium thickness of 45 feet. It is thickest in the north one-half of the county and progressively thins to the south, so that at the Chickasaw County line it is absent, the thinning resulting from both non-deposition and from pre-Clayton erosion. At a few places in Pontotoc County, several unusually thick sections are preserved as erosion remnants. Although the contact of the Owl Creek sands with the underlying clayey facies is sharply drawn in the composite record, some exposures and some test hole records show fairly fossiliferous tongues of calcareous clay extending into the sandy zone. The Owl Creek facies crops out above the clayey zone along low valley walls east of Ecru in the north part of the county; at the bases of steep valley walls along the Pontotoc-Cherry Creek road from Pontotoc to the Union County line; in numerous cuts of Mississippi Highway 15 for a distance of 8 miles south of Pontotoc; and in gullies beneath Clayton sands in the area of high hills (Cen., T.11 S., R.3 E.) 8 miles south-southeast of Pontotoc.

Except the silty sands of the Owl Creek facies, the Prairie Bluff formation is very fossiliferous. In the course of this investigation, only the Scaphites and Eutrephoceras species and the Mosasaur remains seem to be distinctive for the whole of the unit. However, several forms, small echinoderm *Linthia variabilis* and many gastropod casts, are more abundant than in the younger beds in the county.

COMMON FOSSILS FROM THE PRAIRIE BLUFF FORMATION, PONTOTOC COUNTY

Coelenterata
- Clione species

Echinodermata
- Hardouinia subquadrata (Conrad)
- Hemiaster slocumi Lambert
- Linthia variabilis Slocum

Vermes
- Hamulus onyx Morton
- Hamulus squamosus Gabb

Cephalopoda
- Eutrephoceras species
- Scaphites species

Gastropoda
- Turritella species

Pelecypoda
- Inoceramus argenteus Conrad
- Ostrea plumosa Morton
- Gryphaeostrea vomer (Morton)
- Exogyra costata Say
- Lima acutilineata (Conrad)
- Lima reticulata Forbes
- Nucula percrassa Conrad
- Anomia argentaria Morton
- Liopistha protexta (Conrad)

Vertebrata
- Clavicles of Mosasaurs
- Tooth sockets of Mosasaurs
- Sharks teeth

PRAIRIE BLUFF-CLAYTON CONTACT

In northeast Mississippi, the Clayton formation, Midway series, unconformably overlies the Prairie Bluff-Owl Creek formation, Gulf series. This contact is but part of the widespread Cretaceous-Paleocene unconformity in the Gulf Coastal Plain area. In Pontotoc County, the juncture of the Prairie Bluff (Owl Creek sand facies) and the Clayton is a gently undulating surface which is marked by a thin basal conglomerate of coarse quartz pebbles in semi-indurated sand, by light-gray calcareous silt pebbles in a matrix of red-buff sand, by fragments of re-worked fossils replaced by clay, or by thin beds of limonitic semi-indurated silty sand.

CLAYTON FORMATION

The Clayton formation, named for the town of Clayton, Alabama, has an irregular north-south belt of outcrop just east of the center of Pontotoc County. Its thickness is 35 to 75 feet, a variation which is in part due to regional differences in deposition, and in part to the unevenness of the eroded Prairie Bluff-Owl Creek surface upon which it was deposited. The unit consists essentially of fine sand through which are scattered grains of glauconite and medium to coarse quartz sand. It is calcareous near its base, and in some areas it has several lenses of fairly fossiliferous limestone in its lower one-third. At its top are very calcareous coarse fairly glauconitic sands which grade into similar beds interstratified with silts and clays in the lower division of the overlying Porters Creek formation. The upper contact is, therefore, difficult to determine, but it has been arbitrarily set at the base of a lens of fossiliferous siltstone, 3 to 15 feet in thickness, which is exposed in a few roadcuts and gullies at the east edge of the Flatwoods. The entire unit is more sandy than in Tippah County to the north, where Conant[23] recognizes two phases: a basal member of highly fossiliferous glauconitic sandy limestone and marl layers, which has a thickness of about 15 feet; and an upper member consisting of locally fossiliferous and glauconitic dark laminated clays, marls, and sands, having a thickness of 50 to 60 feet.

In Pontotoc County, the limestone lenses in the lower part are exposed in two widely separated areas. In the north area, a cut of Mississippi Highway 15 at the base of the south valley wall of Lappatubby Creek (NE. 1/4, SE. 1/4, NE. 1/4, Sec. 36, T.8 S., R.2 E.), one-half mile south of Ecru, shows irregularly bedded fairly fossiliferous glauconitic, sandy limestone, 12.2 feet in thickness, overlying a 23.6-foot section of Owl Creek and Prairie Bluff strata in test hole N110. The limestone is quarried from the valley wall, approximately one-half mile northwest to a point where it dips beneath the valley floor. In the south area, another highway cut (SE. 1/4, NW. 1/4, NW. 1/4, Sec. 9, T.10 S., R.3 E.), one-half mile south of Pontotoc, shows the basal beds of a similar fossiliferous limestone lens. The fossils in both areas are poorly preserved casts of the interior of small pelecypods and spired gastropods which could not be identified as to genera or species. Undoubtedly the limestone lenses are more extensive than outcrops show, for brick-red sands near the base of the unit contain straw-colored waxy clays and thin lenticular bodies of hard red-brown limonite concretions (roadfork, SE. corner, Sec. 10, T.9 S., R.3 E.), both of which are believed to be weathering products of limestone.

In contrast, the medium to coarse glauconitic slightly calcareous sands weather brick-red. They form rounded slopes or cap the ridges of broad divides which are traversed by Mississippi Highway 15, both north and south of Pontotoc, and by other roads in a broad area east of the highway in Townships 8, 9, and 11, R.3 E. (Plate 1). Fresh cuts and deep gullies along the Pontotoc-Cherry Creek road, 2 to 6 miles north of Pontotoc (Secs. 4, 9, 16, and 21, T.9 S., R.3 E.), show these beds to best advantage. They have been tested nearby (N80, SE. corner Sec. 10, T.9 S., R.3 E.), and beneath the water tower in Pontotoc (N1, N. 1/2, NW. 1/4, NW. 1/4, Sec. 4, T.10 S., R.3 E.).

CLAYTON-PORTERS CREEK CONTACT

The Clayton-Porters Creek contact is gradational, the actual point of contact being arbitrarily placed at the base of the lower of several light-weight gray-white siltstones, which have thicknesses of 1.5 to 5.5 feet in roadcuts and shallow gullies at the east edge of the Flatwoods. The upper 15-foot to 20-foot interval of the Clayton formation contains light-colored calcareous, glauconitic semi-indurated sands, beds of which increase in number and thickness up to the base of the siltstone. Above the siltstone, in the 30-foot to 50-foot lower zone of the Porters Creek, the calcareous, glauconitic coarse sand beds progressively thin and become less numerous, in contrast to a relative increase in beds of dark-colored montmorillonitic clay, greenish-buff clay, and greenish-black micaceous silt. Conant[24] places the contact at the base of a similar, although more glauconitic, siltstone layer in Tippah County.

In Pontotoc County, the siltstone contains large mica flakes and scattered grains of glauconite and coarse quartz sand. It is locally very fossiliferous, having a poorly preserved fauna of small cup corals, several species of small equi-valved pelocypods, high and low spired gastropods, internal casts of a large ammonite, and the siliceous-shelled *Ostrea pulaskensis*. The best fossils were collected from ledges exposed in cuts along the north-south road (W. 1/2, Secs. 8 and 17, T.11 S., R.3 E.) north of Wallfield, 7 miles south of Pontotoc. The casts of ammonites were found in ledges exposed in shallow gullies and in roadcuts (Secs. 11, 12, 13, and 14, T.9 S., R.2 E.), 5 miles northwest of Pontotoc. Barren siltstones are exposed in fresh roadcuts just east of a roadfork (SW. 1/4, SE. 1/4, Sec. 1, T.10 S., R.2 E.) 2 miles southwest of Pontotoc; and beneath a culvert on the Union County line (NW. corner, Sec. 24, T.8 S., R.2 E.), 2 miles northwest of Ecru.

PORTERS CREEK FORMATION

The weathering of the Porters Creek formation has produced the north-south Flatwoods belt which extends west from Pontotoc and Mississippi Highway 15 to the hills in the west one-fourth of the county. The unit is named for a small creek west of Middleton, Tennessee, just north of the Tippah County line.

In Pontotoc County, the Porters Creek is assigned a thickness of 300 to 500 feet, based on data from water well logs, on the interpretation of an electrical log of a recent oil test in adjacent Lafayette County, and on calculations using the width of the outcrop belt and an assumed regional west dip of 25 feet a mile. However, the great variation in thickness is due to the extensive erosion of west dipping Porters Creek strata before the deposition of younger beds. Thus, only the lower 300-foot interval of the unit underlies an Ackerman outlier at Springville (Sec. 9, T.10 S., R.2 E.), whereas a 500-foot interval of Porters Creek underlies Ackerman strata eight miles to the west at Toccopola (Sec. 6, T.10 S., R.1 E.).

In Pontotoc County, the unit has three lithologic divisions: a lower zone 30 to 50 feet in thickness, comprised of gray or greenish-buff calcareous, glauconitic coarse sands interbedded with greenish-buff waxy clays, greenish-black micaceous silts, and dark-colored montmorillonitic clays; a middle zone 150 to 200 feet in thickness, comprised of nearly black montmorillionitic clay and subordinate lenses of gray micaceous silty clay or greenish-black micaceous silt, which are more numerous toward the top; and an upper zone 100 to 250 feet in thickness which is chiefly comprised of the greenish-black micaceous silt lenses and thinner lenses of black clay and gray clayey silt. Conant[25] recognizes these phases in Union and Tippah Counties to the north, but adds a still higher bauxite-kaolin zone which is identified as the Betheden residuum in the present report.

LOWER DIVISION, PORTERS CREEK FORMATION

The lower division of the Porters Creek formation crops out as a narrow irregular belt at the east edge of the Flatwoods, just west of Mississippi State Highway 15. There, it has been tested by 16 auger holes, from which three have been chosen as typical of the several lithologic facies recognized. N17 (N. 1/2, SW. 1/4, SW. 1/4, Sec. 31, T.9 S., R.3 E.), 1 mile west of Pontotoc, sampled the thick limy glauconitic sands and waxy clays at the base of the unit; N220 (SE. 1/4, SW. 1/4, SE. 1/4, Sec. 11, T.9 S., R.2 E.), 5 miles northwest of Pontotoc, revealed light-greenish-buff clays in the mid-portion;

and N20 (E. 1/2, NE. 1/4, NW. 1/4, Sec. 35, T.9 S., R.2 E.), 3 miles west of Pontotoc, tested the greenish-buff silty clays and montmorillonitic clays in the upper part of the zone.

MIDDLE DIVISION, PORTERS CREEK FORMATION

The middle division of the unit crops out in the west one-half of Townships 8, 9, 10, and 11 South, R.2 E., beneath the few Wilcox outliers and east of the main outcrop belt of Wilcox strata (Plate 1). It is comprised chiefly of nearly black massive clay which is largely composed of the mineral montmorillonite,[26] and subordinate lenses

Figure 7.—Roadcut in upper Porters Creek formation, Mississippi Highway 6 road intersection (NE. 1/4, NW. 1/4, SW. 1/4, Sec. 24, T.9 S., R.1 E.), 9 miles west of Pontotoc. November 12, 1941.

of dark-gray slightly micaceous silty clay. The nearly black clay is unstratified except for paper-thin yellow streaks of very fine silt. In the early stages of weathering, it bleaches, and the surfaces repeatedly spawl away, leaving spherical cores of black clay. In later stages of weathering, the belt of black clay is reduced to a nearly level surface which is broken only by low rounded hills held up by rare gray micaceous silty clay lenses.

This portion of the Porters Creek has been tested by 15 auger holes, the records of three of them being representative: N30 (W. 1/2, SW. 1/4, SE. 1/4, Sec. 2, T.10 S., R.2 E.), 4 miles west-southwest of Pontotoc; N128 (NW. 1/4, NW. 1/4, NE. 1/4, Sec. 29, T.8 S., R.2 E.), 3 miles west of Ecru; and N22 (E. 1/2, NW. 1/4, NE. 1/4, Sec. 33, T.9 S., R.2 E.), 5 miles west of Pontotoc. The deepest auger hole in the county, N24 (W. 1/2, NW. 1/4, SW. 1/4, Sec. 4, T.10 S., R.2 E.), a short distance north of Springville, showed alternate lenses of montmorillonitic clay and greenish-black micaceous clay or silt, to a depth of 69.1 feet.

UPPER DIVISION, PORTERS CREEK FORMATION

Strata of the upper division of the Porters Creek formation, which is 100 to 250 feet in thickness, crop out as a narrow belt at

Figure 8.—Faulted Porters Creek and Fearn Springs strata, south valley wall of Two Mile Creek (SW. 1/4, NW. 1/4, NE. 1/4, Sec. 8, T.10 S., R.1 E.), 2 miles southeast of Toccopola. The lower figure stands on downthrown Fearn Springs lignitic silts; on his left is a nearly vertical fault plane indicated by the dark line; beyond the fault is upthrown Porters Creek clay. The upper figure stands on re-worked bauxitic clay at the base of the Fearn Springs formation. October 14, 1941

the west edge of the Flatwoods and are exposed farther west in broad valleys or on valley slopes beneath Betheden, Fearn Springs, or Ackerman beds in the North-Central Hill section (Plate 1). The lower 100-foot interval is comprised equally of lenses of dark-gray to black silty clay (Figure 7), nearly black montmorillonitic clay, and greenish-black locally glauconitic, micaceous silt. However, in the upper interval, the silts thicken and increase toward the top (Figure 8). Since the silts are more resistant to erosion than the clays, the outcrop belt is increasingly rugged downdip to the west, accounting for the rough topography just east of the Ackerman outcrop belt (Plate 1) and for the great relief in the Porters Creek-Fearn Springs or Porters Creek-Ackerman unconformities.

The upper division has been explored by 42 auger holes, of which the following best illustrate the several types of lithology. N204, and 233 tested massive gray-tan or buff weathered montmorillonitic clay to depths of 18.4 and 36.4 feet, respectively, all in the lower part of the division; whereas N212 sampled a 33.6-foot interval of higher beds consisting of alternating silts and clays overlying the black clay. In addition, upper greenish-black silty Porters Creek beds were tested in holes N82, 199, 210, 216, 238, 239, 243, 254, and 275, which sampled lower Betheden clays; in N193 and 194 which sampled the Fearn Springs formation; and in N235 which tested the lower beds of the Ackerman formation.

In most of the above records, the Porters Creek beds below the contacts are greenish-black micaceous silts. Conant[37] observed similar beds at the same horizon in Tippah and Union Counties and suggested that they might represent a northwest extension of the Naheola formation which overlies the Sucarnoochee clay (Porters Creek equivalent) in Alabama, and which was previously recognized by Foster[38] in Lauderdale County and by Mellen[39] in Winston County. In this investigation, the greenish-black silts will be referred to as Naheola type silts.

In several areas, the contact of montmorillonitic clay lenses and overlying Naheola type silts, in the upper part of the division, is marked by a discontinuous layer of nodular brownish-black sideritic concretions which have thicknesses of 0.2 to 1.0 foot and diameters of 0.5 to 3.0 feet. Most of the nodules are homogenous throughout, but a few enclose coarse lignite fragments or have lignite embedded in their upper surfaces. Ledges of the weathered nodules are exposed in the following widely separated roadside localities: creek bridge (NE. 1/4, Sec. 10, T.10 S., R.1 E.), 3 miles north of Randolph; creek bridge (NE. 1/4, Sec. 9, T.11 S., R.1 E.), 3 miles north of Robbs; and creek bridge (SE. 1/4, Sec. 28, T.8 S., R.1 E.), 2 miles west of Esperanza (Hurricane).

MIDWAY-WILCOX CONTACT

An extensive period of weathering followed Porters Creek deposition. During the earlier stages of this interval, the Betheden residuum was formed by the profound alteration of Naheola type silts in the upper division of the Porters Creek. Later, the less-weathered Porters Creek and the Betheden were partly eroded preceding and during the deposition of Fearn Springs continental sediments in valleys surrounded by Porters Creek or Betheden hills. Then the Fearn Springs, Betheden, and Porters Creek strata were reduced during another erosion interval and Ackerman beds were deposited upon their irregular surfaces. Consequently, Ackerman strata may rest on Fearn Springs, Betheden, or Porters Creek beds, and the Fearn Springs may lie on Betheden or Porters Creek strata (Figure 9).

Figure 9.—Roadcut showing Porters Creek, Betheden, and Fearn Springs formations, east valley wall of a small creek near Calhoun County line (SW. 1/4, NE. 1/4, SW. 1/4, Sec. 18, T.11 S., R.1 E.), 2.5 miles northwest of Robbs. Figure at left points to Porters Creek-Fearn Springs contact. Figure at right indicates a thin wedge of bauxite representing the Betheden formation. November 3, 1941.

The contact has a regional west dip of 10 to 15 miles along a line from Springville (Sec. 9, T.10 S., R.2 E.) to Toccopola (Sec. 32, T.9 S., R.1 E.). Farther west, it is recognized in the subsurface by pisolites of bauxite in plastic clay which underlies thick (Wilcox) sands.[30] However, the contact is locally very irregular, as beneath the Springville outlier (Plate 1) where there are differences of 50 to 75 feet in its elevation, in an area less than one-half mile in diameter. Here, and to the west, the dips have no relation to the present topography.

BETHEDEN RESIDUUM

In 1939, Mellen[31] proposed the term Betheden to designate all residual material at the top of the Midway series and below the Midway-Wilcox unconformity, as exposed near Betheden in Winston County, Mississippi. In this unit, which he considered a formation as well as a residuum, he included beds of bauxite, bauxitic clay, and kaolinitic clay derived from Porters Creek strata, the whole overlain by lignite. A short time later, Foster[32] recognized some of these materials that had been re-worked into the Fearn Springs strata in

Figure 10.—Bauxite, J. J. Gregory pit, southwest end of "Third Hill," (E. 1/2, NE. 1/4, SE. 1/4, Sec. 35, T.9 S., R.1 E.), 4 miles east of Toccopola. October 3, 1941.

Lauderdale County to the south. Farther north along the Midway-Wilcox contact, the Betheden was described by Conant as a "bauxite-kaolin zone" in both Tippah[33] and Union[34] Counties.

Previously, Paul F. and William C. Morse[35] had examined the bauxite and some of the underlying bauxitic and kaolinitic clays in northeast Mississippi. Both they and Burchard[36] placed the deposits in the lower Ackerman, near its contact with the Porters Creek clay, but neither discussed the origin of the beds. About the same time Rettger[37] showed that the bauxite and associated clays in Alabama lie just below the Midway-Wilcox unconformity. Later Bramlette[38] proved that the Arkansas deposits were altered Porters Creek clay, laterized syenite plugs, or laterized feldspathic sands derived from the syenite. However, in northeast Mississippi, the Betheden materials have been derived exclusively from the Porters Creek clays, and in Pontotoc County chiefly from lenses of greenish-black clayey silts (Naheola type silts) which are most prevalent near the top of the unit.

In Pontotoc County, the Betheden is comprised of silts, silty sands, kaolinitic clays, and bauxitic clays which are at places capped by bauxite (Figure 10). The overlying lignite noted in Winston County is absent, and the residuum is overlain unconformably by lower Wilcox beds, either those of the Fearn Springs formation or those of the Ackerman formation in areas where the Fearn Springs was not deposited or where it was eroded. The maximum thickness of the complete section is 37 feet, of which only the upper one-fourth may be bauxite. At most places the subjacent strata are, in their successive order, white to buff bauxitic clays, gray or white kaolinitic clays, and sands, sandy clays or silts which darken and become increasingly micaceous with depth. Locally, the bauxitic clays and silts contain thin beds of silty lignite or layers of siderite nodules which either enclose coarse lignite fragments or have lignite-filled depressions in their upper surfaces.

Although the Betheden should be expected to have a continuous outcrop along the Midway-Wilcox contact, exposures are scattered and rarely exceed five acres in extent. Due to a lack of a parent material in some areas, the residuum was never produced, and in other localities it was partly or completely removed by pre-Fearn Springs, by pre-Ackerman, or by recent erosion. The known outcrops are confined either to the Wilcox-capped hills in the west two-thirds of Townships 8, 9, 10, and 11, R.1 E., or to the east parts of these townships where the Wilcox covering is thin or wanting.

In most instances, the thickest and most extensive exposures are those protected by a cap of bauxite. In contrast, most of the thinner deposits have had their caps removed, either exposing bauxitic or kaolinitic clays or the lower less aluminous micaceous silts or silty sands. However, a bauxite cap does not always overlie the thickest beds. Instead, the bauxite appears to represent the highest degree of alteration attained at any point, irrespective of the thickness of the less altered strata beneath.

The bauxite is comprised of alternate very pisolitic material and thin semi-indurated clays containing scattered pisolites which vary greatly in size and color. Most pisolites are one-eighth to one-fourth inch in diameter, but at N275 (SW. 1/4, SE. 1/4, NW. 1/4, Sec. 22, T.9 S., R.1 E.) some are so small as to be scarcely seen with the unaided eye. In color, they range from gray through gray-blue and gray-green to shades of yellow, red, and purple, according to the degree of weathering and to the limonite content which increases toward the top of the bauxite. The ferruginous material fills joint cracks in the upper part, suggesting that it was derived from overlying Wilcox strata and concentrated by groundwater. The thickest bauxite caps Smoky Top (N 1/2, Sec. 29, T.8 S., R.1 E.), Big Hill (SE. 1/4, NW. 1/4, Sec. 36, T.9 S., R.1 E.), Third Hill (NW. 1/4, SW. 1/4, Sec. 36, T.9 S., R.1 E.), and low knobs on the properties of J. W. Tutor (S. 1/2, SW. 1/4, Sec. 16, T.10 S., R.1 E.), Percy Coates (SW. 1/4, SW. 1/4, SE. 1/4, Sec. 15, T.10 S., R.1 E.), and R. S. Worthington (SW. 1/4, SE. 1/4, NW. 1/4, Sec. 22, T.9 S., R.1 E.). N275, at the last named locality, tested 6.9 feet of bauxite, 5.9 feet of bauxitic silts, clays, and sands, and 17.4 feet of non-bauxitic silts and sands which overlie unweathered Porters Creek strata.

The exact nature of the Betheden beds below the bauxite is best shown in the records of the widely separated tests N82, 199, 210, 216, 238, 239, 243, 253, 254, and 275. Until laboratory analyses prove them otherwise, the white, buff, or red pisolitic clays in these test holes are considered bauxitic, and all the light-colored clays, which are plastic when wet or absorbent when dry, are designated as kaolinitic. The bauxitic clays grade into the overlying bauxite and, through a decrease in pisolites, into the kaolinitic material below. Although their combined thickness averages 20.1 feet, thicknesses of 15 to 25 feet are common, the 5.9-foot interval in test N275 and the 34.6-foot interval in test N238 representing the extremes. Except in N199 and 275, the kaolinitic beds grade progressively downward into gray, gray-buff, buff, and greenish-buff micaceous, clayey silts or micaceous silty clays. At varying depths, these beds in turn grade into unweathered greenish-black Porters Creek silts as shown in tests N216, 238, 239, 243, and 253, suggesting that at least some of the Betheden owes its origin to the laterization of Naheola type silts.

In addition to the changes in the color of strata directly above the contact, which resemble those observed in normal weathering, lateritic changes are noted in the clay, mica, and silt content of the superjacent beds. In tests N238, 239, 243, and 254, these beds become more clayey as first the silt and some mica, and then all the mica, is successively removed. Thus, only a little free silica is present in the kaolinitic clays; only mica, in the lower sparingly pisolitic beds; and neither, in the very pisolitic upper strata. Obviously, such a profound and uninterrupted alteration of material could have proceeded only in a thick homogenous body, as in lenses of Naheola type silts which are thicker and more prevalent than other lithologic facies in the upper part of the Porters Creek formation.

But this sequence is interrupted in some test holes where unaltered or slightly altered strata are interbedded with Naheola silts. Thus, in test N199, are two bauxite-kaolin zones, separated by a thick bed of white and buff sand. Beneath the lower zone, a thin bed of green sand overlies Naheola type silts, and seems to have protected them from weathering. However, a single sand body beneath the clay zone in test N275 did not prevent their alteration. Similarly, minor differences in parent materials probably account for alternate bauxitic and non-bauxitic clays in N216, and for a thin bed of very micaceous bauxitic clay between thick non-micaceous pisolitic clays in N82. In test N216, the non-bauxitic clays resemble well weathered nearby exposures of montmorillonitic clay, and in test N82, the highly micaceous beds suggest very micaceous Naheola silts as exposed downdip. However, some of the minor mineral constituents of the parent materials are unchanged, despite the laterization of overlying and underlying strata. Thus in N210, beds of lignitic silt and several layers of siderite nodules enclosing lignite fragments resemble nearby exposures of lignitic and sideritic materials at the contact of black montmorillonitic clays and Naheola type silts.

Field investigations in Pontotoc County have thus confirmed many of the observations of Mellen concerning the origin of the Betheden. Evidence substantiates Mellen's[39] conclusion that the lateritic materials are gradational into the Porters Creek beds, and Conant's[40] later observations to the same effect. However, test hole records show that laterization was completed only where thick lenses of Naheola type silts were exposed in an earlier Flatwoods-like topography, as suggested by Mellen,[41] and then subjected to the specialized types of weathering and solution in a humid climate as outlined by Conant.[42] But this investigation further shows that laterization was incomplete or was interrupted in areas where the silts were interbedded with other materials which were either unaltered or little altered by the same processes.

FEARN SPRINGS FORMATION

The Fearn Springs formation was recently named by Mellen[43] from exposures near that village in Winston County, and has since been recognized in Lauderdale County by Foster,[44] and in Union County by Conant.[45] In his report on Tippah County, Conant[46] considered it the basal clay member of the Ackerman formation, but in the present report it is considered of formational rank.

In Pontotoc County, the unit is comprised of dark-gray silts and sands, carbonaceous or lignitic clays (Figure 8), light-colored silts (Figure 11), and plastic clays, and beds of re-worked bauxite, which

Figure 11.—Gully exposure of Fearn Springs silts and silty clays (NW. 1/4, SW. 1/4, SW. 1/4, Sec. 26, T.8 S., R.1 E.), 1 mile west of Esperanza (Hurricane) School. November 8, 1941.

were deposited in valleys carved in Betheden or Porters Creek strata. This deposition on an irregular surface and pre-Ackerman erosion account for its variation in thickness to a maximum of 68 feet. The formation is thickest in the northwest corner of the county, as exposed in roadcuts (Secs. 28, 29, 30, and 32, T.8 S., R.1 E.) and along the south valley wall of Two Mile Creek south of Toccopola.

