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CANADA

DEPARTMENT OF MINES AND TECHNICAL SURVEYS

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MINES BRANCH INVESTIGATION REPORT IR 59-44

BUFF-FIRING CLAYS FROM THE SHUBENACADIE AREA OF NOVA SCOTIA

by

J. G. BRADY

INDUSTRIAL MINERALS DIVISION

409

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BUFF-FIRING CLAYS FROM THE SHUBENACADIE AREA OF NOVA SCOTIA

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SUMMARY OF RESULTS

One hundred and fifty four bore hole samples from four localities in the Shubenacadie area of Nova Scotia were investigated for the L. E. Shaw Company Limited, Halifax. The work was carried out for the company as an aid in their refractories and buff-firing clay products development program.

Samples from the McDonald farm were principally common red-firing clays. Consequently, they would not be suitable for buff-firing ceramic products. The characteristics of the samples from the Steel Company property, the Densmore property, and the Lawlor pit were in general the same. The majority of the samples were buff-firing fire clays whose P.C.E.'s varied from cone 20 to cone 32. Mineralogically, they were made up principally of the clay mineral kaolinite and various smaller proportions of quartz, carbonaceous material (lignite) and pyrite. The plasticity and workability were generally good, to very good, although some samples had only fair plasticity because of a high quartz content. The very plastic samples had high drying shrinkages and consequently some care should be exercised in drying.

The majority of the buff-firing samples were suitable for buff face brick, tile, stoneware products, sewer pipe and flue liners. The very refractory ones were also suitable for intermediate duty refractories and ladle brick, while others having P. C. E.'s less than cone 29 were suitable for low duty refractories and probably ladle brick. Some samples contained excessive lignite and pyrite and were unsuitable for clay products. Others contained smaller quantities to these materials and some care must be exercised in the oxidation period during firing.

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INTRODUCTION

During the summer and autumn of 1958 the L. E. Shaw Company Limited, Halifax, Nova Scotia, carried out an extensive buff-firing clay exploration campaign in the Shubenacadie, Nova Scotia, region. They were principally interested in establishing the extent and properties of the clay immediately adjacent to their present pit at Shubenacadie and in locating additional high grade buff-firing clay deposits in this area. Auger drill samples at various depths were obtained from the following locations:

1. McDonald Farm; - 13 samples
2. Dominion Steel and Coal Corporation Property; - 117 samples
3. Lawlor Pit; - 8 samples
4. Densmore Property; - 16 samples

The Company forwarded 5 to 10 lb of each sample to the Mines Branch for evaluation. The physical properties of the samples in the raw and fired state were obtained and an appraisal made on the samples for their suitability in the production of buff colored clay products and refractories.

PROCEDURE

The samples as received were initially dried at 185°F to remove the bank moisture. The dried clay was then ground and

pulverized to pass a 16 mesh Tyler laboratory screen. The ground material was tempered with water to a stiff-plastic mass. The workability and plasticity were noted and the water of plasticity calculated. Trial briquettes, 4 1/2 x 1 1/2 x 1 1/4 in., were hand molded in steel molds. The drying behaviour of one of the briquettes from each sample was obtained with rapid drying at 185°F. The balance of the briquettes were dried slowly in the air overnight and finally at 212°F for 24 hr. The samples were then fired at various suitable temperatures in electric laboratory kilns. The fired shrinkage, colour, hardness, and absorption after a 24 hr soak in cold water were determined. The pyrometric cone equivalents (P.C.E.'s) were also obtained.

Differential thermal analysis curves of a few representative samples were obtained in order to obtain a cross-section of the mineralogical compositions. Quartz contents of several samples were obtained by differential thermal analysis.

RESULTS

The unfired and fired properties of the samples are shown in Table 1. The temperature equivalents of the various cones mentioned in the investigation are shown in Table 2. Differential thermal analysis curves of some of the typical samples are reproduced in Figure 1. The quartz contents of several typical samples are listed in Table 3.

TABLE I

Physical Properties of L. E. Shaw Limited Samples

Clay No.	UNFIRED CHARACTERISTICS	P.C.E.	FIRED CHARACTERISTICS					REMARKS
			Cone No.	Fired Shrinkage %	Absorption %	Colour	Hardness	
252 McDonald Hole 1 15 ft	Light grey sandy clay, fair plasticity, works well, water of plasticity 16.1%, safe drying, drying shrinkage 4.0%.	26	1	0	10.8	white	fairly soft	F This material is very sandy and must be mixed with a plastic clay to reduce the quartz content.
			5	0.3	9.9	white	fairly soft	
			10	0.8	8.4	white; specks	fairly soft	
253 McDonald Hole 1 24 ft	Brown sandy clay, fairly good plasticity, water of plasticity 16.1%, safe drying, drying shrinkage 5.0%, fairly good plasticity but inclined to be sandy.	23-26	1	0.4	11.6	near white	fairly soft	F Same comments as 252.
			5	0.6	10.6	light cream	fairly soft	
			10	1.5	8.6	light cream; specks	fairly hard	
254 McDonald Hole 1 36 ft	Slightly calcareous, brown, sandy clay, water of plasticity 19.2%, slight tendency to crack with rapid drying, drying shrinkage 5.1%.	16	03	1.8	6.7	dark red	hard	H Very sandy red burning clay must be mixed with a plastic clay.
			1	2.1	5.4	dark red	very hard	
255 McDonald Hole 1 42 ft	Brown clay, good plasticity, water of plasticity 20.5%, slight tendency to crack with rapid drying, drying shrinkage 4.7%.	10	03	5.3	1.1	dark red	very hard	H Care required in drying. May be suitable for red clay products.
			1	overfired		dark red	steel hard	
256 McDonald Hole 3 18 ft	White clay, good plasticity, safe drying, drying shrinkage 4.8%, water of plasticity 19.5%.	20-23	1	2.5	9.9	almost white	fairly hard	C This material appears to be fairly sandy although it may be suitable for buff clay products.
			5	3.7	7.2	light cream	hard	
			10	4.7	5.3	cream ; specks	very hard	
257 McDonald Hole 3 24 ft	Light pink clay, good plasticity, water of plasticity 19.5%, safe drying, drying shrinkage 4.8%.	16-18	03	2.0	9.5	light salmon	fairly hard	H Somewhat similar to 256 except for the fired color.
			1	3.1	7.9	salmon buff	hard	
			5	4.5	4.9	salmon buff	very hard	

TABLE 1 (Continued)

Physical Properties of L. E. Shaw Limited Samples

Clay No.	UNFIRED CHARACTERISTICS	P.C.E.	FIRED CHARACTERISTICS					REMARKS
			Cone No.	Fired Shrinkage %	Absorption %	Colour	Hardness	
258 McDonald Hole 3 30 ft	Red non calcareous clay, good plasticity, water of plasticity 18.3%, safe drying, drying shrinkage 4.3%.	15-16	03	1.7	10.0	medium red	fairly hard	H Inclined to be sandy. Indications are it should be suitable for red colored clay products such as brick and tile.
			1	2.7	8.2	red	hard	
			5	3.5	6.0	red	very hard	
259 McDonald Hole 3 36 ft	Red calcareous clay, good plasticity water of plasticity 19.4%, safe drying, drying shrinkage 4.6%.	15-16	03	1.3	10.5	medium red	fairly hard	H Same comments as 258.
			1	2.7	8.1	red	hard	
			5	4.0	5.4	red	very hard	
260 McDonald Hole 3 42 ft	Red clay, good plasticity, water of plasticity 18.1%, safe drying, drying shrinkage 4.3%.	15-16	03	1.8	8.9	light red	hard	H Same comments as 258.
			1	2.7	7.1	medium red	very hard	
			5	3.8	5.5	medium red	very hard	
261 McDonald Hole 3 48 ft	Light red to brown clay, good plasticity, water of plasticity 20.8%, safe drying, drying shrinkage 4.7%.	15-16	03	2.7	9.4	dark salmon	fairly hard	H Same comments as 258 except for fired color.
			1	3.7	6.4	dark salmon	very hard	
			5	4.5	4.5	dark salmon	very hard	
262 McDonald Hole 3 54 ft	Light red clay, good plasticity, water of plasticity 19.4%, safe drying, drying shrinkage 4.2%.	16-18	03	2.5	7.6	dark salmon	hard	H Same comments as 258.
			1	4.0	5.5	light red	very hard	
263 McDonald Hole 3 60 ft	Red to brown clay, good plasticity, water of plasticity 18.1%, safe drying, drying shrinkage 4.3%.	16-18	03	1.7	9.1	dark salmon	fairly hard	H Same comments as 258.
			1	2.6	7.9	dark salmon	hard	
			5	3.5	7.3	dark salmon	hard	

TABLE 1 (Continued)

Physical Properties of L. E. Shaw Limited Samples

Clay No.	UNFIRED CHARACTERISTICS	P.C.E.	FIRED CHARACTERISTICS					REMARKS
			Cone No.	Fired Shrinkage %	Absorption %	Colour	Hardness	
264 McDonald Hole 3 66 ft	Red clay, good plasticity, water of plasticity 18.1%, safe drying, drying shrinkage 4.3%.	15-16	03	2.3	8.4	red	hard	H Same comments as 258.
			1	4.1	5.7	red	very hard	
265 Steel Co. Hole 8 12 ft	Dark grey clay, good plasticity, water of plasticity 33.9%, safe drying, drying shrinkage 6.3%.	30	03	4.7	17.3	light cream	fairly hard	D Contains excessive carbon and some pyrite. Not suitable for use by itself.
			1	6.0	14.2	cream-specks	fairly soft	
			5	7.3	12.1	cream-specks	hard	
266 Steel Co. Hole 8 18 ft	Black clay, good plasticity, water of plasticity 33%, safe drying, drying shrinkage 6.2%.	29 1/2	1	5.0	17.0	cream; specks	fairly soft	D High in carbon and pyrite, fires to a light weight. Not suitable for clay products.
			5	7.3	13.0	cream-buff badly speckled	fairly hard	
267 Steel Co. Hole 8 24 ft	Black clay, good plasticity, water of plasticity 36.4%, safe drying, drying shrinkage 4.0%.	27	1	5.8	46.8	cream-buff; specks	very soft	E Very high in carbon and pyrite. Same comments as 265.
			5	8.1	40.0	dark salmon; specks	very soft	
268 Steel Co. Hole 8 30 ft	Dark grey plastic clay, good plasticity water or plasticity 30.8%, safe drying drying shrinkage 5.7%, contains 16% quartz.	29	1	4.0	10.5	cream	fairly hard	A or D 16% quartz, shrinkages are inclined to be high, contains excessive carbon and some pyrite. This material is suitable for buff face brick and tile, stoneware products, sewer pipe, flue liners and intermediate duty refractories provided proper oxidation conditions are maintained.
			5	5.7	9.5	cream	hard	
			10	6.5	9.2	few specks; dark cream	very hard	
269 Steel Co. Hole 8 36 ft	Dark grey clay, good plasticity, water of plasticity 30.6%, safe drying, drying shrinkage 6.3%, contains 15% quartz.	30 1/2	03	4.8	14.0	near white	fairly hard	A Same comments as 268; less pyrite, and appears to have slightly less carbon; 15% quartz.
			1	4.9	13.0	near white	fairly hard	
			5	6.8	9.4	near white	very hard	
			10	6.9	6.7	cream	very hard	

