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Chavesite discredited

Anthony R. Kampf
Mineralogy Section, Natural History Museum of Los Angeles County, 900 Exposition Boulevard, Los Angeles, California 90007, U.S.A.

Pete J. Dunn
Department of Mineral Sciences, Smithsonian Institution, Washington, DC 20560, U.S.A.

Abstract

The mineral described as chavesite by Murdoch (1958) is identical to monetite. Chavesite is discredited as a distinct mineral species.

Discussion

The new mineral chavesite was described in 1958 by Joseph Murdoch in a paper reporting on the phosphate minerals of the Boqueirão pegmatite near the town of Parelhas, Rio Grande do Norte, Brazil. The description in its entirety is as follows (Murdoch, 1958, p. 1154):

> One specimen of lithiophilite shows, on fracture surfaces with huréaulite and tavorite, an intermittent thin colorless crystalline coating which sometimes shows poorly formed individual crystals. This appears to be a new mineral, tentatively named "chavesite" (pronounced shav-ez-ite), after Dr. Onofre Chaves, an engineer of the Brazilian Departmento National da Producão Mineral. It is a hydrated calcium manganese phosphate, but not enough material is available for a chemical analysis. Hardness is near 3, cleavages, two good, in the prism zone, and nearly perpendicular to each other. Optically, biaxial positive, with $2V$ large, and indices α 1.60, β 1.62, γ 1.65. Multiple twinning, with twin plane parallel to elongation of crystals. Extinction about 30° to the twin plane. A cleavage sliver which proved to be a single individual was used to determine the symmetry and cell dimensions. Rotation, and Weissenberg equator, first and second layer lines about c show it to be triclinic with the following values:
>
> $a_0 = 5.49$ $b_0 = 13.07$ $c_0 = 5.79$
> α 91°18½′ β 108°3′ γ 99°44′
> λ 84°58′ μ 71°20′ ν 78°00′ $x'_0 = 0.325$ $y'_0 = 0.093$
> $a:b:c = 1.4200:1:0.4438$
>
> The powder pattern (see Table 3) [column 1, Table 1, this study] closely resembles that of monetite and it has been suggested (Mrose, priv. commun.) that chavesite and monetite may be isostructural. The X-ray powder pattern can be adequately indexed using the above values for the elements.

The original material studied by Murdoch was obtained from the Department of Earth and Space Sciences of the University of California at Los Angeles. In a locked cabinet containing a portion of Murdoch's old research material, several specimens and three mounted crystals were found labeled "chavesite" from "Boqueirão" in Murdoch's own hand. These matched the physical description given above and can reasonably be assumed to be the type specimens of chavesite.

A Gandolfi 114.6-mm X-ray film of the chavesite was compared with one obtained from monetite from Mona Island, Puerto Rico (NMNH no. 128714). In each case, multiple crystal fragments were used to maximize randomization of crystal orientation. The films were found to coincide in every detail. The powder diffraction data for chavesite reported by Murdoch are provided in Table 1, along with the powder data for chavesite obtained in this study and the powder pattern of monetite calculated from the structure data of Catti et al. (1977). The discrepancies between the chavesite patterns could in part be the result of preferred orientation, grinding effects, or contamination in Murdoch's sample. The cell parameters for chavesite refined from our powder data with monetite indexing are $a = 6.921(5)$, $b = 6.643(6)$, $c = 6.988(7)$ Å, $\alpha = 96.25(5)$, $\beta = 103.87(6)$, $\gamma = 88.32(6)$°. These are very similar to those determined for monetite by Catti et al. (1977), $a = 6.910(1)$, $b = 6.627(2)$, $c = 6.998(2)$ Å, $\alpha = 96.34(2)$, $\beta = 103.82(2)$, $\gamma = 88.33(2)$°.

Precession X-ray films for chavesite and monetite were also found to be identical. One of Murdoch's crystals of chavesite, still mounted on its original spindle, was used in the precession study. This crystal proved to be a single individual and probably corresponds to the "cleavage sliver" used in Murdoch's determination of the symmetry and cell dimensions. A newly mounted crystal taken from one of Murdoch's specimens yielded similar precession patterns. The cell parameters reported by Murdoch could not be duplicated in the precession study nor could any way be found to derive them from the monetite cell. We must assume that Murdoch was in error in his interpretation of the Weissenberg films.