SECTION ALONG NORTH-SOUTH ROAD, SOUTH VALLEY WALL OF TWO MILE CREEK, 1.5 MILES SOUTH OF TOCCOPOLA (SE. 1/4, SE. 1/4, SEC. 6, T.10 S., R.1 E.)

	Feet	Feet
17. Soil-silt, sandy red-buff	7.1	
Fearn Springs formation		66.2

16.	Clay, silty light-gray buff-mottled thinly laminated fairly plastic; weathers to thin flakes; freshwater molluscs	3.1
15.	Covered interval	5.8
14.	Clay, silty light-gray red-mottled thinly laminated	6.2
13.	Silt, clayey light-greenish-gray thinly laminated; several thin ledges of flattened nodular limonite concretions	4.8
12.	Silt, clayey very dark-gray very lignitic thinly laminated; nodules of septarian siderite at base	1.9
11.	Clay, very slightly silty light-gray well-bedded blocky	7.2
10.	Clay, dark-gray-tan very lignitic, silty thinly laminated	7.3
9.	Clay, slightly silty light-gray slightly lignitic plastic; dark-gray silty lignitic clay at base	3.7
8.	Covered interval	1.9
7.	Clay, gray-tan lignitic, silty thinly laminated	2.2
6.	Covered interval	8.1
5.	Clay, gray-tan lignitic, silty; grades upward into light-gray, red-mottled silty clay	3.9
4.	Covered interval	1.2
3.	Sand, dark-gray-tan lignitic, silty	1.0
2.	Clay, light-gray-tan lignitic, silty	2.2
1.	Covered to creek bridge	5.7

It is presumed that the unit is a continental deposit, since lignitic silts, carbonaceous clays, and leached plastic clays predominate, and since the only fossils are leaves, leaf stems, and freshwater mussels. From field observations and from a study of test hole records, it is evident that deposition started in the deeper valleys, which were cut during Betheden time, and that it continued intermittently through the contribution of silts, clays, and even bauxite fragments or bauxitic clays weathered from nearby Porters Creek or Betheden hills, until the original drainage lines were choked up and swamps were formed which supported the vegetation now preserved as lignite. Minor unconformities or diastems within the unit are commonly marked by beds of siderite nodules or by a repetition of the sedimentary cycle, as in the Toccopola section.

Test holes which were drilled to sample the Fearn Springs formation are N202 (E. 1/2, NE. 1/4, SE. 1/4, Sec. 32, T.9 S., R.1 E.), 2 miles east of Toccopola, and N70 (SW. 1/4, NE. 1/4, SE. 1/4, Sec. 26, T.8 S., R.1 E.) one-half mile north of Esparanza (Hurricane). The formation has also been tested through efforts to locate contacts: the Porters Creek-Fearn Springs contact was penetrated by N193 and N194, on the upthrow side of a roadside fault (Figure 8), 1.5 miles southeast of Toccopola (NW. 1/4, SW. 1/4, NE. 1/4, and NE. 1/4, SE. 1/4, NW. 1/4, respectively, Sec. 8, T.10 S., R.1 E.); the Porters Creek-Betheden-Fearn Springs contacts were both established by N253 (SE. 1/4, NE. 1/4, SE. 1/4, Sec. 28, T.10 S., R.1 E.); and the Fearn Springs-Ackerman contact was penetrated in N256 (E. 1/2, SW. 1/4, SE. 1/4, Sec. 29, T.10 S., R.1 E.).

ACKERMAN FORMATION

Before the recognition of the Fearn Springs by Mellen,[47] the Ackerman formation was considered the lowest unit of the Wilcox

Figure 12.—Cross-bedded sands in the lower division of the Ackerman formation, roadcut exposure (N. 1/2, NE. 1/4, SE. 1/4, Sec. 32, T.9 S., R.1 E.), one-half mile east of Toccopola. Photographed by L. C. Conant, April 1938.

series. It was named by Lowe[48] from exposures near the county seat of Choctaw County. In Pontotoc County, the unit forms a wide belt of outcrop in the west tier of townships and extends west into Lafayette County, half-way to Oxford. Although only one division of the Ackerman is exposed in Blantons Gap, the type locality, at Ackerman and was thus described by Lowe, three divisions are recognized in Pontotoc County, a basal sandy zone, a middle clayey zone, and a thick upper sandy zone of which only the basal portion is exposed.

LOWER SANDY DIVISION, ACKERMAN FORMATION

Beds of the sandy lower division, 75 to 125 feet in thickness, rest unconformably on Porters Creek, Betheden, or Fearn Springs strata, the thickness reflecting the extent of the pre-Ackerman erosion and the local development of the underlying Betheden and Fearn Springs units. The division is chiefly comprised of cross-bedded sand, as shown in the following hill section 1.8 miles northwest of Thaxton, and in roadcut exposures (NE. 1/4, SW. 1/4, SW. 1/4, Sec. 32, T.9 S., R.1 E.), just east of Toccopola (Figures 12 and 13).

Figure 13.—Spheroidal weathering resembling cross-bedding in lower Ackerman silty sands, roadcut exposure (N. 1/2, NE. 1/4, SE. 1/4, Sec. 32, T.9 S., R.1 E.), one-half mile east of Toccopola. October 14, 1941.

SECTION OF ACKERMAN AND BETHEDEN FORMATIONS, ALONG NORTHWEST-SOUTHEAST ROAD, 1.8 MILES NORTHWEST OF THAXTON (SE. 1/4, SW. 1/4, SEC. 4, T.9 S., R.1 E.)

	Feet	Feet
9. Soil—sand, silty red-buff; to roadfork	3.1	
Ackerman formation		55.3
8. Sand, medium red-buff micaceous cross-bedded; thin laminae of light-gray silty clay	14.2	
7. Limonite, dark-brown; irregularly bedded	0.2	
6. Sand, silty white buff-mottled; light-colored clayey laminae	3.4	
5. Sand, medium yellow-buff cross-bedded; thin layers of buff silty sand containing fragments of fine clay breccia	14.9	
4. Covered interval	3.5	
3. Sand, medium reddish-brown micaceous cross-bedded; thin discontinuous lenses of light-gray silty clay and buff silt	19.1	
Betheden formation (unconformity)		7.8
2. Clay, bauxitic buff; gray and yellow pisolites	0.8	
1. Clay, slightly silty light-gray plastic well-bedded	7.0	

Thick sandy silts near the base of the unit were tested by N25 (SW. 1/4, NW. 1/4, SW. 1/4, Sec. 4, T.10 S., R.2 E.), on the north flank of the Springville outlier (Plate 1), and by N256 (roadfork, E. 1/2, SW. 1/4, SE. 1/4, Sec. 29, T.10 S., R.1 E.), 3 miles west of Randolph. Coarser sands were sampled in N208 (S. 1/2, SE. 1/4, SW. 1/4, Sec. 27, T.9 S., R.1 E.), 2.5 miles east-northeast of Toccopola. Although both sands and silts may rest directly on the underlying units, in some areas the lower part of the division is comprised of contorted silts and silty clays or of coarse clay breccia in a matrix of silty sand. The contorted beds (Figure 14), which are also exposed just east of

Figure 14.—Contorted lower Ackerman silts and silty clays produced by scour and fill, roadcut exposure (N. 1/2, NE. 1/4, SE. 1/4, Sec. 32, T.9 S., R.1 E.), one-half mile east of Toccopola. October 14, 1941.

Toccopola, were presumably formed through the rapid deposition of Fearn Springs or Porters Creek material scoured from nearby outcrops. The breccia (Figure 15) is believed to have had a similar origin, for in the area where it is best developed, 4 miles south of Toccopola (SW. 1/4, NW. 1/4, SW. 1/4, Sec. 20, T.10 S., R.1 E.), the clay cobbles are also of Fearn Springs or Porters Creek material.

In the northwest corner of the county, the Porters Creek-Ackerman contact is marked by discontinuous lenses of coarse micaceous sand containing chert and quartz pebbles. However, the lenses do not contain bowlders as described by Conant[49] in Tippah County to the north, or as described by Mellen[50] in Winston County to the south.

CLAY DIVISION, ACKERMAN FORMATION

The middle division of the Ackerman formation in Pontotoc County is comprised of light-colored silts, carbonaceous clays, silty or re-worked lignites, and flaky lignitic clayey silts. These beds, which aggregate 75 to 100 feet in thickness, crop out near the Lafayette County line west of Thaxton along the Thaxton-Lafayette Springs road (Secs. 7 and 8, T.9 S., R.1 E.), and north of Toccopola along roads in Section 20, T.9 S., R.1 E. However, the best exposure is in

Figure 15.—Breccia near the base of the Ackerman formation, roadcut exposure (SW. 1/4, NW. 1/4, SW. 1/4, Sec. 20, T.10 S., R.1 E.), 4 miles south of Toccopola. Cobbles are light-gray silty clay in a matrix of buff micaceous sand. Photographed by L. C. Conant, April 1938.

adjacent Lafayette County, one-half mile southeast of Lafayette Springs and 4.5 miles west of Thaxton, where the following 57.9-foot section was measured.

ROADCUT SECTION OF CLAY ZONE, ACKERMAN FORMATION, ONE-HALF MILE SOUTHEAST OF LAFAYETTE SPRINGS, LAFAYETTE COUNTY, (NE. 1/4, SW. 1/4, SEC. 12, T.9 S., R.1 W.)

	Feet	Feet
7. Soil—Sand, silty red-buff; to top of hill; probably derived from Ackerman formation	10.4	
Fearn Springs formation		57.9
6. Clay, silty light-gray thin-bedded; several discontinuous layers of flat limonite nodules	19.2	
5. Silt, clayey dark-gray-tan carbonaceous, micaceous; flaky; thinly laminated	2.8	

4. Clay, silty light-gray-tan carbonaceous well laminated	2.1	
3. Lignite, very silty dark-gray to black; reworked	2.1	
2. Clay, slightly silty gray-white plastic; thin lenses of dark-gray silty clay; beds dip to the north with the hill slope and actually expose a thickness of only 12.6 feet. Lower 8 feet unconformably overlain by silty sand which also dips with hill slope	31.7	
1. Covered interval, to church at roadfork		6.8

The lignite, bed 3, crops out on several ridges updip to the east and in Ponototoc County is best exposed at the roadfork (W. 1/2, NW. 1/4, NE. 1/4, Sec. 7, T.9 S., R.1 E.) where N288 was drilled to test the underlying clay.

UPPER SANDY DIVISION, ACKERMAN FORMATION

The carbonaceous clays are overlain by buff micaceous sands which attain a thickness of 25 to 50 feet along the higher ridgetops adjacent to the Lafayette County line in T.9 S., R.1 E. These are the lower beds of a sandy facies 200 to 400 feet in thickness noted in Lafayette County to the west. They are best exposed in roadcuts and shallow borrow pits at the Pontotoc County line (Sec. 18, T.9 S., R.1 E.) 4 miles west of Thaxton and at the crests of hills (Secs. 4, 5, 8, and 9, T.9 S., R.1 E.), 2 miles west-northwest of Thaxton.

STRUCTURE

Most strata of Pontotoc County dip west at rates of 15 to 30 feet a mile toward the axis of the Mississippi embayment. This normal dip is interrupted in one area by flattened and east (reverse) dips which may be indicative of structures favorable to the accumulation of gas or oil. However, surface dips may not represent dips at depths, because of local differences in deposition and buried unconformities. Likewise, it should be remembered that the outcropping Cretaceous strata, which have a probable thickness of only 1800 to 2000 feet beneath Pontotoc, are doubtless all freshwater-bearing and, consequently, have little likelihood of containing oil.

Nevertheless, one small structure 2 miles east of Pontotoc is so sharp that it deserves consideration. It is contoured on the base of the upper Ripley limestone (Figure 3), a horizon which is not entirely satisfactory, but which is more reliable than the upper Ripley-Prairie Bluff unconformity a few feet above it. The normal west dip is recognized in Sections 11, 12, 13, 14, 23, and 24, T.9 S., R.3 E., and in Sections 3, 4, 9, 10, and 16, T.10 S., R.3 E., and is believed present in Sections 33 and 34, T.9 S., R.3 E. However, east dip is established by a reversal of 50 to 60 feet a mile as maintained in a series of exposures paralleling Mississippi Highway 6 in Sections 34 and 35, T.9 S., R.3 E., and by an equal southeast dip in Sections 25 and 36, T.9 S., R.3 E. A saddle (SE. 1/4, Sec. 26, T.9 S., R.3 E.) separates a broad southwest nosing centering in Section 18, T.9 S., R.4 E. from the more favorable structure whose narrow crest appears to pass north-south through the east parts of Sections 3 and 10, T.10 S., R.3 E. Unfortunately, vital east dip to the east of the apparent crest can not be established in the low areas (Secs. 2, 11, and 14, T.10 S., R.3 E.) which are underlain by middle and lower Ripley beds. Likewise, datum points are lacking directly northwest of the crest (Secs. 27, 33, and 34, T.9 S., R.3 E.), since the exposed beds are upper Prairie Bluff and Clayton. Therefore, it is suggested that the easily identifiable Selma-Ripley transitional clay and the equally recognizable upper Ripley limestone both be core-drilled to confirm subsurface dips in the east and in the northwest areas, respectively.

Although the east-dipping upper Ripley beds along Mississippi Highway 6 indicate a sharp reversal, core drilling is imperative here also, for the dip may prove less promising on the top of the transitional clay. Such a divergence in dip would be due to extensive erosion, for, as previously cited, successively older west-dipping middle Ripley beds were progressively cut out from west to east in this very area before the upper Ripley limestone was deposited. Likwise, the slight possibility that the upper Ripley is a transgressive unit is not discarded, in which case contours based on the limestone would reflect local conditions of deposition and would not indicate structure.

Note: The possibilities that these local eastward reverse dips may reflect similar or even greater reverse dips in the underlying Paleozoic rocks should not be overlooked, especially since these Paleozoic rocks in Tishomingo County and adjoining Alabama are saturated with a petroleum residue left behind as the more volatile products escaped. Any place of reverse dips may, therefore, have acted as a structure to trap some of the escaping oil (Morse, W. C., Paleozoic rocks: Mississippi State Geol. Survey Bull. 23, pp. 197, 198, 1930).

ECONOMIC GEOLOGY

The mineral resources of Pontotoc County are, in the order of their apparent importance, bauxitic, kaolinitic, and bentonitic clays, bauxite, and pottery, brick, and tile clays. In addition, there are extensive beds of chalk or chalky limestone for use as agricultural lime and small exposures of glauconitic limestone which can also be used as fertilizer. Oil and gas are potential, although not probable, resources, as pointed out in the discussion of structure.

BAUXITIC AND KAOLINITIC CLAYS

Test hole records show that the bauxitic and kaolinitic beds in the upper part of the Betheden residuum warrant commercial prospecting in three general areas in west Pontotoc County: northwest of Thaxton (Secs. 29 and 33, T.8 S., R.1 E.); east of Toccopola (Secs. 33, 35, and 36, T.9 S., R.1 E. and Sec. 2, T.10 S., R.1 E.); and northwest and west of Randolph (Secs. 15, 16, 22, and 28, T.10 S., R.1 E.). For convenience of description, the following table has been devised to show the specific locations of the deposits in each area, their topographic situation, their thickness in feet, the probable acreage involved, and the thickness and nature of the overburden. At each locality cited, only the less silty, less micaceous beds are included in the table, the underlying 10-foot to 25-foot intervals of transitional, less weathered Porters Creek materials being omitted as too lean for consideration.

TABLE OF BAUXITIC AND KAOLINITIC CLAYS

	Topographic situation	LOCATION	Thickness in feet	Acres	Thickness of overburden	Nature of overburden
Thaxton Area	Narrow ridges	N.½, N.½, Sec. 29, T.8 S., R.1 E.	10–22	105	2–8	Bauxite and Ackerman sands
	Shallow valley	SE.¼, SW.¼, Sec. 29, T.8 S., R.1 E.	2–17	25	5–28	Soil and Ackerman sands
	Hillside	SW.¼, NW.¼, Sec. 33, T.8 S., R.1 E.	5-16	30	2-30	Bauxite and Ackerman sands
	Broad plateau	NE.¼, SW.¼, Sec. 33, T.8 S., R.1 E.	6–14	35	4–8	Soil and Ackerman sands
Toccopola Area	Broad ridges	SE.¼, SE.¼, Sec. 33, T.9 S., R.1 E.	8–20	20	2–10	Soil and Ackerman sands
	Narrow ridges	SW.¼, NW.¼, Sec. 34, T.9 S., R.1 E.	10–22	15	2–6	Bauxite and Soil
	Hillside	NE.¼, SE.¼, Sec. 35, T.9 S., R.1 E.	5–15	8	5–8	Soil
	Broad hill	NW.¼, SW.¼, Sec. 36, T.9 S., R.1 E.	10–15	15	2–8	Bauxite
	Broad hill	SE.¼, NW.¼, Sec. 36, T.9 S., R.1 E.	8–12	15	5–10	Bauxite float
	Hills and ridges	NE.¼, Sec. 2, T.10 S., R.1 E.	5–30	95	5–8	Bauxite and Soil
Randolph Area	Broad ridges	SW.¼, SE.¼, Sec. 15, T.10 S., R.1 E.	10–20	15	2–8	Soil and Bauxite
	Broad ridges	SE¼, NE.¼, Sec. 22, T.10 S., R.1 E.	8–15	5	10–20	Soil
	Broad hills	NW.¼, NW.¼, Sec. 28, T.10 S., R.1 E.	8–15	10	2–15	Soil and Bauxite

THAXTON AREA

In the Thaxton area, the higher of the narrow ridges in Section 29 are capped by bauxite, including Smoky Top and East Smoky Top, hills where bauxite deposits and the subjacent clays were previously examined by Paul F. Morse.[51] Recently, 8 prospect holes dug by the Reynolds Aluminum Company along the ridge crests penetrated to unaltered Porters Creek beds, affording the clay measurements cited in the table. However, these bauxite-capped hills actually constitute but 15 of the 105 acres believed to be underlain by bauxitic and kaolinitic clays. The remaining 90 acres include the unprotected shoulders of the Smoky Top hills and lower and broader Ackerman-capped hills which parallel them to the south and extend nearly to the roadfork (Cen., Sec. 29, T.8 S., R.1 E.).

Approximately a mile south of Smoky Top, a shallow valley (SE. 1/4, SW. 1/4, Sec. 29, T.8 S., R.1 E.) is in part underlain by previously undescribed aluminous clays. Here, a 10.2-foot interval of pisolitic clay, associated with lignitic and carbonaceous silts, is exposed in a small stream 0.3 mile east of the road bridge, and similar beds having thicknesses up to 17 feet are overlain by thin soils and thick Ackerman sands along the north valley wall. Tests N230, N231, N232, N233, and N234 proved the material to be reworked into the Fearn Springs formation, but diligent drilling of the adjacent areas failed to reveal the source of the surprisingly clean Betheden detritus which obviously was not transported far.

The hillside and plateau deposits (Sec. 33, T.8 S., R.1 E.) were described by Morse[52] as on the N. A. Short and T. A. Montgomery properties, but were given small consideration since little bauxite was discovered. However, in this investigation, deepened old test pits and new test holes showed 5-foot to 16-foot thicknesses of workable clay beneath an overburden of thin soil in the plateau area, and beneath bauxite and Ackerman sands in the hillside area. The record of test N82 shows the thickest section of clays encountered in the area, beneath a bauxite ledge which is being removed for road material.

TOCCOPOLA AREA

The most desirable high alumina clays yet discovered in Pontotoc County are in the Toccopola area, as small deposits scattered through Sections 33, 34, 35, and 36, T.9 S., R.1 E., and in Section 2, T.10 S., R.1 E. The deposit in Section 33 is easily accessible as it is bisected by the Toccopola-Springville road whose cuts show pisolitic clay. Here the interval 6.1 to 10.5 feet (N199 2-3) is of nearly silt-free kaolinitic material.

One-half mile north-northeast, narrow bauxite-capped ridges (SW. 1/4, NW. 1/4, Sec. 34) were prospected and described by Morse[53] as the Inmon and Tallant properties. Here, a maximum thickness of 22 feet of pisolitic and white structureless clay was encountered beneath the bauxite and 5-foot to 10-foot intervals of kaolinitic clays were penetrated along the ridge slopes.

Two miles to the east are the three closely associated deposits in Sections 35 and 36, which are known as Big, Second, and Third Hills. Their bauxite caps and the subjacent beds were studied by Morse,[54] but in this investigation, the clays received most attention. As shown by test N210, in a re-opened test pit, the Big Hill clays appear less favorable than those in Third Hill (N216) and in Second Hill, since the Big Hill clays are interbedded with lignitic and sideritic materials.

Across a broad valley to the southwest of Third Hill is a belt of broad hills and narrow ridges (NE. 1/4, Sec. 2, T.10 S., R.1 E.) which are crossed by the Toccopola-Springville road. The bauxite-capped ridges in the northeast corner of the section were prospected by Morse[55] and described as the E. D. McGregor deposit. The underlying clay proved silt-free, but unfortunately it is only 5 to 10 feet in thickness, as is that beneath the hilltop bauxite ledge tested by N242 (NE. 1/4, SE. 1/4, NE. 1/4, Sec. 2) and at the base of the bauxite in the pit to the west (NW. corner, NE. 1/4, Sec. 2). However, examinations of pisolitic and absorbent white clay exposures along the road (N243, SE. 1/4, SW. 1/4, NE. 1/4, Sec. 2) show 15 to 30 feet of material that may prove to be of value.

RANDOLPH AREA

The high alumina clay deposits of the Randolph area are small, widely scattered, and of inferior quality. The best deposit is situated at the crest of a broad ridge (SW. 1/4, SE. 1/4, Sec. 15, T.10 S., R.1 E.) 2 miles north-northwest of Randolph, on the property of Percy Coates. The clays are here protected by massive ferruginous bauxite which is exposed in a roadcut at the south extremity of the hill.

Old test pits and a new auger hole (N239) show 10 to 20 feet of silty bauxitic clay. One-half mile to the southeast (SE. 1/4, NE. 1/4, Sec. 22, T.10 S., R.1 E.) siltier beds are exposed in a roadcut at the crest of a flat-topped divide just north of Gutun Creek. Here, test N238 showed a 19.2-foot thickness of fairly silty limonitic pisolitic clay which becomes progressively less silty to the west in a series of four test pits dug at 200 feet intervals. Evidently the quality improves farther west, for the material is nearly silt-free in N254-3, which tested beds beneath very ferruginous bauxite at a gravel pit (SW. 1/4, NW. 1/4, SW. 1/4, Sec. 28, T.10 S., R.1 E.)

BAUXITE

Although previous investigations of bauxite in Pontotoc County have proved it too siliceous and ferruginous for use as aluminum ore, one deposit recently sampled appears to have a much lower iron content. This deposit caps a small crescentic hill of 1.5 acres (SW. 1/4, SE. 1/4, NW. 1/4, Sec. 22, T.9 S., R.1 E.) on the R. S. Worthington property 1600 feet south of Mississippi Highway 6 and 9 miles west of Pontotoc. Portions of the south outcrop face have lately been removed for highway material, exposing a 6.9-foot thickness of very pisolitic material, the lower two-thirds of which is little weathered and but slightly iron-stained. The underlying beds, also shown in the record of test N275, are too sandy to warrant removal even though the upper beds should prove valuable.

Unless unprecedented demands for aluminum necessitate the utilization of highly ferruginous deposits, such as are found elsewhere in the county, it is probable that their development will have to await the exhaustion of higher grade ores. Unfortunately the material from 13 outcrops is now furnishing road metal for the surfacing of local roads and for the maintenance of Mississippi Highway 9 from Springville to Toccopola.

BENTONITIC CLAY

Unfortunately, new deposits of bentonitic clay were not found in the course of this investigation beyond the previously known outcrop area (parts of Secs. 13, 14, 23, 24, 25, and 26, T.9 S., R.3 E.), 4 and 5 miles northeast of Pontotoc. In this search, the beds beneath the upper Ripley limestone, the stratigraphic position of the clays, were tested by 38 auger holes at widely scattered points both north and south of the producing area, Section 23. In addition, thin beds of re-worked bentonitic clay were examined in gully washes in the fossiliferous middle Ripley sands (W. 1/2, NE. 1/4, SW. 1/4, Sec. 6, T.10 S., R.4 E.) at the crest of the southwest valley wall of Bob Miller Creek, 4 miles east of Pontotoc. Further, beds of Prairie Bluff chalk, Porters Creek clay, and Selma-Ripley transitional clay were tested in areas erroneously reported as containing bentonitic materials.

Due to extensive pre-upper Ripley erosion and to a thick overburden of limestone and chalk, accessible deposits of bentonite are widely scattered, even in the producing area. However, the clay appears of sufficient thickness to warrant commercial mining at the following 5 localities, all beneath limestone ledges along steep valley walls:

1. Northeast-facing gullies, 200 feet northeast of road (NW. 1/4, NE. 1/4, NW. 1/4, Sec. 13, T.9 S., R.3 E.), thickness 2.5 feet.
2. South-facing gullies, one-fourth mile east of road (Cen., SE. 1/4, NW. 1/4, Sec. 14, T.9 S., R.3 E.), thickness 3.2 feet.
3. Southeast-facing gullies, 600 feet west of road (NE. 1/4, NW. 1/4, NW. 1/4, Sec. 24, T.9 S., R.3 E.), thickness 1.8 to 2.7 feet.
4. North-facing gullies, 300 feet north of road (SW. 1/4, NW. 1/4, NE. 1/4, Sec. 26, T.9 S., R.3 E.), thickness 2.9 feet.
5. East-facing gullies, 1100 feet southeast of roadfork (NW. 1/4, NW. 1/4, SW. 1/4, Sec. 23, T.9 S., R.3 E.), thickness 4.1 feet.

Thick beds of slightly silty clays were observed in the Porters Creek formation, one near the base and many scattered through the middle and upper divisions, which remotely resemble bentonitic clay. The best examples are shown in the records of test holes, as follows: samples 1 and 2, N17; sample 1, N24; sample 2, N212; samples 2 to 6 inclusive, N233.

BRICK, TILE, AND POTTERY CLAYS

Clays for making pottery, brick, and tile are limited to beds in the Porters Creek, Betheden, Fearn Springs, and Ackerman formations, the older strata in the east one-half of the county being too calcareous for this purpose.