TABLE 1 (Continued)

Physical Properties of L. E. Shaw Limited Samples

Clay No.	UNFIRED CHARACTERISTICS	P.C.E.	FIRED CHARACTERISTICS					REMARKS
			Cone No.	Fired Shrinkage %	Absorption %	Colour	Hardness	
270 Steel Co. Hole 8 42 ft	Dark grey clay, good plasticity water of plasticity 19.0%, safe drying, drying shrinkage 6.0%, slightly calcareous, 45% free quartz, contains pyrite.	20	03	1.3	10.7	light salmon; speckled	fairly hard	H Contains 45% quartz, this sample is sandier than the materials above and below it. It should be suitable for mixing with the less sandy material.
			1	1.5	9.7	salmon speckled	fairly hard	
			5	2.8	6.5	light brown speckled	hard	
271 Steel Co. Hole 8 48 ft	Dark grey clay, good plasticity, water of plasticity 27.8%, safe drying, drying shrinkage 6.8%, 17% free quartz.	30 1/2	03	4.4	11.2	near white	hard	A Same comments as 268; contains less carbon; contains 17% quartz.
			1	4.5	10.5	near white	hard	
			5	5.7	7.5	light cream	very hard	
			10	6.5	4.1	dark cream	steel hard	
272 Steel Co. Hole 8 54 ft	Black clay, good plasticity, water of plasticity 27.8%, safe drying drying shrinkage 6.8%.	29-30	03	4.7	10.6	near white	hard	A Same comments as 268; contains less carbon and pyrite.
			1	5.3	9.6	near white	very hard	
			5	5.7	6.9	near white	very hard	
273 Steel Co. Hole 8 60 ft	Dark grey clay, good plasticity, water of plasticity 29.2%, safe drying, drying shrinkage 7.2%,	30-31	03	5.1	10.3	light cream; specks	hard	A Same comments as 268; contains less carbon; contains 15% quartz.
			1	5.5	8.9	light cream; specks	very hard	
			5	6.3	7.2	light cream; specks	very hard	
274 Steel Co. Hole 9 42 ft	Dark grey clay, good plasticity, water of plasticity 28.9%, safe drying, drying shrinkage 6.5%, 17% free quartz.	20	03	4.0	13.1	many specks; cream	fairly hard	B This sample is contaminated with pyrite. Care will be required in grinding.
			1	5.1	9.3	many specks; cream	hard	
			5	6.0	9.4	many specks; cream	very hard	
275 Steel Co. Hole 9 48 ft	Black clay, good plasticity, water of plasticity 27.7%, safe drying, drying shrinkage 6.6%.	20-23	03	3.7	12.3	specks - buff	hard	E This sample contains pyrite and carbon and so some difficulty in firing may be expected from this material.
			1	4.6	9.8	specks - buff	hard	
			5	5.8	6.1	specks - buff	very hard	

TABLE 1 (Continued)

Physical Properties of L. E. Shaw Limited Samples

Clay No.	UNFIRED CHARACTERISTICS	P.C.E.	FIRED CHARACTERISTICS					REMARKS
			Cone No.	Fired Shrinkage %	Absorption %	Colour	Hardness	
276 Steel Co. Hole 9 54 ft	Black clay, good plasticity (greasy), water of plasticity 32.2%, safe drying, drying shrinkage 6.2%.	31-32	03	4.7	11.9	near white	hard	A Same comments as 269.
			1	5.3	10.4	near white	hard	
			5	6.1	8.4	near white	very hard	
277 Steel Co. Hole 9 60 ft	Dark grey clay, good plasticity (greasy), water of plasticity 31.9%, safe drying, drying shrinkage 6.2%.	30 1/2	03	4.7	12.8	cream; slight specks	hard	A Same comments as 268.
			1	5.3	10.9	cream; slight specks	hard	
			5	5.7	7.6	cream; slight specks	very hard	
278 Steel Co. Hole 10 42 ft	Brown to black clay, brown part calcareous, good plasticity (slightly greasy), safe drying, drying shrinkage 7.1%, water of plasticity 32.5%.	29 1/2	03	4.3	11.1	cream; slight specks	hard	A Same comments as 268.
			1	5.3	9.7	cream; slight specks	hard	
			5	5.8	6.7	cream; slight specks	very hard	
279 Steel Co. Hole 10 48 ft	Dark grey clay, good plasticity (greasy), water of plasticity 31.9%, safe drying, drying shrinkage 6.0%.	29-30	03	4.3	11.8	cream; slight specks	hard	A Same comments as 268.
			1	4.8	10.0	cream; slight specks	hard	
			5	5.5	7.6	cream; slight specks	very hard	
280 Steel Co. Hole 10 54 ft	Dark brown clay, good plasticity (greasy), water of plasticity 31.9%, safe drying, drying shrinkage 6.8%.	27	03	4.3	12.5	dark cream	fairly hard	B Shrinkages are slightly high. Indications are that this material is suitable for buff clay products, low heat refractories, sewer pipe and flue liners.
			1	4.8	8.9	buff	hard	
			5	5.8	6.3	buff	very hard	
281 Steel Co. Hole 10 60 ft	Brown to grey clay, good plasticity, water of plasticity 25.9%, safe drying, drying shrinkage 7.1%.	14-15	03	3.3	7.8	brownish buff	very hard	H Indications are that this material is suitable for face brick, building tile and drain tile. There are some specks.
			1	4.0	5.1	brownish buff	very hard	
			5	4.7	3.1	light brown	steel hard	

TABLE 1 (Continued)

Physical Properties of L. E. Shaw Limited Samples

Clay No.	UNFIRED CHARACTERISTICS	P.C.E.	FIRED CHARACTERISTICS					REMARKS
			Cone No	Fired Shrinkage %	Absorption %	Colour	Hardness	
282 Steel Co. Hole 11 48 ft	Dark brownish grey calcareous clay, good plasticity, slightly greasy, slight surface cracks with rapid drying, drying shrinkage 7.5%, water of plasticity 28.1%.	14-15	03	2.5	13.1	light buff; specks	fairly hard	G Same comments as 281.
			1	3.1	8.6	light buff; specks	hard	
			5	4.5	5.9	buff; specks	very hard	
283 Steel Co. Hole 11 60 ft	Dark grey clay, works well, slightly greasy, water of plasticity 29.7%, safe drying, drying shrinkage 6.2%.	29	03	4.1	9.9	cream	hard	A Same comments as 269.
			1	4.3	8.6	cream	hard	
			5	5.3	4.7	cream	very hard	
284 Steel Co. Hole 13 36 ft	Grey clay with some red calcareous clay, works well, slightly gritty, water of plasticity 22.1%, safe drying, drying shrinkage 5.8%.	23	03	2.0	10.4	cream; buff	hard	C Contains some pyrite and sand (See 288).
			1	2.3	9.9	cream; buff	hard	
			5	3.5	6.4	buff; black specks.	very hard	
285 Steel Co. Hole 14 36 ft	Black clay with some red calcareous lumps, works well, slightly greasy, water of plasticity 37.5%, safe drying, drying shrinkage 6.6%.	30 1/2	1	6.0	19.4	white; specks	fairly soft	D Contains carbon and pyrite. Should not be used by itself.
			5	6.0	16.3	cream; specks	fairly hard	
			10	7.3	11.7	cream; specks	hard	
286 Steel Co. Hole 14 42 ft	Dark grey clay, works well, contains micaceous material, water of plasticity 22.2%, safe drying, drying shrinkage 5.7%.	23	1	1.0	16.0	white	fairly soft	C Contains a moderate amount of mica and free quartz. (See 288).
			5	2.5	11.7	cream	fairly hard	
			10	4.1	7.5	cream; few specks	very hard	
287 Steel Co. Hole 14 42 ft	Grey plastic clay, good plasticity, water of plasticity 25.8%, safe drying, drying shrinkage 6.7%, contains 30% quartz.	28	1	3.5	12.4	white	fairly hard	B Same comments as 269 except sample is not refractory enough for intermediate firebrick.
			5	4.4	10.5	white	hard	
			10	5.5	6.7	cream; few specks	very hard	

TABLE 1 (Continued)

Physical Properties of L. E. Shaw Limited Samples

Clay No.	UNFIRED CHARACTERISTICS	P.C.E.	FIRED CHARACTERISTICS					REMARKS
			Cone No.	Fired Shrinkage %	Absorption %	Colour	Hardness	
288 Steel Co. Hole 14 48 ft	Grey clay, fair plasticity, water of plasticity 19.2%, safe drying, drying shrinkage 6.2%, contains 41% quartz.	26	1	1.0	11.1	near white	fairly hard	C Inclined to be sandy; should be suitable for buff face brick, buff clay products, sewer pipe, flue liner and low duty firebrick.
			5	1.7	8.9	near white	fairly hard	
			10	2.1	7.0	creamy grey; specks	hard	
289 Steel Co. Hole 15 36 ft	Grey clay with red calcareous pieces, good workability, water of plasticity 23.3%, safe drying, drying shrinkage 6.4%.	26	03	3.7	9.0	light buff	hard	B Same comments as 287; not so plastic.
			1	3.5	9.0	light buff	hard	
			5	4.3	4.8	buff; specks	very hard	
290 Steel Co. Hole 15 42 ft	Grey clay with red calcareous pieces, good workability, safe drying, drying shrinkage 6.8%, water of plasticity 24.4%.	26	03	3.1	9.0	light buff	hard	B Same comments as 287; not so plastic.
			1	3.3	9.0	light buff	hard	
			5	4.7	5.6	light buff; specks	very hard	
291 Steel Co. Hole 15 48 ft	Grey clay with some red calcareous clay, good plasticity, works well, water of plasticity 19.7%, safe drying, drying shrinkage 6.1%.	26	03	1.8	10.0	light buff	hard	C Same comments as 288.
			1	2.0	10.0	light buff	hard	
			5	3.0	7.3	light buff	very hard	
292 Steel Co. Hole 15 54 ft	Grey plastic with a few red calcareous lumps, good plasticity, water of plasticity 20.5%, safe drying, drying shrinkage 6.4%.	28	03	2.3	10.0	light buff	hard	C Same comments as 288.
			1	2.3	9.6	light buff	hard	
			5	3.0	8.4	light buff	very hard	
293 Steel Co. Hole 16 18 ft	Grey clay, good workability, water of plasticity 27.8%, safe drying, drying shrinkage 6.4%.	32	03	4.7	9.6	white	very hard	A Same comments as 269 except the carbon and pyrity content is very low.
			1	5.1	9.0	cream	very hard	
			5	5.2	7.2	cream	very hard	

