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STATE OF GEORGIA

E. D. RIVERS, Governor

DEPARTMENT OF NATURAL RESOURCES

R. F. BURCH, Commissioner

DIVISION OF MINES, MINING, AND GEOLOGY

CAPTAIN GARLAND PEYTON, Director

SUPPLEMENT TO

SEDIMENTARY KAOLINS OF GEORGIA

By

ARTHUR C. MUNYAN

Geologist

GEOLOGICAL SURVEY OF GEORGIA

BULLETIN NO. 44-A

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GEORGIA KAOLIN CO. MINE NO. 6, NEAR DRY BRANCH, TWIGGS COUNTY.

LETTER OF TRANSMITTAL

DIVISION OF MINES, MINING AND GEOLOGY,
DEPARTMENT OF NATURAL RESOURCES,
ATLANTA, GEORGIA, JUNE 27, 1938.

To His Excellency, E. D. RIVERS, Governor of Georgia, and R. F. BURCH,
Commissioner of the Department of Natural Resources.

SIRS: I have the honor to transmit herewith for publication as a part of the series of bulletins entitled the Geological Survey of Georgia, a Supplement to the Sedimentary Kaolins of the Coastal Plain of Georgia.

Bulletin 44, The Sedimentary Kaolins of the Coastal Plain of Georgia, issued in 1929, has played a large part in the rapid development of Georgia's kaolin industry in the nine years that have elapsed since its publication. During this time the yearly tonnage of kaolin mined in Georgia has doubled, becoming Georgia's principal mineral industry. Georgia now produces approximately 66 per cent of all of the pure white clay mined in the United States and over half of that consumed in this country. The future looks bright for a continued increase.

The purpose of this report is to describe the new deposits that have been prospected or developed since the publication of Bulletin 44, to note changes in ownership of the properties described in that report, and to further aid in the development of Georgia's growing kaolin industry.

Very respectfully yours,

CAPTAIN GARLAND PEYTON,
Director.

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SUPPLEMENT TO SEDIMENTARY KAOLINS OF GEORGIA

BY

ARTHUR C. MUNYAN

INTRODUCTION

This report has been prepared as a supplement to the Georgia Geological Survey Bulletin, Number 44, "Sedimentary Kaolins of Georgia" by Richard W. Smith. Being a supplement it does not contain the detailed information of Smith's paper, but has been assembled with the intention of noting all new developments in the kaolin industry of the State, as well as all changes in property ownership of land underlain by deposits of sedimentary kaolin. It is advisable for the reader to secure a copy of Bulletin 44 because frequent reference is made to it in this report.

This survey was authorized by Mr. Richard W. Smith who until recently was Acting Director of the Division of Mines, Mining and Geology. Mr. Smith recognized that many changes have taken place in the kaolin industry since the publication of Bulletin 44 in 1929. The investigation occupied more than two months' time in the field. No samples were taken for testing, nor were any borings made; all examinations were visual and generally confined to working operations.

The following counties were visited in the course of field work: Baldwin, Glascock, Hancock, Richmond, Taylor, Twiggs, Washington, and Wilkinson. These counties lie entirely or partially within the Fall Line Hills division of the Georgia Coastal Plain province, the area in which all of the sedimentary kaolins of the State are mined.

The writer wishes to acknowledge his appreciation of the valuable assistance and criticism of Richard W. Smith; the pertinent comments of A. S. Furcron; the courtesies and assistance of the various newspaper editors of the State, and the secretaries of many Chambers of Commerce for publicity purposes; and the cooperation of the executives of the kaolin mines and plants. He especially wishes to thank Capt. Peyton for the opportunity of publishing the results.

HISTORY OF THE INDUSTRY

The earliest record of the use of Georgia kaolin for commercial purposes is that noted by Sholes¹ in his "Chronological History of Savannah" in which he states that a Mr. Duchet discovered porcelain clay near Savan-

¹Sholes, A. E., Chronological History of Savannah, Ills; p. 47, Savannah Morning News (publishers). 1900.

nah, and made china cups from it in 1741. There are legends to the effect that even prior to this, the Governor of the Province of Georgia learned of the presence of such clays and had some shipped to the famous Wedgewood pottery in England. Soon after this discovery a rather flourishing trade grew up between the colony and England and existed until the English kaolins were discovered. The presence of good kaolin so close to the consumer (Wedgewood) naturally forced a cessation of operation in Georgia, and it was not until over one hundred years later that the industry in the State again started functioning.¹ Several companies were organized and operated for a number of years mining and shipping air-dried crude kaolin to the markets in the north and east.

In 1900 two companies began operations and are continuing in business today. These are the Georgia Kaolin Company, located at Dry Branch in Twiggs County, and the Albion Kaolin Company located at Hephzibah in Richmond County. Other companies mining kaolin in the State at present include: Edgar Brothers Company, McIntyre; John Sant and Company, Dry Branch; Harbison-Walker Mining Company, Gordon and Gibson; Gordon Clays, Inc., Gordon; Dixie Fire-proofing Company, Carrs Station; Georgia Coating Clay Company, Macon; Hall and Stephens, McIntyre; Carolina China Clay Company, Butler; Champion Paper and Fibre Company, Sandersville; General Refractories Company, Stevens Pottery; and Clinchfield Portland Cement Company, Clinchfield. In addition to these, at least two newcomers are assembling equipment to begin operations in the near future. One of these is the United Clay Mines of Sandersville. Other companies using, but not mining kaolin in this area, are the Babcock Wilcox Company, of Augusta; and the Cherokee China Company, Inc., Citizens and Southern National Bank, Atlanta, Georgia, with plant at Gordon, Georgia. The latter company is not ready for operation yet. Several other companies were formed and operated for a while, but the majority of these have been absorbed by mergers with one or another of the existing organizations listed above. A few were forced to suspend operations on account of abnormal business conditions in the past few years.

As stated in Bulletin 44, the first mining methods were indeed crude compared to those employed today. All of the larger operators now depend on mechanical means of stripping overburden and for mining kaolin. Due to special conditions in several mines, the kaolin must be gotten out by pick and shovel. No company now uses the hydraulic method of mining although under correct conditions for its use it could possibly be employed to great advantage.²

Processes for treatment of kaolin have been improved in the last few years so that a very uniform product from each plant is now on the market. Also "blends" and special grades of kaolin are produced by these plants to meet the demands of the consumers, such requirements being either an-

¹Smith, R. W., Sedimentary kaolins of the Coastal Plain of Georgia, Georgia Geol. Survey Bull. 44, pp. 1-4, 1929.

²Henry, A. V.; and Vaughn, W. H., Geologic and technologic aspects of the sedimentary kaolins: Am. Inst. Min. Met. Eng. Tech. Pub. 774, Jan., 1937.

anticipated or scientifically worked out in the modern and well-equipped laboratories maintained by each company.

As in former years the bulk of production is still used in the paper industry for both coating and filling purposes. Another steadily increasing use of Georgia kaolin is in refractories and white ware. Recent reports from the Babcock and Wilcox Company and the Dixie Fireproofing Company, indicate that both plants are running at full capacity and have been for some time past. In fact it appears that most of the kaolin companies have emerged from the depression stronger than ever and with prospects of a very bright future. They should be given much credit, not only for their perseverance in the face of great difficulties, but also for their success in proving to American consumers that the quality of Georgia kaolins equals, if not excels, that produced by any foreign nation.

PRODUCTION AND CONSUMPTION STATISTICS

The following figures and charts will undoubtedly prove that the value of Georgia sedimentary kaolins is not to be passed over lightly when dealing with the State's natural resources. In fact it can be shown that the sedimentary kaolins are the most valuable mineral asset now being exploited in the state. The chart below was taken from one prepared by Reis in a recent paper¹; the production figures for 1935 and 1936 have been added to the chart:

KAOLIN PRODUCING STATES ARRANGED IN ORDER OF RANK BY VALUE OF OUTPUT

Rank	1934	1935	1936
1	Georgia \$1,621,223	Georgia \$2,346,977	Georgia \$2,895,878
2	South Carolina \$658,905	South Carolina \$859,510	South Carolina \$965,183
3	North Carolina \$106,742	North Carolina \$118,972	Pennsylvania \$138,962

Analysis of this chart, with tonnage figures obtained from the United States Bureau of Mines Minerals Yearbook for 1937 shows that Georgia produced 66 per cent of the total kaolin output of the United States.

Additional information on the types of clays and values will be found in the following chart. It is intended to supplement the one in Bulletin 44 on page 4:

¹Reis, H., Clay, Industrial minerals and rocks; (Seeley W. Mudd series) Am. Inst. Min. Met. Eng., p. 227, 1937.

SEDIMENTARY KAOLINS

PRODUCTION OF KAOLIN IN GEORGIA

	Filler and Whiteware		Refractories		Total	
	Quantity Short Tons	Value	Quantity Short Tons	Value	Quantity Short Tons	Value
1928.....	234,028	\$1,668,125	a	a	249,604	\$1,687,654
1929.....	274,825	2,084,219	a	a	288,490	2,098,891
1930.....	240,734	1,977,457	49,146	\$ 83,752	289,880	2,061,209
1931.....	245,304	1,602,248	32,498	54,185	277,802	1,656,433
1932.....	207,519	1,148,000	26,725	48,988	234,244	1,196,988
1933.....	239,271	1,342,512	40,767	75,108	280,038	1,417,620
1934.....	236,606	1,535,046	47,950	86,177	284,556	1,621,223
1935.....	298,275	2,251,785	41,383	95,192	339,658	2,346,977
1936.....	367,463	2,764,065	80,559	156,127	448,022	2,920,192
1937.....	423,065	3,332,851	80,667	213,208	503,732	3,546,059

^aClay used for refractories not given separately.

The above chart shows clearly the steady increase in tonnage and, consequently, the value of the sedimentary kaolins of the Coastal Plain of the State. Some comparison with the values of the other minerals produced in Georgia may be of interest since it shows without doubt the outstanding value of the kaolins as a natural resource of the State.

MINERAL PRODUCTION OF GEORGIA DURING 1936

Product	Quantity	Value
Clay (Kaolin)		
Paper and China		
Clay, etc.....	367,463 short tons	\$ 2,764,065
Refractory uses.....	80,559 " "	156,127
Clay Products.....		2,863,828
Marble.....	40,590 " "	1,853,014
Granite.....	905,600 " "	1,774,754
Bauxite ^o		
Fullers Earth ^o		
Portland Cement ^o		
}.....		2,112,365
Limestone, Lime and Miscellaneous Stone.....	484,321 " "	540,416
Talc ^o		
Slate ^o		
Mica, Chlorite and Sericite Schist ^o		
Tripoli ^o		
}.....		216,309
Sand and Gravel.....	319,849 " "	140,156
Barite.....	38,435 " "	206,336
Manganese.....	6,965 long tons	61,353
Iron Ore.....	5,740 short tons	11,408
Coal ^o		
Ocher ^o		
Kyanite ^o		
}.....	27,788 " "	75,801

MINERAL PRODUCTION OF GEORGIA DURING 1936—Continued.

Product	Quantity	Value
Gold and Silver		
Gold:		
Placer.....	304.26 fine oz. }	15,735#
Lode.....	154.31 " " }	
Silver:		
Placer.....	11.0 " " }	21
Lode.....	17.0 " " }	
Total Value of Mineral Production.....		\$12,791,688
Total Value of Water Power.....		12,910,260
GRAND TOTAL.....		\$25,701,948

°—Less than three producers, so production and value cannot be shown separately.

#—Valued at \$35.00 per ounce.