Gray and greenish-buff slightly silty clays are abundant in the middle division of the Porters Creek and to a less extent in the lower calcareous division and in the upper silty division. The thickest deposits have been tested by N17, N24, N128, N204, N212, N220, and N233, most of which are within hauling distance of Pontotoc. Other large and easily accessible beds, having a position near the base of the formation, are exposed in a railroad cut at Wallfield (Cen., Sec. 18, T.11 S., R.3 E.) and near Friendship Church (Secs. 11 and 12, T.9 S., R.2 E.). In addition to the light-colored Porters Creek clays, thick black clays of undetermined possibilities are common in the Springville area, near the top of the middle division (test N24).

The pottery clays appear to be confined to the Fearn Springs and Ackerman formations, in the west part of the county. Unfortunately these beds are thin and interfinger with lignitic clays, dark and light-colored silts, and sands, so that the operation of these deposits would be expensive. The best Fearn Springs clays are exposed in roadcuts (N70, SW. 1/4, NE. 1/4, SE. 1/4, Sec. 26, T.8 S., R.1 E.) at the base of a south valley wall one-half mile northwest of Esperanza (Hurricane) School, and in cuts of two roads (Secs. 7 and 8, T.10 S., R.1 E.), near the base of the south valley wall of Two Mile Creek, 1 1/2 miles south-southeast of Toccopola. Here, sections of 35 and 66 feet have been tested by N193, N194, N261, and N262. Upstream, 2 miles east of Toccopola roadcuts show lignitic clays which have been tested by N202 (E. 1/2, NE. 1/4, SE. 1/4, Sec. 32, T.9 S., R.1 E.).

The pottery clays of the Ackerman formation are included in the clay division which is best exposed in roadcuts between the Lafayette County line and Thaxton (Secs. 7 and 8, T.9 S., R.1 E.). Clays underlying a lignite bed were tested by N288 at the roadfork (W. 1/2, NW. 1/4, NE. 1/4, Sec. 7), although a thicker section was discovered to the west in Lafayette County, one-half mile southeast of Lafayette Springs (NE. 1/4, SW. 1/4, Sec. 12, T.9 S., R.1 W.).

AGRICULTURAL LIME

Calcareous beds, too lean to be mined for commercial lime, but of sufficient lime content for local use, are abundant in the Selma, Ripley, Prairie Bluff, and Clayton formations. During this investigation, test hole samples of these beds were subjected to acid treatment, the amount of washed residue after drying being subtracted to determine the relative calcium carbonate ($CaCO_3$) content available for fertilizer. On the basis of these crude determinations, chalks and chalky limestones reached a maximum of 39 percent lime (CaO) and chalky clays, 28 percent lime. Pure limestone should analyze approximately 56 percent available lime. Only the best of these chalks and limestones are treated in this discussion.

Desirable chalk lenses in the Selma formation are exposed at the east edge of the county, in the area of gently rolling somewhat barren hills along the east valley wall of Bob Miller Creek south of Furrs (Secs. 13, 14, 15, 23, and 24, T.10 S., R.4 E.) and in the rugged hills between Chesterville and Furrs (Secs. 23, 24, 25, 26, 35, and 36, T.9 S., R.4 E.). In choosing the best material, the freshest roadcut and gully exposures should be selected, and the upper several feet of leached chalk should be discarded.

Similarly, chalky limestones of the lower division of the Ripley formation are exposed in a winding north-south belt from Sherman through Endville, Longview, Plymouth, Woodland, and Troy. The most desirable limestones form steep valley walls, accessible by road, in the following areas: Sec. 27, T.8 S., R.4 E.; S. 1/2, Sec. 9, SE. 1/4, Sec. 19, and N. 1/2, Sec. 33, T.9 S., R.4 E.; and Secs. 2, 3, and 4 and NW. 1/4, Sec. 22, T.11 S., R.4 E.

Farther west, limestone lenses in the thick middle division of the Ripley formation crop out on the south bank of Chiwapa Creek along Mississippi Highway 41 (S. 1/2, Sec. 15, T.10 S., R.3 E.), 3 miles southeast of Pontotoc, and in creek bottoms in the northeast part of Section 2, T.11 S., R.3 E. The most abundant and most easily accessible limestone is that which constitutes the upper Ripley division; it crops out in 17 localities extending west as far as Mississippi Highway 15, as described in the treatment of stratigraphy and areal geology. Along the same highway, lower Clayton limestones are exposed along the south bank of Lappatubby Creek (Sec. 36, T.8 S., R.2 E.) just south of Ecru, in cuts (NW. 1/4, Sec. 9, T.10 S., R.3 E.) 1 mile south of Pontotoc, and at the base of a large Clayton sand pit (Cen., Sec. 5, T.11 S., R.3 E.) 7 miles south of Pontotoc.

Thick chalks and clayey chalks of the lower division of the Prairie Bluff formation are satisfactory for liming adjacent sandy Clayton or Ripley soils, but they are too low in lime content to warrant long haulage. These materials directly overlie the upper Ripley limestone and are accessible to roads in the areas described in the stratigraphic treatment of the unit.

GLAUCONITIC LIMESTONE

Since beds in the lower Porters Creek division locally contain lime and green potash, the potassium-bearing mineral glauconite, application of this material would serve a dual purpose in building up the waxy Flatwoods soils west of Pontotoc. Exposures of glauconitic limy beds are confined to two areas: the flat table lands at the juncture of townships 9 and 10 S., ranges 2 and 3 E., and narrow valley walls in Sections 7 and 8, T.11 S., R.3 E., 1 mile north of Wallfield. In the table lands area, the beds were tested by N17 (N. 1/2, SW. 1/4, SW. 1/4, Sec. 31, T.9 S., R.3 E.) and are exposed in cuts along Mississippi Highway 9 from the west edge of Pontotoc to the roadfork 2 miles to the southeast.

TEST HOLE RECORDS

City of Pontotoc Property

Test Hole Record N1

Location: T.10 S., R.3 E., Sec. 4. N. 1/2, NW. 1/4, NW. 1/4; abandoned city street, 100 feet east of water tower Drilled: July 16, 1941

Elevation: 495 feet Water level: 40 feet

No.	Depth	Thick.	Description of strata and designations of samples
			Clayton formation
1	6.0	6.0	Clay, sandy dark-red
2	13.9	7.9	Sand, clayey dark-red; a few coarse sand grains
3	14.9	1.0	Sand, slightly clayey brownish-red slightly micaceous; a few coarse sand grains
4	20.0	5.1	Sand, silty reddish-brown fairly micaceous
5	27.6	7.6	Sand, fine to coarse light-brown; some coarse sand grains
			Upper division, Prairie Bluff formation
6	41.0	13.4	Sand, silty light-brown slightly micaceous
7	55.6	14.6	Sand, silty light-buff; thinly laminated buff clay at base
			Middle division, Prairie Bluff formation
8	56.2	0.6	Silt, gray-buff limy

G. W. Vance Property

Test Hole Record N17

Location: T.9 S., R.3 E., Sec. 31, N. 1/2, SW. 1/4, SW. 1/4; 15 feet north of Mississippi Highway 6, at hill crest, 1225 feet east of end of concrete

Drilled: July 28, 1941

Elevation: 458 feet

Water level: 28.8 feet

No.	Depth	Thick.	Description of strata and designations of samples
			Porters Creek formation
1	10.3	10.3	Clay, very slightly silty light-greenish-buff slightly waxy; black stain along laminae; P1
2	23.9	13.6	Clay, slightly silty light-greenish-buff; very slightly calcareous; P2
			Clayton formation
3	27.9	4.0	Silt, sandy dark-greenish-gray fairly limy
4	28.8	0.9	Silt, sandy bluish-gray limy; most of sand is coarse quartz
5	31.3	2.5	Sand, silty dark-greenish-buff fairly limy
6	31.8	0.5	Silt, sandy dark-greenish-gray fairly limy

Robert Ferrell, Est. Property

Test Hole Record N20

Location: T.9 S., R.2 E., Sec. 35, E. 1/2, NE. 1/4; NW. 1/4; 50 feet north of the R. O. W. marker of Mississippi Highway 6, above roadcut

Drilled: July 29, 1941

Elevation: 401 feet

Water level: Dry

No.	Depth	Thick.	Description of strata and designations of samples
			Lower division, Porters Creek formation
1	11.0	11.0	Clay, silty gray-buff tan-mottled fairly micaceous thinly laminated
2	18.6	7.6	Clay, silty light-gray slightly micaceous thinly laminated
3	26.6	8.0	Clay, fairly silty light-greenish-gray fairly micaceous slightly limy
4	42.6	16.0	Clay-shale, slightly silty greenish-black to bluish-black fairly limy

E. W. Wardlaw Property

Test Hole Record N22

Location: T.9 S., R.2 E., Sec. 33, E. 1/2, NW. 1/4, NE. 1/4; 30 feet northeast of the J. E. Wardlaw home, northeast corner of road intersection

Drilled: July 31, 1941

Elevation: 398 feet Water level: 23 feet

No.	Depth	Thick.	Description of strata and designations of samples
			Middle division, Porters Creek formation
1	14.1	14.1	Clay, fairly silty light-greenish-buff slightly micaceous; P1
2	25.4	11.3	Clay, fairly silty greenish-gray slightly micaceous; P2
3	41.3	15.9	Silt, clayey dark-greenish-blue slightly micaceous; P3

J. T. Tunnell Property

Test Hole Record N24

Location: T.10 S., R.2 E., Sec. 4, W. 1/2, NW. 1/4, SW. 1/4; 25 feet east of road near base of hill, 0.6 mile north of Springville Drilled: July 31, 1941

Elevation: 460 feet Water level: 60.2 feet

No.	Depth	Thick.	Description of strata and designations of samples
			Middle division, Porters Creek formation
1	27.6	27.6	Clay, very slightly silty buff-tan; P1
2	31.6	4.0	Clay-shale, slightly silty bluish-black; thin breaks gray-buff slightly silty clay-shale; small amount of gypsum; P2
3	39.8	8.2	Clay-shale, slightly silty greenish-black; P3
4	54.8	15.0	Clay-shale, slightly silty greenish-black; layers of black waxy clay-shale; P4
5	59.6	4.8	Clay-shale, silty greenish-black
6	69.1	9.5	Silt, clayey greenish-black slightly micaceous; contains small nodules of yellow-buff bentonitic ? clay

Mrs. Florence A. Simmington Property

Test Hole Record N25

Location: T.10 S., R.2 E., Sec. 4, SW. 1/4, NW. 1/4, SW. 1/4; 40 feet east of road curve in thin woods half way up hill, 0.4 mile north of Springville

Drilled: July 31, 1941

Elevation: 510 feet

Water level: 12 feet

No.	Depth	Thick.	Description of strata and designations of samples
			Ackerman formation
1	11.8	11.8	Silt, sandy red-buff; thin laminae of light-gray clay
2	17.7	5.9	Silt, sandy buff; laminae of light-gray clay
3	19.7	2.0	Silt, slightly sandy gray-buff white-mottled
4	24.4	4.7	Silt, fairly sandy red-buff gray-mottled
5	28.3	3.9	Silt, gray-buff slightly micaceous
6	31.3	3.0	Silt, clayey buff-gray-mottled slightly micaceous
7	33.8	2.5	Silt, clayey light-gray
8	37.2	3.4	Sand, silty buff-gray and black-mottled
9	42.9	5.7	Silt, sandy light-buff slightly micaceous; small flattened pellets of light-gray clay

J. E. Tunnell Property

Test Hole Record N27

Location: T.10 S., R.2 E., Sec. 9, NW. 1/4, SE. 1/4, NW. 1/4, south side Mississippi Highway 9, 125 feet northeast of the Tunnell home, 0.25 mile east of Springville

Drilled: August 4, 1941

Elevation: 440 feet

Water level: 35 feet

No.	Depth	Thick.	Description of strata and designations of samples
			Middle division, Porters Creek formation
1	8.8	8.8	Clay-shale, fairly silty buff
2	19.1	10.3	Clay-shale, very slightly silty greenish-buff; P2
3	28.2	9.1	Clay-shale, slightly silty greenish-gray; P3
4	34.8	6.6	Clay-shale, silty bluish-gray thinly laminated; P4
5	41.2	6.4	Silt, clayey dark-greenish-gray fairly micaceous

J. D. Bost Property

Test Hole Record N30

Location: T.10 S., R.2 E., Sec. 2, W. 1/2, SW. 1/4, SE. 1/4, north side Mississippi Highway 9, 150 feet east of Lappatubby Creek bridge

Drilled: August 5, 1941

Elevation: 428 feet

Water level: 35 feet

No.	Depth	Thick.	Description of strata and designations of samples
	2.5	2.5	Overburden
			Middle division, Porters Creek formation
1	10.4	7.9	Silt, sandy gray-buff slightly micaceous; thin layers of limonitic claystone and ferruginous sandstone
2	28.3	17.9	Clay-shale, very slightly silty cream to buff-colored well jointed; P2
3	34.8	6.5	Clay-shale, slightly silty dark-grayish-green slightly micaceous slightly limy; P3
4	42.6	7.8	Silt, clayey dark-greenish-gray fairly limy

C. W. Bolton Estate Property

Test Hole Record N35

Location: T.9 S., R.3 E., Sec. 35, SW. 1/4, NE. 1/4, NW. 1/4, in depression in west limestone quarry, north side of Bolton Hill

Drilled: December 8, 1941

Elevation: 442 feet

Water level: 10 feet

No.	Depth	Thick.	Description of strata and designations of samples
			Upper division, Ripley formation
1	7.1	7.1	Limestone, sandy fairly fossiliferous gray-white; chalky toward base
			Middle division, Ripley formation
2	14.8	7.7	Sand, fine to medium yellow-buff fairly micaceous
3	23.8	9.0	Sand, clayey brownish-buff fairly micaceous; chalky limestone at base

Remarks: Unconformity between samples 1 and 2

C. B. SELB PROPERTY

TEST HOLE RECORD N43

Location: T.10 S., R.3 E., Sec. 11, SW. 1/4, NW. 1/4, SW. 1/4, scrub oak in pasture, 50 feet east of road at northeast end of limestone outcrop, 500 feet northwest of the Selb home Drilled: August 12, 1941

Elevation: 432 feet Water level: 17 feet

No.	Depth	Thick.	Description of strata and designations of samples
	3.4	3.4	Overburden
			Middle division, Ripley formation
1	7.2	3.8	Sand, fine to medium brown slightly micaceous
2	44.2	37.0	Sand, fine yellow-buff slightly micaceous; slightly limy at base

MISSISSIPPI MINERALS CO. PROPERTY

TEST HOLE RECORD N44

Location: T.9 S., R.3 E., Sec. 23, SE. 1/4, NE. 1/4, NW. 1/4, top of bentonite, south end of bentonite pit, beneath ledge of upper Ripley limestone

Drilled: December 9, 1941

Elevation: 409 feet Water level: 7.5 feet

No.	Depth	Thick.	Description of strata and designations of samples
			Middle division, Ripley formation
1	1.0	1.0	Bentonitic clay, fairly silty dark-bluish-gray; large mica flakes; thin shell fragments; waxy; P1
2	2.0	1.0	Bentonitic clay, slightly silty dark-bluish-gray slightly limy; waxy; P2
3	3.0	1.0	Bentonitic clay, dark-bluish-gray slightly silty; large mica flakes; thin shell fragments; waxy; P3
4	4.0	1.0	Bentonitic clay, slightly silty light-grayish-blue; large mica flakes; waxy; P4
5	5.0	1.0	Bentonitic clay, slightly silty light-gray; waxy; P5
6	6.0	1.0	Bentonitic clay, very slightly silty buff-gray; waxy; slightly weathered; P6
7	7.0	1.0	Bentonitic clay, very slightly silty light-buff; weathered; P7
8	9.7	2.7	Chalk, sandy gray-white buff-mottled; scattered grains of coarse quartz sand; large flakes of mica; fragments of shells

PRIMROSE CHURCH PROPERTY

TEST HOLE RECORD N46

Location: T.10 S., R.3 E., Sec. 14, Cen., NW. 1/4, SE. 1/4, north side of road, 500 feet east of roadfork Drilled: August 12, 1941

Elevation: 378 feet Water level: 25 feet

No.	Depth	Thick.	Description of strata and designations of samples
	2.8	2.8	Overburden
			Middle division, Ripley formation
1	23.6	20.8	Sand, fine to medium brownish-red slightly micaceous
2	34.7	11.1	Sand, fine buff fairly micaceous
3	37.6	2.9	Sand, fine yellow-buff fairly micaceous slightly limy

C. F. COX PROPERTY

TEST HOLE RECORD N48

Location: T.10 S., R.4 E., Sec. 19, E. 1/2, SE. 1/4, NW. 1/4, northwest corner of roadfork Drilled: August 12, 1941

Elevation: 318 feet Water level: 10 feet

No.	Depth	Thick.	Description of strata and designations of samples
	2.9	2.9	Overburden
			Middle division, Ripley formation
1	12.8	9.9	Sand, silty greenish-buff fairly micaceous
2	22.6	9.8	Marl, fairly silty greenish-gray micaceous fairly limy
3	37.5	14.9	Marl, fairly silty greenish-black fairly micaceous fairly limy

JOHN CHEW PROPERTY

TEST HOLE RECORD N53

Location: T.9 S., R.3 E., Sec. 35, SW. 1/4, SE. 1/4, SE. 1/4, 75 feet south of roadfork (between the forks) Drilled: August 15, 1941

Elevation: 459 feet Water level: 22 feet

No.	Depth	Thick.	Description of strata and designations of samples
	3.2	3.2	Overburden
			Middle division, Ripley formation
1	17.9	14.7	Clay, silty yellow-buff red-mottled slightly micaceous
2	21.2	3.3	Sand, fine to coarse reddish-brown
3	36.4	15.2	Sand, fine to medium yellow-buff slightly micaceous
4	48.5	12.1	Sand, fine buff fairly micaceous; limy at base

O. C. Rackley Property

Test Hole Record N61

Location: T.9 S., R.3 E., Sec. 36, NE. 1/4, NE. 1/4, NE. 1/4, on south side of road, at crest of hill in front of house Drilled: August 15, 1941

Elevation: 432 feet Water level: 32 feet

No.	Depth	Thick.	Description of strata and designations of samples
	2.1	2.1	Overburden
			Middle division, Ripley formation
1	3.9	1.8	Silt, sandy reddish-buff slightly micaceous
2	20.8	16.9	Sand, fine to medium Indian-red
3	37.8	17.0	Sand, fine yellow-buff fairly micaceous
4	40.2	2.4	Sand, silty brownish-buff slightly micaceous slightly limy
5	40.4	0.2	Marl, silty greenish-gray fairly micaceous fairly limy

Mrs. W. H. Gentry Property

Test Hole Record N65

Location: T.9 S., R.4 E., Sec. 19, NW. 1/4, SE. 1/4, SW. 1/4, 50 feet west of roadfork, north side of road Drilled: August 18, 1941

Elevation: 456 feet Water level: 40.5 feet

No.	Depth	Thick.	Description of strata and designations of samples
	2.9	2.9	Overburden
			Middle division, Ripley formation
1	9.0	6.1	Silt, clayey Indian-red
2	20.4	11.4	Sand, fine to medium reddish-brown slightly micaceous
3	30.0	9.6	Sand, fine to medium buff
4	39.4	9.4	Sand, medium yellow-buff slightly micaceous
5	44.9	5.5	Sand, fine to medium yellow very slightly glauconitic

Ben Sneed Property

Test Hole Record N70

Location: T.8 S., R.1 E., Sec. 26, SW. 1/4, NE. 1/4, SE. 1/4, in clay east road ditch, crest of south valley wall of small stream, 0.45 mile north of Hurricane School — Drilled: November 29, 1941

Elevation: 377 feet — Water level: Dry

No.	Depth	Thick.	Description of strata and designations of samples
1	0.8	0.8	Soil—silt, clayey gray-buff
			Fearn Springs formation
2	10.8	10.0	Clay, very slightly silty almost black carbonaceous; P2
3	16.2	5.4	Clay, very slightly silty brownish-black; small pellets of limonitic clays; P3
4	17.8	1.6	Silt, sandy gray-white

Clyde McShee Property

Test Hole Record N80

Location: T.9 S., R.3 E., Sec. 10, SE. corner, SE. 1/4, 0.1 mile southwest of road fork — Drilled: August 22, 1941

Elevation: 496 feet — Water level: 51.2 feet

No.	Depth	Thick.	Description of strata and designations of samples
			Clayton formation
1	6.5	6.5	Clay, sandy very dark-red
2	11.7	5.2	Sand, clayey Indian-red slightly micaceous; pellets of ferruginous clay
3	20.0	8.3	Silt, sandy red-buff slightly micaceous; dark-brown ferruginous pellets
4	29.2	9.2	Sand, fine to medium brownish-buff slightly micaceous
5	37.7	8.5	Sand, fine to medium light-brown slightly micaceous
			Upper division, Prairie Bluff formation
6	60.9	23.2	Sand, fine silty dark-buff slightly micaceous
7	64.8	3.9	Sand, silty gray-buff fairly micaceous
			Middle division, Prairie Bluff formation
8	69.0	4.2	Marl, silty greenish-gray fairly micaceous fairly limy

Ellis Russell Property

Test Hole Record N82

Location: T.8 S., R.1 E., Sec. 33, SW. 1/4, SW. 1/4, NW. 1/4, base of bauxite ledge in field, 0.4 mile northwest of road fork

Drilled: November 28, 1941

Elevation: 391 feet — Water level: 25.5 feet

No.	Depth	Thick.	Description of strata and designations of samples
			Betheden residuum
1	7.1	7.1	Clay, very slightly silty white bauxitic; mottled pink and buff; P1
2	10.9	3.8	Clay, very slightly silty cream-colored yellow-mottled bauxitic; P2
3	13.4	2.5	Clay, slightly silty white light-buff-mottled bauxitic; P3
4	14.1	0.7	Silt, clayey gray purple-gray-mottled very micaceous selenitic; laminae of white micaceous bauxitic silty clay; semi-indurated laminae of purple clay; P4
5	19.2	5.1	Clay, slightly silty white bauxitic; P5
			Porters Creek formation
6	22.5	3.3	Silt, fairly clayey light-gray fairly micaceous bauxitic (?); well-weathered; P6
7	26.0	3.5	Silt, clayey gray-buff buff-mottled fairly micaceous; weathered; P7

Remarks: Sample 6 illustrates alteration of Porters Creek clayey silt to bauxitic clay

G. B. Hardin Property

Test Hole Record N90

Location: T.9 S., R.4 E., Sec. 6, E.1/2, NW. 1/4, SW. 1/4, 200 feet south of road fork, east side of road above roadcut — Drilled: August 26, 1941

Elevation: 489 feet — Water level:

No.	Depth	Thick.	Description of strata and designations of samples
1	7.9	7.9	Silt, clayey light-gray red-mottled slightly micaceous
			Prairie Bluff formation
2	11.0	3.1	Clay, silty light-gray buff-mottled slightly micaceous
3	19.5	8.5	Marl, silty light-greenish-buff slightly micaceous
4	32.8	13.3	Marl, silty light greenish-buff
5	33.4	0.6	Marl, silty light-gray buff-mottled fairly micaceous fairly limy
6	39.1	5.7	Marl, silty to clayey gray-buff; fairly fossiliferous
7	46.8	7.7	Marl, silty dark-greenish-gray
			Ripley formation
8	47.1	0.3	Limestone, gray-white; grains of coarse sand

Bethany Baptist Church Property

Test Hole Record N128

Location: T.8 S., R.2. E., Sec. 29, NW. 1/4, NW. 1/4, NE. 1/4; in churchyard, southeast corner of roadfork
Drilled: September 10, 1941
Elevation: 299 feet
Water level: 24 feet

No.	Depth	Thick.	Description of strata and designations of samples
			Middle division, Porters Creek formation
1	24.1	24.1	Clay, silty gray-buff slightly micaceous; P1
2	27.8	3.7	Silt, slightly clayey greenish-gray buff-mottled fairly micaceous; P2
3	43.8	16.0	Silt, dark-grayish-green fairly micaceous; P3

Irene Freeman Property

Test Hole Record N143

Location: T.9 S., R.4 E., Sec. 33, SE. 1/4, NE. 1/4, NW. 1/4, west side of dirt road, at roadcut on crest of hill
Drilled: September 12, 1941
Elevation: 348 feet
Water level: 27 feet

No.	Depth	Thick.	Description of strata and designations of samples
			Lower Ripley transitional clay
1	7.9	7.9	Clay, sandy brownish-buff
2	12.8	4.9	Marl, silty gray-buff; white nodules of caliche; P2
3	21.0	8.2	Clay, fairly silty gray-buff light-buff-mottled fairly limy; P3
			Upper phase, Selma formation
4	36.9	15.9	Marl, fairly silty bluish-gray fairly micaceous; P4

I. N. Knox Property

Test Hole Record N145

Location: T.10 S., R.4 E., Sec. 4, SW. 1/4, NW. 1/4, SE. 1/4, east side of road, just south of hill crest, 250 feet northeast of farm house
Drilled: September 12, 1941
Elevation: 362 feet
Water level: several perched water tables

No.	Depth	Thick.	Description of strata and designations of samples
			Lower Ripley transitional clay
1	7.4	7.4	Clay, fairly silty yellow-buff fairly micaceous; P1
2	27.7	20.3	Clay, fairly silty greenish-buff fairly micaceous fairly limy; blocky fracture; P2
3	39.8	12.1	Silt, fairly clayey light-greenish-buff fairly limy; P3
			Upper phase, Selma formation
4	42.1	2.3	Clay, fairly silty dark-bluish-gray fairly micaceous fairly fossiliferous fairly limy; P4

J. L. Hearndon Property

Test Hole Record N178

Location: T.11 S., R.4 E., Sec. 22, NE. 1/4, NW. 1/4, NW. 1/4, north side of road in front of farm home, 0.4 mile east of Troy

Drilled: September 29, 1941

Elevation: 420 feet

Water level: 57.6 feet

No.	Depth	Thick.	Description of strata and designations of samples
			Lower division, Ripley formation
1	5.3	5.3	Chalk, silty gray-white
2	21.9	16.6	Clay-shale, fairly silty bluish-black fairly limy fairly fossiliferous; P2
			Lower Ripley transitional clay
3	36.5	14.6	Clay, fairly silty dark-buff to light-gray fairly micaceous; blocky fracture; slightly fossiliferous; P3
4	46.5	10.0	Clay, fairly silty greenish-buff fairly limy slightly micaceous; blocky fracture; P4
			Upper phase, Selma formation
5	57.6	11.1	Marl, clayey dark-bluish-gray fairly micaceous; P5
6	62.8	5.2	Marl, silty dark-bluish-gray micaceous; P6

R. W. Prewitt Property

Test Hole Record N192

Location: T.10 S., R.1 E., Sec. 8, SW. 1/4, NW. 1/4, NE. 1/4, east side of road, south valley wall of Two Mile Creek, at outcrop of clay-shale, 25 feet north of fault plane (Fearn Springs faulted against Porters Creek)

