

NOTES AND NEWS

PARATELLURITE, A NEW MINERAL FROM MEXICO¹

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INTRODUCTION

Tellurium dioxide, TeO_2 , occurs in tetragonal and orthorhombic dimorphous forms. Orthorhombic TeO_2 is found in nature as tellurite. The tetragonal form, well known as a chemical compound, has been found associated with tellurite and native tellurium at Cananea, Sonora, Mexico. The name paratellurite is proposed for the new mineral.

TETRAGONAL TELLURIUM DIOXIDE

The structure of tetragonal TeO_2 has been determined by Stehlik and Balak (1949), who found that it has either the space group $P_{4_12,2}$ or $P_{4_22,2}$ with $4(\text{TeO}_2)$ per unit cell.

X-ray powder data for tetragonal tellurium dioxide are given in Table 1. Column 1 gives data obtained on "Specpure" TeO_2 manufactured by Johnson, Matthey and Co., Ltd., London. Data in column 2 were obtained on the naturally occurring material. The two materials give essentially identical patterns.

PARATELLURITE

Paratellurite occurs very sparingly with tellurite in thin seams in native tellurium as an alteration product of tellurium and tellurite.

The mineral is very fine grained, grayish white in color, with a resinous to waxy luster and hardness of 1. A specific gravity of 5.60 was determined on a 13.7 mg. sample with the Berman balance. This value is apparently low due to the fine-grained nature of the material. The calculated density is 6.017 gms./cm.³. Indices of refraction are greater than 2.05.

Scarcity of material and difficulty in its purification made analytical work difficult. A chemical analysis was made by George B. Magin, Jr., of the United States Atomic Energy Commission, on a solution prepared from a 50 mg. sample. Two 20 ml. aliquots were taken and Te was precipitated and weighed. The results of the two determinations were 78.5% and 78.0% Te. Theoretical Te in TeO_2 is 79.94%.

A quantitative spectrographic analysis of paratellurite was made by

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TABLE 1. TELLURIUM (IV) OXIDE, PARATELLURITE, TeO_2 (TETRAGONAL)
(Cu, 1.5405 at 25° C.)

Synthetic (Johnson Matthey Co. Ltd., London)*			Paratellurite, Sonora, Mexico U.S.N.M. R8861	
<i>hkl</i>	<i>d</i> (Å)	I	<i>d</i> (Å)	I
101	4.07	9	4.068	12
110	3.40	88	3.404	86
111	3.10	13	3.107	13
102	2.98	100	2.988	100
112	2.536	1	2.536	1
200	2.407	20	2.407	20
201	2.293	2	2.296	3
210	2.151	2	2.151	3
211	2.071	6	2.071	5
113, 202	2.034	1	2.033	1
004	1.903	8	1.904	10
212	1.872	65	1.873	55
203	1.745	< 1	1.746	2
220	1.700	12	1.701	12
114, 221	1.660	22	1.661	22
213	1.6401	4	1.641	4
301	1.5684	3	1.569	2
310	1.5210	12	1.5212	9
204	1.4923	15	1.4925	12
302	1.4775	9	1.4777	8
223, 312	1.4127	2	1.4129	2
303	1.3554	1	1.3554	< 1
321	1.3139	2	1.3142	2
313	1.3048	< 1	1.3048	2
224	1.2681	4	1.2682	5
322	1.2590	4	1.2590	7
215	1.2433	1	1.2431	2
106, 304	1.2270	5	1.2269	5
400	1.2020	< 1	1.2026	2
116, 314	1.1881	6	1.1882	6
323	1.1806	< 1	1.1812	4
411	1.1531	< 1	1.1530	3
225	1.1341	< 1	1.1339	< 1
331	1.1212	< 1	1.1214	1
412	1.1158	2	1.1159	2
216, 324	1.0928	4	1.0929	3
403, 332	1.0866	< 1	1.0867	1
315, 240	1.0753	< 1	1.0760	< 1
421	1.0647	< 1	1.0646	< 1
107, 413	1.0601	< 1	1.0599	< 1
226, 404	1.0164	1	1.0167	2

Lattice Constants

Synthetic	Paratellurite
$a_0 = 4.809 \text{ \AA}$	$a_0 = 4.810 \text{ \AA}$
$c_0 = 7.614$	$c_0 = 7.613$
Cal. density = 6.019 g/cm. ³	= 6.017 g/cm. ³

* N.B.S. Circular 539, Vol. 7, page 56 (1957).

Harry J. Rose, of the United States Geological Survey. Only Te was found in amounts greater than a few tenths of a per cent. The analysis follows: Te major, Sn .04%, Pb .004, Mn .02, Fe .06, Zr .01, Mg .04, Ca .05, Ba .01. (Al .2 and Si .5% were found but are due to impurity.) Selenium was looked for but not detected. The sensitivity of Se is poor by this method and quantities as high as 10 per cent may not be detected. However, the fact that the unit cell dimensions of paratellurite and "specpure" TeO₂ are practically identical would indicate that if any Se is present it is minor.

Paratellurite occurs as a fine-grained crystalline aggregate, either massive or pseudomorphous after tellurite. Some well-defined tellurite crystals are transparent and unaltered; others, while retaining the tellurite crystal form, are in part or entirely altered to paratellurite. That these latter paratellurite "crystals" are fine-grained aggregates rather than single crystals was demonstrated by placing the tip of one in an α -ray powder camera. A powder-type diffraction pattern was obtained without grinding the sample.

The relationships described above clearly indicate that the orthorhombic form of TeO₂ was the first to form, but that the tetragonal form is the more stable.

Attempts to synthesize orthorhombic TeO₂ were unsuccessful, whereas tetragonal TeO₂ can be readily prepared by heating Te in air at 400° C. An attempt was made to convert tetragonal TeO₂ to the orthorhombic form by heating it in a hydrothermal bomb at 300° C. and 30,000 psi for four days. The tetragonal form persisted.

A sample of tellurite (orthorhombic TeO₂) from Mexico was run with a high temperature α -ray specimen mount on a diffractometer to determine the inversion point to the tetragonal form. The inversion took place at between 600° and 650° C. The change in the natural material apparently took place at a much lower temperature since tellurite and paratellurite occur in native tellurium, and tellurium has a melting point of 452° C.

The specimens of native tellurium with tellurite and paratellurite upon which this work was done were purchased from mineral dealers and are in the United States National Museum collections under numbers R8861 and C5995. The locality was given as Cananea, Sonora, Mexico. Richard V. Gaines (personal communication) reports that the material probably came either from La Moctezuma, or the Santa Rosa mine, near Cananea.

REFERENCE

- STEHLIK, B. AND BALAK, L. The Crystal Structure of Tellurium Dioxide. *Coll. Czech Chem. Commun.*, **14**, 595-607 (1949).