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PALERMO "HÜHNERKOBELITE" IS ALLUAUDITE

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The crystals figured and described by Dr. Moore in the current issue of this journal cannot properly be called *hühnerkobelite*. This name was given to material from Hühnerkobel, Bavaria by Lindberg in 1950 on the basis of *x*-ray powder diffraction data which showed that it was different from type arrojadite and similar to the material from Norrö, Sweden and to some varulites. Lindberg's work was valuable in helping to clear up some confusion, but a new mineral name should not have been suggested on the basis of such scanty data. Nevertheless, the name was enshrined in Danas' System (1951) where it was said to be "probably orthorhombic."

At this time alluaudite (described from Chanteloube, France by Damour in 1848) was not a well-defined species, though it had long been given species rank in Dana, and had been described from Varuträsk, Sweden in 1937 by Quensel. When I gave the first modern optical and *x*-ray description of alluaudite (Fisher, 1955), it soon became obvious that hühnerkobelite, varulite and hagendorfite were of the alluaudite type, and this was made clear in print (Fisher, 1957). The similarity in optical properties was pointed out in this note. Thoreau in 1954 indicated the close relation between the *x*-ray powder pictures of varulite and the Buranga alluaudite.

Herewith in Table 1 sufficient powder diffraction data are given to establish that we are dealing with a single isomorphous series. In particular the near-identity of E and G are enough to identify the Palermo material as alluaudite. In my 1955 paper I used the $C2/c$ orientation for indexing the mineral; in my 1957 paper I changed this to the $I2_1/a$ orientation of this same space group for reasons stated, and my 1962 note has the indexing in this orientation.

When I looked over Moore's manuscript, I pointed out that hühnerkobelite was a discredited name. At that time chemical analytical results on the Palermo material were not available. The data now in Moore's paper make clear that the Palermo mineral fits in my triangular diagram (Fisher, 1957) just "southwest" of no. 1 (the Norrö alluaudite), and a long way from no. 12 (type hühnerkobelite). As for nomenclature in this series, I prefer to stick to the designations given in my table headings

(Fisher, 1957). Many more data on the composition of the alluaudites appear in a paper currently in press (Fisher, 1965).

Just as the name *hühnerkobelite* should be dropped from the literature, it is my opinion that *hagendorfite* too should suffer this fate. This name was assigned by Strunz in 1954 to "a member of the hühnerkobelite-varulite series" which he considered to be "apparently triclinic, but pseudo-orthorhombic." The Strunz description was otherwise quite satisfactory; however, when he sent me a sample for single crystal work (Fisher, 1956) it became clear that it also was monoclinic alluaudite.

The relations of these minerals to one another so far as is known is shown in my triangular diagram (Fisher, 1957). Unfortunately the analyses of the Chanteloube and Buranga alluaudites do not give the amount of FeO (if any) which is present. It is clear from this diagram that if one wishes to give a different mineral name to material falling in each of the three quadrilaterals, the term *varulite* has priority over *hagendorfite*.

TABLE 1. A.S.T.M. CARDS ON ALLUAUDITES

	No.		Lines with visually estimated 1/1					Locality
A	6-0482	2.72/10	6.30/5	3.08/2	2.53/3	5.44/2	3.49/3	Hühnerkobel
B	6-0483	2.72/10	6.33/5	3.08/1	2.51/1	5.47/2	3.50/4	Skrumpetorp
C	6-0487	2.74/10	6.35/3	3.08/1	2.56/4	5.46/3	3.50/4	Varuträsk
D	6-0492	2.71/10	6.26/5	3.12/3	2.53/6	5.44/3	3.48/5	Norrö
E	10-419	2.73/10	6.27/8−	3.07/7	2.51/7−	5.47/6−	3.49/6−	Chanteloube
F	12-25	2.69/10	6.11/5	3.08/5	2.59/8−	5.33/3−	3.42/6	Hagendorf
G	—	2.703/10	6.24/7	3.085/6−	2.531/5	5.41/5	3.465/2	Palermo
	(hkl)	$14\bar{1}$	020	040	$13\bar{2}$	200	310,031	
	(hkl)	330,400		$11\bar{2}$	$31\bar{2}$,420			
	(hkl)	240		$23\bar{1}$				
	Line No.	11c, 12a, b	2	6b, 7, 8	17a, b	3	5	(Fisher, 1955, 1962)