Drilled: September 30, 1941

Elevation: 422 feet

Water level: 13.4 feet

No.	Depth	Thick.	Description of strata and designations of samples
			Fearn Springs formation
1	7.1	7.1	Clay-shale, silty dark-gray-tan lignitic; plant impressions; thin breaks of yellow-buff clayey silt near base; P1
2	13.4	6.3	Sand, fine to medium yellow-buff; scattered grains of coarser sand (fault plane)
			Porters Creek formation
3	22.6	9.2	Clay-shale, silty bluish-black fairly micaceous; P3
4	25.4	2.8	Clay-shale, silty grayish-blue slightly micaceous; P4

Remarks: Sand marks fault plane. Hole drilled on downthrow side of fault in Fearn Springs

R. W. PREWITT PROPERTY

TEST HOLE RECORD N193

Location: T.10 S., R.1 E., Sec. 8, NW. 1/4, SW. 1/4, NE. 1/4; Fearn Springs outcrop, east side of road half way up south valley wall of Two Mile Creek Drilled: September 30, 1941

Elevation: 440 feet Water level: 22.3 feet

No.	Depth	Thick.	Description of strata and designations of samples
			Fearn Springs formation
1	3.9	3.9	Clay, very slightly silty gray-white yellow-mottled
2	5.0	1.1	Clay, very slightly silty gray-white tan-mottled
3	8.4	3.4	Clay-shale, very slightly silty buff-mottled; P3
4	10.9	2.5	Clay, very slightly silty gray-white; yellow silt along joint cracks; P4
5	15.7	4.8	Clay-shale, very slightly silty light-gray; P5
6	20.6	4.9	Clay-shale, slightly silty brownish-black very lignitic; very light in weight; P6
7	22.9	2.3	Clay-shale, very silty dark-brownish-black fairly micaceous very lignitic; P7
			Porters Creek formation
8	28.7	5.8	Sand, silty dark-gray fairly micaceous
9	35.3	6.6	Silt, clayey very dark-gray fairly lignitic slightly micaceous
10	39.0	3.7	Clay, fairly silty very dark-gray fairly micaceous

Remarks: On downthrow side of fault, 120 feet south of fault plane

B. D. TUTOR PROPERTY

TEST HOLE RECORD N194

Location: T.10 S., R.1 E., Sec. 8, NE. 1/4, SE. 1/4, NW. 1/4; west side of road, crest of south wall of Two Mile Creek, 100 feet north of road curve

Drilled: October 4, 1941

Elevation: 452 feet

Water level: 37 feet

No.	Depth	Thick.	Description of strata and designations of samples
			Fearn Springs formation
1	13.0	13.0	Clay, fairly silty gray-white yellow-mottled; blocky fracture; P1
2	18.8	5.8	Clay, slightly silty gray-white fairly plastic; P2
3	31.9	13.1	Clay-shale, slightly silty brownish-black fairly lignitic thinly laminated; thin layers of light-gray plastic clay; P3
4	36.8	4.9	Clay-shale, fairly silty bluish-black slightly micaceous fairly lignitic; P4
			Porters Creek formation
5	40.8	4.0	Silt, slightly clayey very dark-gray slightly micaceous
6	44.3	3.5	Silt, fairly clayey bluish-black
7	46.2	1.9	Silt, slightly clayey bluish-black gray-mottled micaceous

Remarks: Drilled on upthrow side of fault, 300 feet south of fault plane

W. C. SLEDGE PROPERTY

TEST HOLE RECORD N199

Location: T.9 S., R.1 E., Sec. 33, NW. 1/4, SE. 1/4, SE. 1/4, 50 feet north of old Mississippi Highway 6, at hill crest (thin bauxite in roadcut)

Drilled: October 24, 1941

Elevation: 478 feet

Water level:

No.	Depth	Thick.	Description of strata and designations of samples
			Betheden residuum
1	6.1	6.1	Clay, light-gray dark-gray-mottled kaolinitic (?) fairly plastic; P1
2	8.2	2.1	Clay, very slightly silty white kaolinitic (?) or bauxitic (?); fluffy texture; P2
3	10.5	2.3	Clay, chalk-white kaolinitic(?) or bauxitic(?); P3
4	19.5	9.0	Clay, very slightly silty white-buff-mottled bauxitic(?) or kaolinitic(?); thin laminae of yellow-buff slightly micaceous clayey silt; P4
5	20.6	1.1	Sand, silty white slightly micaceous
6	26.6	6.0	Sand, very fine light-yellow slightly micaceous
7	30.1	3.5	Sand, fine yellow-buff fairly micaceous
8	34.3	4.2	Sand, fine white slightly micaceous
9	40.3	6.0	Clay, fairly silty gray-white yellow-mottled bauxitic(?); absorbent
10	42.5	2.2	Sand, medium cream-colored slightly micaceous
			Porters Creek formation
11	46.9	4.4	Clay, silty light-bluish-green fairly micaceous fairly plastic; thin laminae of yellow silty clay
12	53.9	7.0	Clay, silty black; laminae of greenish-black micaceous silty clay

W. A. HODGES PROPERTY

TEST HOLE RECORD N202

Location: T.9 S., R.1 E., Sec. 32, E. 1/2, NE. 1/4, SE. 1/4, south side of road, just east of crest of low divide, east of farm home

Drilled: October 24, 1941

Elevation: 425 feet

Water level: 15 feet

No.	Depth	Thick.	Description of strata and designations of samples
			Fearn Springs formation
1	13.2	13.2	Clay, silty light-gray buff-mottled; P1
2	18.9	5.7	Silt, slightly clayey light-gray buff-mottled very slightly micaceous
3	23.3	4.4	Silt, clayey dark-gray to black carbonaceous; laminae of grayish-white bauxitic(?) clay; P3
4	28.4	5.1	Silt, fairly clayey bluish-black very lignitic; large fragments of lignite; very light in weight; P4
5	33.9	5.5	Clay, silty; dark-gray-tan black-mottled slightly lignitic; silty laminae; P5

WILL MOODY PROPERTY

TEST HOLE RECORD N204

Location: T.9 S., R.1 E., Sec. 22, S. 1/2, SE. 1/4, SE. 1/4; 102 feet west of road-fork, south side of ditch

Drilled: November 17, 1941

Elevation: 421 feet

Water level: Dry

No.	Depth	Thick.	Description of strata and designations of samples
1	5.1	5.1	Soil—silt, clayey gray-buff; probably alluvium
			Upper division, Porters Creek formation
2	7.2	2.1	Silt, clayey light-buff; pellets of gray clayey silt; P2
3	10.5	3.3	Silt, slightly clayey buff; P3
4	14.6	4.1	Clay, slightly silty dark-buff; P4
5	16.2	1.6	Clay, slightly silty dark-buff; nodules of light-blue clay; P5
6	18.4	2.2	Clay, slightly silty brownish-buff; P6
7	20.2	1.8	Silt, clayey dark-buff; laminae of light-blue slightly silty clay and dark-brown silty clay; P7
8	31.3	11.1	Silt, clayey greenish-black micaceous

Ed Gilmore Property

Test Hole Record N208

Location: T.9 S., R.1 E., Sec. 27, S. 1/2, SE. 1/4, SW. 1/4; southwest corner of roadfork
Drilled: October 25, 1941

Elevation: 530 feet
Water level: 55 feet

No.	Depth	Thick.	Description of strata and designations of samples
			Ackerman formation
1	8.1	8.1	Sand, clayey reddish-brown; thin breaks of buff silty clay
2	11.9	3.8	Sand, fine reddish-buff; thin breaks of gray-white silty clay
3	40.2	28.3	Sand, fine gray-buff; a few large coarse grains
4	44.3	4.1	Sand, fine light-greenish-buff; thin limonitic siltstones at base
5	53.9	9.6	Sand, fine to coarse greenish-buff; the coarser grains are very irregular
6	54.7	0.8	Sand, fine to medium yellowish-brown
7	59.8	5.1	Sand, fine gray-buff

Mrs. L. P. McGregor Property

Test Hole Record N210

Location: T.9 S., R.1 E., Sec. 36, SE. 1/4, NE. 1/4, NW. 1/4, bauxite test pit at crest of "Big Hill," 500 feet north-northeast of road fork

Drilled: October 13, 1941

Elevation: 528 (top of pit) feet
Water level: 16.9 feet

No.	Depth	Thick.	Description of strata and designations of samples
	15.8	15.8	Old pit
			Betheden residuum
1	19.5	3.7	Clay, slightly silty light-gray white-mottled bauxitic; contains weathered pisolites; P1
2	29.3	9.8	Clay, slightly silty gray-white bauxitic; contains weathered pisolites; thin beds of black carbonaceous and lignitic clay containing coarse lignite fragments; numerous large nodules of siderite; P2
			Porters Creek formation
3	49.6	20.3	Silt, clayey bluish-black fairly micaceous; dries greenish-black; P3

Remarks: Drilled in bottom of old pit whose depth is 15.8 feet (Mississippi Geological Survey Bull. 19, p. 110, 1923).

Mississippi Bauxite Company Property

Test Hole Record N212

Location: T.9 S., R.1 E., Sec. 36, Cen., NW. 1/4, NE. 1/4; southeast side of road

Drilled: October 10, 1941

Elevation: 458 feet

Water level: Dry

No.	Depth	Thick.	Description of strata and designations of samples
			Upper division, Porters Creek formation
1	7.9	7.9	Clay, slightly silty light-gray buff-mottled; thin laminae of dark-buff micaceous silt; P1
2	29.0	21.1	Clay, very slightly silty light-buff-gray; P2
3	33.6	4.6	Clay, slightly silty blue-black; P3
4	41.7	8.1	Clay, black waxy; breaks with conchoidal fracture; P4

J. J. Gregory Property

Test Hole Record N216

Location: T.9 S., R.1 E., Sec. 35, E. 1/2, NE. 1/4, SE. 1/4, at old test pit; southwest end of "Third Hill", just west of section line at road metal pit

Drilled: October 13, 1941

Elevation: 497 feet

Water level: 26 feet

No.	Depth	Thick.	Description of strata and designations of samples
			Betheden residuum
1	5.9	5.9	Clay, pink-buff gray-white-mottled bauxitic; P1
2	14.2	8.3	Silt, fairly clayey light-buff yellow and purple mottled fairly micaceous bauxitic (?); P2
3	17.9	3.7	Clay, silty gray-white fairly micaceous bauxitic (?); P3
4	18.2	0.3	Silt, slightly clayey white fairly micaceous
5	19.9	1.7	Silt, clayey light-buff gray and yellow streaked; laminae of micaceous silt; contains small nodules of bauxite; P5
			Porters Creek formation
6	28.4	8.5	Silt, clayey bluish-black fairly micaceous; P6
7	39.3	10.9	Clay, very slightly silty waxy; P7

Remarks: Drilled at base of old test pit

W. C. Matthews Property

Test Hole Record N220

Location: T.9 S., R.2 E., Sec. 11, SE. 1/4, SW. 1/4, SE. 1/4; north side of small house along gravel road Drilled: October 14, 1941

Elevation: 418 feet Water level: 14.9 feet

No.	Depth	Thick.	Description of strata and designations of samples
			Lower division, Porters Creek formation
1	4.9	4.9	Clay, slightly silty medium-gray; P1
2	10.6	5.7	Clay, slightly silty light-gray-buff; P2
3	14.9	4.3	Clay, slightly silty light-gray-buff slightly limy; gypsum in joint cracks; P3
4	18.6	3.7	Siltstone, sandy light-gray well-bedded slightly glauconitic
			Clayton formation (?)
5	23.7	5.1	Clay, slightly silty light-gray-buff limy; small white very limy nodules; P5
6	28.9	5.2	Clay, slightly silty light-gray-buff slightly limy; fluffy texture; P6
7	41.1	12.2	Clay, fairly silty bluish-black slightly limy

W. L. Aaron Property

Test Hole Record N230

Location: T.9 S., R.3 E., Sec. 32, SW. 1/4, SW. 1/4, SW. 1/4; 225 feet west of road opposite residence Drilled: April 22, 1941

Elevation: 472 feet Water level:

No.	Depth	Thick.	Description of strata and designations of samples
			Porters Creek formation
1	6.1	6.1	Clay, fairly silty light-greenish-gray
			Clayton formation
2	7.0	0.9	Silt, clayey dark-buff gray and brown mottled; a few coarse grains of sand
3	8.6	1.6	Clay, slightly silty dark-buff red-mottled; a few coarse grains of sand
4	13.8	5.2	Sand, fine to coarse greenish-buff; admixture of silt and limy sand
5	16.3	2.5	Silt, clayey light-brown; a few coarse grains of sand and limy sand

Whit Rogers Property

Test Hole Record N231

Location: T.10 S., R.1 E., Sec. 26, SE. 1/4, SW. 1/4, SE. 1/4; in yard of farm home, southwest side of road 0.5 mile southeast of Randolph gin

Drilled:

Elevation: Water level: 54 feet

No.	Depth	Thick.	Description of strata and designations of samples
			Ackerman formation (?)
1	9.7	9.7	Clay, fairly silty reddish-buff; weathered
2	12.2	2.5	Clay, fairly silty gray-buff red-mottled fairly micaceous
			Porters Creek formation (?)
3	15.3	3.1	Silt, slightly clayey gray buff-mottled fairly micaceous; weathered
4	25.4	10.1	Silt, clayey dark-greenish-gray fairly micaceous
5	36.9	11.5	Silt, fairly clayey greenish-black fairly micaceous

Mrs. R. L. Tutor Property

Test Hole Record N232

Location: T.11 S., R.3 E., Sec. 17, E. 1/2, NW. 1/4, SE. 1/4; northwest of cross roads at Wallfield Drilled: December 3, 1941

Elevation: 421 feet Water level:

No.	Depth	Thick.	Description of strata and designations of samples
1	5.0	5.0	Soil—clay, silty gray-buff
			Porters Creek formation
2	9.9	4.9	Clay, slightly silty light-gray; dark stains along jointing
3	19.1	9.2	Clay, silty light-greenish-gray slightly glauconitic

BAILEY FERGUSON PROPERTY

TEST HOLE RECORD N233

Location: T.10 S., R.1 E., Sec. 36, Cen., NW. 1/4, SE. 1/4; northeast side of road at farm house, 1.5 miles southeast of Randolph

Drilled: November 1, 1941

Elevation: 435 feet

Water level: Dry

No.	Depth	Thick.	Description of strata and designations of samples
1	3.5	3.5	Soil—clay, silty gray-buff
			Upper division, Porters Creek formation
2	9.2	5.7	Clay, very slightly silty gray-tan; blocky fracture; dark-brown to black stains along jointing; P2
3	15.0	5.8	Clay, very slightly silty light-tan; blocky fracture; P3
4	19.9	4.9	Clay, slightly silty tan; thin laminae of slightly micaceous silty clay; thin partings of light-yellow selenite; P4
5	25.0	5.1	Clay, very slightly silty tan; P5
6	31.6	6.6	Clay, very slightly silty dark-tan; P6
7	39.9	8.3	Clay, dark-gray to black waxy; blocky fracture; P7

MRS. LOY LINDSEY PROPERTY

TEST HOLE RECORD N234

Location: T.10 S., R.1 E., Sec. 36, N. 1/2, SW. 1/4, NW. 1/4; north side of road opposite house, 0.3 mile southeast of roadfork Drilled: October 27, 1941

Elevation: 520 feet

Water level: 40 feet

No.	Depth	Thick.	Description of strata and designations of samples
			Ackerman formation
1	8.5	8.5	Sand, fine to medium brownish-red; admixture of clay
2	11.9	3.4	Silt, clayey pinkish-buff red-mottled
3	18.3	6.4	Silt, clayey reddish-buff gray and red-mottled slightly micaceous; thin flakes of clay-shale suggesting a breccia
4	28.0	9.7	Clay, fairly silty light-gray yellow and red-mottled slightly micaceous
			Porters Creek formation
5	45.5	17.5	Clay, slightly silty dark-gray to black; blocky fracture

Mrs. Loy Lindsey Property

Test Hole Record N235

Location: T.10 S., R.1 E., Sec. 36, SW. 1/4, SW. 1/4, NW. 1/4, southeast corner of farmyard Drilled: October 27, 1941

Elevation: 535 feet Water level: 36 feet

No.	Depth	Thick.	Description of strata and designations of samples
			Ackerman formation
1	15.3	15.3	Sand, fine to medium brick-red ferruginous
2	17.8	2.5	Clay, silty light-pink purple-mottled; absorbent
3	27.9	10.1	Breccia; irregular lavender-pink slightly silty clay gravel in a matrix of reddish-buff silty sand
4	31.6	3.7	Sand, fine brownish-buff; semi-indurated layers toward the base
			Betheden residuum
5	35.9	4.3	Clay, slightly silty gray-white pink-mottled; contains a few limonite pellets and a few small buff-colored chert gravel
6	43.0	7.1	Sand, light-brownish-buff; thin laminae of brown clayey silt; semi-indurated near base
			Porters Creek formation
7	57.8	14.8	Silt, fairly clayey greenish-black fairly micaceous

Percy Coates Property

Test Hole Record N238

Location: T.10 S., R.1 E., Sec. 22, NE. 1/4, SE. 1/4, NE. 1/4; west side of road, 400 feet northeast of farm home Drilled: October 25, 1941

Elevation: 425 feet Water level: Dry

No.	Depth	Thick.	Description of strata and designations of samples
			Betheden residuum
1	19.2	19.2	Clay, fairly silty gray-white buff-mottled slightly micaceous bauxitic(?); thin breaks of limonitic siltstone at base; P1
2	29.8	10.6	Silt, fairly clayey gray-buff yellow-mottled fairly micaceous bauxitic(?); P2
3	30.2	0.4	Clay, fairly silty medium-gray buff-mottled slightly micaceous bauxitic(?); P3
4	34.6	4.4	Clay, fairly silty gray-white yellow-mottled bauxitic(?); laminae of buff micaceous silt; P4
			Porters Creek formation
5	36.7	2.1	Silt, fairly clayey medium-gray fairly micaceous; weathered(?)
6	40.9	4.2	Silt, clayey greenish-black fairly micaceous

PERCY COATES PROPERTY

TEST HOLE RECORD N239

Location: T.10 S., R.1 E., Sec. 15, SW. 1/4, SW. 1/4, SE. 1/4, at crest of hill showing bedded bauxite in road cut Drilled: October 25, 1941

Elevation: 455 feet Water level: 39.0 feet

No.	Depth	Thick.	Description of strata and designations of samples
			Betheden residuum
1	11.2	11.2	Clay, slightly silty gray-white yellow and red-mottled bauxitic(?); weathered; P1
2	20.1	8.9	Clay, fairly silty gray-white buff-mottled bauxitic(?) slightly micaceous; weathered; P2
			Porters Creek formation
3	27.2	7.1	Silt, clayey dark-gray-buff fairly micaceous; a weathed zone(?)
4	39.8	12.6	Silt, clayey dark-greenish-gray fairly micaceous

MALT COLLUMS PROPERTY

TEST HOLE RECORD N242

Location: T.10 S., R.1 E., Sec. 2, NE. 1/4, SE. 1/4, NE. 1/4; 250 feet northwest of farm home, 200 feet north of old No. 6 Highway atop gravel pit

Drilled: October 27, 1941

Elevation: Water level:

No.	Depth	Thick.	Description of strata and designations of samples
			Betheden residuum
1	6.0	6.0	Silt, clayey buff fairly micaceous; thin limonitic siltstones near base
			Porters Creek formation
2	20.4	14.4	Silt, clayey dark-gray-buff fairly micaceous; a weathered zone(?)
3	32.1	11.7	Silt, clayey dark-greenish-gray fairly micaceous; slightly weathered(?)
4	47.0	14.9	Clay, fairly silty greenish-black slightly plastic; conchoidal fracture; unweathered zone

E. I. SIMMONS PROPERTY

TEST HOLE RECORD N243

Location: T.10 S., R.1 E., Sec. 2, SE. 1/4, SW. 1/4, NE. 1/4, 500 feet southeast of farm home, in roadcut of old Mississippi Highway 6, 400 feet west of road fork Drilled: October 25, 1941

Elevation: 520 feet Water level: Dry

No.	Depth	Thick.	Description of strata and designations of samples
			Betheden residuum
1	5.2	5.2	Clay, very slightly silty gray-white yellow and pink mottled bauxitic(?); very absorbent; P1
2	9.9	4.7	Clay, slightly silty light-yellow slightly micaceous bauxitic(?); very absorbent; P2
3	17.2	7.3	Clay, slightly silty white buff-mottled slightly micaceous bauxitic(?); very absorbent; P3
			Porters Creek formation
4	25.4	8.2	Silt, clayey dark-greenish-gray fairly micaceous; P4

Remarks: Drilled at base of roadcut exposure of pisolitic bauxite

W. C. PURDON PROPERTY

TEST HOLE RECORD N253

Location: T.10 S., R.1 E., Sec. 28, SE. 1/4, NE. 1/4, SE. 1/4; 35 feet west of road at outcrop of clay, 0.2 mile north of road fork

Drilled: November 8, 1941

Elevation: 411 feet Water level: Dry

No.	Depth	Thick.	Description of strata and designations of samples
1	3.2	3.2	Soil—clay, silty gray-buff
			Fearn Springs formation
2	6.8	3.6	Clay, silty light-gray; thin beds of dark-gray carbonaceous silty clay; P2
3	12.0	5.2	Silt, sandy gray-white; P3
4	13.4	1.4	Clay, fairly silty light-gray fairly plastic; thin beds of very lignitic clayey silt; P4
			Betheden residuum
5	26.5	13.1	Clay, slightly silty white buff-mottled bauxitic(?); P5
6	32.0	5.5	Silt, clayey white bauxitic(?); P6
7	33.8	1.8	Silt, clayey light-gray; P7
			Porters Creek formation
8	38.5	4.7	Silt, slightly clayey greenish-black slightly micaceous

J. M. TUTOR PROPERTY

TEST HOLE RECORD N254

Location: T.10 S., R.1 E., Sec. 28, SW. 1/4, NW. 1/4, SW. 1/4; at pit in bauxite, 300 feet east of road, 0.2 mile southeast of roadfork

Drilled: November 7 1941

Elevation: 471 feet

Water level: Dry

No.	Depth	Thick.	Description of strata and designations of samples
1	0.8	0.8	Soil—silt, clayey red-buff
			Betheden residuum
2	4.2	3.4	Bauxite, pisolitic yellow buff-weathered; P2
3	12.6	8.4	Clay, slightly silty white bauxitic(?); buff and purple mottling along jointing; P3
4	16.8	4.2	Silt, slightly clayey gray-white bauxitic(?); P4
5	23.9	7.1	Silt, clayey gray slightly micaceous; nodules of gray-white silty clay; P5
			Porters Creek formation
6	27.7	3.8	Silt, clayey dark-greenish-buff fairly micaceous; badly weathered; P6

W. C. PURDON PROPERTY

TEST HOLE RECORD N256

Location: T.10 S., R.1 E., Sec. 29, E. 1/2, SW. 1/4, SE. 1/4; northwest corner of roadfork

Drilled: November 6, 1941

Elevation: 450 feet

Water level: 20.0 feet

No.	Depth	Thick.	Description of strata and designations of samples
1	4.8	4.8	Soil—silt, sandy red-buff
			Ackerman formation
2	13.4	8.6	Silt, clayey yellow-buff red-mottled
3	20.0	6.6	Silt, slightly clayey light-greenish-buff
4	22.8	2.8	Silt, sandy light-gray yellow-mottled; clayey laminae; perched water table
			Fearn Springs formation
5	25.1	2.3	Lignite, silty gray to black micaceous; reworked
6	30.8	5.7	Silt, light-gray micaceous

Ivy Daniels Property

Test Hole Record N261

Location: T.10 S., R.1 E., Sec. 6, SE. 1/4, SE. 1/4, SE. 1/4; west side of road, 235 feet north of farm house, near crest of south valley wall of Two Mile Creek atop roadcut of Fearn Springs clay Drilled: November 14, 1941

Elevation: 460 feet Water level: Dry

No.	Depth	Thick.	Description of strata and designations of samples
1	3.7	3.7	Soil—silt, clayey gray-tan
			Fearn Springs formation
2	6.3	2.6	Clay, slightly silty gray-tan red-mottled fairly plastic; P2
3	14.0	7.7	Clay, slightly silty light-gray fairly plastic; P3
4	26.9	12.9	Silt, slightly clayey light-gray-buff
5	29.8	2.9	Clay, silty light-buff-tan fairly plastic; P5

Ivy Daniels Property

Test Hole Record N262

Location: T.10 S., R.1 E., Sec. 6, E. 1/2, SE. 1/4, SE. 1/4; west side of road, two-thirds way up south valley wall at outcrop of black clay

Drilled: November 14, 1941

Elevation: 441 feet Water level: Dry

No.	Depth	Thick.	Description of strata and designations of samples
1	2.6	2.6	Soil—clay, silty light-buff
			Betheden residuum (?)
2	11.8	9.2	Clay, slightly silty; alternate beds of light-gray, yellow-buff, and chocolate-brown; P2
3	19.9	8.1	Clay, fairly silty dark-gray-tan; P3
4	24.9	5.0	Silt, light-brown; P4

J. B. FONTAINE PROPERTY

TEST HOLE RECORD N267

Location: T.10 S., R.3 E., Sec. 17. SE. 1/4, NE. 1/4, NE. 1/4; west side of road atop roadcut of Mississippi Highway 15, 0.1 mile south of roadfork

Drilled: November 10, 1941

Elevation: 428 feet

Water level: Dry

No.	Depth	Thick.	Description of strata and designations of samples
1	4.9	4.9	Soil—sand, clayey red-buff
			Prairie Bluff formation
2	13.2	8.3	Sand, clayey brick-red; scattered grains of coarse sand
3	16.8	3.6	Silt, clayey red-buff slightly micaceous slightly limy
4	17.6	0.8	Chalk, silty cream-colored

ANDREW D. FONTAINE PROPERTY

TEST HOLE RECORD N268

Location: T.10 S., R.3 E., Sec. 17, E. 1/2, SE. 1/4, NE. 1/4; west side of Mississippi Highway 15, north end of roadcut 0.25 mile south of roadfork

Drilled: November 11, 1941

Elevation: 422 feet

Water level: Dry

No.	Depth	Thick.	Description of strata and designations of samples
1	5.1	5.1	Soil—sand, clayey brick-red
2	16.1	11.0	Sand, clayey brick-red; abundant coarse sand; colluvial Clayton material
			Prairie Bluff formation
3	21.9	5.8	Sand, fine to medium red-buff slightly micaceous; a few light-green stains suggesting weathered glauconite; slightly limy light-gray nodules