TABLE 1 (Continued)

Physical Properties of L. E. Shaw Limited Samples

Clay No.	UNFIRED CHARACTERISTICS	P.C.E.	FIRED CHARACTERISTICS					REMARKS
			Cone No.	Fired Shrinkage %	Absorption %	Colour	Hardness	
294 Steel Co. Hole 16 24 ft	Black clay, good workability, water of plasticity 30.8%, safe drying, drying shrinkage 6.3%.	31	03	5.0	12.7	white	hard	A Same comments as 268.
			1	5.5	11.3	cream; specks	hard	
			5	5.4	9.9	cream; specks	hard	
295 Steel Co. Hole 16 30 ft	Black clay, works well, greasy, water of plasticity 32.8%, safe drying, drying shrinkage 5.0%, contains 12% quartz.	30 1/2	1	5.5	19.6	cream; many specks	fairly soft	D Contains excess carbon and some pyrite.
			5	6.7	14.9	cream; many specks	fairly hard	
			10	6.8	8.7	buff; many specks	hard	
296 Steel Co. Hole 16 42 ft	Black clay, works well, slightly greasy, water of plasticity 30.6%, safe drying, drying shrinkage 6.2%	31 1/2	1	5.3	18.4	cream	fairly soft	A Contains some excess carbon and a little pyrite; similar to 268.
			5	6.8	14.5	cream	fairly hard	
			10	7.3	12.0	cream	very hard	
297 Steel Co. Hole 16 48 ft	Black clay, works well, slightly greasy, water of plasticity 32.8%, safe drying, drying shrinkage 5.4%.	29 1/2	1	5.3	21.5	cream; many specks	fairly soft	D Same comments as 295.
			5	5.6	17.8	cream; many specks	fairly hard	
			10	7.8	9.1	pink to cream specks	hard	
298 Steel Co. Hole 16 54 ft	Black clay, works well, slightly greasy, water of plasticity 33.4%, safe drying, drying shrinkage 6.0%.	29 1/2	1	5.0	17.6	cream; specks	fairly soft	D Same comments as 295.
			5	5.7	13.4	cream; specks	fairly hard	
			10	6.7	9.0	cream; specks	very hard	
299 Steel Co. Hole 17 42 ft	Black clay, works well, slightly gritty, water of plasticity 28.1%, safe drying, drying shrinkage 5.3%, contains carbon and pyrite.	20-23	1	2.1	26.2	salmon cream	very soft	E Not suitable for clay products by itself - should be well diluted by good clays.
			5	3.0	21.8	salmon cream	very soft	

TABLE 1 (Continued)

Physical Properties of L. E. Shaw Limited Samples

Clay No.	UNFIRED CHARACTERISTICS	P.C.E.	FIRED CHARACTERISTICS					REMARKS
			Cone No.	Fired Shrinkage %	Absorption %	Colour	Hardness	
300 Steel Co. Hole 17 48 ft	Black clay, works well, gritty, water of plasticity 28.1%, safe drying, drying shrinkage 6.0%.	18-20	1	3.7	23.0	cream - specks	soft	E Contains a great deal of carbon and pyrite. Not suitable for clay products.
			5	4.6	16.7	cream - specks	soft	
301 Steel Co. Hole 17 54 ft	Grey black clay, works well, gritty, water of plasticity 28.4%, safe drying, drying shrinkage 5.7%.	28 1/2	1	3.7	15.3	light cream	fairly hard	B Same comments as 287 contains carbon.
			5	4.7	12.6	light cream	hard	
			10	5.1	6.0	light cream - specks	very hard	
302 Steel Co. Hole 19 24 ft	Grey - black clay, good plasticity, water of plasticity 27.7%, cracks with rapid drying, drying shrinkage 7.2%.	29	03	4.5	10.7	cream; specks	hard	A Same comments as 269, and care required in drying.
			1	4.7	8.6	cream; specks	hard	
			5	5.1	8.6	cream; specks	hard	
303 Steel Co. Hole 19 30 ft	Grey clay, good workability, water of plasticity 23.6%, safe drying, drying shrinkage 5.4%, contains 27% free quartz.	28	03	2.5	10.7	cream; buff	hard	B Same comments as 287.
			1	3.3	10.5	cream; buff	hard	
			5	3.8	8.6	cream; buff	hard	
			10	5.1	4.2	grey; specks	very hard	
304 Steel Co. Hole 19 36 ft	Grey clay, good workability, water of plasticity 24.2%, safe drying, drying shrinkage 6.3%.	27	03	2.8	10.7	white	hard	B Same comments as 287.
			1	2.9	10.4	white	hard	
			5	3.3	9.3	white	hard	
			10	3.7	5.2	cream	very hard	
305 Steel Co. Hole 19 42 ft	Light grey clay, good plasticity, water of plasticity 24.5%, safe drying, drying shrinkage 7.0%, 27% free quartz.	29 1/2	03	3.1	9.6	white	hard	A Same comments as 293; fired shrinkage not excessive.
			1	3.5	9.2	white	hard	
			5	4.1	8.1	white	very hard	

TABLE 1 (Continued)

Physical Properties of L. E. Shaw Limited Samples

Clay No.	UNFIRED CHARACTERISTICS	P.C.E.	FIRED CHARACTERISTICS					REMARKS
			Cone No.	Fired Shrinkage %	Absorption %	Colour	Hardness	
306 Steel Co. Hole 19 48 ft	Light grey clay, fairly good plasticity water of plasticity 17.0%, slightly sandy, safe drying, drying shrinkage 5.6%.	23-26	1	0.5	10.6	white	fairly hard	F Sandy material - should be mixed with a plastic clay.
			5	0	10.6	white	fairly hard	
			10	1.5	7.6	cream; specks	hard	
307 Steel Co. Hole 19 54 ft	Grey clay, good plasticity, water of plasticity 24.7%, safe drying, drying shrinkage 7.0%.	31+	03	4.7	8.9	white	very hard	A Very refractory clay; same comments as 293.
			1	5.0	7.5	white	very hard	
			5	5.3	6.6	white	very hard	
308 Steel Co. Hole 20 18 ft	Grey clay, good plasticity, water of plasticity 22.5%, safe drying, drying shrinkage 6.4%.	28+	03	2.5	11.6	white	fairly hard	C Same comments as 288.
			1	2.7	10.5	white	hard	
			5	2.7	9.9	white	hard	
309 Steel Co. Hole 20 24 ft	Grey clay, good workability, water of plasticity 26.7%, safe drying, drying shrinkage 5.7%, contains stones.	23	03	2.0	16.2	cream; some red	fairly hard	B Contains a few pyrite stones; same comments as 287.
			1	2.7	12.0	cream	fairly hard	
			5	4.0	11.1	cream	hard	
			10	5.5	6.6	light grey	very hard	
310 Steel Co. Hole 20 30 ft	Black clay, good workability, water of plasticity 33.6%, contains stones, safe drying, drying shrinkage 6.8%, contains 14% quartz.	29 1/2	03	4.0	15.8	cream; specks	fairly hard	A Contains a few pyrite stones and, excess carbon; same comments as 268.
			1	5.8	12.5	cream; specks	hard	
			5	4.7	12.5	cream; specks	hard	
			10	6.1	7.3	dark cream; specks	very hard	
311 Steel Co. Hole 20 36 ft	Black clay, good plasticity, water of plasticity 33.3%, safe drying, drying shrinkage 7.6%.	30	03	5.6	14.8	cream; specks	fairly hard	A Same comments as 268.
			1	6.5	11.9	cream; specks	hard	
			5	7.0	10.7	cream; specks	hard	
			10	8.7	5.0	dark cream - specks	very hard	

TABLE 1 (Continued)

Physical Properties of L. E. Shaw Limited Samples

Clay No.	UNFIRED CHARACTERISTICS	P.C.E.	FIRED CHARACTERISTICS					REMARKS
			Cone No.	Fired Shrinkage %*	Absorption %	Colour	Hardness	
312 Steel Co. Hole 20 42 ft	Grey black clay, good plasticity, water of plasticity 30.0%, safe drying, drying shrinkage 7.3%.	29 1/2	03	3.6	16.6	light cream	fairly hard	A Same comments as 269.
			1	4.1	12.6	light cream	hard	
			5	5.0	11.5	light cream	hard	
			10	6.5	6.1	buff; specks	very hard	
313 Steel Co. Hole 21 48 ft	Black clay, fair workability, gritty, safe drying, drying shrinkage 3.7%, water of plasticity 20.3%.	26-27	1	0.1	21.2	cream	very soft	F Very sandy; must be mixed with a plastic clay.
			5	0.5	20.6	cream	very soft	
			10	+0.3	18.4	cream; large specks	very soft	
314 Steel Co. Hole 21 54 ft	Black clay, fair workability, gritty, water of plasticity 21.7%, safe drying, drying shrinkage 2.3%.	27-28	1	0.8	18.5	cream	soft	F Sandy; same comments as 313.
			5	1.1	17.5	cream	soft	
			10	2.5	14.7	buff; large specks	fairly soft	

*a plus sign indicates expansion.