Notes. A, B, C and D are from Lindberg (1950) who called B and C *varulite* and A and D *hühnerkobelite*. For A, lines of 16.06/1 and 8.76/6 were also given. The only indexed card (before G) is E from Fisher (1955), who recognized the material as *alluaudite*. F is from Strunz (1954) who called the mineral *hagendorfite*. G is from Moore (1965) who gave the name *hühnerkobelite*. The order of listing of lines is that of decreasing intensities as given for E. The indices given are for the $I2_1/a$ cell.

I have recently completed a diffractometer study of two alluaudites. The results are shown in Table 2. With such complicated material, the basic noise level was fairly high and many of the "peaks" were not very sharp. For this reason the intensities given are of the integrated type, based on counts or on planimeter readings, and not on peak heights, and the 2ϕ (Fe/Mn) values used to compute the spacings were mostly not much better than ±0.05°. However the results are of considerable interest, for they show how quite different powder pictures may be obtained from isomorphous compounds of this complexity. For instance the most intense peak of the Hagendorf material at $d=2.73$ comes from two planes

TABLE 2. DIFFRACTOMETER RESULTS WITH ALLUAUDITES

Line No.	Buranga				hkl	Hagendorf			
	I_s	d		I_d		I_s	d		I_d
		Calculated	Observed				Calculated	Observed	
1	3	8.2746	8.278	18	110	2	8.2502	—	—
2	9	6.2622	6.267	53	020	7	6.2970	6.292	55
3	7	5.5112	5.472	33	200	6	5.4627	5.429	12
4a^1	?	4.2869	4.260	12	$12\bar{1}$	3	4.3308	—	v.w.
4a	5	4.2546	4.184	12	$21\bar{1}$	4	4.2398	4.208	w.
4b	3	4.1372	4.125	10	220	2	4.1252	—	v.w.
4c	1−	3.7483	—	—	211	1+	3.7468	3.681	20
5a	7+	3.5258	3.503	35	310	8	3.4986	3.480	25
5b	5	3.4966			031	4	3.5264	3.517	w.
6b	6	3.1311	3.063	100	040	4	3.1464	3.110	57
7	9−	3.0890			$11\bar{2}$	10	3.1424		
8	7	3.0536			$23\bar{1}$	7	3.0699	3.059	9
9	5−	2.9775	2.914	13	$32\bar{1}$	2	2.9831	2.954	22
10	5+	2.9404			$20\bar{2}$	9	2.9846		
11a	7+	2.8819	2.871	55	112	9	2.9252	2.900	43
11b	5	2.8609			231	4	2.8663	2.868	19
11b^1	9	2.8494	2.833	26	022	6	2.8914		
11c	9	2.7638	2.758	22	$14\bar{1}$	10	2.7834	2.777	35
12a	6	2.7582			330	5	2.7502		
12a^1	9−	2.7556	2.736	32	400	9	2.7314	2.721	100
12b	9	2.7224	2.721	57	240	10	2.7265		
13	5	2.6882	2.645	8	141	4	2.7028	2.701	30
14	7+	2.6617			$22\bar{2}$	6	2.6967	2.674	16
15	5	2.6214	2.602	15	202	8	2.6398	2.619	13
17a	?	2.5335	2.518	39	$13\bar{2}$	9	2.5671	2.549	44
17b	5+	2.5341			$31\bar{2}$	8	2.5595	2.536	35
17b^1	7+	2.5222			420	7	2.5056	2.519	24
19a	5	2.4183	2.400	v.w.	222	4	2.4360	2.418	w
19c	7	2.3326			051	5	2.3491		

I_s = Uncorrected intensities estimated visually from single crystal photographs.
I_d = Diffractometer intensities (*w* = weak; *v.w.* = very weak).
Calculated spacings are based on unit cells in Fisher, 1956.

