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CLAYS OF ASSAM AND MEGHALAYA, A PHYSICO-CHEMICAL STUDY

D. PHUKAN, T. KATAKI, G. D. BARUAH AND I. HAQUE
Dibrugarh University, Dibrugarh.

Introduction

Assam and Meghalaya are endowed with large deposits of clay mostly as products of weathering of Archaean, Precambrian and Tertiary rocks. (Fig. 1). This paper outlines the geological occurrence of clays of Assam and Meghalaya and their physical and chemical properties.

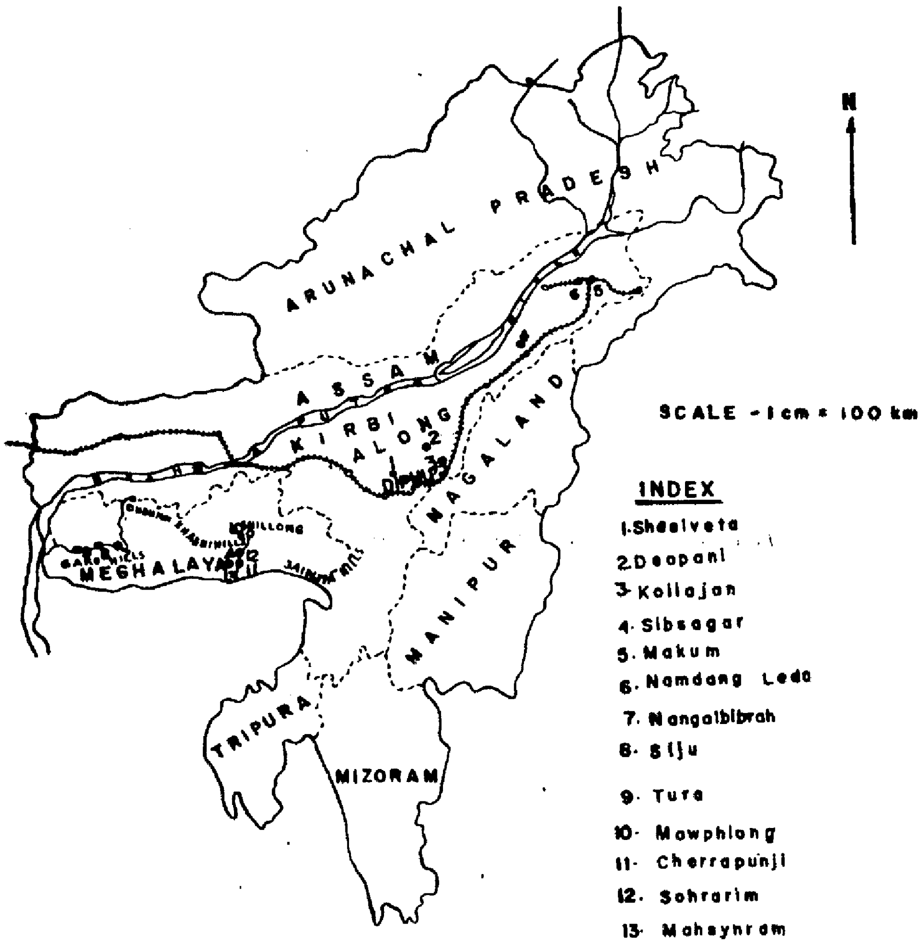


Figure 1. Map of North eastern India showing the locations of clay deposits in Assam and Meghalaya.

Geological Occurrence

Important deposits of clay occur in Sheelveta, Koilajan, Deopani areas of the Karbi Anglong and Makum Namdang areas of Dibrugarh district of Assam. These clays are mainly of two types; kaolin and fire clays in association with coal seams.

Deposits of clay in Meghalaya occur at a number of places. However, notable deposits are formed at Nangwalbibra, Siju, Songgmong, Tura of the Garo Hills and Mawphlong, Cherrapunji and Sohrarim of Khasi and Jaintia Hills. The clays occur as weathering products of granite and at places kaolin is in direct contact with overlying lithomargic clays of sandstone formation. These clays are rather massive hard and white. Fire clays are found in association with coal seams in Sohrarim and Nangwalbibra area.