Since the above figures indicate that the sedimentary kaolins are the most valuable natural resource so far developed in Georgia, it would be well for the citizens of the State to interest themselves in protecting and fostering this great industry so that it will continue to grow and to add to the inherent wealth of the State.

It is advocated that a program of additional research on the kaolins be instituted and carried forward for many years to come, in order that new uses, as well as markets be found to augment the present production and sale of the clay. It is only by research work that such objects can be attained most easily and economically, and at the same time be founded on a firm scientific basis.

CHEMICAL AND PHYSICAL PROPERTIES OF CLAYS

In order to obtain detailed information upon this subject, the reader is referred to Bulletin 44, pages 5 to 23. On page 23 the table END POINTS OF STANDARD PYROMETRIC CONES contains an error in the column labeled, "Heated at 20°C. per hour" and sub-headed "In Arsen furnace at 600° per hour." The figures given under degrees Centigrade and Fahrenheit should be moved up until the top row is opposite Cone No. 34 and not at its present position at Cone No. 36.

An interesting problem in regard to the relative physical hardness of kaolins is that of explaining the difference between the soft, semi-hard, hard, and flint varieties. Henry and Vaughn¹ believe that it can be explained on the basis of alteration after deposition by means of meteoric waters. That is, in the case of the flint kaolins especially, they believe that the original deposit of kaolin was probably of the soft variety. A subsequent burial of this kaolin beneath a fullers earth bed, followed by a leaching of

¹Henry, A. V.; and Vaughn, W. H., Geologic and technologic aspects of the sedimentary kaolins: Am. Inst. Min. Met. Eng. Tech. Pub. 774, Jan. 1937.

silica from the latter, then redeposition, or precipitation of the silica in the underlying kaolin accounts for the flint kaolins of Glascock County. This probably is the manner in which the flint kaolin was formed. Confirmation of a little different sort was observed in an occurrence of flint kaolin in the Albion Kaolin Co., mine at Hephzibah. (See page 34).

Clay in the Albion Kaolin Co. mine is now being taken from the south end of the property, because at the north end there is a bed of flint kaolin which is not desirable for the company's purposes. Overlying this flint kaolin there is a bed of arkosic sandstone varying in thickness from about ten to twenty feet. It is locally known as "grindstone"; Grindstone Creek just to the west takes its name from this rock. During the early history of this State, an old quarry existed at this point for the purpose of extracting water-mill grindstones. The material is light gray, and very coarse-textured, but quite hard for a Cretaceous rock. Observed from a short distance away it appears to be a granite, and it is only upon a very close examination that it can be identified as an arkose. The feldspars have undergone remarkably little weathering and rounding, and the quartz is highly angular in character. The stratum is poorly bedded, although some cross-bedding can be seen.

Beneath the arkosic sandstone are found several feet of flint kaolin, which can be traced laterally into the same bed now being mined at the south of the pit, where it is a soft to semi-hard type. From this evidence, it is suggested that the presence of any highly siliceous formation above a deposit of formerly soft kaolin may be responsible for its alteration to the flint variety. It is not necessary that the material be fullers earth, although it is a good source of silica.

On the other hand, the statement of Henry and Vaughn that "the different degrees of kaolin hardness . . . can be accounted for in a large measure by the same processes under somewhat different conditions" is not borne out by a great many chemical analyses. According to R. W. Smith¹ the hard kaolins do not have a greater silica content, and in many cases, the silica content, shown by analysis, is somewhat lower than that of the semi-hard and even the soft kaolins. Smith suggests that the difference in the hardness may be due entirely to grain size: the softer kaolins having the larger-sized particles; and the hard type, the finer-grained particles. This seems logical when it is considered that the smaller the size of the clay particles (below $2\ \mu$)², the greater the molecular bonding power exerted between the particles. Consequently, a physical test for hardness will show the clay to be of the hard variety if its individual particles are fine enough.

Before this question is definitely settled a great deal of additional work must be done, not only on exact chemical analyses, because of their misleading character in many cases³, but also in the field. A good bit of work

¹Smith, R. W., *op. cit.*, p. 16.

²Ries, H. Clay, *Industrial Minerals and Rocks*: (Seeley W. Mudd series), *Am. Inst. Min. Met. Eng.*, p. 207, 1937.

³Ries, H., *op. cit.*, p. 211.

along this line has recently been performed by Ross and Kerr¹ to show that the clay minerals are not as uniform nor as constant as was formerly believed to be the case. Their work shows the necessity for a petrographic analysis combined with a chemical analysis to demonstrate the true characteristics of any type of clay.

GEOLOGY OF THE COASTAL PLAIN OF GEORGIA

A lengthy discussion of the geology of the Coastal Plain in this report is not considered necessary for it has been ably handled in Bulletin 44, (See pages 27-35). However, it will be necessary to modify and change some sections in order to make formational names correspond to the best usage today. For more detailed information on the physiography and geology, reference should be made to previous bulletins issued by the Georgia Geological Survey.²

The map opposite page 30 in Bulletin 44, shows the general geology of the Fall Line Hills of the Coastal Plain in as far as it influences the sedimentary kaolin deposits found in that area. Fig. 1 in this paper is a table showing the new terminology and the relations of all formations in the Coastal Plain, according to C. W. Cooke's unpublished manuscript of his recent work in Georgia. A forthcoming publication of the Division of Mines, Mining and Geology in cooperation with the U. S. Geological Survey, by C. W. Cooke and others will discuss in detail the geology of the State of Georgia. About one half of the paper will be devoted to the geology of the Coastal Plain and the reader is advised to consult this bulletin, when published, for additional information about the kaolin deposits.

¹Ross, C. S., and Kerr, P. F., The clay minerals and their identity: *Jour. Sedimentary Petrology*, 1, 1931; also *Am. Ceramic Soc. Jour.*, 16, 57, 1933.

The kaolin minerals: U. S. Geol. Survey Prof. Paper 165-E, 1931.

Halloysite and allophane: U. S. Geol. Survey Prof. Paper 185-G, 1934.

²LaForge, Laurence, and others: *Physical geography of Georgia: Georgia Geol. Survey Bull.* 42, 1925.

Veatch, J. O., and Stephenson, L. W., *Geology of the Coastal Plain of Georgia: Georgia Geol. Survey Bull.* 26, 1911.

GEOLOGICAL FORMATIONS OF THE COASTAL PLAIN

SYSTEM	SERIES	GROUP	FORMATION		MEMBER
			WEST GA.	EAST GA.	
QUATERNARY	RECENT		RECENT		
	PLEISTOCENE		PAMLICO HORRY TALBOT PENHOLOWAY WICOMICO SUNDERLAND COHARIE BRANDYWINE		
TERTIARY	MIOCENE		DUPLIN MARL HAWTHORNE TAMPA LIMESTONE		
	OLIGOCENE	VICKSBURG	SUWANEE LIMESTONE FLINT RIVER		
	EOCENE	JACKSON	OCALA LIMESTONE Tivola Tongue	COOPER MARL BARNWELL	
			MCBEAN		
		CLAI-BOURNE	TALLAHATTA		
		WILCOX	WILCOX		
		MIDWAY	CLAYTON		
CRETACEOUS	UPPER CRETACEOUS		PROVIDENCE RIPLEY CUSSETA BLUFFTOWN		
			EUTAW	TOMBIGBEE SANDSTONE	
			TUSCALOOSA		

Fig. 1

ORIGIN AND CLASSIFICATION OF THE SEDIMENTARY KAOLINS OF GEORGIA

(Bull. 44, p. 35-37)

As Smith states on page 37, most geologists who have studied the question of the origin of the kaolin deposits agree that they were derived from deeply weathered feldspathic rocks of the Piedmont, and were subsequently deposited in quiet marine waters, perhaps estuarine. However, there has been little actual field work on the problem, and no data have been secured to point one way or the other. Recently the writer, while mapping the Cretaceous rocks of that area, saw a number of contacts between the Tuscaloosa and the underlying crystalline rocks. The crystalline rocks were weathered to primary kaolin in many instances and could be identified as crystallines only by the presence of thin, but continuous, quartz veins. The overlying rock could be easily identified as an unaltered sediment. In no case observed did it appear that the weathering of the underlying crystalline rocks was due to leaching after the deposition of the sediment.

One of the best exposures occurs in the Harlem quadrangle. It is located on the north side of the Huff Bridge on Brier Creek, where there is an eight-foot exposure in a road cut showing the following:

2. White sand, coarse, with zone of quartz cobbles at base varying in size from one-half to six inches in diameter (Tuscaloosa age)..... 3-0 ft.
1. White "primary" kaolin, sandy, showing remnants of a former schistosity, and cut by predominantly vertical veins of quartz one-eighth to one-quarter inches wide..... 5-0 ft.

About four and one half miles east of Milledgeville in Baldwin County, on the State Highway Routes Nos. 22 and 24, one quarter mile east of their junction, is an outcrop showing the contact between the crystalline rocks and the Barnwell (Eocene) sand. The crystalline rocks at this point have been weathered to a "primary" kaolin showing evidence of former schistosity and are also cut by small quartz veins. They are overlain by the deep-red, coarse-grained Barnwell sand. It is believed that the crystalline rocks were weathered to the kaolinitic state prior to deposition of the Barnwell sand because the clay is not discolored by iron oxide stains except superficially along joint and slip planes. If this alteration had taken place after the deposition of the Barnwell, it is highly probable that the kaolin would be stained more thoroughly by iron oxide derived from the Barnwell.

The above evidence along this line is offered as corroborative proof of the theory that the sedimentary kaolins were derived from a deeply weathered Piedmont surface, which may or may not have been close to absolute peneplanation prior to Tuscaloosa time.

DISTRIBUTION AND DESCRIPTION OF DEPOSITS BY COUNTIES

The arrangement of Bulletin 44 in this report will be followed exactly. However, no information contained in Bulletin 44, will be repeated herein; all property descriptions about which any new data have been accumulated will be discussed in order of their occurrence in Bulletin 44, proper reference being made in each case to page and name. If no statement is made about a particular property, the description found in Bulletin 44 still is correct so far as the writer's knowledge goes. All new property descriptions will be placed at the end of each county division in which they belong.

TAYLOR COUNTY

CAROLINA CHINA CLAY COMPANY

(GOLDING SONS COMPANY)

(Bull. 44, pp. 66-70)

The property described as Golding Sons Company of Trenton, N. J., with mine located 2 to 3 miles west of Butler and $1\frac{1}{2}$ miles south of the Central of Georgia Railway, has been leased recently to the Carolina China Clay Company. The present operator of the property is Mr. Harold Moore, General Manager, whose address is Butler, Georgia.

The mine was not in operation when visited in July, but the drying shed was filled with kaolin and it was reported that the mine was worked at irregular periods. As far as could be determined, all machinery formerly used by Golding Sons Company has been abandoned; the kaolin as well as the overburden is now removed by hand. This is doubtless because mining costs can be kept down in this way, a better product can be obtained, and irregular working conditions can be more easily met. The following section is now exposed at the working face in the pit:

- | | |
|---|--------------|
| 4. Sand, red and white mottled, argillaceous..... | 10 to 30 ft. |
| 3. Kaolin, hard, light grayish-green, stained by iron
oxide, upper surface undulating..... | 5 ft. |
| 2. Kaolin, soft to semi-hard, purple and yellow
mottling..... | 4 ft. |
| 1. Kaolin, soft to semi-hard, light gray..... | 6 ft. |

The kaolin is air-dried for several weeks in open sheds. It is then crushed to small lump size, loaded into trucks, and hauled to the railroad at Butler for shipment to market. All of the product is used in white ware trade.

