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HIGH-GRADE CLAYS OF THE EASTERN UNITED STATES

WITH NOTES ON SOME WESTERN CLAYS

BY

H. RIES, W. S. BAYLEY, AND OTHERS

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INTRODUCTION.

FIELD WORK AND ACKNOWLEDGMENTS.

The field work required for the preparation of this report was done in the summer of 1918. Most of the worked deposits of the types of clay discussed in this report in Pennsylvania, Virginia, Florida, Alabama, Mississippi, Tennessee, Kentucky, Illinois, Arkansas, and parts of Missouri and Georgia were visited, but time was not available for detailed geologic mapping, much of which has already been done by the United States Geological Survey and State surveys.

In all the States visited the State geologists cooperated most cordially. Thanks are also due to the clay-mining companies for similar cooperation and for many courtesies.

The States of North Carolina and South Carolina were visited by W. S. Bayley, whose report is included in this bulletin, as are also some separate descriptions, by W. N. Logan, of the white clays of Indiana; by E. S. Moore, of the Cambrian residual clays of central Pennsylvania; by F. B. Peck, of the residual clays of the Oriskany of eastern Pennsylvania; by G. H. Brown, of the clays of New Jersey; by Wilbur Stout, of the glass-pot clays of Ohio; and by J. P. Buwalda, of some clays of Nevada. Thanks for assistance are also due to Dr. A. V. Bleininger, of the Bureau of Standards; Prof. C. W. Parmelee, of the University of Illinois; C. R. Schroyer, of the Illinois Geological Survey; M. E. Wilson, of the Missouri Geological Survey; Prof. E. S. Moore, of the Pennsylvania State College; Dr. R. R. Hice, then State geologist of Pennsylvania; and Prof. F. B. Peck, of Lafayette College. The petrographic work for the report was done by Dr. R. E. Somers.

IMPORTS OF CLAY.

STATISTICS.

Prior to the beginning of the war, in 1914, the United States had been a large importer of certain high-grade clays, which were used in the manufacture of white-ware pottery, floor and wall tile, electrical porcelain, paper, graphite crucibles, glass refractories, linoleum, paint, and other products. Some idea of the extensive use of these

foreign clays in the domestic industry may be gained from the figures showing the imports for the years 1907–1920, published by the United States Geological Survey.

Clay imported and entered for consumption in the United States, 1907–1920.

Year.	Kaolin or china clay.			Common blue and Gross-Almerode glass-pot clay.		All other clays.				Total.	
						Unwrought.		Wrought.			
	Quantity (short tons).	Value.	Average price per ton.	Quantity (short tons).	Value.	Quantity (short tons).	Value.	Quantity (short tons).	Value.	Quantity (short tons).	Value.
1907..	239,923	$1,582,893	$6.60	12,378	$110,686	31,196	$145,698	2,520	$81,155	286,017	$1,920,432
1908..	176,895	1,129,847	6.39	4,872	37,053	27,730	129,411	1,372	22,990	219,869	1,319,301
1909..	246,381	1,505,779	6.11	12,346	104,401	30,147	134,978	1,906	50,632	290,780	1,795,790
1910..	257,902	1,593,472	6.18	21,176	181,334	27,890	113,352	1,496	26,205	308,464	1,914,363
1911..	255,107	1,461,068	5.73	17,193	124,278	26,086	100,540	1,032	10,436	299,418	1,696,322
1912..	278,276	1,629,105	5.85	23,112	184,018	32,473	127,004	794	12,109	334,655	1,952,236
1913..	268,666	1,623,993	6.04	24,986	204,911	42,582	155,693	1,889	22,178	338,123	2,006,775
1914..	328,038	1,927,425	5.88	16,761	122,325	50,069	195,956	3,232	41,712	398,100	2,287,418
1915..	209,132	1,152,778	5.51	8,864	62,569	23,718	90,367	1,343	12,433	243,057	1,318,147
1916..	253,707	1,326,684	5.22	2,501	12,134	42,478	163,421	180	1,994	298,866	1,504,233
1917..	241,029	1,315,769	5.46	88	709	26,581	123,439	338	2,142	268,036	1,442,059
1918..	168,100	1,153,240	6.86	114	983	26,984	163,484	137	1,087	195,335	1,318,794
1919..	180,592	1,965,393	10.88	4	133	23,759	187,550	498	4,262	204,853	2,157,338
1920..	361,800	3,568,677	9.86	6,837	157,201	34,252	272,524	691	10,267	403,580	4,008,669

This table shows that the chief foreign clay used in this country is English kaolin or china clay, which in 1920 represented nearly 90 per cent of the quantity and value of all the clay imported.

Until 1917 the strong movement of foreign clays to the United States continued, but with the entry of this country into the war the possibility increased that the importation of clay might be shut off, or at least reduced, owing to scarcity of ships, and so a real anxiety arose in the clay-using industries lest there should be a deficiency of clay for making those kinds of ware whose production had depended on a supply of foreign raw material. Not all the industries that used imported clays relied on them exclusively, but some did, and others relied on them to a large degree. Indeed, some manufacturers claimed that it was impossible to get along without a supply of imported raw material.