TABLE 1 (Continued)

Physical Properties of L. E. Shaw Limited Samples

Clay No.	UNFIRED CHARACTERISTICS	P.C.E.	FIRED CHARACTERISTICS					REMARKS
			Cone No.	Fired Shrinkage %	Absorption %	Colour	Hardness	
351(sent in by itself) No location stated	Buff clay, good plasticity, water of plasticity 38.7%, slight cracking with rapid drying, drying shrinkage 8.0%.	16"	04	2.8	16.1	salmon	fairly hard	H This is a common red - firing material which is difficult to dry and has high shrinkages.
			02	8.8	7.1	red	very hard	
			1	8.5	4.4	red	very hard	
370 Lawlor Pit No. 1 24 ft	Black clay, good plasticity, water of plasticity 24.7%, safe drying, drying shrinkage 5.4%.	26	02	2.0	16.4	cream	fairly soft	E Contains carbon and pyrite. not desirable for clay products by itself.
			5	2.3	15.6	cream; large specks	fairly soft	
			10	4.3	10.6	cream; large specks	hard	
371 Lawlor Pit No. 1 30 ft	Black lignitic clay, good workability, water of plasticity 22.5%, safe drying, drying shrinkage 5.0%.	26"	02	1.3	13.8	cream	fairly soft	E Same comments as 370.
			5	1.5	15.1	cream; large specks	fairly soft	
			10	3.3	9.1	cream; large specks	hard	
372 Lawlor Pit No. 2 6 ft	Grey clay, good plasticity, water of plasticity 24.7%, cracks slightly with rapid drying, drying shrinkage 6.4%.	30	02	2.8	12.3	white; specks	hard	A Contains some pyrite and sand. Same comments as 293; care required in drying.
			5	3.8	10.8	white; specks	hard	
			10	5.0	7.0	cream; specks	very hard	
373 Lawlor Pit No.2 12 ft	Black clay, good plasticity, water of plasticity 27.8%, safe drying, drying shrinkage 7.1%.	28	02	2.3	12.7	cream; specks	fairly hard	B Same comments as 287, contains carbon.
			5	3.0	12.2	cream; specks	hard	
			10	4.3	6.7	cream; specks	very hard	
374 Lawlor Pit No. 2 12 ft sandy	Grey sandy clay, fair workability, water of plasticity 20.8%, safe drying, drying shrinkage 6.0%.	28	02	0.5	10.8	white	fairly soft	C Same comments as 288.
			5	1.0	10.2	white	fairly hard	
			10	2.1	8.1	white; small specks	hard	

TABLE 1 (Continued)

Physical Properties of L. E. Shaw Limited Samples

Clay No.	UNFIRED CHARACTERISTICS	P.C.E.	FIRED CHARACTERISTICS					REMARKS
			Cone No.	Fired Shrinkage %	Absorption %	Colour	Hardness	
375 Lawlor Pit No. 2 18 ft	Black clay, slightly gritty, fairly plastic, water of plasticity 26%, safe drying, drying shrinkage 6.0%.	20	02	0.8	19.0	cream; large specks	soft	G Appears to contain considerable non-plastic material, pyrite, and carbon; not desirable material.
			5	0.7	21.0	cream; large specks	soft	
			10	3.0	14.1	grey; large specks	fairly soft	
376 Lawlor Pit No. 2 18 ft	Grey-black, good plasticity, water of plasticity 26.4%, safe drying, drying shrinkage 6.7%.	28+	02	2.5	12.4	white	fairly hard	B Same comments as 287.
			5	3.3	12.3	cream	hard	
			10	5.2	7.3	cream; specks	very hard	
377 Lawlor Pit No. 2 24 ft	Black-grey clay, good plasticity, water of plasticity 26.4%, safe drying drying shrinkage 6.5%.	20-23	02	1.5	15.2	cream; fine specks	fairly soft	C Tends to fire to a soft condition, sandy, probably needs an addition of a more plastic clay; contains carbon.
			5	1.8	14.9	cream; fine specks	fairly hard	
			10	4.7	8.4	cream; fine specks	hard	
378 Densmore No. 2 36 ft	Black clay, good plasticity, water of plasticity 30.6%, safe drying, drying shrinkage 8.3%, contains 25% quartz.	26-28	02	3.8	12.1	pink; cream	fairly hard	B Contains pyrite and some excess carbon, otherwise similar to 287, has high shrinkage.
			5	5.0	9.5	dark cream	hard	
			10	6.6	4.8	light grey; specks	steel hard	
379 Densmore No. 2 42 ft	Grey-black clay, good plasticity, water of plasticity 30.5%, safe drying drying shrinkage 8.3%.	26-28	06	1.5	18.3	pink; cream	fairly hard	B Same comments as 378.
			02	4.3	10.1	pink; cream	hard	
			5	5.5	9.1	pink; cream	very hard	
			10	7.0	3.5	grey; specks	steel hard	
380 Densmore No. 2 48 ft	Black - grey clay, good plasticity, water of plasticity 30.3%, slight tendenty to crack with rapid drying, drying shrinkage 8.1%.	27-28	06	1.8	22.9	cream; pink	fairly soft	B Care required in drying, high shrinkage, same comments as 378.
			02	4.6	13.0	cream	hard	
			5	5.5	10.4	cream; few specks	hard	
			10	7.1	6.3	cream - grey; specks	very hard	

TABLE 1 (Continued)

Physical Properties of L. E. Shaw Limited Samples

Clay No.	UNFIRED CHARACTERISTICS	P.C.E.	FIRED CHARACTERISTICS					REMARKS
			Cone No.	Fired Shrinkage %	Absorption %	Colour	Hardness	
381 Densmore No. 2 54 ft	Black-grey clay, good plasticity, water of plasticity 32.8%, slight tendency to crack with rapid drying, drying shrinkage 8.0%.	29	06	1.8	21.0	creamy; pink	fairly soft	A Care required in drying, same comments as 268.
			02	4.3	11.9	creamy; pink	hard	
			5	6.8	9.9	buff; specks	very hard	
			10	7.5	5.9	grey; specks	steel hard	
382 Densmore No. 2 60 ft	Black clay, good workability, water of plasticity 28.1%, safe drying, drying shrinkage 5.3%.	20-23	02	2.8	16.2	pink; cream	fairly hard	B Same comments as 378.
			5	3.5	12.8	cream; specks	hard	
			10	4.8	4.8	grey; specks	steel hard	
383 Densmore No. 3 30 ft	Grey clay, greasy, works well, water of plasticity 26.5%, safe drying, drying shrinkage 5.1%.	26-27	06	0.5	17.3	pink; cream	fairly soft	B Same comments as 287.
			02	3.7	11.3	pink; cream	hard	
			5	4.5	7.1	cream; specks	very hard	
384 Densmore No. 3 36 ft	Grey clay, greasy, works well, water of plasticity 26.5%, safe drying, drying shrinkage 5.9%.	28 1/2	02	3.5	11.5	cream	hard	B Same comments as 287.
			5	4.5	8.4	cream	very hard	
			10	5.7	1.9	grey	steel hard	
385 Densmore No. 3 42 ft	Grey-black clay, slightly greasy, good workability, water of plasticity 32.2%, safe drying, drying shrinkage 5.8%.	31 3/4	02	4.0	16.0	white	fairly hard	A Very refractory clay, same comments as 269.
			5	5.3	11.6	white	hard	
			10	6.8	5.1	cream; few specks	very hard	
386 Densmore No. 3 48 ft	Grey plastic clay, good plasticity, water of plasticity 30.0%, safe drying drying shrinkage 6.3%.	30 3/4	02	4.5	12.3	cream	hard	A Same comments as 293.
			5	6.1	8.8	cream	very hard	
			10	9.0	0.7	grey - few specks	steel hard	

TABLE 1 (Continued)

Physical Properties of L. E. Shaw Limited Samples

Clay No.	UNFIRED CHARACTERISTICS	P.C.E.	FIRED CHARACTERISTICS					REMARKS
			Cone No.	Fired Shrinkage %	Absorption %	Colour	Hardness	
387 Densmore No. 3 54 ft	Brown clay and lignite, good plasticity gritty, water of plasticity 25.6%, safe drying, drying shrinkage 6.5%.	13	06	1.0	16.0	salmon - Scummed	fairly hard	H Probably difficult to oxidize because of lignite.
			02	4.1	7.0	salmon - Scummed	very hard	
			5	5.3	2.5	red to brown	steel hard	
388 Densmore No. 3 60 ft	Black clay, greasy and tough, good workability, water of plasticity 21.4%, safe drying, drying shrinkage 5.0%.	31 1/2	02	5.3	23.6	white; specks	fairly soft	D or A Contains excessive carbon for use by itself. Very refractory material. Similar to 268.
			5	6.1	19.9	white; specks	fairly hard	
			10	8.1	11.4	cream; specks	hard	
389 Densmore No. 4 36 ft	Grey plastic clay, slightly greasy, good workability, water of plasticity 27.2%, safe drying, drying shrinkage 6.3%.	26	02	3.7	11.5	pink; cream	hard	B Same comments as 287.
			5	4.3	8.1	cream	very hard	
			10	6.5	1.9	grey; specks	steel hard	
390 Densmore No. 4 42 ft	Grey clay, good plasticity, water of plasticity 31.3%, safe drying, drying shrinkage 5.7%.	30 1/2	02	4.3	11.5	light cream	hard	A Same comments as 293.
			5	5.5	8.4	light cream	very hard	
			10	6.7	0.7	grey; small specks	steel hard	
391 Densmore No. 4 48 ft	Black clay and lignite, good workability, water of plasticity 32.2%, safe drying, drying shrinkage 6.0%.	31-32	02	4.3	17.5	white	fairly hard	A Same comments as 269. Very refractory clay; contains some lignite which seems to burn out satisfactorily.
			5	5.7	12.1	white	hard	
			10	7.0	5.2	grey	very hard	
392 Densmore No. 4 54 ft	Black clay, good workability, water of plasticity 23.5%, safe drying, drying shrinkage 5.9%.	20-23	02	1.7	11.6	pink; cream	fairly hard	C Same comments as 288; not so sandy.
			5	2.0	10.0	cream	fairly hard	
			10	3.3	5.2	cream; specks	hard	

TABLE 1 (Continued)

