THE AMERICAN MINERALOGIST, VOL. 49, SEPTEMBER-OCTOBER, 1964

X-RAY POWDER DATA FOR TEINEITE AND CHALCOMENITE

J. A. MANDARINO, *Department of Mineralogy, Royal Ontario Museum, University of Toronto, Toronto, Ontario.*

Teineite was described by Yosimura (1939) as a new copper tellurate with the formula 10 $CuTeO_4 \cdot 3\ CuSO_4 \cdot 26\ H_2O$. More recently, Palache *et al.* (1951) pointed out that this formula can be written also as $Cu[(Te, S)O_4] \cdot 2H_2O$. Zemann and Zemann (1960) showed that the space group and unit cell parameters of teineite resembled those of chalcomenite ($CuSeO_3 \cdot 2H_2O$), and they suggested that teineite is really the tellurium analogue of chalcomenite. They proved this when they worked out the structure of teineite (Zemann and Zemann, 1962).

The *x*-ray powder patterns of teineite and chalcomenite bear out their close structural relationship. Table 1 shows the data obtained from these

TABLE 1. X-RAY POWDER DATA FOR TEINEITE AND CHALCOMENITE, Camera diameter: 114.6 mm, Radiation: $CuK\alpha$

Teineite (U.S.N.M. No. 103196) Teine mine, Hokkaido, Japan				Chalcomenite (R.O.M. No. M21874) Eagle Shaft Area, Eldorado Mining and Refining Company, near Uranium City, Saskatchewan, Canada			
hkl	d(calc.)	d(obs)	I(est)	hkl	d(calc.)	d(obs)	I(est)
011	5.881	5.87	6	011	5.757	5.76	3
110	5.458	5.45	9 brd	110	5.399	5.39	10
101	4.948	4.96	6 brd	101	4.950	4.94	9
020	4.808			020	4.596		
111	4.399	4.39	5	111	4.358	4.35	2
021	4.037	4.01	1	021	3.903	3.88	1
120	3.893	3.89	4	120	3.785	3.77	7
002	3.716	3.70	3	002	3.692		
012	3.467 }	3.45	10	012	3.425	3.42	5
121	3.449 }			121	3.370 }	3.35	8
200	3.315	3.31	2	200	3.336 }		
102	3.242	3.23	2	102	3.231	3.23	1
210	3.134	3.13	2	210	3.136		
112	3.072	3.06	8	112	3.048 }	3.04	7
201	3.028	3.01	½	201	3.040 }		
031	2.943 }	2.94	7	211	2.886	2.883	6
022	2.940 }			022	2.878		

TABLE 1—(*continued*)

Teineite (U.S.N.M. No. 103196) Teine mine, Hokkaido, Japan				(Chalcomenite (R.O.M. No. M21874) Eagle Shaft Area, Eldorado Mining and Refining Company, near Uranium City, Saskatchewan, Canada			
hkl	d(calc.)	d(obs)	I(est)	hkl	d(calc.)	d(obs)	I(est)
211	2.888	2.880	7	031	2.831	2.822	5
130	2.886			130	2.784		
220	2.729	2.731	2	220	2.700	2.692	1
131	2.690			122	2.643	2.640	1
122	2.688	2.683	3	131	2.605		
221	2.562	2.560	4	221	2.535	2.528	7
202	2.474	2.469	3	202	2.475	2.470	2
032	2.427			212	2.390		
040	2.404			013	2.378	2.381	3
013	2.399			032	2.358		
212	2.396	2.392	7	103	2.309		
103	2.321			040	2.298	2.289	2
230	2.304			230	2.257		
041	2.287			113	2.240		
132	2.279	2.271	½	132	2.223		
140	2.260			041	2.194		
113	2.256	2.252	½	222	2.179		
023	2.202			140	2.173		
231	2.201	2.199	4	023	2.170		
222	2.200			310	2.161	2.161	6
141	2.162	2.157	4	231	2.158		
310	2.154			301	2.129		
301	2.118			141	2.085		
123	2.090	2.084	6	311	2.074	2.068	3 doub.
311	2.069	2.069	½	123	2.063		
042	2.018			320	2.002	1.997	4
320	2.008	2.008	6	203	1.980		
203	1.984	1.982	½	042	1.951		
033	1.960			213	1.936		
232	1.958	1.957	4	321	1.932		
240	1.946			232	1.926	1.920	1
213	1.944			033	1.905		
321	1.939	1.938	2	302	1.905		
142	1.931			240	1.893		
302	1.900			142	1.873		
241	1.882			312	1.865	1.865	2
133	1.880	1.877		004	1.846		
312	1.863		2	133	1.844	1.838	3
051	1.862	to	diffuse	241	1.833		
004	1.858		band	223	1.819		
150	1.847	1.844		014	1.810		

TABLE 1—(*continued*)