ANDREW D. FONTAINE PROPERTY

TEST HOLE RECORD N269

Location: T.10 S., R.3 E., Sec. 17, E. 1/2, SE. 1/4, NE. 1/4; 75 feet west of Mississippi Highway 15, atop deep roadcut, 0.3 mile south of roadfork

Drilled: November 11, 1941

Elevation: 467 feet

Water level: Dry

No.	Depth	Thick.	Description of strata and designations of samples
1	4.4	4.4	Soil-sand, clayey brick-red
			Clayton formation
2	11.9	7.5	Sand, clayey brick-red; abundant coarse sand
3	14.3	2.4	Sand, clayey brownish-red abundant coarse sand
			Prairie Bluff formation
4	25.5	11.2	Silt, yellow-buff fairly micaceous
5	25.9	0.4	Silt, yellow-buff fairly micaceous; laminae of light-gray silty clay

J. B. FONTAINE PROPERTY

TEST HOLE RECORD N270

Location: T.10 S., R.3 E., Sec. 17, SW. 1/4, SE. 1/4, NE. 1/4; 45 feet east of Mississippi Highway 15, atop roadcut, 0.5 mile south of roadfork

Drilled: November 11, 1941

Elevation: 480 feet

Water level: Dry

No.	Depth	Thick.	Description of strata and designations of samples
1	4.1	4.1	Soil—sand, clayey very dark-red
			Clayton formation
2	19.2	15.1	Sand, very coarse very dark-red
3	21.0	1.8	Sand, medium to coarse red-buff; a few grains of weathered glauconite
4	27.1	6.1	Sand, medium to coarse brownish-buff slightly glauconitic; fragments of re-worked Prairie Bluff fossils (Trigonia and Idonearca) preserved as clay replacements near base; fragments of thin siliceous shells near top

R. S. WORTHINGTON PROPERTY

TEST HOLE RECORD N275

Location: T.9 S., R.1 E., Sec. 22, SW. 1/4, SE. 1/4, NW. 1/4; top of weathered bauxite at pit
Drilled: November 18, 1941

Elevation: 454 feet
Water level: 18.8 feet

No.	Depth	Thick.	Description of strata and designations of samples
			Betheden residuum
1	1.4	1.4	Bauxite, clayey red-buff fairly pisolitic weathered; P1
2	2.5	1.1	Bauxite, clayey buff fairly pisolitic weathered; P2
3	3.4	0.9	Bauxite, light-buff; coarse green, brown, and gray-blue pisolites; sandy(?) gray-blue matrix; slightly weathered; ferruginous along jointing; P3
4	4.6	1.2	Bauxite, red-buff; medium to coarse red or gray-blue pisolites; slightly weathered; ferruginous along jointing; P4
5	6.5	1.9	Bauxite, gray-white; medium to coarse buff or brown pisolites in sandy(?) non-pisolitic matrix; P5
6	6.9	0.4	Bauxite, gray-white; coarse buff or brown pisolites in white sandy(?) matrix; ferruginous along jointing; P6
7	7.6	0.7	Clay, white buff-mottled bauxitic; P7
8	18.8	11.2	Silt, sandy gray-white bauxitic(?); P8
9	21.1	2.3	Silt, white bauxitic(?); P9
10	21.9	0.8	Silt, clayey yellow-buff slightly micaceous
11	22.4	0.5	Sand, fine white buff-stained fairly micaceous
12	24.2	1.8	Sand, fine buff micaceous; laminae of light-gray silt
13	30.2	6.0	Silt, sandy gray-white fairly micaceous
			Porters Creek formation
14	40.3	10.1	Silt, clayey greenish-black fairly micaceous

Samples 1-6 from test pits

Samples 7-14 from auger holes

Van White Property

Test Hole Record N279

Location: T.9 S., R.1 E., Sec. 15, NE. 1/4, NW. 1/4, SE. 1/4; southwest corner of road fork
Drilled: November 18, 1941

Elevation: 406 feet
Water level: Dry

No.	Depth	Thick.	Description of strata and designations of samples
1	7.6	7.6	Soil—silt, clayey light-buff
			Porters Creek formation
2	21.9	14.3	Clay, slightly silty light-buff gray-mottled; weathered; P2
3	27.9	6.0	Clay, fairly silty light-gray-buff; weathered; P3
4	36.7	8.8	Clay, slightly silty dark-gray well-bedded; unweathered; P4

S. L. Joslin Property

Test Hole Record N288

Location: T.9 S., R.1 E., Sec. 7, W. 1/2, NW. 1/4, NE. 1/4; south side of road fork, above clay
Drilled: November 21, 1941

Elevation: 420 feet
Water level: Dry

No.	Depth	Thick.	Description of strata and designations of samples
1	3.0	3.0	Soil—silt, clayey yellow-buff
			Clay zone, Ackerman formation
2	7.2	4.2	Silt, slightly clayey gray-white
3	11.6	4.4	Clay, slightly silty dark-brown carbonaceous; laminae of light-gray clayey silt; P3
4	14.9	3.3	Clay, silty light-gray buff-mottled; P4
5	25.2	10.3	Clay, fairly silty gray-white light-tan-mottled; P5
6	26.4	1.2	Silt, slightly clayey light-brown slightly micaceous
7	26.5	0.1	Sandstone, fine very dark-brown slightly micaceous

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PONTOTOC COUNTY MINERAL RESOURCES

TESTS

THOMAS EDWIN McCUTCHEON, B.S., Cer. Engr.

INTRODUCTION

The clays of Pontotoc County which are of potential importance lie in the Midway-Wilcox horizon. They are in general like those found in similar beds in Benton, Tippah, and Union Counties. Based on the number and kind of samples tested there seems to be a north to south gradation in quantity and quality of the kaolinitic clays from Benton through Pontotoc Counties. To the contrary, bauxite is best developed in Pontotoc County and decreases in quantity northward.

The clays have been classified according to their economic uses with the exception of those from the Porters Creek and Ripley formations. The varieties of materials available in the county are sufficient to supply several different types of processes and manufacturing units. The plant of the Mississippi Minerals Company at Pontotoc is an example of development of only one of the various raw materials present.

RED BURNING CLAYS—DENSE BODIED

PHYSICAL PROPERTIES IN THE UNBURNED STATE

Hole No.	Sample No.	Water of plasticity in percent	Drying shrinkage		Modulus of rupture in pounds per square inch	Color
			Volume in percent	Linear in percent		
N193	3–4	36.61	34.02	12.98	273	Yellowish gray
N194	1–2	33.07	35.16	13.46	406	Yellowish gray
N202	1	30.93	28.55	10.62	390	Reddish gray
N262	2	37.09	31.87	12.02	326	Gray
N279	2	34.39	38.21	14.87	278	Yellowish gray
N279	3	33.90	33.92	12.93	427	Gray
N279	4	34.66	24.15	8.82	284	Dark Gray

SCREEN ANALYSIS

SAMPLE N193 3-4

Retained on screen	Percent	Character of residue
60	4.50	Limonite-stained clay, with abundant limonite and quartz. Trace of gypsum.
100	3.10	Limonite-stained clay, with abundant limonite and quartz. Trace of gypsum.
250	5.46	Clay and quartz. Traces of limonite and gypsum.
Cloth	86.94	Clay substance including residue from above.

CHEMICAL ANALYSIS

SAMPLE N193 3-4

Ignition loss 9.19
Silica, SiO_2 .... 53.85
Alumina, Al_2O_3 ..... 26.01
Iron oxide, Fe_2O_3 .... 8.50
Titania, TiO_2 .... 1.20
Lime, CaO .... none
Magnesia, MgO 1.22
Manganese, MnO_2 none
Alkalies, (K_2O, Na_2O) 0.30

B. F. Mandlebaum, analyst

PYRO-PHYSICAL PROPERTIES

TEST HOLES N193, N194, N202, N262, N279

Hole No. Sample No.	At cone	Porosity in percent	Absorption in percent	Bulk specific gravity	Apparent specific gravity	Volume shrinkage in percent	Linear shrinkage in percent	Modulus of rupture in lbs./sq. in.	Color and remarks	
N193 3-4	03	22.62	11.55	1.96	2.53	19.56	7.01	1899	Lt. red*	St. H.
	01	17.22	8.34	2.07	2.50	23.90	8.70	2136	Lt. red*	
	2	15.33	7.17	2.14	2.52	26.05	9.59	2624	Lt. red*	
	4	16.06	7.65	2.10	2.50	24.98	9.14	2756	Lt. red*	
	6	13.32	6.20	2.15	2.48	26.66	9.84	3282	Lt. red*	
	8	9.37	4.33	2.17	2.43	27.64	10.25	3936	Brown	
	10	7.29	3.30	2.20	2.37	28.76	10.71	3554	Brown	
N194 1-2	03	18.03	9.13	1.97	2.40	14.65	5.16	2858	Lt. red*	St. H.
	01	15.00	7.40	2.03	2.38	16.91	6.02	2893	Lt. red*	
	2	13.57	6.64	2.05	2.36	17.42	6.21	3334	Lt. red*	
	4	13.43	6.56	2.04	2.36	17.34	6.17	3589	Lt. red*	
	6	12.71	6.20	2.05	2.35	17.68	6.29	3377	Lt. red*	
	8	8.10	3.84	2.11	2.30	20.40	7.36	3905	Brown*	
	10	6.32	6.92	2.17	2.31	22.27	8.07	4253	Brown*	
N202 1	03	22.61	11.61	1.95	2.52	11.96	4.17	2478	Lt. red*	
	01	22.17	11.53	1.93	2.47	11.00	3.81	3054	Lt. red*	
	2	18.84	9.41	2.00	2.47	14.50	5.09	3006	Lt. red*	
	4	19.76	9.92	2.00	2.49	14.37	5.04	4104	Lt. red*	
	6	15.47	7.54	2.05	2.43	16.67	5.91	3976	Lt. red*	
	8	9.54	4.54	2.10	2.32	19.03	6.82	3649	Dk. brown*	
N262 2	03	17.19	8.66	2.02	2.45	26.04	9.59	2242	Lt. red	St. H.
	01	16.55	8.16	2.09	2.50	28.36	10.54	3122	Lt. red	
	2	17.01	8.11	2.13	2.53	28.68	10.66	3847	Lt. red	
	4	11.93	5.61	2.12	2.41	29.54	11.04	2841	Lt. red	
N279 2	03	12.56	5.99	2.10	2.41	19.81	7.13	3023	Lt. red*	St. H.
	01	12.39	5.81	2.14	2.44	20.80	7.48	3097	Lt. red*	
	2	8.68	3.92	2.21	2.42	23.61	8.62	5522	Lt. red*	
	4	7.38	3.31	2.24	2.41	24.09	8.78	4310	Brownish red	
	6	2.51	1.13	2.23	2.29	24.28	8.86	3782	Brownish red	
N279 3	03	14.73	7.25	2.05	2.41	17.47	6.21	2618	Lt. red	St. H.
	01	14.57	7.16	2.04	2.38	16.61	5.91	3068	Lt. red	
	2	10.87	5.02	2.17	2.43	22.12	8.13	4327	Reddish buff	
	4	8.30	3.85	2.16	2.36	21.64	7.82	4735	Reddish buff	
	6	3.97	1.80	2.21	2.30	23.61	8.62	5922	Brown	
	8	1.96	.89	2.21	2.25	23.53	8.58	2961	Brown	
N279 4	03	20.16	10.28	2.08	2.43	21.40	7.71	3016	Dull red	St. H.
	01	17.64	8.83	2.01	2.44	22.97	8.34	3627	Dull red	
	2	16.22	8.28	1.97	2.44	23.82	8.70	3655	Dull red	
	4	14.66	7.45	2.01	2.40	23.23	8.46	3970	Dull red	
	6	10.84	5.09	2.13	2.39	27.24	10.08	N.D.	Dull red	
	8	4.81	2.23	2.15	2.22	25.57	9.39	N.D.	Brown	

* Stained with calcium salts

Abbreviation: St. H., steel hard.

POSSIBILITIES FOR UTILIZATION

The red burning dense bodied clays from test holes other than N279 have limited possibilities due to the presence of gypsum which deposits a white scum on the surface of the clay shapes. The scum is not removed by burning at low temperatures and forms a thin glaze at elevated temperatures.

All of the clays are very plastic, have good working properties, and dry with little warpage. The dry strength is high indicating the possibility of using the clays as bonding clays for the purpose of increasing strength in weaker clay bodies. In Pontotoc County impure kaolins are abundant and would make high grade buff face brick if blended with stronger clays of the type represented in this group. In this instance the stain from calcium salts would be less noticeable.

On burning, the clays are steel hard at cone 01 and do not begin to overburn before cones 6-8. Total drying and burning shrinkage is rather high but not unusual for this type of clay.

Clays from test hole N279 are not stained and are suitable for making dense bodied face brick, partition tile, load bearing tile, and silo tile.

RED BURNING CLAYS—OPEN BODIED

PHYSICAL PROPERTIES IN THE UNBURNED STATE

Hole No.	Sample No.	Water plasticity in percent	Drying shrinkage		Modulus of rupture in pounds per square inch	Color
			Volume in percent	Linear in percent		
N82	7	34.92	29.91	11.21	399	Gray
N192	1	34.56	24.67	9.02	280	Gray
N210	3	32.30	20.90	7.52	280	Gray
N216	6	31.45	16.04	5.68	194	Gray
N238	4	25.75	21.12	7.63	246	Yellowish gray
N243	4	33.41	31.61	11.93	523	Gray
N254	6	31.55	20.94	7.56	284	Gray

SCREEN ANALYSIS

SAMPLE N82-7

Retained on screen	Percent	Character of residue
60	9.07	Abundance of micaceous gray clay, in part limonite stained; some limonite and muscovite; traces of quartz and hematite.
100	8.80	Abundance of micaceous gray clay, in part limonite stained; some limonite and increasing muscovite; traces of quartz and hematite.
250	13.72	Abundance of micaceous gray clay, in part limonite stained; some limonite and increasing muscovite; traces of quartz and hematite.
Cloth	68.41	Clay substance including residue from above.

CHEMICAL ANALYSIS

SAMPLE N82-7

Ignition loss	5.52	Iron oxide, Fe_2O_3	7.49	Magnesia, MgO	1.27
Silica, SiO_2	68.36	Titania, TiO_2	0.98	Manganese, MnO_2	0.11
Alumina, Al_2O_3	15.98	Lime, CaO	0.25	Alkalies, (K_2O, Na_2O)	0.26

B. F. Mandlebaum, analyst

PYRO-PHYSICAL PROPERTIES

Test Holes N82, N192, N210, N216, N238, N243, N254

Hole No. Sample No.	At cone	Porosity in percent	Absorption in percent	Bulk specific gravity	Apparent specific gravity	Volume shrinkage in percent	Linear shrinkage in percent	Modulus of rupture in lbs./sq. in.	Color and remarks	
N82 7	03	28.22	15.66	1.80	2.51	9.23	3.20	1158	Red	
	01	25.24	13.73	1.84	2.46	11.30	3.92	1777	Red	St. H.
	2	24.38	12.90	1.89	2.51	13.67	4.79	2683	Red	
	4	23.68	12.39	1.91	2.50	14.40	5.05	3762	Red	
	6	20.88	11.84	1.97	2.49	16.82	5.98	N.D.	Red	
	8	9.10	4.36	2.08	2.30	21.89	7.91	N.D.	Brown	
	10	9.05	4.24	2.13	2.34	23.18	8.42	N.D.	Brown	
	12	6.28	3.12	2.02	2.16	19.19	6.86	N.D.	Brown	Bl.
N192 1	03	31.16	17.64	1.77	2.57	10.51	3.67	1259	Red	
	01	23.98	12.64	1.87	2.44	13.70	4.78	1763	Red	
	2	19.31	9.82	1.90	2.50	16.60	5.87	2661	Red	
	4	21.91	11.39	1.92	2.47	17.87	6.36	2616	Red	
	6	20.85	11.48	1.82	2.30	13.07	4.57	2540	Reddish brown	Bl.
	8	7.87	6.04	1.33	2.39	24.33	8.90	N.D.	Brown	Bl.
N210 3	03	29.88	16.69	1.87	2.31	12.67	4.43	1429	Red	
	01	28.54	14.96	1.89	2.55	16.81	5.98	1626	Red	St. H.
	2	20.27	10.38	1.90	2.45	17.76	6.29	2279	Red	
	4	18.39	9.86	1.91	2.67	19.99	7.17	2119	Red	
	6	25.76	13.44	1.62	2.28	18.29	6.52	1889	Red	Bl.
	8	17.07	12.37	1.40	1.70	-33.88	-12.89	N.D.	Brown	Bl.
N216 6	03	34.58	20.34	1.70	2.60	9.83	3.42	964	Red	
	01	31.13	17.36	1.79	2.60	14.03	4.94	1227	Red	
	2	29.34	16.10	1.82	2.58	15.81	5.61	1510	Red	St. H.
	4	30.95	16.42	1.89	2.73	18.27	6.94	1493	Red	
	6	26.62	13.91	1.92	2.61	19.92	7.17	1896	Red	
	8	13.86	6.90	2.01	2.34	24.00	8.74	2267	Brown	Bl.
N238 4	03	21.78	10.93	2.01	2.43	13.64	4.79	1898	Red	St. H.
	01	21.56	10.43	1.99	2.55	12.96	4.54	2706	Red	
	2	19.44	9.53	2.04	2.53	15.18	5.35	2511	Red	
	4	18.95	9.22	2.07	2.34	16.10	5.68	3470	Red	
	6	16.88	8.48	2.06	2.54	15.86	5.61	N.D.	Red	
	8	14.46	6.87	2.10	2.46	18.48	6.59	N.D.	Reddish Brown	
N243 4	03	27.86	15.17	1.84	2.55	7.11	2.46	2350	Red	
	01	24.27	12.89	1.88	2.48	9.18	3.17	2256	Red	St. H.
	2	21.60	11.35	1.90	2.43	9.89	3.42	2697	Red	
	4	22.56	12.04	1.89	2.43	8.90	3.06	2824	Red	Bl.
N254 6	03	31.36	17.95	1.74	2.54	8.37	2.88	1516	Red	
	01	30.37	17.33	1.84	2.53	9.90	3.42	1533	Red	St. H.
	2	27.13	14.74	1.87	2.56	13.25	4.65	2046	Red	
	4	25.66	13.74	1.87	2.51	14.65	5.16	2055	Red	
	6	22.60	11.63	1.94	2.51	17.65	6.29	1843	Red	
	8	10.13	4.91	2.06	2.29	22.72	8.26	2869	Brown	

Abbreviations: St. H., steel hard; Bl., bloated.

POSSIBILITIES FOR UTILIZATION

The red burning clays which are designated as open bodied are the carbonaceous, silty, and micaceous variety which make up the upper part of the Porters Creek formation or the lower part of the Betheden formation, depending on just where the geologist places the Midway-Wilcox contact. In some instances the material is considered as the Fearn Springs formation, but in all cases typical Porters Creek lies below. These clays are generally overlain by a considerable thickness of kaolinitic or bauxitic material and are not easily accessible in so far as the test hole records indicate. However, they may be available near the surface in localities other than indicated in this report.

The clays in many respects are similar to alluvium, a type which constitutes the material from which most common brick are made. The clays are plastic, work well, and can be dried and burned with little difficulty and expense. They become steel hard at low temperatures and burn to somewhat open bodies over a firing range of several cones within which there is little alteration of the clay. The clays overburn sharply before vitrification. They are suitable for the manufacture of common brick, some varieties of face brick, drain tile, and partition tile.

BUFF BURNING CLAYS—DENSE BODIED

PHYSICAL PROPERTIES IN THE UNBURNED STATE

Hole No.	Sample No.	Water of plasticity in percent	Drying shrinkage		Modulus of rupture in pounds per square inch	Color
			Linear in percent	Volume in percent		
N199	1	37.15	36.15	13.91	435	Gray
N261	2–3	35.40	42.42	16.84	441	Gray
N288	3	33.55	31.71	11.98	359	Gray

SCREEN ANALYSES

Sample N199-1

Retained on screen	Percent	Character of residue
60	3.88	Limonite-stained clay, and limonite. Traces of quartz and muscovite.
100	4.72	Clay, limonite, quartz, and muscovite abundant. Traces of kaolinite.
250	2.50	Muscovite very abundant, with clay, limonite and quartz. Trace of kaolinite
Cloth	88.90	Light-gray clay substance including residue from above.

Sample N261 2-3

Retained on screen	Percent	Character of residue
60	.71	Gray and tan clay. Traces of lignite, quartz, muscovite, limonite.
100	1.02	Gray and tan clay. Quartz and muscovite abundant. Trace of lignite and limonite.
250	4.06	Gray and tan clay. Quartz and muscovite abundant. Trace of lignite and limonite.
Cloth	94.21	Light-gray clay substance including residue from above.

Sample N288-3

Retained on screen	Percent	Character of residue
60	1.29	Abundance of lignitic, slightly micaceous gray clay; trace of limonite and quartz.
100	1.05	Abundance of lignitic, slightly micaceous gray clay; trace of limonite and quartz; trace of muscovite and hematite.
250	2.75	Abundance of lignitic, slightly micaceous gray clay; trace of limonite and quartz; trace of muscovite and hematite.
Cloth	94.91	Clay substance including residue from above.

CHEMICAL ANALYSES

Sample N199-1

Ignition loss 11.40
Silica, SiO_2 ....47.25
Alumina, Al_2O_3 ....32.56
Iron oxide, Fe_2O_3 ....4.80
Titania, TiO_2 ....1.56
Lime, CaO .... None
Magnesia, MgO 2.03
Manganese, MnO_2 None
Alkalies, (K_2O, Na_2O) 0.27

SAMPLE N261 2-3

Ignition loss	7.85	Iron oxide, Fe_2O_3	1.90	Magnesia, MgO	1.33
Silica, SiO_3	60.14	Titania, TiO_2	0.96	Manganese, MnO_2	None
Alumina, Al_3O_2	26.74	Lime, CaO	0.41	Alkalies, (K_2O, Na_2O)	0.35

SAMPLE N288-3

Ignition loss	7.36	Iron oxide, Fe_2O_3	2.05	Magnesia, MgO	1.65
Silica, SiO_2	62.51	Titania, TiO_2	0.85	Manganese, MnO_2	Trace
Alumina, Al_2O_3	24.66	Lime, CaO	None	Alkalies, (K_2O, Na_2O)	0.28

B. F. Mandlebaum, analyst

PYRO-PHYSICAL PROPERTIES

TEST HOLES N199, N261, N288

Hole No. Sample No.	At cone	Porosity in percent	Absorption in percent	Bulk specific gravity	Apparent specific gravity	Volume shrinkage in percent	Linear shrinkage in percent	Modulus of rupture in lbs./sq. in.	Color and remarks	
N199 1	03	21.46	10.24	2.09	2.66	26.07	9.59	4235	Lt. buff	St. H.
	01	14.52	6.68	2.16	2.49	28.47	10.58	2125*	Lt. buff	Cr.
	2	13.15	6.08	2.18	2.55	28.81	10.75	N.D.*	Lt. buff	Cr.
	4	9.28	4.18	2.22	2.44	30.50	11.42	1530*	Lt. buff	Cr.
	6	4.39	1.93	2.28	2.39	32.30	12.24	N.D.*	Lt. buff	Cr.
	8	2.16	.94	2.29	2.34	32.75	12.41	5050	Gray	
	10	2.93	1.27	2.31	2.39	33.33	12.67	5699	Gray	
	12	2.49	1.15	2.36	2.41	34.44	13.13	5300	Gray	
	14	6.25	2.90	2.12	2.26	28.50	10.58	3597	Gray	Bl.
N261 2-3	03	16.54	8.11	2.04	2.44	17.89	6.36	3708	Lt. buff	St. H.
	01	14.00	6.80	2.11	2.42	18.47	6.59	3631	Lt. buff	
	2	12.84	6.08	2.06	2.39	20.38	7.32	3945	Lt. buff	
	4	6.34	2.93	2.16	2.31	22.82	8.30	3368	Lt. buff	
	6	6.68	3.06	2.19	2.34	23.39	8.50	3756	Lt. buff	
	8	1.09	.50	2.19	2.21	23.62	8.62	7513	Gray	
	10	1.24	.57	2.20	2.23	24.26	8.86	8098	Gray	
	12	2.53	1.13	2.24	2.29	25.13	9.22	8269	Gray	
	14	16.19	8.36	1.94	2.31	13.73	4.83	5205	Gray	
N288 3	03	17.05	8.34	2.00	2.41	17.52	6.25	2456	Lt. buff	St. H.
	01	14.07	6.75	2.09	2.43	21.03	7.60	3386	Lt. buff	
	2	12.16	5.72	2.12	2.42	22.61	8.22	4838	Lt. buff	
	4	12.48	5.70	2.13	2.43	22.60	8.18	4402	Lt. buff	
	6	7.35	3.33	2.20	2.38	25.45	9.35	4619	Lt. buff	
	8	.82	.36	2.26	2.33	27.41	10.16	8991	Gray	
	10	.34	.15	2.30	2.31	28.87	10.75	9583	Gray	
	12	.51	.22	2.30	2.32	28.53	10.62	3388	Gray	
	14	18.83	10.05	1.88	2.31	12.17	4.24	N.D.	Gray	Bl.

* Valves not reliable due to cracks in test pieces

Abbreviations: St. H., steel hard; Cr., cracked

POSSIBILITIES FOR UTILIZATION

The buff burning dense-bodied clays represent the better grade from the Fearn Springs formation. They contain less sand and silt than most of the Fearn Springs clays and, consequently, burn to dense vitreous bodies. Chemical analyses indicate a higher alumina content than would be expected judging from the low ignition loss. This seems to be due to the presence of a considerable quantity of magnesia-bearing mica which is in an extremely fine state of division. The clay-like mica is characteristic of the Fearn Springs clays and serves to distinguish them from other varieties. It also imparts to the clay the property of resisting thermal shock to a greater degree than the common type of dense-burning bond clay. At best the clays are somewhat contaminated and should be beneficiated by washing out accessory minerals which decrease their efficiency and application.

The clays have sufficient strength in the dry state to be classed as bond clays. They are very plastic, have good working properties, and dry without warping. On burning they become quite vitreous at cone 4 and extremely dense at cones 6-8. The low porosity is maintained up to cone 14 at which point there is slight overburning. It is believed that beneficiated clays would have a higher overburning temperature. The modulus of rupture values of the fired clays are unusually high; 4000-5000 pounds per square inch are very common and values of 8000-9000 pounds per square inch are recorded at certain cone temperatures.