Physical Properties of L. E. Shaw Limited Samples

Clay No.	UNFIRED CHARACTERISTICS	P.C.E.	FIRED CHARACTERISTICS					REMARKS
			Cone No.	Fired Shrinkage %	Absorption %	Colour	Hardness	
393 Densmore No. 4 60 ft	Brown black clay, greasy, good workability water of plasticity 22.9%, safe drying, drying shrinkage 5.5%.	20-23	02	2.3	10.3	pink - cream	fairly hard	C Same comments as 288.
			5	2.8	8.0	cream	hard	
			10	4.3	3.4	grey; specks	very hard	
394 Steel Co. 7A 18 ft	Black lignite clay, works well, water of plasticity 40.6%, safe drying, drying shrinkage 5.9%.	28	02	5.3	25.5	pink - cream; specks	soft	E Contains carbon and lignite. Appears to be unsuitable for use in any large quantity.
			5	7.3	19.5	cream - specks	fairly hard	
			10	8.1	13.5	dirty cream; specks	hard	
395 Steel Co. 7A 24 ft	Grey - brown clay, good workability, water of plasticity 37.8%, safe drying, drying shrinkage 6.1%.	20-23	02	6.0	15.6	salmon - brown	fairly hard	H Fires to a peculiar color. Contains stones which do not appear to be pyrite. Should be suitable for clay products.
			5	7.5	11.7	salmon - brown	hard	
			10	9.0	5.8	light brown	very hard	
396 Steel Co. 7A 30 ft	Black clay with pyrite lumps, fair plasticity, water of plasticity 37.5%, safe drying, drying shrinkage 4.1%.	26-28	unsuitable for clay products					E Not suitable for firing because of high carbon content.
397 Steel Co. 7A 36 ft	Black lignite clay, very plastic, water of plasticity 38.6%, safe drying, drying shrinkage 7.2%.	31	02	5.1	21.1	pink with stains	fairly hard	D Contains excessive carbon and some pyrite, unsuitable.
			5	6.1	19.0	white; few specks	fairly hard	
			10	8.0	11.9	cream; few specks	hard	
398 Steel Co. 7A 42 ft	Black plastic clay, good workability, water of plasticity 42.5%, safe drying, drying shrinkage 8.4%.	31-32	02	6.1	16.7	rusty cream; specks	fairly hard	D Contains carbonaceous material; very refractory - should be used with a low carbon clay.
			5	6.6	15.9	white	fairly hard	
			10	7.3	11.6	white; few specks	hard	

TABLE 1 (Continued)

Physical Properties of L. E. Shaw Limited Samples

Clay No.	UNFIRED CHARACTERISTICS	P.C.E.	FIRED CHARACTERISTICS					REMARKS
			Cone No.	Fired Shrinkage %	Absorption %	Colour	Hardness	
399 Steel Co. 7A 48 ft	Black plastic clay with pyrite, fair plasticity, water of plasticity 36.9%, safe drying, drying shrinkage 5.7%.	31-32	02	5.8	31.9	poor; cored and specks	soft	D Excessive carbon and pyrite make this material undesirable.
			5	7.0	29.2	cream; specks	soft	
			20.7	8.5	12.0	cream; specks	fairly hard	
400 Steel Co. 7A 54 ft	Black clay, good workability, water of plasticity 33%, safe drying, drying shrinkage 6.6%.	28	02	5.8	12.0	buff; specks	hard	E Contains excessive carbon and pyrite.
			5	6.1	10.7	buff; specks	hard	
			10	7.0	4.3	buff; specks	very hard	
401 Steel Co. 7A 60 ft	Brown to black clay, good plasticity water of plasticity 25.8%, slight tendency to crack in rapid drying, drying shrinkage 6.2%.	14 1/2	06	2.1	15.3	salmon	fairly hard	H This is a brown firing clay which is inclined to be difficult to dry.
			02	3.8	9.2	salmon	hard	
			5	4.6	6.7	brown	very hard	
402 Steel Co. 8A 36 ft	Black lignitic clay with pyrite, fair plasticity, water of plasticity 26.4%, safe drying, drying shrinkage 4.7%.	20-23	02	2.5	21.9	pink cream; specks	soft	E The briquettes were badly scummed. This material is unsuitable for clay products.
			5	3.5	19.4	cream; specks	fairly soft	
			10	3.8	19.4	cream; specks	fairly soft	
403 Steel Co. 8A 42 ft	Black lignitic clay with pyrite.	Cone crumbled		Could not obtain properties - briquettes disintegrated.				E Mainly lignite, unsuitable for clay products.
404 Steel Co. 8A 48 ft	Black lignitic clay.	14		Could not obtain properties - briquettes disintegrated.				E Mainly lignite, unsuitable for clay products.

TABLE 1 (Continued)

Physical Properties of L. E. Shaw Limited Samples

Clay No.	UNFIRED CHARACTERISTICS	P.C.E.	FIRED CHARACTERISTICS					REMARKS
			Cone No.	Fired Shrinkage %	Absorption %	Colour	Hardness	
405 Steel Co. 8A 54 ft	Grey - brown clay, fairly good plasticity, gritty, water of plasticity 23.5%, slight crack in rapid drying, drying shrinkage 5.4%.	16	02	1.2	14.5	dark salmon	fairly soft	H Unsuitable by itself. This is a common red burning material which fires to a very soft condition.
			5	2.2	11.1	brown; red	fairly soft	
			10	2.7	5.7	red - brown; specks	hard	
406 Steel Co. 8B 48 ft	Black lignitic clay with pyrite, good workability, water of plasticity 34.7%, safe drying, drying shrinkage 6.3%.	26	02	6.0	28.4	pink - cream	soft	E This material contains pyrite and a high proportion of lignite. Not a desirable material for clay products.
			5	7.6	24.0	cream; specks	fairly soft	
			10	7.8	17.5	cream; specks	fairly hard	
407 Steel Co. 8B 60 ft	Grey clay, good workability, water of plasticity 30%, very slight tendency to crack in rapid drying, drying shrinkage 6.6%.	26-27	02	4.3	12.6	pink - cream	hard	B Care required in drying. Same comments as 287.
			5	5.5	9.6	cream	very hard	
			10	6.7	1.5	grey; specks	steel hard	
408 Steel Co. No. 12 48 ft	Grey clay, good plasticity, water of plasticity 25%, safe drying, drying shrinkage 7.6%.	14+	02	1.7	13.1	salmon	fairly hard	H Red to brown firing clay. Suitable for brick and tile. Contains pyrite.
			5	4.1	7.5	light brown	hard	
			10	2.6	1.9	brown; specks	overfired	
409 Steel Co. No.12 54 ft	Grey clay, good plasticity, water of plasticity 22.2%, safe drying, drying shrinkage 6.4%.	18-20	02	1.1	10.9	pink - cream	fairly hard	G Similar to 408 except for lighter color and less pyrite.
			5	2.0	9.5	cream	hard	
			10	4.3	3.2	grey; specks	steel hard	
410 Steel Co. No. 12 60 ft	Grey clay, good plasticity, water of plasticity 25%, very slight tendency to crack with rapid drying, drying shrinkage 6.1%.	26	02	1.8	12.3	cream	fairly hard	B Care required in drying. Same comments as 287 except shrinkage are less.
			5	2.7	11.7	cream	hard	
			10	5.0	3.1	grey; few specks	steel hard	

TABLE 1 (Continued)

Physical Properties of L. E. Shaw Limited Samples

Clay No.	UNFIRED CHARACTERISTICS	P.C.E.	FIRED CHARACTERISTICS					REMARKS
			Cone No.	Fired Shrinkage %	Abrorp-tion %	Colour	Hardness	
411 Steel Co. 12B 36 ft	Grey clay, very good plasticity, slightly greasy, water of plasticity 30.5%, safe drying, drying shrinkage 7.7%.	30	06	1.1	19.1	pink - cream	fairly hard	A Same comments as 293.
			02	3.8	11.7	cream	hard	
			5	4.5	9.4	cream	very hard	
			10	6.3	1.4	grey; fine specks	very hard	
412 Steel Co. 12B 48 ft	Black clay, fair workability, water of plasticity 23%, gritty, safe drying, drying shrinkage 5.3%.	20-23	02	0.7	18.7	pink; specks	soft	F Very sandy; should be mixed with a more plastic clay; contains pyrite and probably carbon.
			5	1.6	17.0	pink - cream; specks	soft	
			10	2.5	12.2	buff; many specks	fairly hard	
413 Steel Co. 13 B 42 ft	Highly calcareous black lignitic clay, good workability, water of plasticity 27.8%, safe drying, drying shrinkage 6.3%.	10	02	2.0	17.0	salmon; specks	soft	H This is a low grade common clay containing lignite, not a desirable raw material.
			7	6.5	7.0	brown	very hard	
414 Steel Co. 13 B 48 ft	Black lignitic clay with pyrite, good workability, water of plasticity 34.7%, safe drying, drying shrinkage 6.6%.	18-20	02	5.1	28.5	pink - cream; specks	soft	H Contains excess pyrite and lignite; not a desirable raw material.
			5	6.1	24.1	cream; specks	fairly soft	
			10	8.7	10.7	rust; many specks	hard	
415 Steel Co. 13 B 54 ft	Black lignitic clay with pyrite, good workability, water of plasticity 36.1%, slight tendency to crack with rapid drying, drying shrinkage 7.7%.	20-23	02	4.1	14.8	pink - cream	fairly hard	E Same comments as 414.
			5	4.8	12.2	cream; specks	hard	
			10	6.7	2.8	buff; specks	very hard	
416 Steel Co. 13 B 60 ft	Black lignitic clay with pyrite, good workability, water of plasticity 36.1%, safe drying, drying shrinkage 8.0%.	28	02	5.0	16.2	pink - cream; specks	fairly hard	E Contains excess lignite and consequently should be well diluted with a non-carbonaceous clay. Contains 15% quartz.
			5	6.6	13.5	cream; specks	hard	
			10	8.1	2.9	grey; many specks	very hard	

TABLE 1 (Continued)