Teineite (U.S.N.M. No. 103196) Teine mine, Hokkaido, Japan				Chalcomenite (R.O.M. No. M21874) Eagle Shaft Area, Eldorado Mining and Refining Company, near Uranium City, Saskatchewan, Canada			
hkl	d(calc.)	d(obs)	I(est)	hkl	d(calc.)	d(obs)	I(est)
223	1.834			330	1.800	1.797	1
014	1.824	1.821	2	051	1.784		
330	1.819			104	1.779	1.775	1
151	1.792			150	1.773		
104	1.789	1.787	2	322	1.760		
322	1.767			331	1.749		
331	1.767			114	1.747	1.744	2
114	1.759	1.759	4 brd	151	1.724		
024	1.733			024	1.713		
043	1.725	1.723	5	242	1.684		
242	1.724			043	1.680	1.680	3
052	1.708			400	1.668	1.666	1
233	1.687	1.685	2	233	1.663		
124	1.677			124	1.659		
143	1.670			303	1.650		
250	1.663	1.664	2 diff.	052	1.646		
400	1.658			410	1.641		
152	1.654	1.651	4 diff.	143	1.629		
303	1.649			401	1.627		
332	1.634			313	1.624	1.624	3
410	1.633			332	1.618		
340	1.627			204	1.615		
313	1.625	1.622	4 brd	250	1.610		
251	1.623			411	1.602		
204	1.621			152	1.598		
401	1.618			340	1.598		
034	1.607			214	1.591	1.589	3
060	1.602	1.599	3	034	1.581		
214	1.598			251	1.573		
411	1.595			420	1.568		
341	1.589			341	1.562		
061	1.567			323	1.553	1.551	1
420	1.567			134	1.539		
134	1.562			421	1.534		
323	1.560	1.560	4	060	1.532		
160	1.558			224	1.524		
224	1.536			402	1.520		
421	1.533			061	1.500		
243	1.530			243	1.500		
161	1.525			412	1.499	1.497	2
053	1.519	1.521	4 brd	160	1.493		

TABLE 1—(*continued*)

Teineite (U.S.N.M. No. 103196) Teine mine, Hokkaido, Japan				(Chalcomenite (R.O.M. No. M21874) Eagle Shaft Area, Eldorado Mining and Refining Company, near Uranium City, Saskatchewan, Canada			
hkl	d(calc.)	d(obs)	I(est)	hkl	d(calc.)	d(obs)	I(est)
252	1.518			252	1.476		
402	1.514			053	1.473		
412	1.495	1.495	2	342	1.467		
342	1.490			430	1.465		
153	1.481			161	1.464		
430	1.472			015	1.458	1.458	1 brd
062	1.471			333	1.453		
044	1.470			422	1.443		
015	1.469	1.467	4	105	1.442		
333	1.466			044	1.439		
105	1.451			153	1.438		
350	1.451			431	1.437	1.435	1
234	1.446	1.447	4	234	1.429		
422	1.444			115	1.425	1.424	1
431	1.444			304	1.420		
260	1.443			350	1.417		
162	1.437			062	1.415		
144	1.435			144	1.407		
115	1.434	1.433	2	025	1.406		
351	1.424			314	1.404	1.403	1
304	1.422	1.422	1	260	1.392 }	1.389	1
025	1.420			351	1.392 }		
261	1.416			162	1.384		
314	1.407	1.407	½	403	1.381		
125	1.389	1.388	2 brd	125	1.376		
253	1.381			261	1.368		
403	1.378			413	1.365		
432	1.369			432	1.362 }	1.360	1 brd
440	1.365 }			324	1.357 }		
324	1.364 }	1.365	4	205	1.350		
413	1.364 }			440	1.350		
343	1.360			253	1.347		
205	1.356			343	1.340	1.335	½
071	1.351					1.320	1
352	1.351					1.299	1 brd
035	1.349					1.275	½
063	1.346 }					1.259	1
170	1.345 }					1.241	1
262	1.345 }	1.345	4				
244	1.344 }						
441	1.342						

two minerals. All d-spacings (permitted by the space group) down to d=1.340 Å were calculated using the cell parameters of Zemann and Zemann (1960) for teineite and those of Gattow (1958) for chalcomenite.

Mr. Paul Desautels of the United States National Museum kindly supplied a crystal of teineite (U.S.N.M. No. 103196) for this study.

REFERENCES

GATTOW, G. (1958) Die Kristallstruktur von $CuSeO_3 \cdot 2H_2O$, Chalkomenit. *Acta Cryst.* **11**, 377.

PALACHE, C., H. BERMAN AND C. FRONDEL (1951) *Dana's System of Mineralogy*, 7th Ed., Vol. II, p. 636, John Wiley & Sons, Inc., N.Y.

YOSIMURA, T. (1939) Teineite, a new tellurate mineral from the Teine mine, Hokkaido, Japan. *Jour. Fac. Sc. Hokkaido Univ.* [4], **4**, 465.

ZEMANN, A. AND J. ZEMANN (1960) Zur Kenntnis des Teineits. *Beitr. Mineral. Petr.* **7**, 436–438.

——— (1962) Die Kristallstruktur von Teineit. Ein Beispiel für die Korrektur einer chemischen Formel auf Grund der Strukturbestimmung. *Acta Cryst.* **15**, 698–702.

THE AMERICAN MINERALOGIST, VOL. 49, SEPTEMBER-OCTOBER, 1964

NEW DATA ON BARYSILITE

F. P. GLASSER, *Department of Chemistry, University of Aberdeen, Old Aberdeen, Scotland.*

Chemical analyses of barysilite have been generally interpreted as indicating the composition $Pb_3Si_2O_7$, although Hey (1955) suggests a relation between barysilite and the synthetic phase $K_2O \cdot 2PbO \cdot 2SiO_2$.

Single crystals of barysilite have been examined. These were from a sample labelled U.S.N.M. C-6389, Franklin, N. J. *X*-ray oscillation and rotation photographs confirm that the rhombohedral symmetry deduced from the crystal morphology is correct, and give the following cell dimensions (referred to hexagonal axes).

$$a = 8.46 \pm 0.02 \text{ A}, \qquad c = 38.3 \pm 0.2 \text{ Å}$$

$$V_{hex.} = 2380 \text{ Å}^3$$

Powder *x*-ray data are shown in Table I. Because of the very long *c* spacing no attempt has been made to index these data; however, single crystal photographs were compared with powder photographs taken on the same camera. All stronger reflections match powder arcs perfectly.

Unit cell contents have been calculated in Table II. Complete data—chemical analysis, unit cell volume and density—are not available for any one specimen. However, all three chemical analyses are similar; the sample used in the present study is probably very similar to anal. 3,