The following estimate, compiled by the United States Shipping Board, shows the quantity of English china clay required by the United States in 1918.

English china clay required by the clay-working industry of the United States in 1918.

	Long tons.
Porcelain and electrical	20,000
Paper filler	112,000
Paper coating	30,000
China	50,000
Oilcloth, cotton filler, and bleaching	12,000
Sanitary ware and tile	25,000
Ultramarine and paint	2,000

crossed, but in the walls beyond there appeared to be wide, clean exposures of clay.

The best samples taken from the best pockets differ from samples of the average material of the walls, exclusive of the pegmatite veins, only in being almost free from mica and coarse grains of quartz. The average sample is lumpy, but the selected samples are nearly uniform in structure. Both are gritty, but the grit in the better sample is so fine as to be scarcely visible, whereas that in the average sample consists of quartz grains one-eighth to one-quarter inch in diameter. Moreover, little groups of these grains together with mica flakes are aggregated into lumps. The cracks between the grains are badly stained by iron compounds that have infiltrated and oxidized, and therefore the crushing of the lumps seriously discolors the clay. The better samples are pure white when first taken, but upon standing in a dry atmosphere they turn pinkish or pinkish yellow, possibly through the oxidation of iron salts. These samples contain no visible impurities except tiny grains of sand.

Unquestionably deposits exposed by the pits and tunnels on this hill contain a great deal of kaolin, but it is very doubtful if any of the deposits are large enough to be worked economically. Besides the deposits described above a dozen others in the vicinity of Dillsboro and Webster have been mentioned in the different reports on the clays of the State but none of them are valuable at the present time. A few have been worked and abandoned after a year or two. Others have been prospected but not worked, and still others have merely been sampled. The locations of all those in which kaolin is known to occur are shown on the sketch map (fig. 8).

ETOWAH, HENDERSON COUNTY.

Valentine property.—Mr. G. H. Valentine, of Hendersonville, reports a deposit of kaolin in Henderson County close to the west bank of French Broad River, 1¼ miles north of Etowah. The deposit is known to be from 50 to 75 feet wide and more than 10 feet deep, but its length has not been determined. Several small excavations have been made in it, and the grade for the public highway cuts it. Most of the clay is white, but in some places it is pink or salmon colored. The deposit is a few hundred yards from the river and about 50 feet above it, and a mountain brook near by might furnish all the water needed in mining. A road 2 miles long, which is used for heavy hauling by trucks to a point less than one-fourth of a mile from the deposit, leads to Etowah, on the Toxaway branch of the Southern Railway.

The sample furnished by Mr. Valentine is a white gritty powder that becomes only slightly sticky when moistened with a little water. When shaken with water the mass rapidly separates into a sediment

and a thin fluid of a very pale gray, almost white color. The sediment consists of small sharp-edged transparent quartz grains and larger masses of grains that are cemented by kaolinite, particles of material stained by limonite, and a few fragments of other substances, some of which are organic. The unwashed powder is composed of comparatively few small flakes of kaolinite, fragments of rosettes and wormlike aggregates of the same mineral, many fragments of clear, colorless quartz, and flakes and groups of grains and a few other particles that may be partly kaolinized feldspar. A few of the quartz grains are large, measuring about 0.3 millimeter in their longest dimensions, but most of them are between 0.05 and 0.07 millimeter.

The sample is composed mainly of a fine quartz sand together with a comparatively small proportion of kaolinite. Whether the material is residual or sedimentary in origin can not be determined from its appearance. If it is sedimentary, its components have not been carried far, for the quartz grains show little or no evidence of rounding. The area that contains the deposit is underlain by Henderson granite, which, according to Keith,[26] "upon complete decay * * * produces a yellowish or reddish clay, which is frequently leached out nearly white. This is mixed with sand and fragments of rock on the mountain sides and is of no great depth."

Material of this kind partly assorted by water might yield a product resembling the sample, which is very much like the samples from Richmond and Montgomery counties in North Carolina and from the vicinity of Abbeville in South Carolina.

HAZELWOOD, HAYWOOD COUNTY.

Herren property.—A deposit in Haywood County that has not hitherto been described is well up toward the top of a spur at the southwest end of Lickstone Mountain, on the property of J. P. Herren, of Waynesville, about 4½ miles south of Waynesville and 3½ miles southeast of Hazelwood. There are several openings on the property, but they are now filled with débris and difficult to study. The largest opening furnishes a vertical section 12 feet long and originally exposed a surface 12 feet high, including 7 feet of kaolin. The lower portion of the section is now covered by fallen material. The part now visible shows an almost horizontal contact between mica schist and a very quartzose stained kaolin that exhibits the structure of a pegmatite. It is cut by little quartz stringers and contains masses of decomposed black mica, flakes of decomposed white mica, and sharp-edged fragments of quartz. (See fig. 9.) Other

[26] Keith, Arthur, U. S. Geol. Survey Geol. Atlas, Pisgah folio (No. 147), p. 4, 1907.