CRAWFORD COUNTY

(Bull. 44, p. 91.)

The old pottery industry that existed for a number of years in the eastern part of this county has, in the past few years, been reduced to a single survivor—the Middle Georgia Pottery. This company has abandoned the use of kaolin entirely, and now depends upon the nearby stream deposits to supply the necessary clay.

According to J. E. Merritt, the present owner and operator, the company discontinued the use of kaolin, when the change from wood to coal-firing of the kilns was made, because it was discovered that there was too great a shrinkage involved in the use of kaolin. As a consequence, alluvial clay is used exclusively. No other changes in the process or plant have been made. Flower pots and sagers are manufactured.

HOUSTON COUNTY

CLINCHFIELD PORTLAND CEMENT COMPANY

(Bull. 44, p. 96.)

The kaolin pit of the Clinchfield Portland Cement Company is being worked at necessary intervals in order to keep abreast of plant production. The pit has been extended about 100 yards in a general northerly direction since 1929. The lower six-foot bed seems to have been mined for a short time as indicated by a pit roughly 50 feet by 75 feet, now filled with water. The present operation is located several hundred feet beyond this point; the intervening clay has been mined out.

TWIGGS COUNTY

AMERICAN CLAY COMPANY PROPERTY

GEORGIA KAOLIN COMPANY

(Bull. 44, p. 108.)

The Moore and Munger Company gave up its lease on the American Clay Company property at Dry Branch in December, 1933. The Continental Clay Company of Chicago, Ill., leased the plant only, in September, 1934, in order to process kaolin obtained on the C. C. Humphries property at Myricks Mill on Big Sandy Creek, about nine miles from the plant. It continued in operation until 1936, when the Georgia Kaolin Company, (see page 12), leased the plant and mine from the American Clay Company. Today the plant, known as Number One, is probably the second largest in Georgia. The mine is no longer operated. This plant was not visited by the writer.

SEDIMENTARY KAOLINS

JOHN SANT AND COMPANY

(Bull. 44, p. 111.)

This plant is operating in much the same manner as it was in 1929. No changes have been made in machinery or personnel. Mr. Tharpe, the superintendent and manager, reports that much of their best grade kaolin is now being used in the linoleum industry.

E. J. NELSON PROPERTY

(Bull. 44, p. 112.)

Officials of the Georgia Kaolin Company report this property was prospected by them in 1934, and a small pit was opened up. It was soon abandoned because the deposit contained only a very small quantity of commercial kaolin lying under an overburden of too great thickness for profitable mining.

OLD MACON MINING COMPANY PROPERTY

(Bull. 44, p. 116.)

The Superior Mineral Products Company, managed by Martin L. Markel and Robert S. Finney, of Summerset, Penn., bought this property in November, 1930. They mined, dried, and crushed kaolin for several years, but ceased business and dismantled the plant in January, 1935.

GEORGIA KAOLIN COMPANY

(FLAMOGA CLAY COMPANY)

(Bull. 44, p. 118.)

The Georgia Kaolin Company leased this property in 1930 from the Flamoga Clay Company. They are not mining it at present.

GEORGIA KAOLIN COMPANY

(Bull. 44, p. 120.)

Headquarters: 433 N. Broad Street, Elizabeth, N. J.

Mines and Plants: Dry Branch, Georgia.

E. J. Grassman	President
R. W. Howell	Vice-President
B. B. Shaw	General Manager

The Georgia Kaolin Company was organized about 1900 and has continued operations steadily since that time. The company was reorganized in 1928, followed by a large expansion of mining and plant operations.

Mine (No. 2)

The mine has been worked steadily since 1929, and consequently has been considerably enlarged. One of the outstanding features of this pit is the tremendous thickness of overburden compared to that of the kaolin.

For an average kaolin thickness of 10 to 12 feet, an average of 60 feet of overburden is removed. The largest section, as seen in the east end of the mine, is:

7. Clay, red sandy.....	30 ft.
6. Fullers earth, weathered, light greenish-gray.....	40 ft.
5. Fullers earth, greenish-gray, blocky fracture.....	35 ft.
4. Sand, unconsolidated, gray, medium-coarse.....	8 ft.
3. Sand, argillaceous and calcareous.....	13 ft.
2. Kaolin, soft, white.....	12 ft.
1. Kaolin, sandy.....	?

138 ft.

Mining operations are carried on at various levels in the pit so that the overburden will not occur in a vertical wall. That is, there are three terraces above the level of the kaolin, and on each a standard-gage tram line is laid to the point of operation. Electric shovels load the side-dump tram cars which, in turn, are hauled by small diesel locomotives to the northwest portion of the property for unloading and dumping the overburden outside of the mine proper. The levels are roughly 40 feet apart vertically. By such methods, the overburden can be removed quickly, cheaply, and without too much risk.

The kaolin is mined mechanically by means of electric and gas-electric shovels, which load it into narrow-gage tram cars; it is then hauled to the nearby mill.

Plant (No. 2)

The present plant is the outgrowth of many years of experience and experimentation on the part of the Georgia Kaolin Company. Even today changes are being made in order to meet and anticipate the needs of the consumer.

In general, the plant consists of two parts—the wet side and the dry side. In the dry portion of the plant, the kaolin is dumped first into a storage bin from which it is removed by belt conveyors as needed. After passing through a jaw crusher and hammer mill, part of the clay is sent to the wet mill; the remainder goes to a large rotary drier on the “dry side.” From the dryer the kaolin passes into another hammer mill; it is then screened, the finer particles passing on to a “squirrel cage” pulverizer, the oversize pieces returning to the hammer mill for additional grinding. Upon emergence from the pulverizer, the kaolin is blown through a series of eight Gayco air classifiers, thus separating the fines, which are sacked. The rejects, consisting of mica, clay, and fine sand, are sent over to the wet mill for the final refining process. About 75 per cent of the plant output comes from the dry mill.

The wet mill is very up-to-date, thus its process is an interesting one. The kaolin, issuing from the initial crushing on the dry side, and the final rejects from the air classifiers, are blunged in a “log-type” disintegrater. The slip then goes into a “squirrel cage” pulverizer from which it may

enter either a series of Dorr classifiers, or several Bird electrostatic separators. This step in the process makes a complete, and final separation of the commercial clay from all sand, mica, and other deleterious material occurring in it. The cleaned slip is sent to filter presses where 80 per cent of the water is removed, leaving a cake of kaolin consisting of approximately 80 per cent clay and 20 per cent water. This cake is then dried in a rotary drier, pulverized, and finally sacked, or loaded loose in box cars for shipment.

At various points through the process, clays from different properties are added in needed proportions to prepare "blends" for special purposes of the consumer. The plant capacity is reported to be 150,000 tons per year. Most of the product is used as a filler and coating clay, although a considerable portion is consumed by the ceramic trades.

T. S. THARPE PROPERTY

(Bull. 44, p. 122.)

No kaolin is present on this land according to the Georgia Kaolin Company.

J. W. BRYANT PROPERTY

(Bull. 44, p. 123.)

The Georgia Kaolin Company found no kaolin on this property after prospecting it.

MRS. MARTHA BALCOM PROPERTY

(Bull. 44, p. 123.)

This property should now be known as the Balcom Estate. It is controlled by the Georgia Kaolin Company, but is not being mined.

STEWART BROS. PROPERTY

(Bull. 44, p. 125.)

No kaolin occurs on this property in commercial quantities according to the Georgia Kaolin Company.

F. J. RAY & BRO. PROPERTY

(Bull. 44, p. 125.)

The Georgia Kaolin Company tested and inspected the clay found on this land but rejected it for commercial use.

DEFOE AND ASBELL PLACES

(Bull. 44, p. 129.)

This property belongs to the Georgia Kaolin Company but has not been opened for mining so far.

SMITH AND BUTLER MELTON PLACES

(Bull. 44, p. 132, paragraph just before J. H. Hull property; beginning
"The Smith Place")

The Smith place and the Butler Melton place are now owned by J. E. Schmidt, 7th and Pine Sts., Macon, Georgia. Mr. Schmidt reports that while prospecting with a hand auger, he found a soft, white kaolin deposit averaging 15 feet in thickness, covered by a soft clay and sand overburden from 10 to 20 feet thick.

The samples he showed the writer indicated that the deposit may be well worth detailed investigation by interested persons.

TWIGGS COUNTY KAOLIN COMPANY

(Bull. 44, p. 132.)

This company still controls the property but has never operated it. The addresses that appear in Bulletin 44 should read as follows:

Frank Lawson, Pres. (Dry Branch, Rt. 1, Georgia)
Dr. J. M. Boyd, Vice-Pres. (Jeffersonville, Georgia)

MRS. C. E. MCDONALD ESTATE

(Bull. 44, p. 140.)

No kaolin was found by the Georgia Kaolin Company while prospecting this property.

SOLOMON'S PINEY WOODS PLACE

(Bull. 44, p. 141.)

It is rumored that Moore and Munger tested the kaolin on this property and decided that it was not quite commercial in grade.

D. S. MCGEE PROPERTY

(Bull. 44, p. 142.)

A division of this property was made in 1936. The 278 acres lying south of the G. B. Wood estate are now owned jointly by Prof. A. E. Wood, Mississippi College, Clinton, Miss., and Mrs. D. S. McGee. The other 125 acres, situated north of the G. B. Wood estate are owned by Mrs. D. S. McGee (Dry Branch, Rt. 2).

G. W. METHVIN PROPERTY

(Bull. 44, p. 148.)

This place, consisting of 420 acres, is located four miles from Jeffersonville, $1\frac{1}{2}$ miles northeast of the Macon road on a secondary side road. Recently the owner has been prospecting the central portion of the farm with a hand auger, and has bored twenty test wells in an area of about 100 acres. It is reported that these wells have penetrated a bed of kaolin about

20 feet thick. The clay from the boreholes appears to have a good white color in places and is soft to semi-hard. There seems to be a large area underlain by the kaolin but additional prospecting is necessary to completely determine the value of the deposit. Prospect pits should be dug in order to secure samples and to inspect the bed closely. Present evidence shows that this preliminary work should be done.

NEW PROPERTIES

GEORGIA KAOLIN COMPANY, MINE NO. 4

OLD ARD AND WILLIAMS PROPERTY

The Georgia Kaolin Company (see page 12) now operates the Old Ard and Williams property located 3 miles southeast by road from the Atkins store, which is approximately 5 miles south of the Macon-Jeffersonville paved highway on the Cochran Short Route. This land, found to be underlain by a large deposit of valuable kaolin, was opened up several years ago. The mine is known as No. 4.

The deposit is roughly lenticular in a north-south direction; present operations in it are extending the pit toward the north. The kaolin averages about 20 feet in thickness and can be classed as a semi-hard variety of good white color. The top three or four feet of the clay, at some points, is badly stained and contains small sand lenses. This portion of the bed is hand-picked and discarded before the underlying kaolin is mined. The clay at the southeast side of the mine is highly bauxitic, very stained, and consequently, is not mined.

The overburden in general is quite thick in comparison to the kaolin, averaging 63 feet at the working face, and increasing to over 100 feet at the other points on the property. In addition, the overburden is troublesome to remove at places because of the presence of a 3 to 10 foot bed of siliceous rock, cherty in character, and very hard. When this bed is encountered, dynamite must be used to shoot it down because a shovel will not remove it. The other portions of the overburden consist of unconsolidated sand and the usual fullers earth.

