EVALUATION OF THE AMOUNT AND DISTRIBUTION OF MONTMORILLONITE IN SOME GEORGIA AND SOUTH CAROLINA KAOLINS[1]

by

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EXTENDED ABSTRACT

A method developed for measuring small amounts of montmorillonite associated with the kaolinite in the kaolin deposits of the Coastal Plain of southeastern United States (Hinckley and Bates, 1960) consists of exchanging the Sr^{2+} ion on to the montmorillonite, removing the excess strontium by dialysis, analyzing the exchanged sample for strontium by x-ray fluorescence and computing the percentage of montmorillonite from a curve obtained by similar treatment of known standards. Application of the method shows that a precision of approximately ± 0.5 percent in the range of 0.5 to 8.0 percent montmorillonite is obtained.

In evaluating the data the following assumptions are made:

(1) The ratio of the base exchange capacity of the montmorillonite to that of the kaolinite is constant.

(2) The base exchange capacity of the montmorillonite in the standards is the same as that of montmorillonite in the samples.

The material investigated by this method consists of samples taken from six drill cores obtained from three deposits in the Macon, Georgia; Sandersville, Georgia; and Langley, South Carolina, areas.

The cores were drilled in pairs from two " soft " type and one " hard " type clay pits and were supplied through the courtesy of the Georgia Kaolin Company, the Huber Corporation and the Minerals and Chemicals Corporation. Six samples were taken from each of six cores according to a stratified-random sampling plan in which each core is arbitrarily divided into thirds with no stratigraphic implication and two 6 in. samples are taken at random from each third (Fig. 1). Each 6-in. sample is subdivided into three 2 in. subsamples providing 18 subsamples from each core or a total of 108 individual 2 in. subsamples from the six cores.

The 108 subsamples were treated and analyzed according to the method previously described. The two values produced by the x-ray fluorescence analyses of the duplicate packings on each 2 in. subsample were averaged to produce the data appearing in Table 1.

The data were treated statistically by an analysis of variance as a combined group of three pits, as a combination of one hard and one soft type pit and independently as hard and soft type pits. The results of these analyses are shown on Table 2. In all instances significant differences are noted on the sixths and cores level.

[1] Contribution no. 59–36, Mineral Industries Experiment Station, The Pennsylvania State University, University Park, Pennsylvania.

This work was performed under National Science Foundation Research Grant G3735.

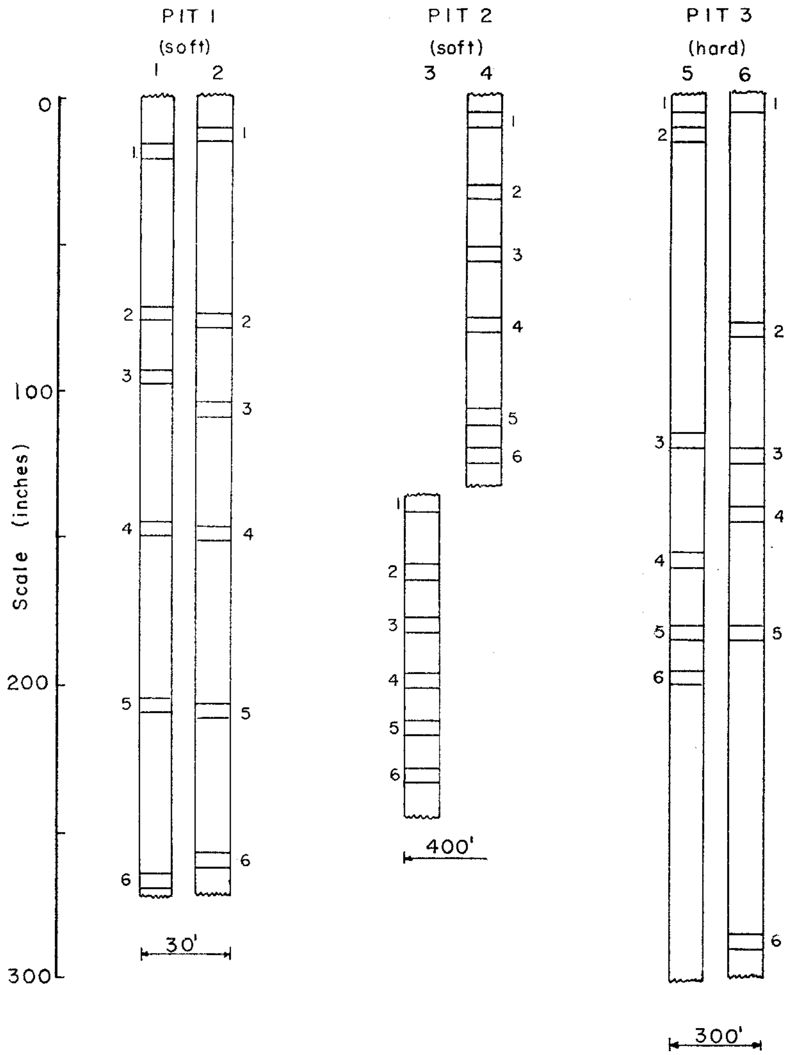

FIGURE 1.—Distribution of samples.

https://doi.org/10.1346/CCMN.1959.0080105 Published online by Cambridge University Press

Relative to subsamples, which are used as a measure of unexplained variation, montmorillonite content in sixths has greater variability. This means that the montmorillonite in both the hard and soft clay deposits is not homogeneously distributed.