Experimental

Infrared spectra are recorded in a Carl Zeiss specord IR Grating spectrophotometer in the region 4000 – 2200 Cm in hexachlorobutadine and also in nujol mull using between two KBR windows. The fluorescene spectra are recorded on Q – 24 medium quartz spectrograph using a discharge tube.

Result and Discussion

Table I shows the results of the chemical analysis of some clay samples of Assam and Meghalaya.

TABLE I. Showing chemical composition of clays of Assam and Meghalaya.

Constituents	Sheelveta (1)	Sheelveta (2)	Deopani (1)	Deopani (2)	Nangwal bibra (Fire clay)1 after Kamal *et al* 1979	Siju after Arogyaswamy 1959	Tura Rongram	Rongchee giri	Sohvarim	Mawphlong	Cherrapunji
							(After Chatterjee *et al* 1979)				
SiO_2	42.28	45.08	47.40	42.60	44.32	44.65	44.56	45.0	46.94	49.55	54.4
Al_2O_3	34.21	36.12	32.70	33.56	36.48	36.02	35.45	37.24	37.58	36.97	31.22
Fe_2O_3	3.75	2.24	—	6.00	0.67	0.92	0.92	2.26	1.46	0.43	2.2
TiO_2	2.04	1.62	—	1.90	1.15	3.75	3.27	1.36	0.66	—	0.26
CaO	0.42	0.45	0.48	0.58	0.23	0.65	—	—	—	—	—
MgO	—	—	—	—	—	Trace	—	—	—	—	—
K_2O	0.04	0.04	0.43	0.13	0.16	—	—	—	—	—	—
Na_2O	0.07	0.26	0.17	0.29	0.03		—	—	—	—	—
L.O.I.	14.16	15.20	12.50	14.40	16.76	14.65	14.65	13.70	12.66	12.63	—

Assignment of infrared bands to the different samples are presented in Table II. The absorption bands due to CH stretching vibrations are found at 3700 Cm^{-1}, 3657 cm^{-1} and 3623 cm^{-1} and 3622 cm^{-1} which contain both kaolinite and dickite with perhaps a small proportion of nacrite. Hence, presence of small proportion of nacrite in these samples cannot be ruled out. Moreover in the clay samples weak band is formed at 1620 cm^{-1} which is characteristic of dickite. A doublet in the

TABLE II. Showing intensity and assignment of infrared band.

	Sheelveta	Sheelveta	Sheelveta	Deopani	Assignment Minerals
1.	3700 S(8.5)	3700 S(8.9)	3700 S(8.5)	3697 S(8.1)	kaolinite, dickite
2.	3657 m(5.1)	3652 S(8.4)	3653 S(8.0)	3655 sh(6.3)	kaolinite, dickite
3.	3623 m(6.0)	3624 S(8.4)	3625 S(8.1)	3620 s(6.8)	kaolinite, dickite
4.	1623 w(1.6)	1627 w(1.2)	1627 w, b(1.6)	1627 w(1.3)	dickite
5.	1156 sh(7.2)				kaolinite, dickite
6.	1117 sh(8.3)	1123 s(8.8)	1123 s(10.0)	1120 s(10.4)	kaolinite, dickite
7.	1100 b(8.4)	1100 sh(9.0)	1100 s(10.2)	1100 sh(10.6)	—
8.	1093 sh(8.4)	1093 b(9.1)	1090 b(10.3)	1093 sh(10.6)	—
9.	1030 b(8.8)	1043 sh(10.2)	1040 b(10.9)	1040 b(11.2)	—
10.	1010 sh(8.7)	1017 s(10.0)	1014 b(10.7)	1014 b(11.2)	kaolinite
11.	940 sh(7.2)	943 sh(5.6)	937 sh(8.0)	940 sh(8.9)	—
12.	915 s(7.8)	917 s(7.0)	915 s(9.4)	915 s(10.2)	—
13.	797 sh(5.8)	979 sh(3.6)	793 b(5.0)	797 sh(5.2)	Quartz
14.	780 b(5.7)	780 sh(3.5)	783 sh(4.7)	787 sh(5.3)	—
15.	750 b(5.4)	753 sh(3.7)	750 b(5.7)	750 b(5.8)	Quartz
16.	693 s(6.9)	693 b(5.0)	690 b(7.8)	693 b(8.0)	—
17.	653 sh(5.8)	650 b(3.9)	650 sh(6.6)	646 sh(6.9)	—
18.	600 sh(6.6)	600 sh(4.8)	600 sh(7.8)	600 sh(7.9)	
19.	540 b(8.7)	543 s(3.6)	543 b(10.5)	543 b(10.9)	
20.	506 sh(7.2)	506 sh(6.3)	506 b(10.5)		
21.	467 b(8.8)	475 s(8.3)	473 s(10.2)	470 s(10.6)	