Physical Properties of L. E. Shaw Limited Samples

Clay No.	UNFIRED CHARACTERISTICS	P.C.E.	FIRED CHARACTERISTICS					REMARKS
			Cone No.	Fired Shrinkage % *	Absorption %	Colour	Hardness	
417 Steel Co. 14 A 24 ft	Grey-black clay, good plasticity, water of plasticity 30.5%, tendency to crack with rapid drying, drying shrinkage 7.6%.	29+	02	3.3	14.0	cream; specks	fairly hard	A Same comments as 268. contains excess carbon. care required in drying.
			5	3.8	13.6	cream; specks	fairly hard	
			10	6.7	5.9	cream; specks	very hard	
418 Steel Co. 14 A 30 ft	Grey sandy clay, fairly good workability water of plasticity 17.5%, very slight crack in rapid drying, drying shrinkage 4.6%.	20-23	02	0.3	13.3	cream	fairly soft	F Sandy clay which contains stones. Should be mixed with a plastic clay.
			5	+0.7	11.7	cream	fairly soft	
			10	2.0	7.9	grey	hard	
419 Steel Co. 14 A 36 ft	Buff clay, good plasticity, water of plasticity 31.7%, safe drying, drying shrinkage 8.7%.	27	06	1.5	17.3	salmon	fairly hard	H Refractory salmon to brown firing clay. Suitable for clay products.
			02	5.3	8.4	salmon	very hard	
			5	6.1	5.7	brown - salmon	very hard	
420 Steel Co. 14 A 42 ft	Grey sandy clay, water of plasticity 19.7%, fair workability, safe drying drying shrinkage 6.1%.	20	02	0.8	11.3	cream	fairly hard	C Same comments as 288.
			5	0	9.2	cream	hard	
			10	5.6	4.7	dark cream; specks	very hard	
421 Steel Co. 14 A 48 ft	Grey sandy clay, poor workability, water of plasticity 18%, safe drying, drying shrinkage 4.1%.	20	02	+0.5	12.1	cream	fairly soft	F Very sandy material; should be mixed with ap plastic clay.
			5	+0.3	11.5	cream	fairly soft	
			10	0.3	9.1	cream; specks	fairly soft	
422 Steel Co. 14 A 54 ft	Brown - grey clay, fair plasticity, water of plasticity 20%, safe drying, drying shrinkage 5.3%.	20-23	02	0.3	13.1	salmon	fairly soft	F Same comments as 421.
			5	0.7	12.2	buff	fairly soft	
			10	2.5	7.5	buff; specks	hard	

* a plus sign indicates expansion

TABLE 1 (Continued)

Physical Properties of L. E. Shaw Limited Samples

Clay No.	UNFIRED CHARACTERISTICS	P.C.E.	FIRED CHARACTERISTICS					REMARKS
			Cone No.	Fired Shrinkage % *	Absorption %	Colour	Hardness	
423 Steel Co. 14A 60 ft	Grey clay, slightly gritty, fair workability, water of plasticity 19.2%, safe drying, drying shrinkage 5.5%, contains 47% quartz.	18-20	02	1.3	11.0	salmon	fairly soft	H Common clay, sandy, contains pyrite. Should be suitable for buff clay products if diluted with a buff firing clay.
			5	1.8	9.2	salmon	fairly hard	
			10	4.3	3.6	buff; many specks	hard	
424 Steel Co. 14 B 18 ft	Grey - black clay, very plastic, water of plasticity 34.4%, safe drying, drying shrinkage 7.5%.	26-28	02	4.1	17.0	cream; specks	fairly hard	E Contains lignite, should be diluted with a non-carbonaceous clay.
			5	4.8	15.8	cream; specks	fairly hard	
			10	6.0	8.0	cream; specks	very hard	
425 Steel Co. 14 B 24 ft	Grey clay, fair workability, sandy, water of plasticity 17.8%, slight tendency to crack with rapid drying, drying shrinkage 5.0%.	20	02	0.3	11.4	cream	fairly soft	F Sandy clay, should be mixed with a more plastic clay.
			5	0.5	10.8	cream	fairly soft	
			10	2.0	7.3	cream; specks	hard	
426 Steel Co. 14 B 30 ft	Light grey clay, fairly good workability, water of plasticity 19.4%, safe drying, drying shrinkage 6.0%.	23+	02	0.7	10.4	white	fairly soft	F Same comments as 425.
			5	0.8	9.7	white	fairly soft	
			10	2.1	7.4	white; specks	hard	
427 Steel Co. 14 B 42 ft	Brownish grey clay, wet, slightly gritty, fair workability, water of plasticity 20.3%, safe drying, drying shrinkage 4.8%.	20	02	+0.1	12.1	cream - buff	soft	F This sample was marked "wet". Same comments as 425.
			5	0.1	11.1	cream - buff	soft	
			10	1.5	8.1	grey - buff; specks	fairly hard	
428 Steel Co. 14 B 42 ft	Grey clay, fair workability, water of plasticity 21.9%, safe drying, drying shrinkage 5.1%.	20+	02	0.3	12.0	cream	fairly soft	F Same comments as 425. Sample marked same as 427 except "wet" in above sample.
			5	0.7	11.5	cream	fairly soft	
			10	2.5	7.1	cream; specks	hard	

* a plus sign indicates expansion.

TABLE 1 (Continued)

Physical Properties of L. E. Shaw Limited Samples

Clay No.	UNFIRED CHARACTERISTICS	P.C.E.	FIRED CHARACTERISTICS					REMARKS
			Cone No.	Fired Shrinkage %	Absorption %	Colour	Hardness	
429 Steel Co. 14 C 42 ft	Grey clay, fair workability, water of plasticity 21.9%, safe drying, drying shrinkage 6.1%.	18-20	02	2.5	9.9	buff	fairly hard	C Inclined to be sandy. Should be suitable for buff brick and tile.
			5	3.0	8.8	buff	hard	
			10	4.0	2.3	grey - buff; specks	very hard	
430 Steel Co. 14 C 48 ft	Grey clay, good workability, water of plasticity 23.6%, safe drying, drying drying shrinkage 7.0%.	20	02	2.4	8.2	buff	hard	C Same comments as 429; contains less sand than 429.
			5	3.3	7.1	buff	hard	
			10	5.1	2.6	grey	very hard	
431 Steel Co. 14 C 54 ft	Grey clay, fairly good workability, water of plasticity 21.1%, very slight tendency to crack with rapid drying, drying shrinkage 6.6%.	23	02	1.1	10.6	buff	fairly hard	C Inclined to be sandy; same comments as 429. Care required in drying.
			5	1.7	9.3	buff	fairly hard	
			10	4.1	3.4	grey; specks	very hard	
432 Steel Co. 14 C 60 ft	Grey sandy clay, fair workability, water of plasticity 18.8%, safe drying, drying shrinkage 5.0%.	18-20	02	0.3	9.9	cream	fairly hard	C Same comments as 429.
			5	0.7	8.8	cream	fairly hard	
			10	2.3	5.4	buff	hard	
433 Steel Co. 14 D 36 ft	Black clay, good plasticity, water of plasticity 35.5%, safe drying, drying shrinkage 7.1%.	26-28	02	4.1	17.2	pink - cream	fairly hard	E High in lignite; should be mixed with a non-carbon clay with less plasticity.
			5	5.3	12.3	cream - buff	hard	
			10	7.3	3.3	cream - grey; buff	steel hard	
434 Steel Co. 14 D 42 ft	Black plastic clay, good plasticity, water of plasticity 34.4%, safe drying, drying shrinkage 7.4%.	26-28	02	4.8	16.1	pink - cream	fairly hard	E Same comments as 433.
			5	6.1	10.4	cream; specks	hard	
			10	7.3	2.8	cream - grey; specks	steel hard	

TABLE 1 (Continued)

Physical Properties of L. E. Shaw Limited Samples

Clay No.	UNFIRED CHARACTERISTICS	P.C.E.	FIRED CHARACTERISTICS					REMARKS
			Cone No.	Fired Shrinkage %	Absorption %	Colour	Hardness	
435 Steel Co. 14 D 48 ft	Grey plastic clay, good plasticity, water of plasticity 25%, safe drying, drying shrinkage 7.0%.	26+	02	2.3	11.8	cream	fairly hard	B Same comments as 287.
			5	2.5	10.8	cream	hard	
			10	4.3	6.6	cream; specks	very hard	
436 Steel Co. 14 D 54 ft	Grey clay, greasy, good plasticity, water of plasticity 25.0%, safe drying, drying shrinkage 5.7%.	26-28	02	2.5	12.5	cream	fairly hard	B Same comments as 287.
			5	3.0	11.0	cream	hard	
			10	4.3	5.7	cream; fine specks	very hard	
437 Steel Co. 14 D 60 ft	Grey clay, water of plasticity 22.5%, good workability, safe drying, drying shrinkage 7.0%.	28+	02	2.0	10.8	cream	fairly hard	B Same comments as 287.
			5	2.7	9.4	cream	hard	
			10	3.8	5.3	cream	very hard	
438 Steel Co. 14 E 12 ft	Black lignitic material.	14-	Not suitable for clay products					E Mainly lignite.
439 Steel Co. 14 E 18 ft	Black lignitic material.	14+	Not suitable for clay products					E Mainly lignite.
440 Steel Co. 14 E 24 ft	Black lignitic clay, fairly plastic water of plasticity 45.5%, safe drying drying shrinkage 7.6%.	26-28	Not suitable for clay products					E Contains excessive lignite.

TABLE 1 (Continued)

Physical Properties of L. E. Shaw Limited Samples

Clay No.	UNFIRED CHARACTERISTICS	P.C.E.	FIRED CHARACTERISTICS					REMARKS
			Cone No.	Fired Shrinkage %	Absorption %	Colour	Hardness	
441 Steel Co. 14 E 30 ft	Dark grey clay, good plasticity, water of plasticity 32.5%, safe drying, drying shrinkage 5.7%.	30	02	4.5	18.6	cream	fairly hard	D High in carbon; should be diluted with a non-carbon clay.
			5	5.5	18.4	cream	fairly hard	
			10	6.7	11.1	cream; few specks	hard	
442 Steel Co. 14 E 36 ft	Black lignitic clay, fair plasticity, water of plasticity 38%, slight tendency to crack with rapid drying, drying shrinkage 8.0%.	30	02	6.0	21.5	cream; specks	fairly hard	D Same comments as 441.
			5	6.8	19.4	white; specks	fairly hard	
			10	8.7	15.3	white; specks	hard	
443 Steel Co. 14 E 42 ft	Black lignitic clay containing pyrite.	16	Not suitable for clay products					E Too high in lignite.
444 Steel Co. 14 E 48 ft	Dark grey clay, good plasticity, water of plasticity 30.8%, safe drying, drying shrinkage 5.5%.	28+	02	3.5	18.6	cream	fairly hard	D Same comments as 441.
			5	4.8	15.2	cream; specks	fairly hard	
			10	6.3	8.3	cream; large specks	very hard	
445 Steel Co. 14 E 54 ft	Dark grey plastic clay, good plasticity, greasy, water of plasticity 34.4%, safe drying, drying shrinkage 5.8%.	30	02	5.0	13.8	white	fairly hard	D or A Same comments as 441; not so much carbon as 441; also similar to 268.
			5	5.6	10.2	cream	hard	
			10	6.3	2.4	cream - grey; specks	steel hard	
446 Steel Co. 14 E 60 ft	Dark grey - black clay, water of plasticity 35.9%, safe drying, drying shrinkage 6.7%.	30	02	5.1	15.1	cream	fairly hard	D Same comments as 441.
			5	6.1	11.6	cream	hard	
			10	7.7	4.2	cream; few specks	steel hard	