Following is a section taken at the working face in the northwest part of the pit, in July, 1937:

6. Soil.....	2 ft.
5. Fullers earth, mottled greenish.....	38 ft.
4. Chert, or flint rock, light-gray.....	8 ft.
3. Sand, light-green, coarse, arkosic, loose.....	15 ft.
2. Kaolin, semi-hard, good white.....	20 ft.
1. Kaolin, very yellow, not mined.....	?

83 ft.

The mine is pumped because the topography does not favor natural drainage. The kaolin is mined by a diesel power-shovel, loaded into trucks, and hauled to the railroad at Swift Creek. The overburden is also mined by a diesel-powered shovel which loads it into side-dump tram cars, hauled by a gasoline locomotive to the southeastern part of the mine.

GEORGIA KAOLIN COMPANY, MINE NO. 5

OLD ISADORE BALCOM PLACE

The Georgia Kaolin Company (see page 12) mine No. 5, as the pit is known, is located approximately 4 miles southeast of Dry Branch on the northeast side of the old Jeffersonville road. The mine is about three acres in area; present operations are tending to extend it in a northwestern direction.

The kaolin bed is about 10 feet thick and is overlain by a bauxitic clay that averages about 2 feet in thickness. The latter is discarded during mining, as are irregular pockety occurrences of colored and stained clay found on the slightly-rolling top surface of the deposit in various places. The kaolin is very soft.

Above the clay are 8 to 30 feet of sand and clay consisting of red sand (Barnwell) at the top, then fullers earth, and next a coarse, micaceous, loose sand lying on the kaolin. This, like the kaolin, is stripped by a gasoline shovel. Both are loaded into trucks for removal. The overburden is hauled to the east side of the pit and dumped, and the kaolin is hauled to the plant, a distance of about three miles.

GEORGIA KAOLIN COMPANY, MINE NO. 6

OLD B. C. THARPE ESTATE

This property is located approximately 6 miles southeast of Dry Branch on the old Jeffersonville road, and is now known as Mine No. 6 of the Georgia Kaolin Company (see page 12). The pit covers an area of about three acres; present mining is extending it in a westerly direction. The kaolin is very soft and remarkably free from fine sand particles; it has a good white color, although there are irregular patches, stained pink. At the southwest end of the mine the lower five feet of the bed is so badly stained that operations were forced to cease there. The clay averages 13 feet in thickness; it is mined by means of a diesel-powered shovel and loaded into trucks which haul it to the plant four miles away.

The overburden, consisting of argillaceous red sand and fullers earth, is also stripped by a diesel shovel, loaded into trucks that haul it to the eastern side of the pit and dump it. The mine has no natural means of drainage and must be pumped. (See Frontispiece and Plate II).

GEORGIA COATING CLAY COMPANY

Office and Plant: Macon, Georgia.

Mine: 2 miles south of the M. D. & S. R. R. at Franklinton, Georgia.

Officers: E. J. Sawyer, President.

E. Y. Mallory, Vice-President.

Mine

The mine, located as above, is on the property of Mrs. Ada L. Burch, and consists of 100 acres, in Land Lot 49. The Georgia Coating Clay

Company has made a long-term lease with arrangements to mine the kaolin from this area. The adjoining property of Alton O'Neill, which contains 350 acres, has also been leased by this company for mining purposes. The O'Neill place, according to Mr. Mallory, contains a soft to semi-hard kaolin averaging 20 feet in thickness beneath an overburden that averages about 30 feet thick.

The present pit is situated on the south slope of an east-west ridge with a topographic relief of about 50 feet. The kaolin deposit occurs at the bottom of the hill and is 20 feet thick. The clay seems to be soft to semi-hard, with a good white color, but is highly jointed in many directions. Most of the joint planes are stained by iron oxide or organic material. The top of the deposit is very regular. The following section was measured in July, 1937:

5. Sand, light-gray, loose, hilltop mantle.....	10 ft.
4. Fullers earth, greenish-gray, waxy, sandy.....	12 ft.
3. Sand, iron-stained, containing chert boulders similar to concretions.....	3 ft.
2. Sand, greenish and glauconitic, coarse, argillaceous.....	8 ft.
1. Kaolin, soft to semi-hard, white, jointed.....	20 ft.
	53 ft.

The clay is mined by diesel-shovel, loaded into trucks, and hauled to the railroad at Franklinton for shipment to Macon. Mining operations are paralleling the ridge in order to avoid as much as possible the heavier overburden of the central part of the hill.

The overburden is stripped from a series of terraces by means of a power shovel, loaded into trucks, and dumped to the west of the property. The terrace arrangement makes the mining operation a great deal simpler and cheaper.

Plant

Due to the fact that several new methods have been introduced into the usual plant procedure, officers of the company would not permit the plant to be inspected by the writer. It was stated by them, however, that washing and air separations are made along the usual lines. Completely new equipment was purchased and set up for this plant in Macon, and its capacity was reported to be 100 tons per day. Plans are now being made to double this output, by means of the installation of additional units.

The finished product is sold under the trade name of Vanderbilt-Cherokee Clay, and is used as a filler and coater of paper, as well as in the manufacture of heavy whiteware bodies. Two of the unique characteristics of this clay, according to Mr. Mallory, are its cleanliness and its extremely fine particle size.



GEORGIA KAOLIN CO. MINE NO. 6, SIX MILES SOUTHEAST OF DRY BRANCH, TWIGGS COUNTY.

P. W. MARTIN GORDON CLAYS, INC.
MOORE AND CROSBY PROPERTIES
(Bull. 44, p. 184.)

Plants: Two at Gordon, Georgia.

Mines: Twiggs, Wilkinson and Washington counties, Georgia.

P. W. Martin, of Macon, Georgia, died in February, 1932. He was one of the original pioneers of kaolin mining in Georgia, and took a large part in its subsequent development.

J. W. M. Scott, General Manager, Gordon, Georgia.

The following information was given the writer by Mr. Scott in August, 1937: The tram line of the company was extended from Wilkinson to Twiggs County in May, 1929. At that time mining was started on the old Dyer Estate, now owned by Mrs. C. H. Ryle of Florida, and was continued until March, 1931, when the pit was abandoned. From there operations were moved to the Cannon Place, immediately south, and continued until March, 1934, when this deposit was also abandoned.

At this time an extension of the tram line took place to the Moore and Crosby properties, still farther south of the Cannon Place. The Moore and Crosby properties are located 8 miles southwest of Gordon, just across the Twiggs-Wilkinson line on the Twiggs County side. Since being opened in 1934, mining operations have uncovered an average of 12 feet of good white, soft to semi-hard kaolin, covered by an overburden that has averaged from 20 to 45 feet in thickness.

The kaolin is loaded directly into 4-yard cars by means of steam shovels, and hauled over a narrow-gauge railroad about 8 miles to the plants at Gordon. The overburden is stripped by a very large movable drag-line, (see Plate III), equipped with a 4-yard bucket. The pit is back-filled with the overburden, making it unnecessary to utilize additional space in disposing of the material. The overburden is chiefly a red argillaceous sand (Barnwell), underlain by greenish-gray fullers earth (Twiggs Clay member). The sand content of the kaolin varies from about 4 to 10 per cent.

The limits of the deposit had almost been reached when visited in August, 1937. In October, 1937, the Moore and Crosby deposit was finally abandoned and all equipment moved to the Betty and Ella Epps Property.

P. W. MARTIN GORDON CLAYS, INC.
BETTY AND ELLA EPPS PROPERTY

The Betty and Ella Epps property is located one-half mile southeast of the Moore and Crosby deposit (see above). Prospecting has indicated the presence of a good white, soft kaolin averaging about 12 feet in thickness, with an overburden varying from 15 to 50 feet in thickness. This property has been reported leased by P. W. Martin, Gordon Clays, Inc.

Officials of the company state that all deposits so far mined by their company have been small and lenticular in outline, and that, although prospecting has been carried on continuously for ten years, no large deposits of the softer grades of kaolin have ever been found in the Gordon area.

SEDIMENTARY KAOLINS

D. Y. CALIFF PROPERTY

Sixty-six acres belonging to Mr. D. Y. Califf of Jeffersonville are located 3 miles north of that city on the Irwinton road. The farm adjoins the H. M. Johnson and Whitaker property on the south. On this land Mr. Califf has drilled a number of auger holes prospecting for kaolin, and has also sunk one test pit. When visited by the writer in August, 1937, it was impossible to enter the pit for a close inspection of the strata, and, consequently, the only examination possible was that of material brought to the surface when the pit was dug. This kaolin appears to be grayish and somewhat stained, but very soft and free from grit.

Mr. Califf reports that the kaolin in the test pit is 6 feet thick with an overburden of about 9 feet. The top of the pit is located approximately 10 feet above the bed of an intermittent stream.

Another property of 700 acres lies immediately north of the intervening Johnson and Whitaker land and is reported to be underlain by a deposit of kaolin. An outcrop of 8 to 10 feet of kaolin was observed along a road bounding the property on the south. It is believed that more prospecting should be done in this area to discover the quality of the kaolin, and to evaluate the deposits known to exist there.

WILKINSON COUNTY

MITTIE RYLES PROPERTY

(Bull. 44, p. 164.)

Lizzie Ryles Moore (colored), 410 South Hazel Street, Hope, Arkansas, is now owner of the estate of Mittie Ryles.

CHEROKEE CHINA COMPANY, INC.

(FORMERLY GEORGIA WHITE BRICK CO.)

(Bull. 44, p. 166.)

The Cherokee China Company, Inc., recently purchased the old Georgia White Brick Company property located in Gordon, Georgia.

Cherokee China Company, Inc.

Headquarters: 421 Citizens and Southern National Bank, Atlanta, Georgia.

Plant: Gordon, Georgia.

Officers: Mr. A. K. Adams, President, Atlanta, Georgia.

Mr. Alfred Badowski, Vice-President, Atlanta, Georgia.

Mr. J. H. Franklin, Jr., Sec.-Treas., Atlanta, Georgia.

The Cherokee China Company, Inc., has dismantled and sold most of the brick-making machinery formerly used by the Georgia White Brick Company during its operation. Some few remnants of the old plant have been retained for use in the manufacture of whiteware by the new company. Notable among these is the excellent Harrop tunnel-kiln which is very adaptable to use in firing chinaware. Officers of the company estimate that the use of this kiln will give the plant a capacity of some 25,000

dozen pieces per week. A more complete description of this kiln will be found in Bulletin 44, page 170; excellent photographs of it can be seen on the opposite page (Plate X).

The company, after removal of the brick machinery, plans to install modern machinery for manufacturing whiteware, and operations will begin on what is known as straight-line production. In addition the plans call for erection of a completely enclosing brick wall around the entire building as well as other improvements of a similar type.

The company will use various kinds of clay as raw materials; it contemplates the utilization of approximately 25 per cent of kaolin in the finished product, although most of the Georgia kaolin will be used as car blocks, saggars and refractories.

The types of ware to be produced are inexpensive, semi-porcelain dinnerware and tea sets in solid colors and with decorations. Also, some kitchen pottery, containers, specialized articles, and art ware will be manufactured; for it is believed that such will find a good market in the South, and will compete advantageously with similar ware now shipped in from northern points.

GEORGIA WHITE BRICK COMPANY

(Bull. 44, p. 166.)

The Georgia White Brick Company operated for several years after its opening in 1925. For various reasons it failed to become the success that it undoubtedly deserved to be; and now, after lying idle for sometime, it has been purchased by the Cherokee China Company, Inc. (See above).

