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THE AMERICAN MINERALOGIST, VOL. 47, JANUARY-FEBRUARY, 1962

ALLUAUDITE AND CARYINITE

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That alluaudite and caryinite are isostructural was pointed out by Strunz (1960). Using the less oblique $I2_1/a$ cell for alluaudite (Fisher, 1956), the powder data (Fisher, 1955) are indexed as shown in Table 1,

TABLE 1. POWDER PHOTOGRAPH DATA

	Alluaudite					Caryinite		
No.	d_c	d_m	I_s	I_p	*hkl*	*d*	I	*hkl*
1	8.19	8.39–18	3	2–3	110	8.60	1	110
2	6.27	6.37–26	9	8	020	6.59	1	020
—	5.67	- - - - -	0	0	011	6.05	1	011
3	5.47	5.52–45	7	4–6	200			
—	- - -	4.90–88	- - -	½—	- - -	5.10	1	—
—	- - -	4.65–64	- - -	½—	- - -			
—	4.30	4.3–4.2	- - -	½—	$12\bar{1}$	4.54	1	$\bar{1}21$
4*a*,*b*	4.18–14	4.16–12	5, 3	1–3	$21\bar{1}$, 220	4.45	1	$\bar{2}11$
—	3.99	- - - - -	- - -	0	121	4.19	1	121
—	3.91	- - - - -	1	0	130	4.09	1	130
—	3.71	- - - - -	1—	0	211	3.88	1	211
5	3.49	3.51–48	7+	5–7	310	3.69	1	031
			5		031	3.64	1	310
—	- - -	3.35–31	- - -	1—	- - -			
6a	3.17	3.20	1	1—	002	3.39	1	002
—						3.33	1	- -
6*b*	3.13	3.16–11	6	1	040	3.29	2	040
7	3.07	3.09–05	9—	5–8	$11\bar{2}$			$\bar{1}12$
8	3.05	3.055	7	½—	$23\bar{1}$	3.21	1	$\bar{2}31$
9	2.964	2.97	5—	½—	$32\bar{1}$	3.14	2	$\bar{2}02$
10	2.917	2.93	5+	1—	$20\bar{2}$	3.12	1	$\bar{3}21$
11*a*	2.868	2.91–88	7+	1–2	112	3.03	3	112, 022
11*b*	2.849–36	2.86–85	5, 9	1–3	231, 022	2.964	1	231
11*c*	2.760	2.82–77	9	1–3	$14\bar{1}$	2.903	2	$\bar{1}41$
12*a*	2.745–34	2.74	6, 9—	7—	330, 400	2.868	10	330, 240
12*b*	2.715	2.74–72	9	10	240	2.849		400
13	2.696–80	2.71	1—, 5	½—	321, 141	2.810	1	321
14	2.647	2.67–64	7+	1–2	$22\bar{2}$	2.790	2	- - -
15	2.600	2.61	5	1—	202	2.730	2	202

(continued on next page)

Explanation of columns

No. = The number of the line as given in Fisher (1955)

d_c = Calculated spacing assuming $I\ 2_1/a$ with $a = 11.03$, $b = 12.53$, $c = 6.40$, $\beta = 97°34'$ as given in Fisher (1956)

d_m = Measured spacings from Fisher (1955)

I_s = Uncorrected visual intensities estimated from single crystal photographs of the Buranga alluaudite. Those not observed are indicated by a dash.

I_p = Uncorrected visual intensities from Fisher (1955).

Note: the caryinite figures are taken (with minor modifications) from Boström. The 3.14 spacing is a calculated value (with intensity from a Weissenberg photograph), since it was shadowed by a line from the standard.

TABLE 1.—(*continued*)