The clays in the crude state could best be utilized by blending with the underlying materials for the production of a number of products. Sample N199-1 overlies a 5-foot bed of fairly clean kaolin (N199-2). Blends of the two distinctly different clays would be suitable for the production of a very high grade white to cream face brick. In addition, flue lining, garden pottery, chimney block, building block, fireproofing, and load-bearing tile are possibilities. It should be pointed out that the contamination in sample N199-1 is principally limonite. It is present in the ground clay as coarse particles, and may be present in the deposit as a thin stratum which could be avoided in mining. The limonite particles do not stain the clay and are only noticeable at high temperatures. This accounts for the high percent of iron oxide shown in the chemical analyses and the unexpected light-buff color of the clay. Should the limonite be removed either by beneficiation or by avoidance in mining, the clay has excellent possibilities in the field of ceramic products where the resistance to thermal shock is important. Such products requiring a bond clay of this type are spark plugs, high tension insulators, electrical porcelain, chemical porcelain, crucibles, gas and electric grids, and oven ware. Other types of ware not requiring a perfectly white body such as cream dinner ware, sanitary ware, art pottery, and faience are possibilities. All of the products mentioned are usually compounded from a number of ceramic materials, such as kaolin, flint, feldspar, grog, etc., using a plastic bond clay to impart the required working properties and fired properties to the body. It is for this function that Sample N199-1 has possibilities.

Sample N261 2-3 overlies a bed of silty clay and could best be utilized by blending with the lower stratum for the production of products mentioned for the crude sample N199-1. The beneficiated clay has the same possibilities as the uncontaminated material before mentioned.

Sample N288-3 is the upper stratum of an increasing series of silty beds. This sample represents the least contaminated bed of clay. Its possibilities for utilization are the same as given for the other two samples in this group.

BUFF BURNING CLAYS—OPEN BODIED

PHYSICAL PROPERTIES IN THE UNBURNED STATE

Hole No.	Sample No.	Water of plasticity in percent	Drying shrinkage		Modulus of rupture in pounds per square inch	Color
			Volume in percent	Linear in percent		
N82	6	29.33	23.72	8.66	245	Lt. gray
N193	5	32.87	30.52	11.46	278	Dk. gray
N254	5	27.01	18.72	6.71	271	Dk. gray
N288	4	29.34	26.92	9.96	225	Yellowish gray
N288	5	23.60	22.45	8.15	289	Lt. gray

SCREEN ANALYSES

Sample N82-6

Retained on screen	Percent	Character of residue
60	1.85	Micaceous slightly lignitic gray and limonite-stained clay, with muscovite; traces of limonite and hematite.
100	2.80	Micaceous slightly lignitic gray and limonite-stained clay, with muscovite; traces limonite, hematite, and quartz.
250	10.90	Muscovite and quartz, with some clay.
Cloth	84.45	Light-tan clay substance including residue from above.

Sample N193-5

Retained on screen	Percent	Character of residue
60	2.70	Micaceous and lignitic gray and tan clay, with quartz and limonite.
100	2.00	Micaceous and lignitic gray and tan clay, with quartz and limonite; trace of muscovite.
250	9.52	Micaceous and lignitic gray and tan clay, with quartz and limonite; traces of muscovite. Quartz increasing.
Cloth	85.78	Tan clay substance including residue from above

Sample N254-5

Retained on screen	Percent	Character of residue
60	4.61	Micaceous slightly lignitic gray and limonite-stained clay; traces of limonite, muscovite, quartz.
100	5.44	Micaceous slightly lignitic gray and limonite-stained clay; traces of limonite, muscovite, and quartz. Slightly fossiliferous.
250	10.15	Clay, with abundant muscovite and quartz; traces of limonite and kaolinite.
Cloth	79.80	Grayish-tan clay substance including residue from above.

SAMPLE 288-4

Retained on screen	Percent	Character of residue
60	.94	Micaceous lignitic gray or limonite-stained clay, with quartz and limonite; traces of pyrite, muscovite, lignite, feldspar.
100	.86	Micaceous lignitic gray or limonite-stained clay with quartz and limonite.
250	1.75	Micaceous lignitic gray or limonite-stained clay with quartz and limonite; traces of muscovite and lignite.
Cloth	96.45	Tan clay substance including residue from above.

SAMPLE N288-5

Retained on screen	Percent	Character of residue
60	.05	Quartz, clay, limonite, hematite, lignite, muscovite.
100	.13	Muscovite, with clay, quartz and lignite; traces of limonite and hematite.
250	7.80	Quartz, with lignite and muscovite; traces of limonite and hematite.
Cloth	92.02	White silty clay including residue from above.

CHEMICAL ANALYSES

Sample N82-6

Ignition loss	6.07	Iron oxide, Fe_2O_3	1.90	Magnesia, MgO	0.49
Silica, SiO_2	68.61	Titania, TiO_2	0.86	Manganese, MnO_2	0.11
Alumina, Al_2O_3	19.57	Lime, CaO	0.28	Alkalies, (K_2O, Na_2O)	1.11

Sample N193-5

Ignition loss	7.50	Iron oxide, Fe_2O_3	1.70	Magnesia, MgO	1.57
Silica, SiO_2	66.00	Titania, TiO_2	1.28	Manganese, MnO_2	None
Alumina, Al_2O_3	21.34	Lime, CaO	None	Alkalies, (K_2O, Na_2O)	0.33

Sample N254-5

Ignition loss	5.69	Iron oxide, Fe_2O_3	1.70	Magnesia, MgO	1.64
Silica, SiO_2	71.78	Titania, TiO_2	0.82	Manganese, MnO_2	Trace
Alumina, Al_2O_3	18.05	Lime, CaO	None	Alkalies, (K_2O, Na_2O)	0.30

Sample N288-4

Ignition loss	6.75	Iron oxide, Fe_2O_3	2.00	Magnesia, MgO	1.54
Silica, SiO_2	64.53	Titania, TiO_2	1.28	Manganese, MnO_2	Trace
Alumina, Al_2O_3	23.33	Lime, CaO	None	Alkalies, (K_2O, Na_2O)	0.33

Sample N288-5

Ignition loss	5.40	Iron oxide, Fe_2O_3	1.35	Magnesia, MgO	1.54
Silica, SiO_2	70.24	Titania, TiO_2	1.00	Manganese, MnO_2	Trace
Alumina, Al_2O_3	19.59	Lime, CaO	None	Alkalies, (K_2O, Na_2O)	0.38

B. F. Mandlebaum, Analyst

PYRO-PHYSICAL PROPERTIES

TEST HOLES N82, N193, N254, N288

Hole No. Sample No.	At cone	Porosity in percent	Absorption in percent	Bulk specific gravity	Apparent specific gravity	Volume shrinkage in percent	Linear shrinkage in percent	Modulus of rupture in lbs./sq. in.	Color and remarks
N82 [illegible]	03	27.67	15.45	1.79	2.48	6.31	2.18	1265	Lt. buff
	01	26.57	14.57	1.82	2.38	7.95	2.74	1589	Lt. buff
	2	23.33	12.61	1.82	2.48	9.90	3.42	2173	Lt. buff St. H.
	4	22.99	12.23	1.88	2.45	11.05	3.85	2311	Lt. buff
	6	22.28	11.77	1.89	2.44	11.55	4.03	3137	Lt. buff
	8	12.08	5.80	2.07	2.36	19.60	7.05	4016	Buff
	10	11.60	5.57	2.08	2.35	19.70	7.09	4416	Buff
	12	7.67	3.59	2.14	2.32	21.71	7.87	4442	Gray buff
	14	5.79	2.80	2.12	2.25	21.18	7.63	3934	Gray buff
N193 5	03	25.47	14.09	1.79	2.39	9.20	3.17	1505	Lt. buff
	01	22.34	11.96	1.87	2.36	12.93	4.54	1912	Lt. buff
	2	21.84	11.77	1.87	2.41	12.67	4.43	2478	Lt. buff
	4	21.03	11.28	1.94	2.37	13.17	4.61	2651	Lt. buff St. H.
	6	17.55	9.02	1.86	2.38	16.43	5.83	2641	Lt. buff
	8	12.89	6.48	1.99	2.28	18.56	6.63	4062	Lt. buff
	10	13.66	6.81	2.00	2.32	19.07	6.82	3795	Lt. buff
	12	11.00	5.84	2.02	2.29	19.87	7.13	2297	Buff
	14	7.36	3.53	2.09	2.22	22.40	8.11	N.D.	Brown
N254 5	03	29.29	16.64	1.77	2.50	4.67	1.59	1101	Lt. buff
	01	26.91	14.80	1.82	2.49	7.64	2.64	1477	Lt. buff
	2	26.24	14.03	1.87	2.54	8.73	3.02	1685	Lt. buff St. H.
	4	26.94	14.74	1.83	2.50	10.39	3.59	1767	Lt. buff
	6	23.46	12.38	1.90	2.48	11.70	4.06	2083	Lt. buff
	8	17.36	8.63	2.02	2.44	16.87	5.98	2901	Gray buff
	10	13.86	6.66	2.09	2.42	19.88	7.13	3813	Gray buff
	12	9.53	4.47	2.14	2.36	25.08	9.18	3930	Gray buff
	14	6.42	3.13	2.05	2.19	18.55	6.63	3511	Dk. Gray buff
N288 4	03	22.42	12.04	1.87	2.40	9.01	3.13	1425	Lt. buff
	01	21.48	11.23	1.92	2.39	11.52	4.03	2314	Lt. buff
	2	19.81	10.32	1.91	2.44	11.00	3.81	3631	Lt. buff St. H.
	4	18.03	9.30	1.94	2.37	12.42	4.35	3650	Lt. buff
	6	17.10	8.65	1.98	2.38	14.06	4.94	3245	Lt. buff
	8	14.19	7.10	2.00	2.33	15.15	5.35	N.D.	Buff
	10	13.77	6.78	2.03	2.35	13.81	4.87	N.D.	Buff
	12	11.28	5.48	2.05	2.32	17.59	6.25	N.D.	Buff
	14	5.91	2.80	2.08	2.24	19.87	7.13	N.D.	Gray brown
N288 5	03	19.15	10.09	1.90	2.34	5.12	1.76	1209	Lt. buff
	01	23.87	11.71	1.90	2.44	5.04	1.73	1759	Lt. buff
	2	23.21	12.28	1.88	2.46	4.66	1.59	2061	Lt. buff St. H.
	4	21.70	11.39	1.90	2.43	5.58	1.90	2137	Lt. buff
	6	19.66	10.10	1.94	2.42	7.35	2.53	2146	Lt. buff
	8	16.10	8.14	1.98	2.36	9.22	3.20	3256	Lt. buff
	10	15.14	7.56	2.00	2.36	10.42	3.63	2790	Lt. buff
	12	13.72	6.78	2.03	2.35	11.30	3.92	3759	Lt. buff
	14	7.08	3.40	2.08	2.23	13.41	4.72	3632	Gray brown

Abbreviation: St. H., steel hard

POSSIBILITIES FOR UTILIZATION

The buff burning open bodied clays are from the Betheden and the Fearn Springs formations. Samples N82-6, N193-5, and N254-5 are from the lower part of the Betheden. They are overlain by kaolinitic material but may be more accessible in the immediate vicinity of the test hole or in other areas. Samples N288-4 and N288-5 are from the Fearn Springs formation and are overlain by a stratum of typical Fearn Springs clay (Sample N288-3). The clays from both formations have very similar properties. They contain silt, sand, and mica in sufficient quantity to prevent excessive shrinkage in drying and burning.

All of the clays have excellent plastic and drying properties. The dry strength is better than average for heavy clay products. On burning, the clays mature gradually over a long firing range. The burning shrinkage is low and does not increase appreciably over a firing range of several cones.

The clays are especially suited for making high-grade buff face brick, facing tile in glazed and natural finishes, building block, faience, buff flower pots, flue lining, chimney blocks, garden pottery, and many other buff-burning clay products. Samples N288-4 and N288-5 blended with the dense burning clay (N288-3) which lies immediately above these materials would be suited for making stoneware, art pottery, floor tile, roofing tile, and earthen ware. The materials from test hole N288 are very promising for local commercial development.

BUFF BURNING CLAYS—CARBONACEOUS

PHYSICAL PROPERTIES IN THE UNBURNED STATE

Hole No.	Sample No.	Water of plasticity in percent	Drying shrinkage		Modulus of rupture in pounds per square inch	Color
			Volume in percent	Linear in percent		
N192	3–4	32.46	23.53	8.58	229	Dk. gray
N193	6	42.07	19.57	7.01	162	Dk. brown
N193	7	34.51	67.98	31.60	224	Dk. gray
N194	3–4	42.34	26.19	9.63	157	Black
N202	3	36.42	14.25	5.01	129	Black
N202	4	44.29	11.58	4.03	97	Black
N202	5	22.32	14.93	5.27	158	Brownish gray
N262	3	34.36	21.05	7.60	239	Dk. gray

SCREEN ANALYSES

Sample N193-6

Retained on screen	Percent	Character of residue
60	29.71	Brownish micaceous clay, with traces of hematite, limonite, and other ferruginous minerals.
100	9.16	Brownish micaceous clay, with traces of hematite, limonite, and other ferruginous minerals, and quartz.
250	10.68	Brownish micaceous clay, with traces of hematite, limonite, and other ferruginous minerals and quartz.
Cloth	50.45	Chocolate-colored clay substance including residue from above.

Sample N193-7

Retained on screen	Percent	Character of residue
60	19.56	Lignitic clay and lignite; traces of limonite, quartz, and muscovite.
100	20.16	Lignitic clay with abundant lignite, quartz, and muscovite; trace of limonite.
250	30.35	Quartz, with clay, lignite, muscovite; trace of limonite.
Cloth	29.93	Gray clay substance including residue from above.

Sample N262-3

Retained on screen	Percent	Character of residue
60	18.73	Micaceous, slightly limonite-stained gray clay; traces of lignite, kaolinite, muscovite, and limonite.
100	8.60	Micaceous, slightly limonite-stained gray clay; traces of lignite, kaolinite, muscovite, limonite, and quartz.
250	9.30	Micaceous, slightly limonite-stained gray clay; traces of lignite, kaolinite, muscovite, limonite, and quartz; increase in muscovite.
Cloth	63.37	Dark-gray clay substance including residue from above.

CHEMICAL ANALYSES

Sample N193-6

Ignition loss 23.67	Iron oxide, Fe_2O_3 ....1.42	Magnesia, MgO 1.33
Silica, SiO_2 ....45.77	Titania, TiO_2 ....1.32	Manganese, MnO_2 None
Alumina, Al_2O_3 ....25.39	Lime, CaO ....None	Alkalies, (K_2O, Na_2O) 0.28

Sample N193-7

Ignition loss 13.66	Iron oxide, Fe_2O_3 ....1.52	Magnesia, MgO 1.68
Silica, SiO_2 ....64.29	Titania, TiO_2 ....1.22	Manganese, MnO_2 None
Alumina, Al_2O_3 ....17.30	Lime, CaO ....None	Alkalies, (K_2O, Na_2O) 0.28

Sample 262-3

Ignition loss 14.41	Iron oxide, Fe_2O_3 ....4.32	Magnesia, MgO 1.18
Silica, SiO_2 ....55.04	Titania, TiO_2 ....1.78	Manganese, MnO_2 None
Alumina, Al_2O_3 ....21.93	Lime, CaO 0.51	Alkalies, (K_2O, Na_2O) 0.41

B. F. Mandlebaum, Analyst

PYRO-PHYSICAL PROPERTIES

TEST HOLES N192, N193, N194

Hole No. Sample No.	At cone	Porosity in percent	Absorption in percent	Bulk specific gravity	Apparent specific gravity	Volume shrinkage in percent	Linear shrinkage in percent	Modulus of rupture in lbs./sq. in.	Color and remarks	
N192 3-4	03	33.86	20.25	1.69	2.57	10.20	3.52	1392	Lt. buff*	
	01	32.26	18.69	1.72	2.53	11.26	3.92	1479	Lt. buff*	
	2	32.45	18.88	1.72	2.57	11.81	4.14	1636	Lt. buff*	St. H.
	4	29.02	15.75	1.84	2.60	17.50	6.21	1750	Buff*	
	6	29.55	16.79	1.78	2.54	15.07	5.31	1724	Buff*	
	8	22.47	12.00	1.87	2.42	19.06	6.82	2089	Dk. buff*	
	10	22.76	12.18	1.89	2.44	19.65	7.05	2044	Dk. buff*	
	12	19.85	10.36	1.92	2.34	20.68	7.44	2570	Dk. buff*	
	14	11.26	5.54	2.03	2.29	25.29	9.27	2915	Brown*	
N193 6	03	54.68	43.90	1.25	2.75	18.03	6.44	447	Lt. buff	
	01	50.45	37.56	1.34	2.71	20.47	7.36	578	Lt. buff	
	2	50.96	37.91	1.34	2.74	23.92	8.74	716	Lt. buff	
	4	50.82	37.54	1.36	2.75	24.36	8.90	720	Lt. buff	
	6	48.68	32.51	1.38	2.65	25.54	9.39	879	Lt. buff	
	8	46.30	31.75	1.46	2.72	29.67	11.08	833	Lt. buff	St. H.
	10	45.10	30.27	1.49	2.70	31.21	11.76	N.D.	Lt. buff	
	12	41.03	26.44	1.56	2.64	33.93	12.93	N.D.	Buff	
	14	38.25	23.93	1.59	2.58	35.89	13.78	N.D.	Buff	
N193 7	03	45.13	30.83	1.46	2.58	6.12	2.11	327	Lt. buff	
	01	44.13	30.02	1.47	2.63	7.29	2.50	476	Lt. buff	
	2	43.43	29.82	1.47	2.67	6.75	2.32	492	Lt. buff	
	4	44.79	30.03	1.49	2.71	8.89	3.06	512	Lt. buff	
	6	44.95	30.05	1.50	2.71	8.96	3.01	539	Lt. buff	
	8	43.72	28.86	1.52	2.69	10.17	3.52	N.D.	Lt. buff	
	10	42.49	27.65	1.54	2.67	12.16	4.24	N.D.	Lt. buff	
	12	40.66	25.87	1.57	2.64	13.00	4.57	N.D.	Buff	St. H.
	14	39.29	24.96	1.58	2.60	13.41	4.72	N.D.	Buff	
N194 3-4	03	53.37	42.26	1.27	2.72	16.55	5.87	666	Lt. buff	
	01	51.29	39.13	1.31	2.69	19.27	6.90	700	Lt. buff	
	2	51.29	39.55	1.30	2.66	18.40	6.55	562	Lt. buff	
	4	50.40	37.94	1.33	2.65	23.42	8.54	479	Lt. buff	St. H.
	6	47.70	34.49	1.33	2.68	20.59	7.40	961	Lt. buff	
	8	46.18	33.02	1.40	2.60	24.31	8.90	553	Lt. buff	
	10	45.08	32.24	1.40	2.63	24.93	9.14	1605	Lt. buff	
	12	44.53	31.04	1.43	2.59	26.43	9.75	1186	Buff	
	14	40.68	26.97	1.51	2.55	30.09	11.25	1709	Buff	

* Stained with calcium sulfate

Abbreviation: St. H., steel hard

TEST HOLES N202, N262

Hole No. Sample No.	At cone	Porosity in percent	Absorption in percent	Bulk specific gravity	Apparent specific gravity	Volume shrinkage in percent	Linear shrinkage in percent	Modulus of rupture in lbs./sq. in.	Color and remarks
N202 3	03	45.03	28.45	1.58	2.76	15.86	5.61	343	Lt. buff
	01	43.05	27.58	1.58	2.80	16.93	6.02	675	Lt. buff
	2	42.11	26.72	1.58	2.73	16.67	5.91	641	Lt. buff
	4	41.08	25.61	1.60	2.72	18.21	6.52	683	Lt. buff
	6	40.57	25.18	1.61	2.71	18.34	6.55	824	Lt. buff
	8	37.12	22.02	1.69	2.70	22.35	8.11	1172	Buff
	10	37.26	22.02	1.69	2.69	22.15	8.03	1274	Buff St. H.
	12	35.65	20.47	1.69	2.54	23.88	8.70	1350	Buff
	14	29.16	15.73	1.86	2.62	29.24	10.91	N.D.	Buff
N202 4	03	49.65	35.70	1.39	2.76	23.43	8.54	629	Lt. buff
	01	51.34	37.96	1.35	2.78	21.56	7.79	792	Lt. buff
	2	51.02	37.51	1.36	2.78	21.76	7.87	531	Lt. buff
	4	50.20	36.49	1.38	2.77	22.77	8.26	606	Lt. buff
	6	49.03	34.95	1.40	2.75	24.26	8.86	N.D.	Lt. buff
	8	44.73	29.51	1.52	2.74	30.09	11.25	N.D.	Buff St. H.
	10	42.24	26.77	1.58	2.73	32.82	12.45	N.D.	Buff
	12	42.02	26.19	1.60	2.75	33.82	12.89	N.D.	Buff
	14	31.84	17.63	1.81	2.65	41.41	16.37	N.D.	Buff
N202 5	03	34.87	19.67	1.78	2.73	1.00	.33	305	Lt. buff
	01	34.43	19.40	1.77	2.70	1.24	.44	475	Lt. buff
	2	34.37	19.35	1.78	2.71	1.12	.40	492	Lt. buff
	4	34.16	19.07	1.79	2.72	1.86	.64	558	Lt. buff
	6	34.12	19.05	1.79	2.72	1.86	.64	554	Lt. buff
	8	32.51	18.10	1.79	2.66	2.47	.84	934	Buff
	10	32.73	17.90	1.79	2.67	2.86	.98	693	Buff
	12	32.00	17.65	1.81	2.66	3.22	1.11	762	Buff
	14	29.91	16.37	1.83	2.61	4.30	1.46	891	Lt. br. spk. Not St. H.
N262 3	03	40.10	24.94	1.59	2.53	16.02	5.68	1358	Gray buff St. H.
	01	39.30	23.99	1.61	2.68	17.58	6.25	1757	Gray buff
	2	38.36	23.48	1.63	2.65	18.79	6.71	1722	Gray buff
	4	38.39	23.35	1.65	2.68	19.21	6.90	2191	Gray buff
	6	38.53	23.35	1.65	2.69	19.56	7.01	1815	Gray buff
	8	29.87	16.90	1.77	2.53	24.87	9.10	2169	Dk. Buff
	10	32.74	18.89	1.74	2.58	23.56	8.58	2412	Dk. buff
	12	29.70	16.40	1.82	2.58	26.60	9.79	2970	Dk. buff
	14	18.90	9.91	1.91	2.39	30.41	11.42	2360	Brown

Abbreviation: St. H., steel hard

POSSIBILITIES FOR UTILIZATION

The buff burning clays that are very carbonaceous are more open bodied after burning than those in the preceding group. The carbonaceous matter which is chiefly lignite is consumed during the firing process leaving voids between the clay particles. The clays are somewhat silty and refractory and do not shrink enough on burning to cone 14 to close up the voids left by the lignite.

The clays are plastic, have normal drying shrinkage and medium to low dry strength. The burning shrinkage is low and does not increase appreciably over a wide firing range. Fired strength in all clays except N192 3-4 and N262-3 is too low for most heavy clay products. The porosity of all clays except the two samples before mentioned is too high to permit their use as weather resistant products. All of the clays except N202-5 could be used to produce drain tile, flue lining, and fire-proofing. Samples N192 3-4 and N262-3 are suitable for making face brick.

BAUXITIC AND KAOLINITIC CLAYS AND BAUXITE

PHYSICAL PROPERTIES IN THE UNBURNED STATE

Hole No.	Sample No.	Water of plasticity in percent	Drying shrinkage		Modulus of rupture in pounds per square inch	Color
			Volume in percent	Linear in percent		
N82	1	33.41	14.53	5.12	48	Pink
N82	2	38.43	21.01	7.60	85	Yellow
N82	3-4	35.86	22.98	8.34	148	Yellow
N82	5	28.78	21.40	7.71	120	Lt. gray
N199	2-3	27.83	11.73	4.10	68	White
N199	4	29.53	18.23	6.52	88	Lt. yellow
N216	1-2	35.79	17.68	6.29	52	Yellow
N216	3-5	29.75	19.62	7.05	114	Lt. yellow
N238	1-2	28.77	22.77	8.26	157	Yellow
N239	1-2	31.97	21.89	7.91	113	Yellow
N243	1-2	32.11	17.32	6.17	65	Yellow
N243	3	29.01	19.69	7.05	123	Lt. gray
N253	5	32.57	15.07	5.31	41	Yellow
N253	6	27.71	20.07	7.21	104	Lt. gray
N254	3	37.56	23.82	8.70	80	Yellow
N254	4	27.37	19.83	7.13	92	Tan

SCREEN ANALYSES

SAMPLE N82-1

Retained on screen	Percent	Character of residue
60	12.06	Limonite-stained clay, with limonite and traces of quartz, gypsum, and muscovite.
100	5.12	Limonite-stained clay, with limonite and traces of quartz, gypsum, and muscovite.
250	6.01	Limonite-stained clay, with limonite and traces of quartz, gypsum, and muscovite.
Cloth	76.81	Pinkish-tan clay substance including residue from above.

SAMPLE N82-2

Retained on screen	Percent	Character of residue
60	4.63	Iron-stained clay with abundant limonite and hematite; traces of muscovite and kaolinite.
100	4.47	Iron-stained clay with abundant limonite and hematite; traces of muscovite, kaolinite, and lignite; muscovite increasing.
250	6.35	Iron-stained clay with abundant limonite and hematite; traces of muscovite, kaolinite, and lignite; muscovite increasing.
Cloth	84.55	Yellowish clay substance including residue from above.

SAMPLE N82 3-4

Retained on screen	Percent	Character of residue
60	5.30	Limonite-stained clay, limonite and hematite; traces of quartz, gypsum, and muscovite.
100	4.27	Limonite-stained clay, limonite and hematite; traces of quartz, gypsum, muscovite and kaolinite; increase in muscovite.
250	6.85	Limonite-stained clay, limonite and hematite; traces of quartz, gypsum, muscovite, and kaolinite; increase in muscovite and kaolinite.
Cloth	83.58	Red clay substance including residue from above.

SAMPLE N82-5

Retained on screen	Percent	Character of residue
60	.53	Muscovite, with hematite, limonite and kaolinite.
100	1.23	Muscovite, with hematite, limonite and kaolinite.
250	10.88	Quartz and muscovite, with traces of hematite, kaolinite, and limonite.
Cloth	87.36	White clay substance including residue from above.

SAMPLE N199 2-3

Retained on screen	Percent	Character of residue
60	.98	White and limonite-stained clay; traces of quartz, limonite, and lignite.
100	1.16	Clay with quartz and traces of lignite, kaolinite, and tourmaline.
250	3.09	Clay with quartz and traces of lignite, kaolinite, tourmaline, hematite, and muscovite.
Cloth	94.77	White clay substance including residue from above.