Some of the more salient features that contributed to its failure were: the mining methods, some unforeseen, and some unpredictable; difficulties of plant design; and finally the sales organization. In the first case, that of mining operations; it is thought that the aplite operations, in the vicinity of Milledgeville, were not suitable to mechanical mining methods. At that locality the aplite occurs in thin branching veins in a country rock of ferruginous, mica-schist, which makes it almost mandatory to carefully hand-pick the entire product in order not to include the iron-bearing schist, if a white-colored brick is desired. Evidently this was not done, because the finished brick showed by its buff color, that considerable quantities of ferruginous material made up some of the mix.

The buff color of such brick is, in itself, not objectionable for building purposes. In fact, for a great many uses it may be more desirable than a white brick. Nevertheless, since the organization had been designed to produce white brick, and had gone so far as to incorporate under the name of the Georgia White Brick Company there was much adverse criticism when it failed to produce such a brick.

The second reason, in the writer's opinion, why the company failed, was the plant design, in which there were two outstanding flaws. The first of these was the construction, and use, of two large cylindrical tanks or hoppers for raw kaolin storage within the plant. Because of their shape it was impossible for the clay to dry thoroughly, for air could not reach any but the topmost layers. After the installation of these hoppers the manage-

ment discovered its error, and, attempting to correct it, installed a series of coiled steam pipes within the tanks. Instead of helping the condition, the steam pipes aggravated it by sweating. A very simple method would have been to cut openings at the base of the hoppers, and, by means of forced draft, to have circulated hot, dry air through them. In reality, however, the most economical method of drying the kaolin would have been to erect open air sheds of the tier type.

The second portion of the plant design that added to the difficulties as well as to the cost of operations, was the use of the Harrop tunnel-kiln. This kiln made it necessary to run the plant at full capacity, or not at all. It is obvious that there were many times during operations when it was not convenient, nor economical, to run full capacity. Consequently, the plant did not have the flexibility so often required in modern business.

The last reason for the company's failure is believed due to the fact that the sales organization was not correctly handled to place the finished product on all available markets. Also, the fact that white brick was promised, but not produced, added greatly to sales difficulties, although, as stated before, this feature is not objectionable; it could have been turned to advantage by the proper methods of selling.

Another, and perhaps the greatest, reason for the non-success of the Georgia White Brick Company, is the fact that it was incorporated during the decline of the building industry, so that it was eventually hard hit by the depression. This last factor, of course, was in no way the fault of the management, as were the others. It is to be deplored that such a promising industry has been lost to the State, but it may be that the many difficulties which it encountered, combined with a subsequent analysis of the reasons for failure, will enable another organization to succeed along the same lines.

HARBISON-WALKER MINING COMPANY
EVANS AND DETTRICH PROPERTY

(Bull. 44, p. 170.)

Since purchasing this property in 1929, the Harbison-Walker Mining Company has opened it up and mined a large tonnage of kaolin from it. The pit at present is about 250 feet in diameter and 30 to 40 feet deep. It does not have natural drainage and therefore must be pumped.

The very hard, white, and much-jointed kaolin is mined by steam shovel, and loaded into trucks for haulage to the Central of Georgia railroad siding one-half mile south. The overburden is also stripped by a steam shovel, loaded into a mule-drawn tram car, and hauled to the western part of the property for dumping.

The section, as measured in August, 1937, was:

4. Soil and covered (ascending hill).....	?
3. Fullers earth, greenish-gray.....	20 ft.
2. Marl, bluish-gray, broken shells of fossils (Tivola tongue, Ocala limestone).....	10 ft.
1. Kaolin, hard, white, worm-cast structure.....	35 ft.
	<hr/>
	65 ft.



MOVABLE DRAGLINE SCRAPER OWNED BY P. W. MARTIN, GORDON CLAYS, INC. THIS MACHINE IS USED TO REMOVE OVERBURDEN.

The top of the kaolin is irregular on a small scale, having depressions five to ten feet in diameter and a few inches to a foot deep, scattered over the top surface.

GORDON CLAYS, INC.
(GORDON KAOLIN COMPANY)

(Bull. 44, p. 177.)

The property described in Bulletin 44, under the title of the Gordon Kaolin Company and also the Savannah Kaolin Company, has been leased to P. W. Martin, Gordon Clays, Inc., (see page 19) since 1927. The latter company is now operating the plants and pits of the former companies.

The pit now designated by Gordon Clays, Inc., as G-1 is on the property of Hallie Myers, Peyton Bell, and the Ezell Tract described on page 178 of Bulletin 44. The kaolin exposed in this pit is hard, but very white, and averages 15 feet thick. It is covered by an overburden of fullers earth and sand 8 to 30 feet thick.

The clay is mined and loaded by hand into trucks for hauling to the plant at Gordon, 1 mile away. Some is placed in a small drying shed nearby for air-drying. The pit is about 100 feet in diameter. No mechanical method for stripping overburden was noted.

P. W. MARTIN, GORDON CLAYS, INC.

(Bull. 44, p. 184.)

This company is still using the leased plants of the Gordon Kaolin Company and the Savannah Kaolin Company at Gordon, Georgia.

OLD J. J. FITZPATRICK PLACE

(Bull. 44, p. 186.)

P. W. Martin, Gordon Clays, Inc., opened the deposit on this property in 1927 and had mined it out by January 1929 when it was abandoned.

J. J. SHEPPARD PROPERTY

(Bull. 44, p. 200.)

Mine

The deposit was opened by J. M. Sheppard several years ago. The kaolin mined from this pit supplies his plant located on the grounds of the J. M. Hall Lumber Company at McIntyre, Georgia, and also the plant of the Akron Pigment Company in that town, (See page 224, Bull. 44.) which he operates for that company at present.

The kaolin bed averages about 15 feet thick and appears to be a soft type of fairly good white color, although in places it is spotted by irregular cream- and brown-colored patches. There is also a small percentage of some finely-divided black mineral present in the clay. It is probable that this mineral is either iron or ilmenite, but this is not detrimental because either or both of them can be removed by suitable washing.

The overburden averages 20 feet in thickness. The top ten feet is a red, loose, coarse sand (Barnwell), and the basal ten feet consists of a sandy, gray-green fullers earth containing small pellets of kaolin in the bottom foot. The contact between the kaolin and the overlying fullers earth, where exposed in the pit, is definitely a well-developed unconformity.

The mine dimensions are approximately 50 feet by 100 yards, the longer dimension being in a north-south direction. The kaolin is mined by a small gasoline shovel, and is hauled in trucks to the plant at McIntyre, six miles north. The overburden is removed by a steam shovel, and trucks haul this material about 200 yards to the north-east of the working face.

Plant

The plant, located at McIntyre, consists of a series of shelves in an open shed on which the kaolin is placed for air drying. When dried sufficiently the lumps are crushed and pulverized and the material is loaded directly into box cars on a siding of the Central of Georgia railroad for shipment.

WILLIS BLOODWORTH PROPERTY

(Bull. 44, p. 208.)

This property was bought by Hatfield and Owens, of Gordon, Georgia, in February, 1931. The H. M. Bloodworth place adjoining it was also included in the sale.

WALKER'S GEORGIA KAOLIN MINES

(Bull. 44, p. 209.)

Mr. John Scott, of Gordon Clays, Inc., told the writer that this mine and plant had closed down in 1931, and that the property was still owned by Mr. J. M. Walker, of McIntyre, Georgia.

EDGAR BROTHERS COMPANY

(Bull. 44, p. 216.)

Headquarters: Metuchen, N. J.

Georgia Mines and Plants: McIntyre, Georgia.

Local Superintendent: C. E. Todd.

Due to inviolable company rules, the writer was not permitted to visit either the plants or mines of this company. Plant officials, however, were kind enough to describe them for use in this report.

Plant

The plant described in Bulletin 44, page 222, is still in operation. Some new mechanical equipment has been added which improves the quality of the product and the efficiency of the plant.

Mines

The scene of the present mining operation is on the Smith and Hardy properties which adjoin the old Klondike No. 2, Mine (Bull. 44, Page 218). The kaolin mined there is a portion of the deposit mined on the other properties nearby, and is soft with a good white color, containing but $1\frac{1}{2}$ to $2\frac{1}{4}$ per cent of sand and mica. The bed averages 16 feet in thickness, but in a few places near the top there are irregular pockets of bauxitic material. At the base it grades into a loose, highly micaceous, argillaceous sand.

Above the kaolin are 35 feet of overburden, consisting of soil and loose red sand (Barnwell), and a little fullers earth (Twiggs Clay) immediately on top of the clay.

The kaolin is mined by means of power shovels, then loaded onto narrow-gauge tram cars and hauled directly to the plant at McIntyre. The overburden is stripped in the same manner, and dumped from the tram cars at the southeast of the mine. The present pit covers an area of about ten acres, and is a continuation of the old Klondike mine. It has natural drainage.

The kaolin is treated at the plant for use as a coating and filling material for paper, but a little is used by the whiteware industry.

AKRON PIGMENT COMPANY

(Bull. 44, p. 224.)

The mine of this company has recently been abandoned but the plant is still in operation. Mr. J. M. Sheppard, of McIntyre, Georgia, is operating the plant at present on a royalty basis for the Akron Pigment Company whereby he supplies the raw kaolin to the plant, does the processing, and supplies them with the finished product. The kaolin treated there comes from the J. J. Sheppard property which also supplies another plant owned and operated by Mr. Sheppard at McIntyre (see page 23). The entire output of the Akron Pigment Company plant is used as a filler in the manufacture of rubber products.

H. A. WALDEN PROPERTY

(Bull. 44, p. 230.)

The H. A. Walden property was leased in 1935 to the United Clay Mines Corporation of Trenton, N. J., of which Mr. Clyde W. Hall is Vice-President. The deposit has not yet been worked.

GENERAL REFRACTORIES COMPANY

NADINE MINE

(Bull. 44, p. 250.)

The General Refractories Company of Philadelphia, Pa. has purchased the Evens and Howard Firebrick Company's old General Bauxite Company's Nadine Mine. They are not working the property at present. (See page 27).

SEDIMENTARY KAOLINS

WESLEY JONES PROPERTY
 OLD DUPONT PLACE
 (Bull. 44, p. 261.)

The statement concerning ownership of this land should be as follows: Wesley Jones (colored) owns the surface rights, and the mineral rights are owned by R. S. Perry, Georgia-Louisiana Corporation, P. O. Box 153, Station A, Atlanta, Georgia.

GENERAL REFRACTORIES COMPANY
 (KIER FIRE BRICK COMPANY PROPERTY)
 (GENERAL BAUXITE COMPANY)
 (Bull. 44, p. 263.)

The property known as the Old General Bauxite Company's Toombsboro Mine has been acquired by the General Refractories Company of Philadelphia, Pa., (see page 27). It is not being mined.

J. F. MILLER PROPERTY
 (Bull. 44, p. 275.)

Mr. J. F. Miller, 246 Main Street, Sarasota, Florida, the owner of this land, reports that samples he obtained from kaolin occurring there tested less than one per cent of sand.

NEW PROPERTIES

W. S. RYLE MINE

Mr. W. S. Ryle of Gordon, Georgia is operating a small kaolin mine located on the south side of an east-west ridge, 2 miles east of Gordon and three-quarters of a mile north of the Milledgeville road. The kaolin is about 17 feet thick, and is hard with a good white color. The upper foot or two seemed to be somewhat bauxitic in character. The deposit, as in the nearby Harbison-Walker Mine (page 22), is highly jointed in all directions, and the top of the bed is slightly irregular. The joint planes are stained by iron oxide.