N. B. (The intensities of the band are given in parenthesis.) (m=medium)

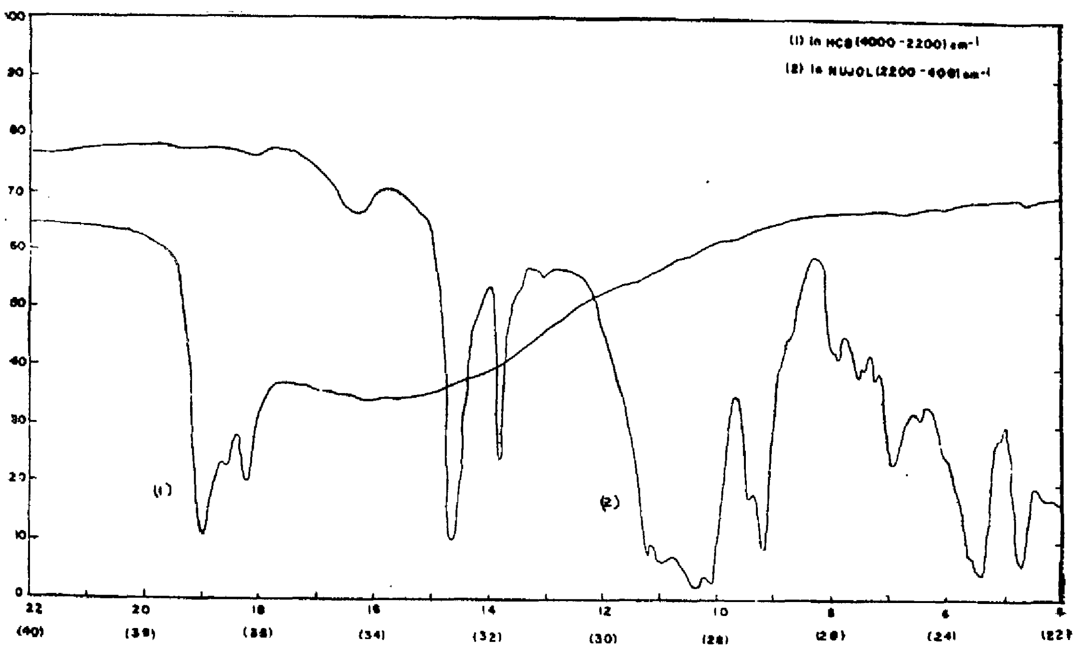


Figure 2. Infrared spectra of clay samples

range of 900 – 950 cm^{-1} and a triplet in the range of 1000 – 1125 cm^{-1} have been observed which are characteristic of kaolinite and dickite (Fig. 2). The absorption bands at 800 cm^{-1} is found to be a doublet at 798 and 779 cm^{-1} which is characteristic for the presence of quartz. The intensity of the band at 3700 cm^{-1} in the samples is found to increase which is perhaps due to the presence of mica, since OH band appears strongly in this region in aluminium and magnesium bearing micas. Moreover in the 3600 – 3700 cm^{-1} range triplets have been observed. The most intense band in this region has been found to be at 3700 cm^{-1} and the intensity gradually decreases towards 3600 cm^{-1} which indicates kaolinite. Thus, it is observed that clay samples are composed predominantly of kaolinite with a small proportion of dickite.