SAMPLE N199-4

Retained on screen	Percent	Character of residue
60	5.52	Limonite-stained clay and limonite; some muscovite; trace of kaolinite.
100	3.39	Clay, quartz, and muscovite abundant; traces of limonite and kaolinite.
250	13.91	Quartz and muscovite, with some clay; traces of kaolinite and tourmaline.
Cloth	77.18	Tan clay substance including residue from above.

SAMPLE N210-1

Retained on screen	Percent	Character of residue
60	17.67	Cream-colored clay, with lignite, chert, and hematite.
100	6.04	Clay, with lignite; traces of quartz, muscovite, and hematite.
250	7.35	Clay, with lignite; traces of quartz, muscovite, and hematite.
Cloth	68.94	Light-tan clay substance including residue from above.

SAMPLE N210-2

Retained on screen	Percent	Character of residue
60	23.71	Lignitic gray clay, with abundant hematite and lignite; traces of feldspar, apatite, and other ferruginous minerals.
100	6.51	Lignitic gray clay, with abundant hematite and lignite; traces of feldspar, apatite, muscovite, quartz, and other ferruginous minerals.
250	7.68	Lignitic gray clay, with abundant hematite and lignite; traces of feldspar, apatite, muscovite, quartz, and other ferruginous minerals.
Cloth	62.10	Clay substance including residue from above.

SAMPLE N216 1-2

Retained on screen	Percent	Character of residue
60	13.39	Limonite-stained clay, with limonite and hematite; traces of muscovite and kaolinite.
100	9.85	Clay, with some muscovite, limonite, hematite.
250	9.40	Clay, with abundant quartz and muscovite; traces of limonite, hematite, and kaolinite.
Cloth	67.36	Tan clay substance including residue from above.

SAMPLE N216 3-5

Retained on screen	Percent	Character of residue
60	2.56	Limonite-stained clay and muscovite, with abundant ferruginous material; traces of lignite and kaolinite.
100	4.06	Muscovite, with clay and ferruginous minerals; traces of quartz and kaolinite.
250	10.97	Muscovite and quartz, with small amounts of clay and ferruginous minerals.
Cloth	82.41	Tan clay substance including residue from above.

SAMPLE N243 1-2

Retained on screen	Percent	Character of residue
60	24.96	Limonite-stained clay and ferruginous minerals; traces of quartz, muscovite, and gypsum.
100	8.45	Limonite-stained clay; increase in quartz and muscovite.
250	7.02	Muscovite and quartz, with minor amounts of clay and limonite.
Cloth	59.57	Tan clay substance including residue from above.

SAMPLE N243-3

Retained on screen	Percent	Character of residue
60	5.25	Hematite, limonite, and muscovite; trace of quartz.
100	3.55	Muscovite, with hematite and limonite; traces of quartz and kaolinite.
250	12.88	Muscovite and quartz, with hematite, limonite, and trace of kaolinite.
Cloth	78.32	White clay substance including residue from above.

SAMPLE N253-5

Retained on screen	Percent	Character of residue
60	7.95	Limonite-stained clay, with limonite; traces of quartz, hematite, and pyrite.
100	2.17	Limonite-stained clay, with limonite; traces of quartz, hematite, muscovite, and pyrite.
250	2.94	White and limonite-stained clay; traces of quartz, muscovite, and limonite.
Cloth	86.94	Tan clay substance including residue from above.

SAMPLE N253-6

Retained on screen	Percent	Character of residue
60	.56	Light-colored clay, with quartz and muscovite; traces of kaolinite and hematite.
100	.96	White clay and muscovite, with traces of quartz and kaolinite.
250	4.36	Muscovite, with quartz and traces of clay, biotite, limonite, and kaolinite.
Cloth	94.12	White clay substance including residue from above.

SAMPLE N254-3

Retained on screen	Percent	Character of residue
60	12.71	Limonite-stained clay, with limonite and hematite; traces of quartz and muscovite.
100	4.70	Limonite-stained clay, with limonite and hematite; traces of quartz and muscovite.
250	5.03	Limonite-stained clay with limonite and hematite; traces of quartz, muscovite; muscovite greatly increased.
Cloth	77.56	Reddish-tan clay substance including residue from above.

SAMPLE N254-4

Retained on screen	Percent	Character of residue
60	3.25	Hematite, limonite, and iron-stained clay; traces of quartz and muscovite.
100	.84	Hematite, limonite, and iron-stained clay; traces of quartz and muscovite and kaolinite; great increase in quartz and muscovite.
250	1.69	About equal amounts of quartz, muscovtie, and hematite, limonite, and clay; some kaolinite.
Cloth	94.22	Red clay substance including residue from above.

SAMPLE N275 1-7

Retained on screen	Percent	Character of residue
60	50.18	Slightly pisolitic gray, white, and tan bauxite; much quartz.
100	15.82	Quartz and bauxite.
250	10.86	Quartz and bauxite.
Cloth	23.14	Tan clay substance including residue from above.

CHEMICAL ANALYSES

SAMPLE N82-1

Ignition loss	13.08	Iron oxide, Fe_2O_3	11.72	Magnesia, MgO	0.14
Silica, SiO_2	38.57	Titania, TiO_2	1.56	Manganese, MnO_2	0.04
Alumina, Al_2O_3	33.27	Lime, CaO	0.09	Alkalies, (K_2O, Na_2O)	0.72

SAMPLE N82-2

Ignition loss	12.24	Iron oxide, Fe_2O_3	15.14	Magnesia, MgO	0.15
Silica, SiO_2	39.17	Titania, TiO_2	1.66	Manganese, MnO_2	0.05
Alumina, Al_2O_3	30.62	Lime, CaO	0.21	Alkalies, (K_2O, Na_2O)	0.42

SAMPLE N82 3-4

Ignition loss	11.13	Iron oxide, Fe_2O_3	10.82	Magnesia, MgO	0.28
Silica, SiO_2	42.75	Titania, TiO_2	1.61	Manganese, MnO_2	0.08
Alumina, Al_2O_3	32.02	Lime, CaO	None	Alkalies, (K_2O, Na_2O)	0.48

SAMPLE N82-5

Ignition loss	7.91	Iron oxide, Fe_2O_3	1.47	Magnesia, MgO	0.30
Silica, SiO_2	62.32	Titania, TiO_2	1.17	Manganese, MnO_2	0.09
Alumina, Al_2O_3	24.55	Lime, CaO	None	Alkalies, (K_2O, Na_2O)	0.51

SAMPLE N199 2-3

Ignition loss	15.45	Iron oxide, Fe_2O_3	1.29	Magnesia, MgO	1.24
Silica, SiO_2	38.85	Titania, TiO_3	1.72	Manganese, MnO_2	None
Alumina, Al_2O_3	40.70	Lime, CaO	0.16	Alkalies, (K_2O, Na_2O)	0.29

SAMPLE N199-4

Ignition loss	10.05	Iron oxide, Fe_2O_3	6.55	Magnesia, MgO	0.59
Silica, SiO_2	50.04	Titania, TiO_2	1.72	Manganese, MnO_2	0.28
Alumina, Al_2O_3	30.45	Lime, CaO	None	Alkalies, (K_2O, Na_2O)	0.33

SAMPLE N210 1-2

Ignition loss	16.60	Iron oxide, Fe_2O_3	6.99	Magnesia, MgO	0.21
Silica, SiO_2	36.63	Titania, TiO_2	1.47	Manganese, MnO_2	N.D.
Alumina, Al_2O_3	37.77	Lime, CaO	None	Alkalies, (K_2O, Na_2O)	0.24

SAMPLE N216 1-2

Ignition loss 13.80	Iron oxide, Fe_2O_3 . 13.21	Magnesia, MgO 0.51
Silica, SiO_2 ....35.68	Titania, TiO_2 ....1.61	Manganese, MnO_2 ....0.16
Alumina, Al_2O_3 ....34.72	Lime, CaO ....None	Alkalies, (K_2O, Na_2O) 0.25

SAMPLE N216 3-5

Ignition loss 9.00	Iron oxide, Fe_2O_3 ....6.61	Magnesia, MgO 0.35
Silica, SiO_2 ....55.38	Titania, TiO_2 ....1.11	Manganese, MnO_2 ....0.14
Alumina, Al_2O_3 ....27.55	Lime, CaO ....None	Alkalies, (K_2O, Na_2O) 0.24

SAMPLE N238 1-2

Ignition loss 8.06	Iron oxide, Fe_2O_3 ....7.31	Magnesia, MgO 1.20
Silica, SiO_2 .... 55.54	Titania, TiO_2 ....1.85	Manganese, MnO_2 Trace
Alumina, Al_2O_3 ....25.69	Lime, CaO ....None	Alkalies, (K_2O, Na_2O) 0.40

SAMPLE N243 1-2

Ignition loss 12.09	Iron oxide, Fe_2O_3 .. 27.12	Magnesia, MgO 1.53
Silica, SiO_2 ....32.15	Titania, TiO_2 ....1.25	Manganese, MnO_2 ... 0.27
Alumina, Al_2O_3 .... 25.58	Lime, CaO ....None	Alkalies, (K_2O, Na_2O) 0.39

SAMPLE N243-3

Ignition loss 9.48	Iron oxide, Fe_2O_3.... 8.69	Magnesia, MgO 1.45
Silica, SiO_2 ....51.88	Titania, TiO_2 ....1.16	Manganese, MnO_2 ... 0.03
Alumina, Al_2O_3 .... 27.31	Lime, CaO ....Trace	Alkalies, (K_2O, Na_2O) 0.31

SAMPLE N253-5

Ignition loss 13.47	Iron oxide, Fe_2O_3 ....7.53	Magnesia, MgO 0.76
Silica, SiO_2 .... 40.23	Titania, TiO_2 .... 2.00	Manganese, MnO_2 None
Alumina, Al_2O_3 ....35.59	Lime, CaO ....None	Alkalies, (K_2O, Na_2O) 0.37

SAMPLE N253-6

Ignition loss 7.62	Iron oxide, Fe_2O_3 .... 0.86	Magnesia MgO 1.57
Silica, SiO_2 .... 65.67	Titania, TiO_2 ....1.09	Manganese, MnO_2 None
Alumina, Al_2O_3 .... 22.64	Lime, CaO 0.17	Alkalies, (K_2O, Na_2O) 0.41

SAMPLE N254-2

Ignition loss 22.64	Iron oxide, Fe_2O_3 .. 16.66	Magnesia, MgO 0.55
Silica, SiO_2 .... 13.18	Titania, TiO_2 .... 2.64	Manganese, MnO_2 Trace
Alumina, Al_2O_3 ..... 43.79	Lime, CaO .... None	Alkalies, (K_2O, Na_2O) 0.42

SAMPLE N254-3

Ignition loss 11.89	Iron oxide, Fe_2O_3 .. 17.00	Magnesia, MgO 0.48
Silica, SiO_2 .... 38.17	Titania, TiO_2 .... 1.20	Manganese, MnO_2 Trace
Alumina, Al_2O_3 ..... 30.97	Lime, CaO .... None	Alkalies, (K_2O, Na_2O) 0.42

SAMPLE N254-4

Ignition loss 7.28	Iron oxide, Fe_2O_3 .... 4.58	Magnesia, MgO 1.31
Silica, SiO_2 .... 63.43	Titana, TiO_2 .... 1.07	Manganese, MnO_2 Trace
Alumina, Al_2O_3 ..... 21.71	Lime, CaO .... None	Alkalies, (K_2O, Na_2O) 0.33

SAMPLE N275 1-7

Ignition loss 12.81	Iron oxide, Fe_2O_3 .. 3.96	Magnesia, MgO 0.89
Silica, SiO_2 .... 44.05	Titania, TiO_2 .... 1.35	Manganese, MnO_2 ... 0.18
Alumina, Al_2O_3 ..... 35.65	Lime, CaO .... None	Alkalies, (K_2O, Na_2O) 0.57

B. F. Mandlebaum, analyst.

PYRO-PHYSICAL PROPERTIES

Test Holes N82, N199

Hole No. Sample No.	At cone	Porosity in percent	Absorption in percent	Bulk specific gravity	Apparent specific gravity	Volume shrinkage in percent	Linear shrinkage in percent	Modulus of rupture in lbs./sq. in.	Color and remarks
N82 1	03	45.91	28.34	1.61	2.95	13.22	4.65	78	Pink Cr.
	01	33.95	17.11	1.96	2.84	26.47	10.05	N.D.	Pink Cr. St. H.
	2	33.83	17.28	1.96	2.96	29.81	11.17	152	Pink Cr.
	4	31.41	15.54	2.02	2.95	31.96	12.50	104	Pink Cr.
	6	25.07	11.48	2.18	2.91	36.97	14.27	125	Pink Cr.
N82 2	03	32.30	17.76	1.82	2.69	25.00	9.14	1077	Lt. red St. H.
	01	17.73	8.55	2.07	2.53	35.86	13.78	2929	Lt. red
	2	19.11	8.86	2.16	2.68	36.87	14.23	2630	Lt. red
	4	18.85	8.68	2.17	2.67	37.01	14.32	2490	Lt. red
	6	17.27	7.82	2.21	2.67	38.28	14.87	2018	Lt. red
	8	9.18	3.97	2.31	2.57	41.25	16.27	1046	Brown
N82 3-4	03	25.42	13.11	1.94	2.60	25.00	9.14	1678	Salmon St. H.
	01	20.35	9.90	2.05	2.53	29.56	11.04	2310	Salmon
	2	18.74	9.12	2.06	2.58	29.40	11.00	3125	Salmon
	4	19.01	9.15	2.07	2.57	30.20	11.29	1909	Salmon Cr.
	6	17.98	8.39	2.14	2.61	32.35	12.24	1872	Buff Cr.
	8	10.40	4.64	2.24	2.44	35.62	13.69	1948	Buff Cr.
	10	12.45	5.66	2.20	2.51	34.05	12.98	3863	Buff Cr.
	12	7.30	3.16	2.31	2.49	37.20	14.36	4358	Dk. buff Cr.
	14	7.69	4.47	2.16	2.39	33.28	12.63	1822	Brown Cr.
N82 5	03	29.41	16.90	1.74	2.46	7.81	2.71	1137	Cream St. H.
	01	29.27	16.59	1.82	2.47	8.86	3.06	1673	Cream
	2	26.52	14.40	1.76	2.49	11.85	4.14	2079	Cream
	4	25.99	14.26	1.83	2.47	12.02	4.21	1984	Cream
	6	26.82	14.76	1.82	2.49	12.48	4.35	2457	Cream
	8	19.72	10.18	1.94	2.42	17.47	6.21	2761	Cream
	10	18.88	9.62	1.97	2.43	18.42	6.59	2405	Cream
	12	15.25	7.58	2.02	2.39	20.79	7.48	3587	Cream, specked
	14	8.49	4.03	2.11	2.30	23.97	8.74	3442	Cream, specked
N199 2-3	03	42.77	26.32	1.63	2.84	13.34	4.68	N.D.	White Ch.
	01	41.85	25.61	1.64	2.81	13.85	4.87	78	White Ch.
	2	40.58	24.13	1.68	2.83	16.66	5.91	66	White Ch.
	4	40.58	24.08	1.69	2.84	16.81	5.98	78	White Ch.
	6	38.66	22.13	1.75	2.85	19.55	7.01	249	White Ch.
	8	28.30	13.85	2.04	2.85	31.36	11.81	469	Cream Ch. St. H.
	10	30.29	15.34	1.97	2.83	29.01	10.83	614	Cream Ch.
	12	24.85	11.64	2.13	2.84	34.27	13.07	1002	Cream Ch.
	14	15.97	6.92	2.31	2.74	39.19	15.28	1013	Cream Ch.

Abbreviations: Cr., cracked; St. H., steel hard; Ch., checked

TEST HOLES N199, N216, N238

Hole No. Sample No.	At cone	Porosity in percent	Absorption in percent	Bulk specific gravity	Apparent specific gravity	Volume shrinkage in percent	Linear shrinkage in percent	Modulus of rupture in lbs./sq. in.	Color and remarks
N199 4	03	27.87	14.64	1.91	2.64	19.77	7.09	794	Buff St. H.
	01	29.14	15.75	1.85	2.61	17.23	6.14	1048	Buff
	2	29.71	15.98	1.86	2.64	17.55	6.25	1105	Buff
	4	28.14	14.66	1.92	2.67	20.14	7.25	1271	Buff
	6	27.14	13.91	1.95	2.68	21.50	7.75	1219	Buff
	8	24.97	12.61	1.98	2.64	22.80	8.26	2415	Gray buff
	10	23.87	11.94	2.00	2.63	23.15	8.42	2583	Gray buff
	12	17.93	8.42	2.13	2.59	18.54	6.63	2850	Gray buff
	14	13.82	6.27	2.20	2.56	30.45	11.42	2898	Brown
N216 1-2	03	44.84	28.36	1.59	2.90	15.00	5.27	486	Salmon
	01	33.30	18.54	1.79	2.70	24.74	9.06	923	Salmon
	2	34.17	17.86	1.91	2.91	29.35	10.96	1043	Salmon St. H.
	4	32.18	16.63	1.94	2.86	30.48	11.42	1889	Salmon
	6	31.66	16.08	1.97	2.88	31.61	11.93	1938	Salmon
	8	31.62	15.72	2.01	2.94	33.02	12.54	2876	Gray buff
	10	24.11	11.30	2.14	2.81	37.24	14.41	2818	Gray buff
	12	14.35	6.14	2.34	2.73	42.75	16.99	3563	Brown
N216 3-5	03	29.22	16.49	1.78	2.51	12.10	4.21	2165	Salmon St. H.
	01	23.71	12.41	1.91	2.51	18.40	6.55	2471	Buff
	2	21.14	10.86	1.95	2.48	19.90	7.13	2800	Buff
	4	23.69	11.62	2.04	2.68	23.61	8.62	3074	Buff
	6	19.79	9.95	1.99	2.48	21.87	7.91	3003	Buff
	8	13.24	6.35	2.09	2.40	25.67	9.43	2824	Buff
	10	13.76	6.55	2.10	2.43	25.83	9.51	3964	Gray buff
	12	11.85	5.54	2.14	2.43	27.43	10.16	3895	Gray buff
	14	5.09	2.28	2.23	2.35	30.41	11.42	1877	Brown
N238 1-2	03	21.24	10.59	1.96	2.47	16.94	6.02	1475	Salmon St. H.
	01	22.72	11.56	1.97	2.54	16.96	6.02	2807	Salmon
	2	19.81	9.70	2.04	2.55	19.96	7.17	2837	Salmon
	4	20.42	10.09	2.02	2.54	19.49	6.98	2878	Salmon
	6	18.74	9.11	2.06	2.53	20.68	7.47	2891	Salmon
	8	15.50	7.47	2.08	2.46	21.92	7.95	3246	Dk. buff
	10	15.42	7.31	2.11	2.50	22.74	8.26	3629	Dk. buff
	12	9.93	4.51	2.20	2.44	25.93	9.55	3184	Brown

TEST HOLES N239, N243, N253

Hole No. Sample No.	At cone	Porosity in percent	Absorption in percent	Bulk specific gravity	Apparent specific gravity	Volume shrinkage in percent	Linear shrinkage in percent	Modulus of rupture in lbs./sq. in.	Color and remarks
N239 1-2	03	29.01	15.59	1.86	2.61	16.22	5.76	1660	Salmon St. H.
	01	24.80	12.92	1.99	2.62	21.82	7.91	1853	Salmon
	2	25.01	12.53	2.00	2.66	22.02	7.99	2277	Salmon
	4	24.49	12.25	2.00	2.65	22.28	8.07	1962	Salmon
	6	22.93	11.25	2.03	2.64	23.64	8.62	2511	Salmon
	8	19.43	9.27	2.09	2.60	25.93	9.55	2016	Buff
	10	19.17	9.24	2.08	2.57	25.07	9.18	2916	Dk. buff
	12	14.21	6.44	2.22	2.59	30.43	11.42	2840	Dk. buff
	14	8.17	3.68	2.22	2.42	30.16	11.29	1748	Brown
N243 1-2	03	41.15	21.89	1.88	3.20	20.69	7.44	744	Lt. red Cr.
	01	33.41	15.75	2.12	3.19	29.64	11.08	1495	Red Cr. St. H.
	2	31.62	14.54	2.18	3.19	31.40	11.81	951	Red Cr.
	4	31.75	14.66	2.17	3.18	31.37	11.81	1090	Red Cr.
	6	30.56	13.93	2.19	3.17	32.26	12.19	1021	Red Cr.
	8	24.97	10.80	2.32	3.09	35.64	13.69	1011	Brown Cr.
N243 3	03	30.41	16.99	1.79	2.57	10.24	3.56	1859	Cream St. H.
	01	23.36	11.99	1.95	2.55	17.72	6.32	1853	Cream
	2	23.97	12.26	1.96	2.57	17.92	6.40	1723	Cream
	4	24.36	12.65	1.93	2.55	16.76	5.95	2378	Cream
	6	21.29	10.71	1.99	2.53	19.26	6.90	2966	Cream
	8	15.48	7.41	2.09	2.48	23.59	8.58	2951	Lt. gray, specked
	10	14.43	6.79	2.12	2.49	24.49	8.94	3071	Lt. gray, specked
	12	12.47	5.78	2.16	2.46	25.91	9.55	2591	Lt. gray, specked
	14	5.76	2.54	2.24	2.38	28.72	10.71	2589	Dk. gray, specked
N253 5	03	41.52	24.43	1.71	2.92	19.10	6.82	589	Pink Cr. St. H.
	01	36.24	20.00	1.82	2.84	23.89	8.70	527	Pink Cr.
	2	34.94	18.87	1.85	2.85	25.68	9.43	435	Pink Cr.
	4	28.69	14.38	2.01	2.82	31.48	11.85	317	Pink Cr.
	6	24.42	11.40	2.14	2.83	34.92	13.38	293	Pink Cr.
	8	19.33	8.88	2.18	2.67	36.79	15.18	732	Gray brown Cr.
	10	19.83	8.86	2.24	2.72	38.53	15.01	786	Gray brown Cr.
	12	13.07	5.52	2.36	2.72	41.90	16.56	1354	Gray brown Cr.
	14	4.63	1.83	2.53	2.66	45.85	18.52	2902	Brown Cr.

TEST HOLES N253, N254

Hole No. Sample No.	At cone	Porosity in percent	Absorption in percent	Bulk specific gravity	Apparent specific gravity	Volume shrinkage in percent	Linear shrinkage in percent	Modulus of rupture in lbs./sq. in.	Color and remarks	
N253 6	03	29.39	17.23	1.68	2.42	4.46	1.52	1390	Cream	
	01	27.97	15.68	1.78	2.48	8.44	2.92	1722	Cream	
	2	28.41	15.92	1.78	2.49	8.84	3.06	1781	Cream	St. H.
	4	26.25	14.67	1.79	2.43	9.49	3.27	1744	Cream	
	6	24.49	13.43	1.83	2.42	11.07	3.85	1684	Cream	
	8	22.25	11.71	1.91	2.45	15.10	5.27	2952	Cream	
	10	19.60	10.05	1.95	2.43	16.97	6.02	2976	Cream	
	12	18.98	9.57	1.98	2.45	18.36	6.55	3524	Cream	
	14	13.37	6.54	2.05	2.36	21.03	7.60	3791	Lt. gray, specked	
N254 3	03	28.91	14.72	1.99	2.81	27.76	10.29	1000	Lt. red	St. H.
	01	27.00	13.30	2.07	2.63	29.89	11.17	2376	Lt. red	
	2	24.03	11.37	2.11	2.78	32.00	12.06	2622	Lt. red	
	4	23.87	11.22	2.13	2.80	32.75	12.41	2470	Lt. red	
	6	19.25	8.64	2.23	2.76	35.66	13.69	2303	Lt. red	
	8	17.60	7.78	2.26	2.75	36.73	14.18	2650	Brown	
	10	12.24	5.25	2.35	2.68	38.98	15.19	3315	Brown	
N254 4	03	29.73	16.69	1.79	2.54	7.29	2.50	1093	Buff	
	01	28.06	15.26	1.84	2.59	9.99	3.45	1716	Buff	
	2	26.20	14.00	1.87	2.53	11.16	3.88	1569	Buff	St. H.
	4	27.59	14.90	1.85	2.56	10.61	3.70	1787	Buff	
	6	26.65	14.20	1.87	2.56	11.51	4.03	1623	Buff	
	8	24.33	12.69	1.92	2.53	14.13	4.98	2173	Buff	
	10	24.33	12.64	1.93	2.55	14.40	4.98	2015	Buff	
	12	21.50	10.91	1.97	2.51	16.12	5.72	2916	Buff	
	14	11.42	5.45	2.10	2.37	21.37	8.50	2559	Brown	

St. H., steel hard

POSSIBILITIES FOR UTILIZATION

The bauxitic and kaolinitic clays represent a very wide variety of materials comprising the major part of the Betheden formation. The clays and bauxite are generally so contaminated with various forms of iron, silt, and sand that they have little commercial value. Several of the samples tested are of such composition that they may be utilized.

In the preceding tables the samples are listed in numerical order according to test holes and individual sample numbers. In the summation which follows the various classes of materials are classified as individual samples or groups of samples having common properties.

The first of the several classifications comprises a single sample of slightly bauxitic kaolin fairly free of impurities. Although this type of clay is abundant in Tippah, Benton, and Union Counties and is generally believed to be abundant in Pontotoc County, only one sample, N199 2-3, from a large number is of high quality. Chemical analysis of sample N199 2-3 shows 40.70 percent alumina and 1.29 percent iron oxide. The screen analysis indicates that most of the iron is present as non-slaking limonitic nodules which could be removed by washing. The washed clay is fairly white and is of such texture and character as to have possibilities as a filler in rubber, paper, oil cloth, linoleum, etc. The crude clay is suitable for the production of alumina and aluminum salts by processes now in development. The calcined clay would be suitable for refractory grog. As pointed out in a previous section of this report, Sample N199 2-3 underlies a stratum of very plastic bond clay and, if blended with it, would produce a body suitable for high-grade cream-colored face brick, pottery, and other similar products.

The second group of materials is composed of three kaolinitic clays which burn to light-colored bodies but which are silicious and micaceous and consequently low in alumina. These samples are N82-5, N243-3, and N253-6. Sample N243-3 contains 8.69 percent iron calculated as iron oxide. The iron is present as small nodules of iron carbonate and has no staining action on the fired clay except at high temperatures where the effect is that of black specks on a light-cream body. The clay has low dry strength but if blended with dense-burning bond clays it would be suitable for making very attractive face brick. Samples N82-5 and N253-6 represent clays which burn to light-cream colors and would likewise be suitable for making high-grade face brick if blended with bond clay.