TABLE 1 (Continued)

Physical Properties of L. E. Shaw Limited Samples

Clay No.	UNFIRED CHARACTERISTICS	P.C.E.	FIRED CHARACTERISTICS					REMARKS
			Cone No.	Fired Shrinkage %	Absorption %	Colour	Hardness	
447 Steel Co. 15 A 54 ft	Grey - black plastic clay, good workability, water of plasticity 23.4%, safe drying, drying shrinkage 6.0%.	20	02	2.1	10.1	pink - cream	fairly hard	C Same comments as 288.
			5	2.7	8.1	cream	hard	
			10	4.3	3.5	grey; specks	steel hard	
448 Steel Co. 15 A 48 ft	Grey plastic clay, good plasticity, water of plasticity 27.8%, safe drying, drying shrinkage 7.5%.	30 1/2	06	1.5	12.8	pink - cream	fairly hard	A Same comments as 293.
			02	4.7	8.8	cream	hard	
			5	4.8	5.8	cream	very hard	
449 Steel Co. 15 A 30 ft	Grey clay, good workability, water of plasticity 23%, safe drying, drying drying shrinkage 7.5%.	26 1/2	06	0.8	14.7	pink - cream	fairly hard	B Same comments as 287.
			02	3.8	9.8	pink - cream	hard	
			5	4.7	5.0	buff	very hard	
450 Steel Co. 15 A 36 ft	Grey clay, good workability, slightly sandy, water of plasticity 20.3%, safe drying, drying shrinkage 6.6%, contains 36% quartz.	26	02	1.5	9.3	cream	hard	C Same comments as 288.
			5	2.3	7.2	cream; specks	hard	
			10	3.6	4.4	cream; specks	very hard	
451 Steel Co. 15 A 42 ft	Grey sandy clay, fair plasticity, water of plasticity 19.2%, safe drying, drying shrinkage 5.5%.	18	02	0.2	10.6	cream	fairly hard	F Sandy clay; should be mixed with a more plastic clay for buff clay products.
			5	1.3	8.1	buff; specks	hard	
			10	2.5	5.6	buff; specks	hard	
452 Steel Co. 15 A 60 ft	Brown clay, sandy fair workability, water of plasticity 20.5%, safe drying, drying shrinkage 5.7%.	14	06	0.1	13.1	salmon	fairly soft	H Sandy clay which burns salmon to brown and contains pyrite.
			02	1.5	9.3	salmon	hard	
			5	4.5	3.0	brown; spots	very hard	

TABLE 1 (Continued)

Physical Properties of L. E. Shaw Limited Samples

Clay No.	UNFIRED CHARACTERISTICS	P.C.E.	FIRED CHARACTERISTICS					REMARKS
			Cone No.	Fired Shrinkage %	Absorption %	Colour	Hardness	
453 Steel Co. No. 25 30 ft	Grey clay, sandy, fair workability, water of plasticity 21.9%, safe drying, drying shrinkage 6.0%.	15	06	0	16.1	pink cream	fairly soft	F Very sandy common clay. Could be used for buff colored clay products if mixed with a plastic clay.
			02	1.8	11.5	cream	fairly hard	
			5	2.8	7.7	buff - specks	hard	
454 Steel Co. No. 25 36 ft	Grey sandy clay, fair workability, water of plasticity 18.3%, safe drying, drying shrinkage 3.3%, contains 52% quartz.	20-23	02	0.6	13.5	cream	soft	F Same comments as 453.
			5	0.3	13.0	cream	soft	
			10	1.7	10.0	cream - fine specks	soft	
455 Steel Co. No. 25 42 ft	Black lignitic clay, good plasticity, water of plasticity 37.5%, safe drying, drying shrinkage 9.0%, contains 12% quartz.	31+	02	5.5	12.4	cream	hard	D Contains too great a quantity of carbon, not suitable for clay products by itself, high shrinkages.
			5	6.3	9.5	cream	very hard	
			10	8.0	7.9	cream - fine specks	steel hard	
456 Steel Co. No. 25 48 ft	Black clay containing sand and pyrite, fairly good workability, water of plasticity 27.8%, safe drying, drying shrinkage 6.4%.	23	02	3.0	20.3	salmon cream	fairly soft	E Scummed, contains excess carbon and sand; not suitable for clay products Sample marked "black".
			5	4.0	18.0	dark rust - specks	fairly hard	
			10	3.8	15.6	rusty cream specks	fairly hard	
457 Steel Co. No. 25 48 ft	Black lignitic clay containing sand.	14	Not suitable for clay products because of high lignite content					E Contains too large a quantity of lignite. Sample marked "black lignite".
458 Steel Co. No. 25 54 ft (Black)	Black lignitic clay, good plasticity, water of plasticity 34.7%, safe drying, drying shrinkage 7.0%.	27	02	5.0	19.6	cream pink - specks	fairly soft	E Scummed, contains excess lignite. Sample marked "black" whereas sample 459 was marked "black - brown specks".
			5	5.5	17.0	rusty buff - specks	fairly hard	
			10	6.5	12.0	rusty - cream - specks	hard	

TABLE 1 (Continued)

Physical Properties of L. E. Shaw Limited Samples

Clay No.	UNFIRED CHARACTERISTICS	P.C.E.	FIRED CHARACTERISTICS					REMARKS
			Cone No.	Fired Shrinkage %	Absorption %	Colour	Hardness	
459 Steel Co. No. 25 54 ft (Black - brown specks	Black lignitic clay containing pyrite, sandy and gritty, good workability, water of plasticity 31.4%, safe drying, drying shrinkage 6.6%.	26-27	02	4.0	23.1	cream and salmon	fairly soft	E Contains excess carbon and pyrite; not suitable for clay products.
			5	4.8	20.3	dark rust; specks	fairly soft	
			10	5.8	15.5	rusty buff; specks	fairly hard	
460 Steel Co. No. 25 60 ft	Black lignitic clay, slightly gritty, good plasticity, water of plasticity 23.9%, safe drying, drying shrinkage 6.7%.	18	06	3.1	17.4	light salmon	fairly soft	H Not a desirable material, contains carbon and pyrite, fires to a poor color. Sample identification same as 461.
			02	4.8	9.6	light salmon	hard	
			5	0.5	4.7	brown	very hard	
461 Steel Co. No. 25 60 ft	Black lignitic clay with pyrite, good plasticity, water of plasticity 27%, safe drying, drying shrinkage 5.3%.	26	02	3.3	21.0	pink cream	soft	H Scummed, contains high carbon and some pyrite. Not desirable for clay products.
			5	5.0	17.0	rusty buff; specks	fairly soft	
			10	4.3	15.3	rusty buff; specks	fairly hard	

TABLE 2

Temperature - Cone Equivalents

Cone Number	Temperature °F	Cone Number	Temperature °F
06	1816	18	2772
03	1987	19	2806
02	2014	20	2847
1	2077	23	2921
5	2151	26	2950
7	2219	27	2984
10	2345	28	2995
13	2460	29	3018
14	2548	30	3029
15	2606	31	3061
16	2716	31 1/2	3090
17	2754	32	3123

TABLE 3

Quartz Contents of Selected Samples

Sample	Group	Quartz %	Sample	Group	Quartz %
268	A or D	16	303	B	27
269	A	15	305	A	27
270	H	45	310	A	14
271	A	17	378	B	25
273	A	15	416	E	15
274	B	17	423	H	47
287	B	30	450	C	36
288	C	41	454	F	52
295	D	12	455	D	12

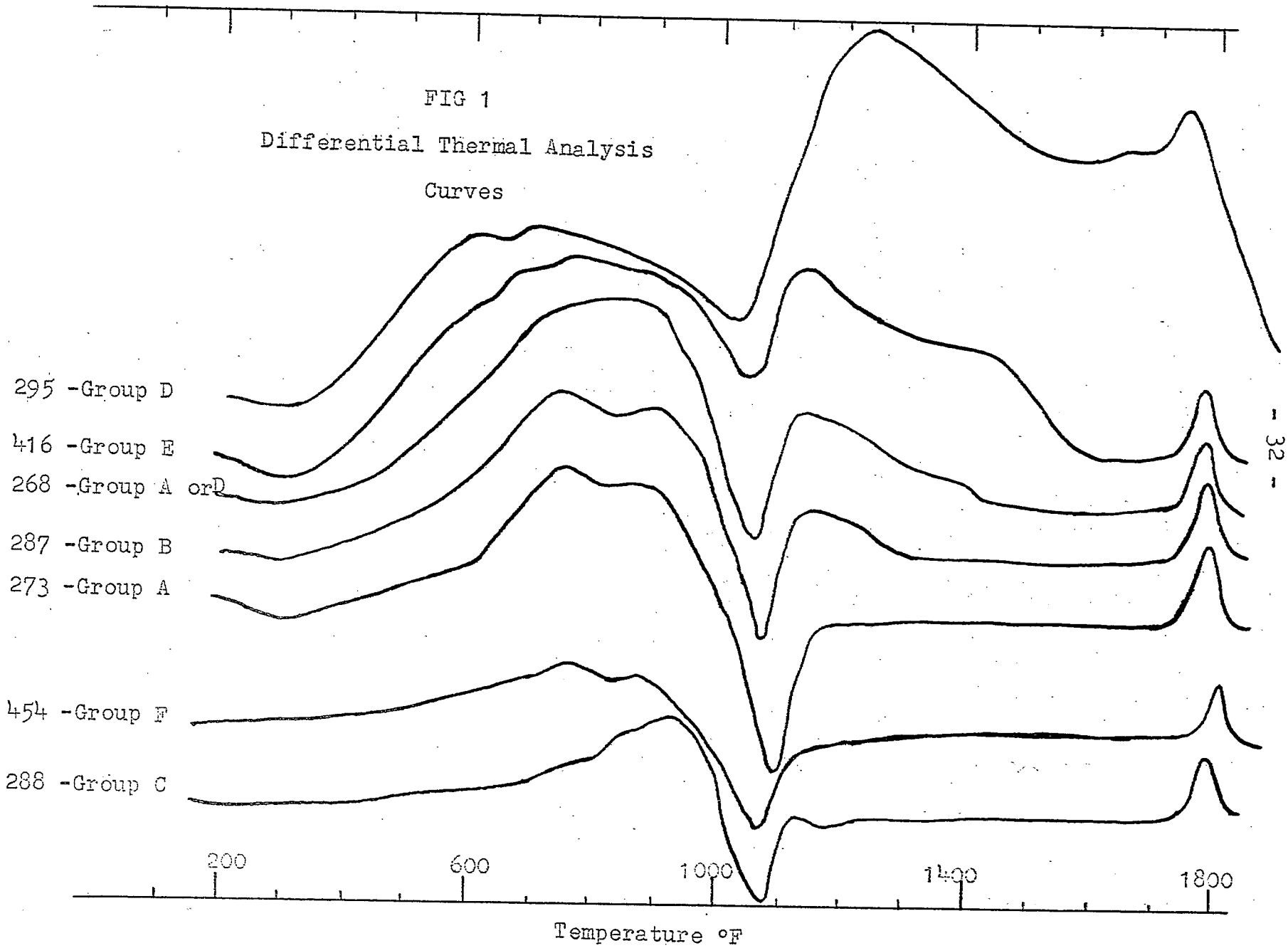
FIG 1
Differential Thermal Analysis
Curves
295 -Group D
416 -Group E
268 -Group A or D
287 -Group B
273 -Group A
454 -Group F
288 -Group C
200
600
1000
1400
1800
Temperature °F