Variability among thirds is no greater than that found among sixths. This lack of distinction among thirds indicates greater homogeneity at this level than among sixths.

Relative to the variation of thirds and sixths, cores have greater variation and on this basis a distinction can be made between them. These differences may be caused by sampling different portions of an inhomogeneous deposit, e.g. one having layers or patches.

TABLE 1.—MONTMORILLONITE DATA
(PERCENT)

Clay Type		Soft				Soft				Hard			
Pit Number		1				2				1			
Core No.		1		2		3		4		5		6	
			$\bar{X}$		$\bar{X}$		$\bar{X}$		$\bar{X}$		$\bar{X}$		$\bar{X}$
Sample 1	A	1.58		2.34		0.66		6.20		1.49		2.28	
	B	1.82	1.74	2.33	2.33	0.59	0.63	6.47	6.13	1.50	1.45	2.50	2.37
	C	1.84		2.33		0.65		5.72		1.37		2.34	
Sample 2	A	0.34		0.72		0.45		5.06		1.94		2.98	
	B	0.29	0.21	0.43	0.52	0.50	0.49	4.75	4.88	1.80	1.92	2.52	2.88
	C	0.01		0.42		0.51		4.84		2.03		3.16	
			0.97		1.42		0.56		5.50		1.68		2.62
Sample 3	A	0.36		0.14		0.36		3.68		1.24		2.42	
	B	0.32	0.36	0.19	0.14	0.39	0.38	3.48	3.58	1.45	1.36	2.27	2.32
	C	0.40		0.08		0.40		3.59		1.40		2.26	
Sample 4	A	0.19		0.21		1.26		2.65		1.08		2.74	
	B	0.16	0.18	0.16	0.21	1.12	1.12	2.38	2.49	1.06	1.08	2.66	2.75
	C	0.20		0.26		0.97		2.43		1.09		2.84	
			0.27		0.17		0.75		3.04		1.22		2.53
Sample 5	A	0.11		0.38		1.36		2.12		1.18		2.44	
	B	1.16	0.74	0.66	0.53	1.74	1.61	2.04	2.10	1.00	1.17	2.43	2.41
	C	0.94		0.56		1.74		2.16		1.34		2.36	
Sample 6	A	2.04		1.83		2.59		4.88		1.38		2.22	
	B	1.94	2.05	1.77	1.90	2.80	2.71	5.08	5.05	1.42	1.45	2.59	2.41
	C	2.17		2.10		2.74		5.20		1.56		2.42	
			1.39		1.21		2.16		3.58		1.31		2.41
			0.87		0.93		1.15		4.04		1.40		2.52

Summary statistics: Hard type clay s = 0.63, $\bar{X}$ = 1.96, Range 1.00–3.16.
Soft type clay s = 1.67, $\bar{X}$ = 1.75, Range 0.01–6.47.

TABLE 2.—ANALYSIS OF VARIANCE OF MONTMORILLONITE DATA

Source of Variation	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	F .01
A. Combined clay types					
Among pits	2	50.59	25.29	1.1 NS	30.82
cores	3	85.37	28.46	11.0**	4.51
thirds	12	41.36	3.44	1.7 NS	3.37
sixths	18	36.00	2.00	50.0**	2.28
subsamples	72	2.84	0.04	—	—
B. Pit 1 (soft) Pit 3 (hard)					
Among pits	1	20.59	20.59	3.5 NS	98.49
cores	2	11.70	5.85	4.1*	5.85
thirds	8	12.00	1.50	1.1 NS	4.50
sixths	12	16.62	1.38	3.1**	2.58
subsamples	48	2.17	0.45	—	—
C. Hard type clay pit					
Among cores	1	11.68	11.68	36.5**	10.04
thirds	4	1.28	0.32	1.0 NS	9.15
sixths	6	1.92	0.32	3.2*	3.67
subsamples	24	2.43	0.10	—	—
D. Soft type clay pits					
Among pits	1	49.17	49.17	1.3 NS	98.49
cores	2	73.70	36.85	9.8**	5.85
thirds	8	40.08	5.01	1.7 NS	4.50
sixths	12	35.05	2.92	7.1**	2.58
subsamples	48	2.00	0.41	—	—

** Significant at 0.01 level.
* Significant at 0.05 level.

REFERENCES

Hinckley, D. N. and Bates, T. F. (1960) An x-ray fluorescence method for the quantitative determination of small amounts of montmorillonite in kaolin clays: *Amer. Min.*, v. 45, pp. 239–241.