A chavesite crystal from one of the type specimens was subjected to electron microprobe analysis, yielding CaO

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Table 1. X-ray powder data for chavesite and monetite

Chavesite				Monetite (calc**)		
Murdoch		This study*				
I	*d*	*I*	*d*	*I*	*d*	*hkl*
10	6.33	10	6.75	10	6.757	001
5	5.03	2	5.05	3	4.990	$0\bar{1}1$
5	4.56					
5	4.35	2	4.36	2	4.394	$\bar{1}11$
				3	4.280	101
5	3.89	1	4.08	3	4.028	$\bar{1}11$
10	3.69	2	3.72	1	3.702	$1\bar{1}1$
5	3.54					
5	3.48	3	3.48	7	3.486	111
				52	3.378	002
100	3.35	80	3.366	45	3.355	200
				5	3.354	$\bar{1}02$
				18	3.337	$\bar{2}01$
5	3.24	1	3.317	5	3.293	020
5	3.18					
5	3.13	10	3.129	15	3.127	$\bar{1}12$
5	3.076?			3	3.093	$0\bar{2}1$
20	3.023					
				34	2.960	120
30	2.945	100	2.961	41	2.953	$1\bar{2}0$
				25	2.936	$\bar{1}21$
				3	2.912	$\bar{2}11$
5	2.87	1	2.896	5	2.884	012
				2	2.867	$\bar{1}12$
5	2.81					
20	2.74	10	2.760	10	2.765	102
				18	2.756	$\bar{2}01$
20	2.72	20	2.728	28	2.726	$\bar{2}02$
				6	2.715	$\bar{1}21$
5	2.66					
5	2.63	1	2.601	1	2.580	$2\bar{1}1$
5	2.56			2	2.531	121
10	2.489	15	2.496	14	2.495	$0\bar{2}2$
		1	2.342	1	2.347	$2\bar{2}0$
10	2.305	5	2.302	6	2.307	$\bar{1}03$
				12	2.252	003
30	2.23	20	2.246	4	2.242	$0\bar{2}2$
				8	2.233	$\bar{1}22$
				4	2.214	$1\bar{2}2$
10	2.198	10	2.202	5	2.204	$0\bar{1}3$
				6	2.195	030
5	2.155	7	2.159	9	2.157	$0\bar{3}1$
5	2.124	1	2.132	5	2.139	$3\bar{1}1$
				4	2.120	310
10	2.087	1	2.099	4	2.088	130
				3	2.072	221
10	2.034	2	2.038	5	2.033	122
10	1.978	4	1.998	4	1.997	212
				4	1.987	301
		1	1.959	1	1.959	$0\bar{2}3$
				1	1.958	$\bar{2}13$
20	1.918	30	1.918	15	1.916	$3\bar{2}1$
		2	1.868	5	1.869	$\bar{2}23$
				6	1.851	$2\bar{2}2$
20	1.85	30	1.852	15	1.848	$3\bar{2}0$
20	1.79	5	1.799	6	1.798	$\bar{1}23$
				4	1.793	$3\bar{1}3$
5	1.75	4	1.755	4	1.753	$\bar{1}32$
				3	1.739	$\bar{1}04$
				4	1.729	$\bar{1}14$
30	1.725	35	1.728	6	1.727	$4\bar{0}1$
				6	1.724	$3\bar{2}1$
				13	1.723	$3\bar{2}2$
				5	1.693	203
10	1.685	4	1.691	5	1.684	231
				5	1.680	$3\bar{2}1$
				4	1.668	$4\bar{0}2$
5	1.657	2	1.657	3	1.663	$0\bar{3}3$
				4	1.654	$3\bar{2}3$
		2	1.643	5	1.641	123

* Obtained with 114.6-mm Gandolfi camera, Cu$K\alpha$, Ni-filtered radiation (λ = 1.54178 Å), visually estimated intensities.

** Calculated from the structure data of Catti et al. (1977). Calculated lines for which $I < 3$ have not been included unless they correspond to observed lines.

39.6, MnO 0.6, FeO 0.2, P_2O_5 50.3. This compares reasonably well with the theoretical composition of monetite, CaO 41.22, P_2O_5 52.16, H_2O 6.62. The Mn noted by Murdoch was apparently determined by a qualitative test. The small amount of MnO in the material could have provided a positive microchemical test, or his sample may have been contaminated by lithiophilite or huréaulite.

The obvious conclusion from the foregoing is that chavesite is identical to monetite. The Commission on New Minerals and New Mineral Names, IMA has approved the discreditation of chavesite as a distinct mineral species. The original type material is now deposited in the Natural History Museum of Los Angeles County under catalog numbers 38919–38925.

References cited

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