DISCUSSION OF RESULTS

Sample Groups

In general, the clays may be broken down roughly into the following groups:-

A. Very Refractory Buff-firing Clays

The samples in this group have P.C.E.'s of Cone 29 or higher. The most refractory specimens have a P.C.E. of Cone 32. The clays are very plastic and have a high drying shrinkage. The water of plasticity is above approximately 26% and the drying shrinkage above approximately 5.5%. Some care is likely required in drying because of the high shrinkage and high water content. Addition of some of the more non-plastic clays would reduce the shrinkage and aid drying. Some of the samples in this group contain excess carbonaceous material and some pyrite which will cause difficulty in firing if the percentage becomes too great. These samples are considered to be suitable for buff face brick and tile, sewer pipe, flue liners, stoneware products, intermediate refractories, and ladle brick.

B. Refractory, Plastic, Buff-firing Clays

The P.C.E.'s of this group vary from approximately 20 to 28+. They are plastic, buff-firing materials which have a high drying shrinkage. The water of plasticity is generally greater than 25% and the drying shrinkage approximately 5.5% or greater. Since these clays are plastic, with high shrinkages, care is probably required

in drying. An addition of a less plastic material would probably improve drying. Some of the samples contain a little excess carbonaceous material and pyrite. These materials are similar in many respects to Group A. Since they are less refractory they are not suitable for intermediate firebrick but could be used for low heat refractories. They may be used for the other products listed in Group A.

C. Sandy, Refractory, Buff-firing Clays

The P.C.E.'s of this group are similar to Group B and vary from Cone 20 to 28+. The samples are, in general, less plastic than Group B because of a larger proportion of quartz. However, their workability and plasticity are generally satisfactory. The water of plasticity is usually below 23% and the drying shrinkage 5 to 6%. The pyrite content is variable and generally the carbon content is low. They are suitable for the same purposes as Group B.

D. Very Refractory Buff-firing Clays Containing Excessive Carbonaceous Material and Pyrite

The P.C.E.'s of this group are above Cone 29. They contain excessive carbonaceous material principally from lignite and some pyrite from stones. Many samples of this type are not suitable for use in the manufacture of clay products and should be discarded. The majority of the others should be diluted by clays containing little carbonaceous material or pyrite so that less trouble will be encountered

in oxidizing these materials during firing. The majority of the briquettes in this group are either black-cored, very porous, or badly speckled with dark spots from the pyrite. No bloating was observed. The water of plasticity is high and usually over 30%. The shrinkage is inclined to be high, and is generally above 6%.

E. Refractory Buff-firing Clays Containing Excessive Carbonaceous Material and Pyrite

Except for refractoriness, this group is similar to Group D. The P.C.E.'s are Cone 20 to 28+. Generally, they are unsuitable for use by themselves because of the high carbon (lignite) and pyrite content. Many of them should not be used for clay products. The majority of the samples have a water of plasticity greater than 30% and have a fired shrinkage of approximately 5.5% or greater.

F. Very Sandy Buff or Cream-firing Clays

These clays contain a substantial proportion of quartz and variable quantities of carbonaceous material and pyrite. The amount of carbonaceous material is usually small. Generally the samples in this group do not have satisfactory workability and they should be mixed with a more plastic material or used in a dry-pressed body. The majority have P.C.E.'s between Cone 20 and Cone 27.

G. Buff-firing Clays Having PCE's of Cone 20 or less

There are very few clays in this classification and

consequently they are not significant.

H. Common, Salmon, Red, and Brown-firing Clays of Various Properties

This group of samples is mainly red-burning. Some samples are suitable for the manufacture of red brick and tile.

Differential Thermal Analysis

The differential thermal analysis curves reproduced in Figure 1 were obtained in an air atmosphere. The samples are buff-firing, and show typical reactions for Groups, A, B, C, D, E and F. The samples contain, principally, the clay mineral kaolinite. The endothermic peaks (pointing down) in the 1040 to 1085°F range are caused by typical kaolinite reactions. All samples contain quartz which undergoes an inversion at 1060°F. The peak from this reaction is obscured by the large kaolinite peak in this region. If the latter peak is initially eliminated the quartz reaction, which is reversible, may be detected and the percent quartz estimated.

The principal difference in the curves shown is in the variation of the size of the broad exothermic reactions in the 600 to 1500°F range. They are caused chiefly by the burn-out of carbonaceous material (principally lignite). The small exothermic-endothermic combinations which occur on the larger peaks in the 600 to 900°F region are caused by the decomposition of a small amount of pyrite.

Sample 295, which is classified as a "D" type, contains a very large quantity of carbonaceous material. The burn-out occurs

below and above the endothermic clay peak at 1040°F. This is true also of sample 416 (Group E), and to a lesser extent for sample 268 (Group A or D), and sample 287 (Group B). Samples 273 (Group A), 288 (Group C), and 454 (Group F), contain lesser amounts of oxidizable material.

The quartz contents listed in Table 3 indicate that the very plastic clays and those high in carbon contain a moderate to small amount of quartz (25% or less). The clays in Group C and F are sandier and their quartz contents are considerable higher.

Discussion of Samples by Area

McDonald Farm

The majority of the samples from this area are sandy, red-burning clays. Three samples are sandy, buff-firing materials. Thus, considering the samples examined, it is likely that there is not sufficient buff-firing material in this area which is suitable for commercial use.

Lawlor Pit

This is the pit now in use for the production of buff face brick at the Lantz, N.S. plant. The samples submitted for evaluation are not all suitable for use. Two of the eight samples are high in carbon and one contains considerable pyrite.

Densmore Property

The samples from the Densmore property are in general suitable for the manufacture of clay products. Approximately half of

the samples contain considerable carbonaceous material so that care may be required if firing during the oxidation period.

Steel Co. Property

The majority of the samples are from this area. Approximately 35% of the samples are very high in carbonaceous material, some of which are not suitable for the manufacture of clay products because of the difficulty of proper oxidation. Other samples high in carbon may be used by blending them with clays containing little or no carbonaceous material. Approximately 20% of the samples are very refractory plastic clays which would be suitable for the manufacture of intermediate refractories, ladle brick, or buff colored clay products such as face brick, tile, and sewer pipe. A further 25% are similar in properties but not quite so refractory. They would be suitable for the same products as the very refractory plastic clays with the exception that only low heat refractories could be manufactured from them. Approximately 12% of the specimens are very sandy and should be mixed with plastic clays. The remaining 8% are chiefly the ones which do not fire to a buff color.

In addition to carbonaceous materials many of the samples contain pyrite stones which cause trouble during the oxidation period and black specks on the ware. The pyrite stones should be finely ground to prevent bursting and discoloration of the product faces.

CONCLUSIONS

The evaluation results of the samples from the McDonald farm show that there is not sufficient buff-firing material in this area to warrant development. All samples except one are red-burning.

In general the clays from the Steel Company property, Densmore property and Lawlor pit are buff firing clays of low, medium, or fairly high refractoriness. The majority of them fall into the fireclay category and are made up principally of the clay mineral kaolinite. They vary considerably in their plasticity but generally work well and would extrude satisfactorily. The majority are safe drying, although care will likely be required in drying the more plastic ones because of their high drying shrinkage and high water of plasticity. Some of the samples are very sandy and should be well blended with the more plastic ones.

A substantial proportion of the samples contain considerable carbonaceous material which is principally lignitic in character. Some of the samples are mainly lignite and the seams containing material of this nature should, preferably, be discarded. The lignite and other organic material appears to burn out easily provided the proportion is not too high. The burn-out range in the laboratory varies from 600 to 1500°F. No bloating was observed, although there was some black-coring. Because of the number of samples containing organic material, it is likely that a fairly long oxidation

period is necessary to prevent black-coring of thick walled products.

A considerable number of the samples contain pyrite stones. Consequently, proper grinding facilities are essential in order to properly reduce the size of these stones to 10 or 12 mesh. The percentage of pyrite does not appear to be high and oxidation of this material will likely present a problem only if the percentage of carbonaceous material is high.

With the exception of the seams very high in organic material, pyrite and quartz, the majority of the buff-firing samples are suitable for the manufacture of buff face brick and tile, stoneware products, sewer pipe, and flue liners. In addition, the materials having a P.C.E. of Cone 29 or greater are suitable for intermediate heat refractories and ladle brick, while the ones having a P.C.E. from Cone 20 to 29 are suitable for low duty refractories and probably ladle brick. Blending of the very plastic clays with the less plastic, sandy ones is necessary so that a uniform raw material with consistent characteristics is obtained. This is particularly important if the manufacture of ladle brick or other refractories is comtemplated. The less plastic materials may be suitable for dry-pressed products provided the amount of quartz, pyrite or carbonaceous material is not excessive.

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