The overburden varies in thickness from about 8 to 30 feet, and is comprised mainly of fullers earth with a few feet of red sand and soil at the surface (Barnwell). The overburden is stripped by a drag-line which is motivated by means of a tractor-drum arrangement using a cable attached to a scraper guided by hand. The kaolin is mined by hand and loaded into trucks for haulage to Gordon and shipment by rail.

D. Y. CALIFF PROPERTY

The property of D. Y. Califf is located 7 miles northeast of Jeffersonville, on the southeast side of the McIntyre road, and consists of 500 acres. At one point along the main road there is an outcrop of soft stained kaolin 15 feet thick, extending along the road for about 200 feet on the southwest side of a northwest-southeast trending ridge. The top of the kaolin is approximately 40 feet beneath the top of this ridge. If this deposit is to be prospected, auger holes should be drilled parallel to the ridge, for that is probably the way in which it would be mined if it proves to be of commercial interest.

BALDWIN COUNTY

GENERAL REFRATORIES COMPANY
 (EVENS AND HOWARD FIRE BRICK COMPANY)
 (STEVENS, INC.)
 (Bull. 44, p. 285.)

The General Refractories Company purchased the Evens and Howard Fire Brick Company plants and properties in January, 1930. Following is the address of this company:

Headquarters: 1600 Real Estate Trust Building, Philadelphia, Pa.
 Georgia Plant: Stevens Pottery, Georgia.
 Local Supt.: L. H. Feese.

At the time of the purchase in 1930, the General Refractories Company acquired all rights in the Stevens Bros. Company and Stevens, Inc., as well as the Kier Fire Brick Company property at Toombsboro, Georgia, and the T. E. Rhodes property in Glascock County (See Bull. 44, p. 361).

According to Mr. Feese, his company has done some additional prospecting on the old original kaolin mines at Stevens Pottery which were thought to have been mined out. The investigation showed that the deposits were not exhausted as believed, but contained considerable more tonnage. This deposit is not being worked now but is being held as a reserve for future needs.

Plant

No important changes have been made in the plant. The names of the two firebricks produced by the Evens and Howard Fire Brick Company have been changed to "Kaolin" for "Kaofrax"; and "Stevens" for Stevens' "Volcano." The same requirements and specifications are maintained for the respective bricks as formerly.

Mine

The General Refractories Company is now mining the Joe Wood Place (Bull. 44, p. 286) located $2\frac{1}{2}$ miles southwest of the plant at Stevens Pottery. The kaolin is a good white color, soft to semi-hard, and 30 to 35 feet thick.

It is overlain by a cover averaging 45 feet in thickness; the following section is exposed:

4. Soil and fullers earth mottled red and green.....	25 ft.
3. Fullers earth, light gray-green, sandy.....	12 ft.
2. Sand, argillaceous, light gray and brown.....	8 ft.
1. Kaolin, soft to semi-hard, good white.....	35 ft.
Sand, fine (not exposed).....	45 ft.

125 ft.

The kaolin is mined by a steam shovel, loaded into tram cars, and hauled to the plant for treatment. The overburden is also stripped by steam shovel, loaded into narrow-gage side-dump tram cars, and hauled to the southeastern part of the property for disposal.

SEDIMENTARY KAOLINS

W. A. HALL PROPERTY

(Bull. 44, p. 288.)

H. C. Buckmore, of Tucapau, S. C., purchased the mineral rights only on this property in 1935. It is not being mined.

HANCOCK COUNTY

ATLANTIC REFRACTORIES COMPANY

DIXIE FIREPROOFING COMPANY

(WYSONG BROS.)

(Bull. 44, p. 292.)

Headquarters: Atlantic Refractories Company, Macon, Georgia.

W. P. Stevens, President.

R. H. Mason, Vice-President.

Washington Dessau, Secretary.

Plant and Mine: Carrs Station, Georgia.

Mr. J. M. Smoot, Plant Manager:

The Atlantic Refractories Company is the sales company for the refractory products manufactured by the Dixie Fireproofing Company at Carrs Station. Mr. Stevens reports that a new plant is being constructed at Macon, Georgia, for the production of refractories, but it is not known whether this will be an addition, or whether it will supplant the one at Carrs Station. According to present plans the new plant will be in operation about the first of 1939.

Mine

The pit visited by Smith during field work in preparation for Bulletin 44, has been worked out and abandoned since 1926. A new pit, a continuation of the same deposit, has been opened about 50 yards to the east of the old one. The new pit is opposite the plant and directly across the tracks of the Georgia Railroad.

The kaolin now mined is soft to semi-hard, slightly gritty, cream to white in color, and highly jointed. In some places the joint planes are stained pink. The deposit appears to be thickening to the east, although the great irregularities noted in the top and bottom contacts of the bed make it difficult to determine the true increase. In fact, it may be that differential settling of the underlying beds is the cause of the apparent abrupt increase in thickness. At the west side of the pit the kaolin bed is about 15 feet thick, but this suddenly increases to 20 feet, to the east, because of an abrupt irregularity in the basal contact.

The kaolin is mined by hand, loaded into trucks, and hauled to the plant across the railroad.

The overburden is removed by steam shovel, loaded into trucks, and hauled to one side out of the way of operations. The cover consists of fullers earth which is very sandy and colored red by iron oxide. It averages about 10 to 15 feet in thickness.

Plant

The products of the Dixie Fireproofing Company are:

Atlantic First —A fire brick corresponding to the one formerly known as "Southland."

Southern Standard—Same product as in the past.

Spartan Steel —The equivalent of the old "American."

All three are high-grade fire bricks. In addition, a high-temperature mortar and plastic are manufactured, as well as a prepared fire-clay.

The plant itself has undergone few changes since it was visited by Smith in 1926. Only three kilns have been built; the fourth noted as under construction in 1926 was not completed.

WASHINGTON COUNTY

(Bull. 44, p. 297.)

The changes in property ownership noted in Washington County were reported to the writer by Mr. L. D. Ennis of Sandersville, Georgia.

TOM HODGES PROPERTY

(Bull. 44, p. 302.)

Mr. L. D. Ennis now owns the Tom Hodges property, and has recently prospected it. He reports that he found 22 feet of kaolin beneath the bauxite noted as occurring there.

SOUTHERN CLAY CORPORATION

E. PIERCE WOOD PROPERTY

(Bull. 44, p. 305.)

The E. Pierce Wood property was purchased by Spaulding, McDougal, and Sibley, Atlanta Trust Building, Atlanta, Georgia, in September, 1931. The deposit has not been opened.

SAM ENNIS PROPERTY

(Bull. 44, p. 313.)

According to Mr. L. D. Ennis, Mrs. Jack H. Hardin, of Sandersville, Georgia now owns 500 acres of this tract located east of the old residence and on the north side of Oconee River.

C. H. SMITH PROPERTY

(Bull. 44, p. 313.)

The C. H. Smith property was purchased by the Cleveland-Oconee Lumber Company which has prospected it and found that the land is underlain by 8 to 20 feet of soft, white kaolin, covered by an overburden averaging 20 to 30 feet in thickness. It is reported that the deposit will be opened in the near future.

SEDIMENTARY KAOLINS

C. F. FOWLER PROPERTY

(Bull. 44, p. 313.)

L. D. Ennis reports that auger prospecting indicates the presence of 14 feet of good white kaolin, overlain by 6 feet of stained kaolin, on this tract. There is an overburden of 16 to 24 feet.

EDGAR BROTHERS COMPANY

R. J. WOOD PROPERTY

(Bull. 44, p. 314.)

The writer was not permitted to visit this mine by the Edgar Bros. Company (see page 24) but company officials described it for publication.

The kaolin is about 23 feet thick; it is very soft and white with a sand and mica content varying between one and three per cent. The overburden averages 46 feet in thickness and consists of loose red sand and soil.

The kaolin is mined by power shovel and hauled by trucks to the plant on the Central of Georgia Railway, at Gardner, Georgia, a distance of about 16 miles. The overburden is also stripped by power shovel.

W. E. PROSSER PROPERTY

(Bull. 44, p. 315.)

The Cleveland-Oconee Lumber Company now owns the W. E. Prosser property.

GEORGIA KAOLIN COMPANY

(AMERICAN INDUSTRIAL CLAYS, INC.)

(Bull. 44, p. 316.)

This property is now owned by the Georgia Kaolin Company (see page 12) and is operated by them at the present time. The pit being mined is a westward extension of the original one mined by the American Standard Clay Company and later by the American Industrial Clays, Inc. It is reported by company officials of the Georgia Kaolin Company that the deposit is almost mined out and shortly will be abandoned.

The writer and Mr. Smith visited the locality in July, 1937; the kaolin bed averages about 8 feet of good white, soft clay. The upper 6 to 12 inches contains small sand "pipes" which seem to be irregular cylindrical openings filled with sand from the overlying material. Little is known concerning their origin. They are generally removed by hand-picking and discarded before the power shovel is used in mining the clay. Beneath the commercial clay is a bed of yellow and pink-stained clay about 2 feet thick, which cannot be used. The top of the kaolin at one place contains small balls of a grayish-colored clay.

The overburden is a loose, gravelly sand about 10 feet thick. It is stripped by a steam shovel and hauled away by trucks to a point east of the mine. Trucks also haul the kaolin to the railroad at Sandersville for shipment to the main plants at Dry Branch in Twiggs County.

TUCKER'S GILES PLACE

(Bull. 44, p. 321.)

This property is under option to the United Clay Mines Corporation, which is constructing a new treating plant near Sandersville.

STEPHEN'S BUTLER PLACE

(Bull. 44, p. 321.)

According to L. D. Ennis, this property has been sold to Mr. E. Pierce Wood of Sandersville.

J. R. GLADDIN PROPERTY

(Bull. 44, p. 324.)

This property is now owned by Mr. Harper Tucker.

WINNIE RENFROE PROPERTY

(Bull. 44, p. 325.)

It is reported that Moore and Munger have optioned this tract; it is not operated at present.

T. J. FIELD PROPERTY

(Bull. 44, p. 325.)

The name of this property owner should read: T. J. Veal.

HALE BROTHERS

R. H. DAVIS PROPERTY

(Bull. 44, p. 331.)

This tract has been purchased and prospected by Hale Bros., 1314 Citizens & Southern Bank Bldg., Atlanta, Georgia. The writer did not visit the property, but according to R. W. Smith, who visited it twice during the prospecting in 1937, the borings showed hard cream to white kaolin from 25 to 35 feet in thickness, under overburden consisting mostly of fullers earth ranging from 0 to 45 feet in thickness. The thickest bed of fullers earth encountered was 41 feet.

J. T. HARRIS PROPERTY

(Bull. 44, p. 337.)

It is reported that Moore and Munger has optioned this farm.

NEW PROPERTIES

CHAMPION PAPER AND FIBRE COMPANY

Headquarters: 601 North B. Street, Hamilton, Ohio.

Local Superintendent: C. B. Hutchinson, Milledgeville, Georgia.

The mine of the Champion Paper and Fibre Company is located about 12 miles west of Sandersville and half a mile southwest of the Sandersville-Milledgeville Highway.

The deposit now mined contains 27 feet of semi-hard kaolin divided, by color differences, into upper and lower benches. The upper one consists of a slightly variegated clay stained pink by iron oxide; it also contains small, spherical, brownish-yellow inclusions. The color of the lower part is more uniform and, for the most part, good white. It contains, however, small hard "pea-size" pellets of kaolin which will not disperse in the usual manner during blunging. The two benches are not separated in mining. All of the clay is dug by hand, loaded into trucks, hauled to Sandersville to the railroad, where it is shipped raw to the Ohio plant.