Fig. 3 shows the emission spectra of the clay samples taken from Karbi Anglong District of Assam and the other from Cherrapunji area of Meghalaya. It is

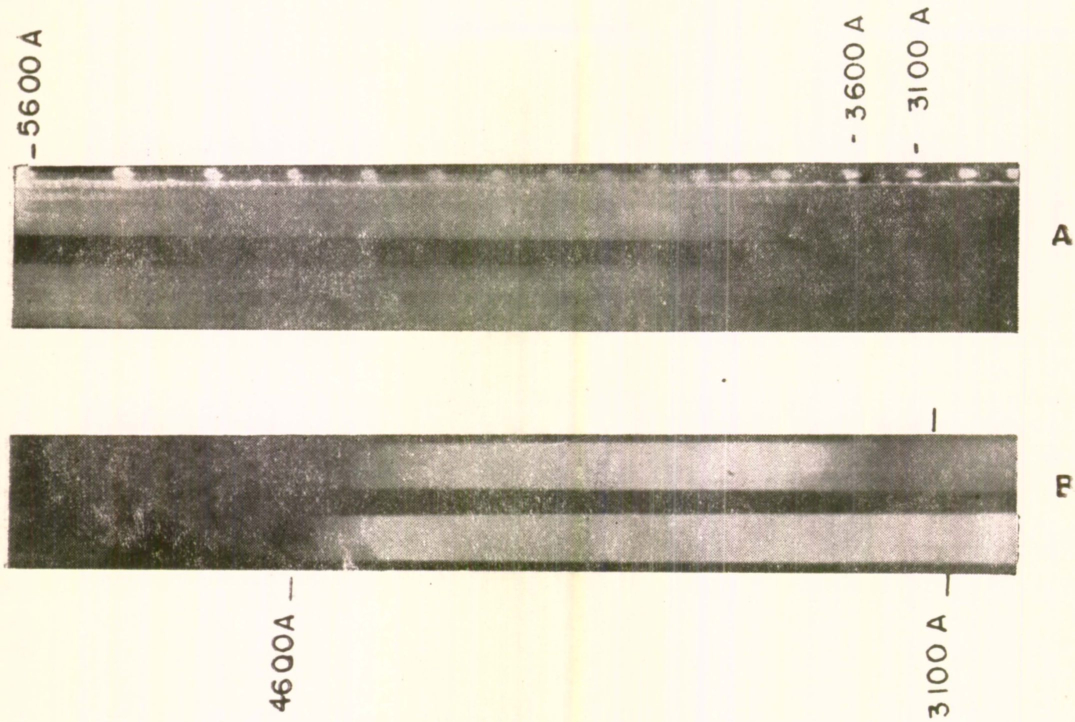
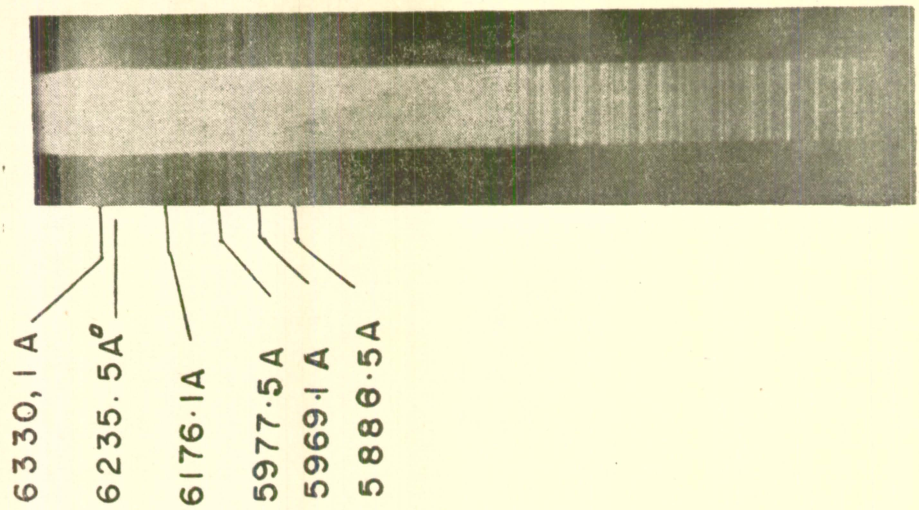