Taple 2 (*continued*)

Line No.	Buranga				hkl	Hagendorf			
	I_s	d		I_d		I_s	d		I_d
		Calculated	Observed				Calculated	Observed	
21b	?	2.1995	2.182	v.w.	$33\bar{2}$	5	2.2187	2.204	9
22b	7	2.1712	2.155	5±	510	7	2.1543	2.138	20
$24a^1$	9	2.1030	2.086	58	013	9	2.1401	2.117	26
24a	7	2.0874			060	6	2.0990	2.099	12
24b	7	2.0696			350	7	2.0706	2.066	8
24c	9	1.9940			332	7	2.0000	1.989	10
25a	5	1.9641			402	5	1.9625	1.958	7
$25a^1$	7	1.9521			260	6	1.9595		
25b	7+	1.9494			530	5	1.9380		
26	?	1.9148			152	4+	1.9302	1.925	6
28a	9	1.8241			$45\bar{1}$	6	1.8263	1.841	28
28b	?	1.8212			$44\bar{2}$	3	1.8313		
29a	7+	1.8116			$61\bar{1}$	7	1.8017	1.820	w.
29b	1	1.7886			$41\bar{3}$	3	1.8082	1.784	6
30a	?	1.7711			$14\bar{3}$	7	1.7961	1.751	11
30b	7	1.7583			$53\bar{2}$	8	1.7635		
$30b^1$	?	1.7483			062	7 –	1.7644		
31	7	1.7232			071	6	1.7330		
32a	5	1.6882			541	5	1.6818	1.701	6
$32a^1$	5	1.6833			323	5	1.6948		
32b	9	1.6639			442	8	1.6655	1.656	8
33a	5	1.6549			550	3	1.6512		
$33a^1$	5	1.6337			$62\bar{2}$	4	1.6344		
34a	?	1.6241			053	6	1.6448		
$34a^1$	7	1.6086			370	4	1.6133	1.606	4
34b	3	1.6006	1.580	9	$11\bar{4}$	3	1.6297		
$34b^1$	5 –	1.5999			004	0	1.6288		
35a	9	1.5923			$20\bar{4}$	9	1.6228		
$34b^{11}$	?	1.6020			$25\bar{3}$	7	1.6216		
35b	5+	1.5911			$52\bar{3}$	4	1.6045	1.602	9
36a	9	1.5845	1.577?	13	640	8	1.5771	1.566	7
$36a^1$	9	1.5656			080	5	1.5743		
37	?	1.5623							
					710	5	1.5489	1.541	14
	?	1.5097			602	8	1.5028		

(400 and 240) that are not sharply separated in d values, as they are in the case of the Buranga sample. In the latter the most intense peak is at d = 3.09 coming from three planes (040, $11\bar{2}$, $23\bar{1}$); diffraction from these appears as two separate peaks on the chart from the Hagendorf sample. Similarly single peaks from planes numbers 17 and 24 for the Buranga sample each appears as triple peaks from the Hagendorf material. Many peaks representing spacings less than 2.00 that could not be distinguished from background on the Buranga chart were significant on the Hagendorf record.

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REPLY TO PROF. D. J. FISHER

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I welcome Prof. Fisher's note; it emphasizes the continuing problem of nomenclature of the orthophosphates of manganese and iron. I have explicitly employed the name *hühnerkobelite* (= Fisher's ferroan-alluaudite) in consonance with its use in Palache *et al.* (1951) and as implied by the given composition in Strunz (1957). In particular, I feel that Palache *et al.* (1951) shall continue to be the most frequently used source of mineral nomenclature and I shall strive, at least where applicable, to use their proposed terminology.

In Table 1 of Fisher (above), note that "G," Palermo hühnerkobelite,