The overburden of the Champion Paper and Fibre Company mine averages 8 or 9 feet in thickness, with a maximum of 34 feet. It is mainly a grayish, loose sand which is mined by steam shovel, and loaded into narrow-gauge tram cars which haul it to a point north of the pit for dumping. The pit has natural drainage.

The writer raised the question, at the time of his visit in July, 1937, whether it would not be more economical to dry the clay in Georgia before shipment out of the State. Company officials said that they had determined that the manner in which they were proceeding was most profitable to them, since a plant in Sandersville would not be a good investment.

However, in the writer's opinion, such a plant could be constructed and operated so that it would be profitable for the following reasons: (1) A large saving would result from extraction of the water from the clay, for it usually contains 20 to 25 per cent moisture which is a dead loss when shipped by rail. (2) All laborers' wages are considerably lower in Georgia than in the northern United States. (3) An initial plant investment would quickly be retired because of the above savings. (4) Such a plant could be easily enlarged to include processing methods when paper manufacturing consumers begin operations in Georgia. (5) Such a plant would be very close to such markets.¹

GEORGIA KAOLIN COMPANY

HAMP FRANKLIN PROPERTY

It is reported that the Georgia Kaolin Company purchased the Hamp Franklin property, located one mile north of Deepstep on the Linton

¹It is reported (August, 1938) that since the above was written, the Champion Paper and Fiber Company has acted upon the suggestion for a clay treating plant in Sandersville, and is in the process of erecting a modern, large plant valued at about \$175,000. This will be a great addition to Georgia.

road. The tract, bought in 1937, consists of 16 to 28 feet of good kaolin, and with an overburden of 22 to 34 feet.

GEORGE VEAL PROPERTY

The George Veal property, situated 3 miles north of Deepstep on the Linton road, contains 62 acres; it is reported to contain a deposit of kaolin.

R. M. BROWN PROPERTY

The R. M. Brown property which adjoins the Edgar Brothers property on the southwest contains 90 acres; it is reported to have been prospected recently. The results of that investigation are said to have revealed 18 to 22 feet of soft, good white kaolin, under a cover of 14 to 22 feet overburden.

P. W. MARTIN GORDON CLAYS, INC.

This company (see page 19), operates a mine located $1\frac{1}{2}$ miles west of Deepstep on the Tucker road. The mine, when visited in August 1937, showed about 15 feet of soft, good white kaolin, greatly jointed and with many of the joint planes stained pink by iron oxide coatings. It is reported that another 8 feet of kaolin exists beneath the present mine floor.

The overburden consists of about 12 feet of red, white, and purple-mottled clay containing a great deal of fine sand, just above the kaolin; and next above, about 25 or 30 feet of reddish sand and gravel. The overburden is stripped by a movable dragline.

The kaolin is mined by hand, and loaded into trucks for hauling to the Central of Georgia Railroad at Tennille, Georgia. The pit does not have natural drainage and must be pumped.

HALE BROTHERS

THOMAS HOLT PROPERTY

Hale Brothers, 1314 Citizens and Southern National Bank, Atlanta, Georgia, in the summer of 1937 purchased from Ben Tarbutton of Sandersville, the Thomas Holt property of 214 acres, which is located east of Bluff Creek, $1\frac{1}{4}$ miles north of the Sandersville-Milledgeville road, adjoining and due east of Edgar Brothers property (see page 30).

A thorough prospecting under the supervision of Arthur D. Little, Inc., Cambridge, Mass., revealed that about 75 acres of this property are underlain by a deposit containing 1,900,000 tons of excellent soft white kaolin averaging $13\frac{1}{2}$ feet in thickness, under an overburden averaging 38 feet in thickness. The deposit is evidently a continuation of that being mined by Edgar Brothers.

GLASCOCK COUNTY

HARBISON-WALKER MINING COMPANY

(Bull. 44, p. 350.)

Headquarters: 1800 Farmers Bank Building, Pittsburgh, Pa.

Gibson Mine: Rocky Comfort Creek, 2 miles southeast of Gibson.

This mine, visited by the writer in September, 1937, has been worked sporadically and enlarged somewhat to the north since Bulletin 44 was published. No changes have occurred in the section that is noted on page 351, Bulletin 44.

The Tennille Branch of the Georgia and Florida Railroad over which the clay was formerly shipped, has been abandoned and the clay is now trucked 12 miles to Stapleton, where it is loaded in railroad cars for shipment to the Harbison-Walker Refractories Company at Bessemer, Alabama.

GENERAL REFRACTORIES COMPANY

T. E. RHODES PROPERTY

(Bull. 44, p. 361.)

When the General Refractories Company (see page 27) took over the operation of the old Stevens Pottery plant and properties, the T. E. Rhodes property, adjoining the Harbison-Walker Company's mine, also was purchased. Company officials reported that no efforts have been made to mine the flint kaolin said to underlie this property.

GENERAL REFRACTORIES COMPANY

JOHN MAYS PLACE

(Bull. 44, p. 371.)

The John Mays Place also was bought by the General Refractories Company (see page 27), when the Stevens Pottery and the Evens and Howard Fire Brick Company were purchased in 1930. It is being operated by them at present to supply the plant at Stevens Pottery, Georgia.

RICHMOND COUNTY

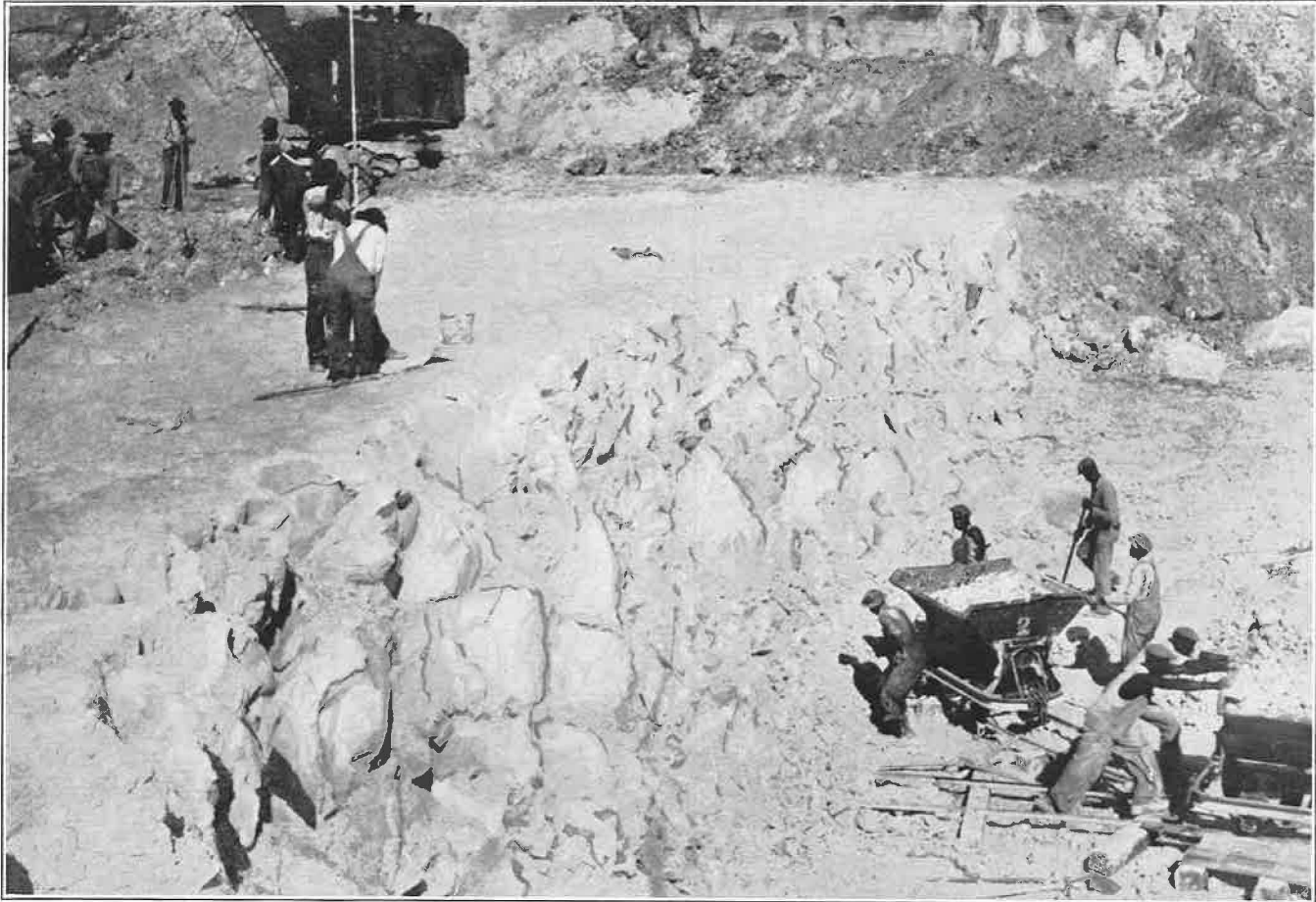
ALBION KAOLIN COMPANY

(Bull. 44, p. 397.)

The Albion Kaolin Company has been mining steadily since 1929, extending the old pit several hundred yards further south during that time. The present working face shows almost the same section reported by R. W. Smith during his visit in 1929 (see page 398, Bull. 44). (See Plate IV).

Plant

Several changes have been made recently in the plant, the most notable being the addition of a five-roll Raymond mill with overhead cyclone



MINING OPERATIONS OF ALBION KAOLIN CO., NEAR HEPZIBAH, RICHMOND COUNTY.

separator, and an oil-fired dryer which forces hot air into the Raymond mill during grinding. This will eventually replace the old rotary drier, and will also add greatly to the capacity output of the plant. No washing of the kaolin is done at the plant. The greater part of the kaolin produced by the Albion Kaolin Company is sent to the Babcock-Wilcox Company at Augusta for use in the manufacture of refractory firebrick.

THE BABCOCK & WILCOX COMPANY

REFRATORIES DIVISION

(Bull. 44, p. 407.)

Headquarters: 19 Rector Street, New York City.

Georgia Plant: Augusta, Georgia.

Officials: A. M. Kohler, General Manager,
Refractories Division,
19 Rector Street, N. Y.C. L. Norton, Jr., Technical Director,
Refractories Division,
19 Rector Street, N. Y.F. S. Douglas, Works Manager,
Augusta, Georgia.

The Babcock and Wilcox Company of New York, one of the largest manufacturers of boilers and special refractory products, constructed in 1930 a very modern plant at Augusta, Georgia, for the purpose of making refractory products from Georgia sedimentary kaolin. The plant property consists of 35 acres on the Old Savannah Road. The buildings are of all-steel construction, housing three continuous kilns, several periodic kilns, and a rotary calciner, in addition to the necessary dryers and other manufacturing equipment.

Products

A variety of products, all made with sedimentary kaolin as a base, are manufactured at the plant. Two special refractory firebricks produced may be described as follows:

The B&W 80 Firebrick is made of kaolin grog calcined in the rotary calciner at a temperature of more than 3000 degrees F., mixed with an additional amount of raw kaolin as a binder. The molded and dried bricks are fired about 3000° F., in one of the continuous kilns, resulting in a product free from shrinkage and with a high development of mullite crystals. As the kaolin used has practically no free quartz, and hence no tendency toward sudden thermal expansion, the brick does not spall readily. It is suitable for the most severe furnace conditions and is notable for its load-bearing capacity at high temperatures.