Figure 3. Emission spectra of clay. A. Sohrarim (Meghalaya). B. Karbi – Anglong (Assam).

observed that there is a striking difference between the emission spectra recorded for the two different samples. The emission spectra of clay from Meghalaya lie in the region 4600 – 3100Å. In the ultraviolet side, it is mixed up with the emission spectrum of benzene vapour which usually lies in the region 2600 – 2900Å. The emission spectra of clay from Karbi Anglong District lies in the region of 5600 – 3600Å. The spectra consists of two systems, one in the region 3400 – 4700Å and the other in the region 4800 – 5800Å. The emission spectra in most cases are diffuse and devoid of any structure. The spectrum has also been reported for pure kaolin



Figuree 4. Visible emission spectrum of clay. Photographed on a two prism glass. Spectrograph. (The emission is not identified).

TABLE III. Physical properties of clays of Assam and Meghalaya.

Serial No.	Locality	Plasticity	Field colour	Refractoriness	Linear shrinkage	Liquid limit	Plastic limit
1	Sheelveta (1)	Low plastic	Pale white at 1250°C	No vitrification at 1250°C	4.0% at 110°C 14.0% at 1250°C	20.3%	14.5
2	Sheelveta (2)	Low plastic	Pale white at 1250°C	No vitrification at 1250°C	3.5% at 110°C 13.75% at 1250°C	18.2%	22.4%
3	Deopani (1)	Moderate	Pale white at 1250°C	Little vitrification at 1400°C	—	15.25%	10.0%
4	Deopani (2)	Moderate	—	—	—	10.0%	11.25%
5	Tura Rongran	Low plastic	White to dull white	—	—	n.d.	n.d.
6	Rongchugiri	Low plastic	White to dull white	Little vitrification at 1400°C	—	n.d.	n.d.
7	Sohvarim	Good	White at 1250°C	Vitrification at 1450°C	—	—	—
			Light bluish at 1450°C	No vitrification at 1250°C			
8	Mawphlong	—	White at 1400°C	No vitrification at 1250°C	—	—	—
				Little vitrification at 1400°C			
9	Cherrapunji	Fair	Pinkish cream at 1450°C	High vitrification at 1450°C			

(From 5 to 9 after Chatterjee *et al* 1979) one identical to those observed in the case of clay samples. The spectrum has also been recorded on a large glass spectrograph. As shown in Fig. 4, the visible system of emission in the region 4800 – 600Å shows discrete structure resembling an emission spectra from a diatomic molecule or small polyatomic rediant or molecule.

The physical properties of clays are shown in Table III. Plasticity of the clays varies from low to fair, the fired colour ranges between white to dull white. The clays show no vitrification at 1250°C. However, at 1450°C the clays of Sohrarim and Cherrapunji show vitrification. Shrinkage test shows low shrinkage value. The liquid and plastic limit test performed on clays of Assam show that the former varies from 10.00% to 20.00% and latter from 10.00% to 22.40%.

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References

AROGYASWAMY, R. N. P., (1959) Clay in India. *Bull. Geol. Surv. of India*, no. 29, 220 p.

CHATTERJEE, B. D., JOHNSON, M. M. and DUTTA, S. N., (1977) Exploration of ceramic raw materials of North Eastern Region. *Proceeding volume. All India seminar on Raw materials for glass, ceramic and Refractory industries*, pp. 221-231.

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