The third group of clays is the silicious variety high in iron and is represented by the following samples, N199-4, N216 3-5, N238 1-2, N239 1-2, and N254-4. The silica content is in the range of 50-60 percent and the iron oxide content varies between 4-7 percent. The clays have good plastic properties but low dry strength. If blended with bond clay, they would be suitable for making buff face brick, fireproofing, flue lining, and drain tile.

The fourth group of materials are the bauxites and bauxitic clays which contain variable but high proportions of iron oxide. The silica content is lower than would be expected for clay but is too high for commercial grades of bauxite. The bauxitic clays are represented by the following samples: N82-1, N82-2, N82 3-4, N210 1-2, N216 1-2, N243 1-2, N253-5, N254-2, N254-3, and N275 1-7.

The ceramic properties were determined on all samples except N210 1-2, N254-2, and N275 1-7, which are essentially bauxite and which have little ceramic possibilities. Samples N82-2 and N254-3 burn to dense bodies but have little dry strength. The total shrinkage of these clays is too large to permit additions of bond clay. Sample N82 3-4 has low dry strength and cracks on burning. Samples N82-1, N216 1-2, N243 1-2, and N253-5 have low dry and burned strength. It is not likely that the materials in the fourth group will be utilized for ceramic purposes as much better clays are available.

The samples of bauxite are of lower grade than are now being used commercially.

PORTERS CREEK CLAYS

PHYSICAL PROPERTIES IN THE UNBURNED STATE

Hole No.	Sample No.	Water of plasticity in percent	Drying shrinkage		Modulus of rupture in pounds per square inch	Color
			Volume in percent	Linear in percent		
N17	1	78.50	110.00	55.35	836	Drab gray
N17	2	76.35	112.00	55.52	861	Drab gray
N22	1	54.20	72.97	35.37	475	Drab gray
N22	2	52.89	62.81	28.14	701	Drab gray
N22	3	51.52	46.08	18.62	548	Blue gray
N24	1	59.69	90.04	53.74	682	Drab gray
N24	2–3	57.73	71.90	34.50	808	Dk. gray
N24	4	55.25	57.10	24.58	559	Dk. gray
N27	2–3	62.65	82.93	44.60	899	Drab gray
N27	4	66.03	54.90	23.31	564	Blue gray
N30	2	72.90	86.20	48.32	652	Drab gray
N30	3	67.06	71.26	34.04	759	Blue gray
N70	2–3	44.40	29.18	10.87	380	Dk. gray
N204	2–7	45.55	56.99	24.52	745	Drab
N212	1–2	50.23	59.49	26.01	780	Drab gray
N212	3–4	48.47	35.33	13.55	440	Blue gray
N216	7	45.03	22.62	8.22	310	Blue gray
N220	1	39.55	67.35	31.18	773	Blue gray
N220	2–3	65.77	71.74	34.42	548	Drab
N220	5–6	66.81	41.97	16.60	429	Lt. drab
N233	2–6	47.48	37.99	14.73	542	Lt. brown
N233	7	43.41	12.01	4.21	110	Dk. gray

PYRO-PHYSICAL PROPERTIES

Test Holes N17, N22, N24, N27, N30, N70, N204, N212, N216, N220, N233

Hole No.	Sample No.	At cone	Porosity in percent	Absorption in percent	Bulk specific gravity	Apparent specific gravity	Volume shrinkage in percent	Linear shrinkage in percent	Modulus of rupture in lbs./sq. in.	Color and remarks	
N17	1	03	7.38	3.69	2.01	2.16	25.07	9.18	N.D.	Salmon	Cr. St. H.
N17	2	03	11.78	6.34	1.86	2.11	16.57	5.87	N.D.	Salmon	Cr. St. H.
N22	1	03	20.29	10.60	1.91	2.40	14.43	5.09	N.D.	Lt. red	Cr. St. H.
N22	2	03	24.61	13.54	1.82	2.42	15.50	5.46	N.D.	Lt. red	Cr. St. H.
		03	30.96	18.06	1.71	2.48	15.83	5.61	1643	Lt. red	
N22	3	01	22.46	12.73	1.79	2.32	19.85	7.13	1845	Lt. red	
		2	22.52	12.25	1.84	2.37	21.72	7.87	2201	Red	St. H.
N24	1	03	2.98	1.30	2.24	2.32	26.28	9.67	N.D.	Red	Cr. St. H.
N24	2–3	03	35.89	29.68	1.22	1.90	–28.50	–10.58	N.D.	Red	Cr., Bl., St. H.
N24	4	03	15.35	8.87	1.74	2.05	15.86	5.61	N.D.	Salmon	Cr. St. H.
N27	2–3	03	4.57	2.12	2.16	2.26	26.93	9.96	N.D.	Salmon	Cr. St. H.
N27	4	03	37.64	24.90	1.51	2.43	16.95	6.02	N.D.	Salmon	Cr. St. H.
N30	2	03	21.07	12.00	1.76	2.22	19.36	6.94	N.D.	Salmon	Cr. St. H.
N30	3	03	21.63	12.93	1.68	2.14	17.39	6.17	N.D.	Salmon	Cr. St. H.
N70	2–3	03	10.25	4.51	2.27	2.53	36.74	14.18	N.D.	Red	Cr., Bl., St. H.
N204	2–7	03	10.69	4.85	2.21	2.48	24.07	8.78	N.D.	Red	Cr. St. H.
		03	8.04	3.67	2.19	2.38	25.42	9.35	3382	Red	St. H.
N212	1–2	01	3.23	1.67	2.21	2.29	26.37	9.71	1815	Red	Bl. Cr.
		2	2.73	1.19	2.16	2.21	24.24	8.86	1896	Red	Bl. Cr.
N212	3–4	03	13.45	6.28	2.15	2.48	34.53	13.20	2095	Red	St. H
		01	12.08	6.14	1.97	2.24	28.71	10.71	218	Red	Cr. Bl.
N216	7	03	11.20	5.39	2.08	2.34	35.43	13.59	881	Red	Cr. St. H.
		01	12.19	6.00	2.05	2.34	34.69	13.24	1502	Red	Cr. Bl.
N220	1	03	17.17	8.78	1.96	2.36	9.53	3.31	N.D.	Salmon	Cr. St. H.
N220	2–3	03	25.63	14.48	1.77	2.35	20.30	7.28	N.D.	Red	Cr. St. H.
		03	37.87	25.44	1.51	2.47	23.16	8.42	1084	Salmon	St. H.
N220	5–6	01	37.33	24.83	1.52	2.44	23.81	8.70	1009	Salmon	
		2	29.50	17.50	1.69	2.40	31.46	11.85	1330	Salmon	
	2–6	03	4.76	3.14	1.52	1.59	1.67	.57	1784	Red	St. H.
N233	2–6	01	6.81	2.98	2.29	2.45	35.14	13.46	2513	Red	
	2–6	2	9.20	2.53	2.33	2.48	36.06	13.87	N.D.	Red	Cr. Bl.
N233	7	03	15.94	9.03	1.78	2.12	26.73	9.88	N.D.	Red	Cr. St. H.

Abbreviations: Cr., cracked; St. H., steel hard, Bl., bloated.

POSSIBILITIES FOR UTILIZATION

Typical clays from the Porters Creek formation are characterized by their high water of plasticity, high drying shrinkage, and high dry strength. On burning, the clays crack or bloat or both and are consequently unsuited for ceramic products. The bentonitic character of these clays suggests that they may be utilized as a bond in molding sand and as a drilling mud.

CLAYS OF THE RIPLEY FORMATION

PHYSICAL PROPERTIES IN THE UNBURNED STATE

Hole No.	Sample No.	Water of plasticity in percent	Drying shrinkage: Volume in percent	Drying shrinkage: Linear in percent	Modulus of rupture in pounds per square inch	Color
N143	3	41.33	40.70	15.99	561	Tan
N145	1-2	42.30	61.77	27.44	750	Tan
N145	3	43.96	63.57	28.60	840	Tan
N178	2	43.03	54.68	23.20	775	Dk. gray

CHEMICAL ANALYSIS

SAMPLE N44 1-6

Ignition loss	10.00	Iron oxide, Fe_2O_3	5.27	Magnesia, MgO	3.58
Silica, SiO_2	58.29	Titania, TiO_2	0.24	Manganese, MnO_2	None
Alumina, Al_2O_3	18.09	Lime, CaO	3.30	Alkalies (K_2O, Na_2O)	0.51

B. F. Mandlebaum, Analyst

PYRO-PHYSICAL PROPERTIES

TEST HOLES N143, N145, N178

Hole No. Sample No.	At cone	Porosity in percent	Absorption in percent	Bulk specific gravity	Apparent specific gravity	Volume shrinkage in percent	Linear shrinkage in percent	Modulus of rupture in lbs./sq. in.	Color and remarks
N143 3	03	16.36	8.29	1.97	2.36	20.21	7.28	3070	Lt. red*
	01	16.97	8.59	1.98	2.39	20.37	7.32	3087	Red*
	2	15.62	7.76	2.02	2.39	21.78	7.87	3589	Red*
	4	9.32	4.77	1.95	2.15	19.63	7.05	3821	Dark red*
N145 1-2	03	23.63	13.30	1.79	2.35	7.42	2.57	1909	Red* St. H.
	01	17.85	9.20	1.94	2.36	11.02	3.85	1654	Red*
	2	15.65	8.14	1.85	2.19	6.87	2.36	1901	Dark red*
N145 3	03	22.04	12.15	1.81	2.27	9.73	3.38	1084	Salmon St. H.
	01	14.53	7.88	1.84	2.16	12.20	4.24	2483	Red
N178 2	03	22.17	13.30	1.67	2.16	3.88	1.32	4258	Red St. H.
	01	21.86	17.92	1.24	1.60	-31.57	-11.89	2776	Red Bl.

Abbreviations: St. H., Steel hard; Bl., Bloated

* Stained with calcium sulfate

POSSIBILITIES FOR UTILIZATION

The clays from the Ripley formation, as represented by the samples tested, are distinctly bentonitic. Three varieties of materials are represented by the samples. Clays from test holes N143 and N145 are silty, micaceous, and contain shell fragments and gypsum. These clays are very impure and distinctly weathered. Sample N178-2 is similar but unweathered. The clays have little ceramic value when used alone but have possibilities as a bonding material when blended with less plastic clays. They have adequate strength for use as a bond in molding sand but are too impure for efficient application.

The clay from test hole N44 is a high grade bentonite which is mined and milled for commercial application in bonding sand. The bentonite is processed at Pontotoc by the Mississippi Minerals Company and distributed and sold by the Eastern Clay Products Inc. of Eifort, Ohio. The product is sold under the trade name of "Dixie Bond." Ceramic tests were attempted on this material but the test pieces on drying cracked to such an extent that no data were obtained. A chemical analysis is given (Sample N44 1-6) which may or may not represent the clay as selected for commercial use.

N. J. Dunbeck, Vice President of the Eastern Clay Products Inc., states that: "The Pontotoc bentonite is finding an ever increasing market as a bonding clay for molding sand. It is replacing western bentonite, because it is superior for certain applications. Having moderate dry strength it works particularly well in gray iron production systems and in malleable iron foundries where it gives insurance against cracked castings due to high dry strength of sand. It is being increasingly used in steel foundries to reduce dry strength and this gives an easier shake out and less lumpy sand at the shake out. Pontotoc County bentonite is unique in that it is the only type of bonding clay now available which may be cut directly into a sand heap without eventually causing trouble" (Personal communication in November 1942).

LABORATORY PROCEDURE

PREPARATION

Preliminary drying of the clays was unnecessary, for they had been collected in the field and stored in a steam-heated laboratory several months prior to testing. Primary samples of about 200 pounds were crushed in a No. 2 jaw crusher. The crushed material was screened through a No. 20-mesh Tyler standard screen; residue coarser than 20-mesh was ground in a burr mill until it passed the 20-mesh screen. The clay which had passed 20-mesh screen was thoroughly mixed and reduced to a 10-pound sample by coning and quartering. This operation was accomplished in a metal lined tray approximately 4 feet square and 8 inches deep. The 10-pound sample was reserved for screen analysis, chemical analysis, and for making pyrometric cones. Approximately 75 pounds of clay from the remainder was mixed with water and kneaded by hand to a plastic consistency. The plastic mass was divided into small portions and thoroughly wedged to remove entrapped air and to develop a homogenous plastic body. The small portions were recombined in the same manner and stored in a metal lined damp box until used for making test pieces.

FORMING OF TEST PIECES

Test pieces were of two sizes: short bars, 1 inch square by 2 inches long, and long bars, 1 inch square by 7 inches long. The test pieces were made by wire-cutting bars of approximate size from the plastic mass and pressing in molds to the final size. The long bars were pressed by hand in a hardwood mold of the plunger type. The short bars were formed in a Patterson screw press fitted with a steel die. Each test piece was identified as to test hole number, sample number, and individual piece number. The identification was made by stamping the necessary letters and numerals on the test pieces. A shrinkage mark of 10 centimeters was stamped on the long bars. Sixty long bars and thirty short bars were made from each primary clay sample. Certain samples were not large enough to make the full number of test pieces.

PLASTIC, DRY, AND WORKING PROPERTIES

Immediately on forming the short bars their plastic volume was determined in a mercury volumeter. The plastic weight was measured to 0.01 gram using a triple beam balance. All of the test pieces were allowed to air-dry several days on slatted wooden pallets and then oven-dry by gradually increasing the temperature of the oven from room temperature to 100°C. in 4 hours and maintaining the oven temperature between 100°C. and 110°C. for an additional hour. After drying, the short bars were placed in descicators, and on cooling to room temperature they were reweighed, and the volume was determined as above described. Five long bars were broken on a Fairbanks cross-breaking machine to determine modulus of rupture.

The workability of the clay was observed during grinding, wedging, and the forming of the test pieces. The water of plasticity, modulus of rupture, and volume shrinkage were calculated by methods outlined by the American Ceramic Society. The linear shrinkage was calculated from the volume shrinkage and is based on the dry volume.

FIRED PROPERTIES

The long and short bars were burned in a down-draft surface combustion kiln especially designed for the purpose. Butane gas was used for fuel. Oxidizing conditions were maintained in the kiln during the entire period of firing. The test pieces were stacked criss-cross in the kiln to permit complete circulation of gases. The kiln was fired at the rate of 200°F. per hour to within 200°F. of the maximum temperature. The last 200°F. rise was accomplished in two to three hours. The rate of firing was measured by means of a Chromel-Alumel thermocouple up to 2,100°F., at which point the couple was withdrawn from the kiln; and, by means of pyrometric cones above 2,100°F.

On completing the firing of the long and short test pieces the kiln was cooled gradually in twenty-four to thirty-six hours, after which the short bars were immediately placed in descicators and weighed to an accuracy of 0.01 gram on a triple beam balance. After weighing, the bars were placed in water which was then heated to the boiling point and was kept boiling for four hours. They were allowed to cool in the water to room temperature and were reweighed as before mentioned. Immediately thereafter the volumes of the test pieces were determined in a mercury volumeter. Volume shrinkage, porosity, absorption, bulk specific gravity, and apparent specific gravity were calculated in accordance with methods outlined by the American Ceramic Society. The long bars were broken on a Fairbanks testing machine to determine modulus of rupture. Five long bars were burned and tested for each clay at each cone temperature indicated in the table of pyro-physical properties. Three short bars were fired as test pieces for each clay at each cone temperature.

CONVERSION TABLE

CONES TO TEMPERATURES

Cone No.	When fired slowly, 20°C per hour		When fired rapidly 150°C. per hour	
	°C	°F	°C	°F
010	890	1,634	895	1,643
09	930	1,706	930	1,706
08	945	1,733	950	1,742
07	975	1,787	990	1,814
06	1,005	1,841	1,015	1,859
05	1,030	1,886	1,040	1,904
04	1,050	1,922	1,060	1,940
03	1,080	1,976	1,115	2,039
02	1,095	2,003	1,125	2,057
01	1,110	2,030	1,145	2,093
1	1,125	2,057	1,160	2,120
2	1,135	2,075	1,165	2,129
3	1,145	2,093	1,170	2,138
4	1,165	2,129	1,190	2,174
5	1,180	2,156	1,205	2,201
6	1,190	2,174	1,230	2,246
7	1,210	2,210	1,250	2,282
8	1,225	2,237	1,260	2,300
9	1,250	2,282	1,285	2,345
10	1,260	2,300	1,305	2,381
11	1,285	2,345	1,325	2,417
12	1,310	2,390	1,335	2,435
13	1,350	2,462	1,350	2,462
14	1,390	2,534	1,400	2,552
15	1,410	2,570	1,435	2,615
16	1,450	2,642	1,465	2,669
17	1,465	2,669	1,475	2,687
18	1,485	2,705	1,490	2,714
19	1,515	2,759	1,520	2,768
20	1,520	2,768	1,530	2,786

Cone No.	When heated at 100°C per hour		Cone No.	When heated at 100°C per hour	
	°C	°F		°C	°F
23	1,580	2,876	32	1,700	3,092
26	1,595	2,903	33	1,745	3,173
27	1,605	2,921	34	1,760	3,200
28	1,615	2,939	35	1,785	3,245
29	1,640	2,984	36	1,810	3,290
30	1,650	3,002	37	1,820	3,308
31	1,680	3,056	38	1,835	3,335

The properties and uses of pyrometric cones: The Standard Pyrometric Cone Company, Columbus, Ohio.

SCREEN ANALYSES

A quantity of clay from each quartered sample was dried at 110°C.-constant-weight, after which exactly 100 grams were blunged in approximately two liters of water by pouring the slip back and forth until all the substance apparently disintegrated.

The disintegrated clay in slip form was poured through a nest of Tyler standard screens, the sizes being 60, 100, and 250. The material passing through the 250-mesh screen was caught on a cloth in a plaster vat. After a fair sample was caught on the cloth, the screens, still in nest, were then washed with a stream of water until no further material passed through the screens. The screens were dried at 110°C., after which the residue from each screen was weighed and collected in glass vials for further study.

It is evident that the above treatment would not completely disintegrate all of the clay nodules; and, though this could have been accomplished by blunging with rubber balls, it was not the purpose of this screen analysis to break the clay down to a finer state of division than would ordinarily occur in usual commercial blunging procedure; consequently, the screen analysis will show residue as "clay nodules" which indicates that a very thorough blunging will be necessary to disintegrate completely the clay in commercial use.

The residue from each screen was examined carefully under a binocular microscope. The finer material was examined under a petrographic microscope. Determinations were made from the physical appearance of mineral grain and crystal form corroborated by use of physical properties test, magnetized needle, reactions to wet reagents; and, where grain size permitted, blow pipe analyses were made.

Undoubtedly there were minerals present in the clays that could not be distinguished under the microscope, because of their fine state of division. However, those that have been recorded have been definitely identified.

Terms used in the tables of screen analyses for describing quantity of residue are: "abundance," meaning one-half or more of residue on screen; "considerable quantity," between one-fourth and one-half; "small amount," less than one-fourth; and "trace," few grains scattered throughout residue.

CHEMICAL ANALYSES

Grinding: Samples were ground to pass a 100-mesh screen.
Ignition loss: One gram of each sample was heated in a platinum crucible at full heat of a blast burner for one hour.

Silica: Ignited samples were fused with 6 to 8 times their weight of anhydrous sodium carbonate, and the fusion dissolved in dilute of hydrochloric acid. The samples were double dehydrated with hydrochloric acid. The silica was filtered off, washed, ignited, weighed, volatilized by hydrofluoric acid, and the crucible reweighed. SiO_2 was found by loss in weight. Any residue after evaporation was fused with sodium carbonate and dissolved in the original filtrate for alumina determination.

Alumina: Alumina, iron, and titania were precipitated together by ammonium hydroxide in the presence of ammonium chloride. Double precipitations were necessary to remove all the chlorides. The mixed hydroxides were filtered off, washed free of chlorides, ignited, and weighed. The weight represents the total of alumina, iron, and titania. The mixed oxides were fused with potassium bisulphate and dissolved in dilute sulphuric acid. In some cases a small amount of silica was recovered by filtration, ignition, and volatilization with hydrofluoric acid. This amount was added to silica and deducted from alumina.

Iron: An aliquot of the solution of bisulfate solution was reduced with aluminum dust in sulphuric acid solution and titrated with standard potassium permanganate solution. The iron was calculated as Fe_2O_3.

Titania: Another aliquot of the bisulfate solution was placed in a Schreiner type colorimeter tube and a few drops of hydrogen peroxide added. This solution was compared in color with a standard titania solution. The total of iron and titania was subtracted from the mixed precipitate of alumina, iron, and titania, leaving alumina.

Manganese: Manganese was removed from the sample used for the ultimate analysis, but discarded, and the determination was made on a separate larger sample. The sample was treated with hydrofluoric acid and sulfuric acid, twice evaporated, and the insoluble residue removed by filtering. Manganese was determined colorimetrically using potassium periodate as the color reagent, and matching against a standard color sample.

Lime: Lime was determined from the filtrate of the manganese determination by precipitation as the oxalate in the presence of ammonium acetate in alkaline solution. It was weighed as CaO.

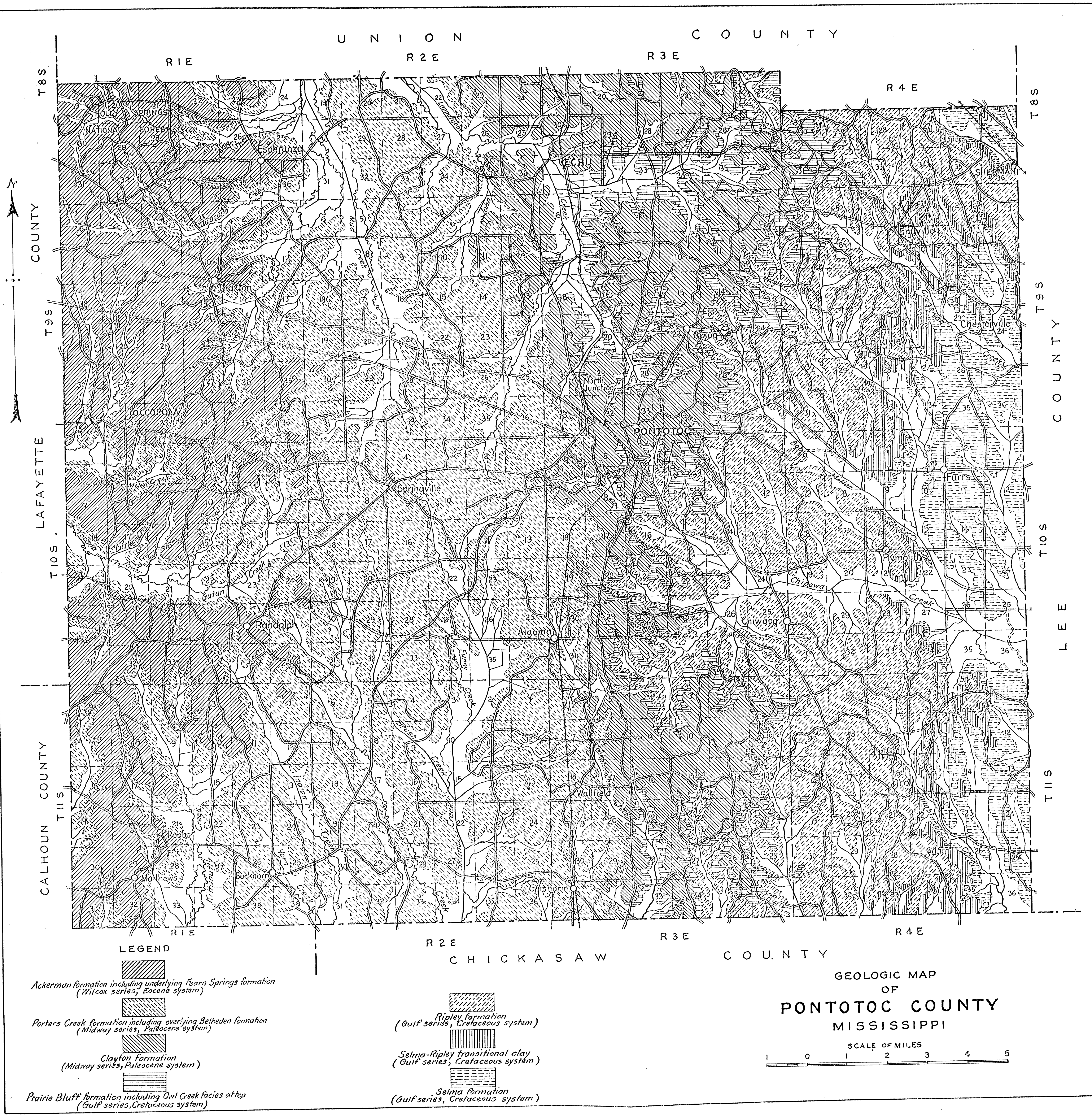
Magnesia: Magnesia was determined from the lime filtrate by precipitation as mixed ammonium phosphate in alkaline solution. It was ignited and weighed as $Mg_2P_2O_7$, and calculated to MgO.

Alkalies: Alkalies were determined by the J. Lawrence Smith method as outlined in Scott "Standard Methods of Chemical Analysis." Sodium and potassium were not separated but reported as combined oxides.

Sulfur: Sulfur was determined in a separate sample by a carbonate fusion, solution in dilute hydrochloric acid, oxidation to SO_4 with bromine and precipitation with 10 percent barium chloride solution. Precipitate was weighed as barium sulfate, and reported as SO_3.

Duplicates were made on all samples and the average was reported.

PAGE REFERENCES TO TEST HOLES


UNION COUNTY
LAFAYETTE COUNTY
CALHOUN COUNTY
LEE COUNTY
CHICKASAW COUNTY
R1E
R2E
R3E
R4E
T8S
T9S
T10S
T11S
HOLLY SPRINGS NATIONAL FOREST
Esperanza
ECRU
SHERMAN
Endville
Thaxton
Chesterville
Toccopola
North Junction
PONTOTOC
Furrs
Springville
Plymouth
Randolph
Algoma
Chiwapa
Chiwapa Creek
Gutun Creek
Wallfield
Troy
Bubbs
Matthews
Buckhorn
Cirlsborn
GEOLOGIC MAP OF PONTOTOC COUNTY MISSISSIPPI
SCALE OF MILES
1 0 1 2 3 4 5
LEGEND
Ackerman formation including underlying Fearn Springs formation (Wilcox series, Eocene system)
Porters Creek formation including overlying Betheden formation (Midway series, Paleocene system)
Clayton Formation (Midway series, Paleocene system)
Prairie Bluff formation including Owl Creek facies at top (Gulf series, Cretaceous system)
Ripley formation (Gulf series, Cretaceous system)
Selma-Ripley transitional clay (Gulf series, Cretaceous system)
Selma formation (Gulf series, Cretaceous system)