The other special firebrick is called the B&W Junior Firebrick. It is made in a manner similar to the B&W 80 Firebrick, but will not withstand the extreme conditions for which the latter is designed. It is suitable

for furnace conditions where first quality fire clay brick deteriorate rapidly but where it is unnecessary to use the most resistant materials.

In addition to the refractory firebrick, there are five insulating firebricks produced at this plant. These bricks are lightweight, have high insulating values, and can sometimes be used as refractories exposed directly to furnace gases, when required. The five bricks are branded:

B&W K-20
B&W K-22
B&W K-26
B&W K-30
B&W K-30-3

The numbers following the "K" in the brand name indicate the service temperature limits to which each brick may be used. The K-30-3 brick is a special highly refractory brick, heavier than the K-30. These bricks weigh from 30 pounds per cubic foot (1.75 lbs. per standard 9 inches straight) in the case of the K-20, to 49 pounds per cubic foot (2.9 lbs. per 9 inches straight) for the K-30-3. They are of considerable value, not only in reducing the heat losses from a furnace by conduction and radiation, but also in reducing the heat stored in the furnace walls.

The plant also produces several types of refractory mortars and plastics. The mortars are for use in laying the firebrick, and for coating the surfaces of furnace brickwork exposed to the combustion gases. The plastics are used to mold burner rings, door openings, door linings, boiler baffles, and to make other monolithic structures.

The plant also produces lightweight aggregates for making lightweight insulating concrete and also premixed concrete mixtures for the same purpose. Other miscellaneous products include bases for high temperature mortars, calcined kaolin for electrical insulators, etc. The company's products are used extensively in many industries and in many types of furnace applications such as boilers, both stationary and marine, heating furnaces in the steel-making and forming industries, glass melting furnaces, ceramic kilns and furnaces, non-ferrous metal melting and heating furnaces, oil stills and furnaces used in the chemical industry, and many others.

Manufacture

The company does not mine its own kaolin, but buys most of its requirements from the Albion Kaolin Company of Hephzibah, Georgia, which is only a few miles to the south.

In the manufacture of the B&W 80 Firebrick and the B&W Junior Firebrick, the lump kaolin is broken down by means of a crusher into small fragment size, elevated to storage bins, and is then conveyed to a rotary kiln. The material is calcined in the rotary kiln, then crushed and screened to the desired size of the brick, and conveyed to another bin in the brick manufacturing building. Beside this bin is another one which contains pulverized raw kaolin. The two materials are fed from the storage into a mixing machine, water is added, and the ingredients are thoroughly mixed. The plastic mass is then extruded and cut into sizes approximating the

final brick in size and shape. These blocks are repressed to true up the corners and edges and to impress the trademark on the brick. Finally, they are run through one of the continuous kilns.

The fines, resulting from the crushing and the screening of the calcined kaolin, which are not used for the brick are used in the manufacture of the refractory mortar and plastics. Additional clay and binders are added to obtain the various characteristics and properties required of these materials.

The lightweight insulating firebricks are also made from the same kaolin by combining it with ground sawdust and mixing with water. This mixture is molded and fired in one of the continuous kilns in a manner similar to the dense B&W 80 and Junior Firebrick.

The three continuous kilns are for use in firing the standard 9 inch series and other standard shapes. The kilns are of different sizes and capacities allowing for greater flexibility in adjusting production to the sales demands for the various products.

The kiln temperatures are very carefully controlled by electrical pyrometers to insure uniform burning at all times. Special shapes are usually fired in periodic kilns since the firing cycles of these kilns can be more easily adjusted than those of the continuous type to meet the requirements of the various size pieces fired.

A large storage building for sawdust, equipped with sawdust grinding and sizing machinery, has recently been erected on the plant grounds.

BAUXITE DEPOSITS OF THE COASTAL PLAIN SUMTER COUNTY

B. F. EASTERLIN PROPERTY

(Bull. 44, p. 434.)

The B. F. Easterlin property has, since 1928, become known as the B. F. Easterlin, Jr., property. A small amount of bauxite has been mined from the deposit each year but no figures are available on the production.

AMERICAN CYANAMID AND CHEMICAL CORPORATION

R. D. HATTON PROPERTY

(SWEETWATER BAUXITE MINE)

(Bull. 44, p. 435.)

The Sweetwater Bauxite Mine was purchased by the American Cyanamid and Chemical Corporation in 1930.

Headquarters: New York, New York.

Mine: Andersonville, Georgia.

The American Cyanamid and Chemical Corporation, at the time of the property transfer in 1930, determined that the most economical way of removing the bauxite from beneath the heavy overburden would be to mine it by underground methods. Consequently a room and pillar system

was devised so that entries were driven 105 feet apart, on center, and then cross-cuts driven 65 feet apart on center. Mining proceeds by removing alternate, and staggered rooms first. Upon completion of this phase, the pillars are pulled in the usual way, from back to front, as far as possible. Complete recovery of all the bauxite remaining in the pillars is impossible because of the unconsolidated quality of the roof, which caves in unexpected places. A good portion of the deposit, however, is recovered.

The bauxite is dried in a rotary drier to a 2 per cent moisture content, then is trucked to Andersonville for shipment by the Central of Georgia railroad.

This property was not visited by the writer during his investigation of 1937. The above data are from the notes of R. W. Smith, who was there in November, 1936.

WARM SPRINGS DISTRICT

(Bull. 44, p. 451.)

According to the conclusions of Shearer¹ and Smith² there seemed little doubt of the sedimentary origin of the bauxite deposits located $2\frac{1}{2}$ miles west of Warm Springs on the north slope of Pine Mountain, in Meriwether County. This deposit was visited recently by C. W. Cooke and the writer in order to determine the age of bauxite for possible correlation with similar beds within the Coastal Plain province. It was believed necessary to do so, because, if it could be shown that Cretaceous or Tertiary sediments once extended to that point, it might be possible to find additional outcrops equally distant from the Fall Line at other points.

An examination of the beds, however, revealed no evidence of any possible connection with Coastal Plain sediments. On the contrary, it is believed that the bauxite, and associated kaolin, have been derived from the weathering of either feldspathic dikes, or more likely, from lenses of sericite-schist. This conclusion is drawn from the fact that the dip of the bauxite beds conforms strictly to that of the enclosing country rock which is mica-schist. Furthermore, from the structure observed, it would be impossible for either the bauxite or kaolin to have been laid down as sediments in either a marine or lacustrine basin.

A possible clue to the origin of these beds, according to Smith³, is furnished by the road outcrops on the north side of Pine Mountain in Pike County on the Zebulon-Thomaston Highway. A stained kaolin, similar to that in the Warm Springs district, crops out at the foot of the mountain. On the slopes of the mountain these outcrops grade into a more sandy and micaceous clay and then into a residual mixture of fine sand and sericite mica with some clay, interbedded with thin layers of quartzite. These

¹Shearer, H. K., A report on the bauxite and fullers earth of the Coastal Plain of Georgia: Georgia Geol. Survey Bull. 31, p. 319, 1917.

²Smith, R. W., *op. cit.*, p. 452.

³Smith, R. W., Personal communication, December 7, 1937.

are the topmost beds of the Hollis quartzite.¹ It appears evident that some surface weathered debris from these thin-bedded sericitic and argillaceous quartzite beds have been transported down the slope and sorted by stream action.

FUTURE OF THE INDUSTRY

The healthy growth and ultimate success of any industry, as Smith states in Bulletin 44, page 460, depends largely upon the market and also upon the fabrication of a good product at a minimum cost. However, low costs should not be derived entirely from the use of untrained labor exclusively, of which the South has such an abundant supply. The employment of semi-skilled and skilled labor should naturally occur in any progressive plan of industry in this region for the reason that such training, with its higher wages, will more than pay for itself.

There are many reasons why men should be trained in industry; the most important ones, economically, are that skilled labor works more efficiently; and that it raises the general welfare level of the workers. Of course, there will probably always be a great need of unskilled labor, but no industry should be founded and maintained upon its sale alone. The finished product should be able to meet competition upon its own merits.

The Georgia kaolin producers have realized the inevitable truth of such labor policies, and have maintained a high wage level for a good many years. In fact, they have raised wages in many instances. This act must be highly commended for it was made at a time when the kaolin market was seriously threatened by an influx of foreign clay because of a contemplated reduction in our tariff barriers. Such a reduction, if consummated, would probably do irreparable damage to Georgia's kaolin industry, because not only would present markets be surfeited, but also wages would have to be lowered to meet the foreign price level. It is a well known fact that the low cost of foreign materials is usually due to low wages only. Consequently, it would be extremely unfair to our kaolin industry, or any other in this country, to force it to meet such prices, especially under the conditions of the recently passed Wage-Hour Bill.

The economic status of the South has been improving "by leaps and bounds" in the past few years. No greater index to the State's position can be had than to compare it to the United States as a whole during the last business recession. Figures show that Georgia experienced only a slight reduction of income as compared to as much as fifty per cent in some of the northern industrial states. Of course, part of this may be attributed to a lesser volume of business in the South, but it is also undoubtedly due to better conditions in the South.

The general movement of industry to Georgia depicts a bright future for the economic development of our State. Those industries which specifically influence the kaolin plants are probably lead by the paper mills,

¹Hewett, H. F., and Crickmay, G. W., *The Warm Springs of Georgia—their geologic relations and origin*: U. S. Geol. Survey Water Supply Paper 819, pp. 27-29, 1937.

and whiteware manufacturers. The pulp mills will, without doubt, eventually produce high-grade paper filled and coated with Georgia kaolin. Whiteware, likewise, will develop into a sizable industry, for its beginnings are now materializing in the form of a large plant near Gordon (see page 20). ¹In this connection it may be added that the Division of Mines, Mining and Geology is carrying on experiments to determine the extent and quality of feldspar and ball clay found in the State, which may be suitable for use in the whiteware industry.

Other important uses of Georgia kaolin, now made of it in other states, include: the filling of rubber, linoleum, and cloth. There is no valid reason why such operations cannot be performed in Georgia, and there are many reasons why they should. The rubber industry, for instance, uses great quantities of cotton, and kaolin. The latex is shipped in from South America, and at present not only cotton but kaolin is then shipped north for fabrication at a point having no resources except space. The place to manufacture this product is close to the source of supply, and this means Georgia.

The use of sedimentary kaolin in refractories and related products has greatly increased in the past few years with the addition of new plants in the State. Their output could be increased by the establishment of industries using refractory products in this State.

Vast amounts of stained kaolin, hard, and flint kaolins still remain useless for economic purposes because suitable research has been lacking to develop them. So, too, remain large tonnages of low-grade bauxite for want of more efficient processing at lower costs. If the sedimentary kaolin industry lacks one thing, it is facilities for ample and unhurried research on the low-grade ores not now being marketed, in order to devise new methods of beneficiation and above all new uses. The Georgia Engineering Experiment Station and the Georgia Division of Mines, Mining and Geology of the Department of Natural Resources should be helped and encouraged in their efforts to secure such results, for their impartiality makes all benefits derived from such work available to the citizens of the State in general, and not to a favored few.

The thoughts of every Georgian should be turned towards the establishment of industries in the State, for once the trend is well started beneficial results will accumulate much in the manner of a rolling snowball which gathers volume and speed as it progresses. So can the kaolin industry be built to greater and greater heights by the cooperation of the citizens of Georgia.

¹Since the above was written, announcement has been made of the establishment in Atlanta of the Bauer Pottery Company, a branch of a large California Pottery, which will manufacture art ware and colored luncheon ware using a special body intermediate between earthenware and white ware.

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