	Alluaudite					Caryinite		
No.	d_c	d_m	I_s	I_p	*hkl*	*d*	I	*hkl*
16	2.583	2.59	3+	1±	$41\bar{1}$	2.686	5	$13\bar{2}$
17*a*	2.525	2.54–53	---	3–6	$1\bar{3}\bar{2}$			$\bar{4}11, 31\bar{2}$
17*b*	2.517–00	2.52–50	5+, 7+	2–6	$31\bar{2}$, 420	2.659	1	---
—	2.443	2.45	1–	1–	150			
18	2.408	2.42–39	---	1–	132	2.536	2	132
	2.396	2.32–	5, 1–		222, 411			
19	-----			1		2.445	1	411
	2.332	2.35	7		051			
	2.290							
20	----	2.25–	1, 5		$34\bar{1}, 43\bar{1}$			
	----			1–				
	2.225	2.22	–, 1–		$042, 40\bar{2}$	2.363	1	042
	2.210	2.20–	0, –		$312, 33\bar{2}$	2.329	1	$\bar{3}32$
21	-----			1–				
	2.183	2.18	0		$25\bar{1}$			
22	2.160–51	2.17–15	1–, 7	1–3	341, 510	2.258	1	---
	2.135		–, 0		$24\bar{2}$, 251			
23	----	2.097		2–				
	2.096		1+		$42\bar{2}$			
	2.089	2.10–	7, 9		060, 013			
24*a*	----			2–4				
	2.078	2.08	1+		431			
	2.064	2.08–	7, 3		350, 440			
24*b*	-----			1–3				
	2.033	2.06	1–, 1+		$52\bar{1}, 2\bar{1}\bar{3}$			
—	2.015	----	1, –	0	$1\bar{2}\bar{3}$, 242			
	1.998							
	1.980		9		332	2.080	1	$\bar{1}52$
—	----	1.98		1–				
	1.966		–, 1–		$1\bar{5}\bar{2}, 16\bar{1}$,	2.072	1	332
25*a*	1.951–44	1.96–94	7, 5	1–3	260, 402			
	1.937	1.94–	0, 7+		161, 530			
25*b*	-----			1–3				
	1.929	1.92	3		123			
26	1.908–02	1.92–90	–, 1+	1–	$152, \bar{5}12$	2.010	1	152
—	1.886	-----	1–, 3	0	521, 033			
	1.869	1.87–	1, 1+		$213, \bar{3}\bar{2}3$			
27	-----			1–				
	1.853	1.85	5+		422			
	1.848	1.84–	0, 0		$2\bar{3}\bar{3}$, 600			
28	-----			1–2				
	1.817	1.83	9		$45\bar{1}$			
—	1.813	1.818	--	2–	$44\bar{2}$	1.925	1	$\bar{4}42$
29	1.795–93	1.81–79	7+, –	2–	$61\bar{1}, 35\bar{2}$	1.900	1	--
—	1.775	---	1, 0	0	$41\bar{3}, 54\bar{1}$			
	1.773	---	0		$36\bar{1}$			
30*a*	1.767–61	1.78–76	1–, –	1–	$170, 1\bar{4}\bar{3}$	1.877	1	--
30*b*	1.748	1.76–	7, 1–	2±	$53\bar{2}$, 620	1.849	1	$\bar{5}32$
	1.746	1.74	–		062			
31	1.730	1.74–	0, 7	1±	451, 071	1.841	1	--
	1.722	1.72	–		233			
—	1.711	--	1	0	361			
	1.700	--	–, –		$143, 26\bar{2}$			
—	1.680	1.678	1, 1	½–	$60\bar{2}$, 512	1.801	1	$\bar{6}02$?
	1.674		0		611			
	1.674	1.66–	5, 3		$541, 35\bar{2}$			
32	----		5, 3	2–	$323, 63\bar{1}$	1.748	1	323?
	1.660	1.65	1–		$27\bar{1}$			
—	1.653	--	--	0	$34\bar{3}$	1.730	1	--
—	1.649	--	3, 9	0	$43\bar{3}$, 442			
	1.647		1–		460			
33	1.646	1.63–	5, 0	1	$550, 26\bar{2}$	1.714	1	550
	1.622	1.62	0, 5		$271, 62\bar{2}$			
34*a*	1.616–07	1.60–59	–, 7	1±	$053, 3\bar{7}\bar{0}$			
34*b*	1.593	1.593	3, –	1–	$1\bar{1}\bar{4}, 2\bar{5}\bar{3}$	1.699	1	004
	1.592					1.666	1	---
35	1.586	1.58	9, 5–,	3–5	$20\bar{4}, 004, 52\bar{3}$	1.641	1	$532, \bar{1}72$
	1.567	1.57	5+9, 9		640, 080			$080, \bar{2}24$
36		1.549–45		1–2		1.610?	1	172
37		1.533–26		2		1.558	1	$\bar{4}71$
38		1.517–09		1–2		1.551	1	602
39		1.498–83		1–3		1.540	1	$\bar{3}34$
40		1.471–68		2		1.536	1	---
		1.459		½	$40\bar{4}$	1.522	1	224, 730
41		1.450–32		½–2		1.507	1	471
42		1.418–09		1–2		1.491	1	---
—		1.384		---		1.435	1	570, 372
								381, 642
						(Six more lines)		

which also gives intensities observed on single crystal photographs. These correspond very well with the spacing and indexing for caryinite as given by Boström (1958). These are added to the last three columns of the table for comparison.

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THE AMERICAN MINERALOGIST, VOL. 47, JANUARY-FEBRUARY, 1962

ADSORPTION OF DYES BY CLAY MINERALS

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INTRODUCTION

Recent investigations on clay-organic complexes have led to the discovery of several commercial clay products (Grim, 1960). Adsorption study of organic compounds provides a rapid method of studying cation exchange, surface area and mineralogical composition of clay minerals (Faust, 1940; Grim, 1953; Hauser, 1955; MacEwan, 1948; Mackenzie, 1948; Bradley, 1945; Emodi, 1949; Bossazza, 1944; Ramachandran, Kacker and Patwardhan, 1961; Ramachandran, Garg and Kacker, 1961).

Much of the work on clay-organic complexes pertains to reactions between montmorillonite and halloysite and various organic compounds. Hendricks (1941) and Grim *et al.* (1947) found that small organic molecules replace the exchangeable cations on montmorillonite quantitatively, but with larger molecules the exchange is incomplete due to the "cover up effect."

In general the cation exchange capacity (CEC) values of clay minerals obtained by methylene blue adsorption are far less than those obtained by other standard methods (Worall, 1958; White and Cowan, 1960; Robertson and Ward, 1951). Much discrepancy is reported between surface areas calculated by methylene blue adsorption and B.E.T. methods (Kipling and Wilson, 1960).

In spite of a large amount of work there is still confusion about the exact mechanism involved in the adsorption of dyes by clay minerals. This note discusses the studies on adsorption of three basic organic dyes, *viz.*, malachite green (MG), methylene blue (MB) and methyl violet B