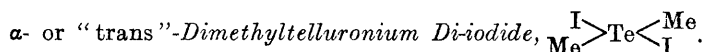


XII.—Organic Derivatives of Tellurium. Part III. Crystallographic and Pharmacological Comparison of the α - and β -Dimethyltelluronium Dihaloids.

By ISABEL ELLIE KNAGGS and RICHARD HENRY VERNON.

OF the six dimethyltelluronium dihaloids, the two iodides were the most suitable for crystallographic investigation, which was carried out by one of us (I.E.K.) in the Mineralogical Department under the direction of Mr. A. Hutchinson.



This was prepared in the usual manner, and the large crystals from chloroform or benzene were examined.

Crystal System.—Monoclinic. Class: holohedral. Axial angle = $72^\circ 21'$. Axial ratio: $a:b:c = 0.5578:1:0.4310$.

Forms Observed.

$A = \{100\}$, $B = \{010\}$, $C = \{001\}$, $k = \{20\bar{1}\}$, $m = \{110\}$, $m' = \{120\}$, $m'' = \{130\}$, $q = \{011\}$, $l = \{021\}$, $o = \{111\}$, $o' = \{\bar{1}11\}$, $n' = \{\bar{1}21\}$.

Table of Angles.

Angle measured.	No. of measurements.	Limits.	Mean observed.	Calculated.	Difference.
$A : C = (100) : (001)$	2	$72^\circ 21' - 72^\circ 21\frac{1}{2}'$	$72^\circ 21'$	$72^\circ 21'$	0'
$C : k' = (001) : (201)$	6	$70^\circ 2' - 70^\circ 14'$	$70^\circ 9'$	*	—
$k' : A' = (201) : (100)$	3	$37^\circ 26' - 37^\circ 34'$	$37^\circ 30'$	*	—
$B : m' = (010) : (130)$	7	$32^\circ 3\frac{1}{2}' - 32^\circ 27'$	$32^\circ 12'$	$32^\circ 6'$	6'
$B : m'' = (010) : (120)$	18	$43^\circ 10' - 43^\circ 24'$	$43^\circ 16'$	*	—
$B : m = (010) : (110)$	14	$61^\circ 48' - 62^\circ 10\frac{1}{2}'$	$62^\circ 2'$	$62^\circ 1'$	1'
$B : q = (010) : (011)$	8	$67^\circ 17' - 67^\circ 44'$	$67^\circ 39'$	$67^\circ 39'$	0'
$B : l = (010) : (021)$	6	$50^\circ 30' - 50^\circ 46'$	$50^\circ 37'$	$50^\circ 34\frac{1}{2}'$	$2\frac{1}{2}'$
$C : m = (001) : (110)$	5	$74^\circ 28' - 74^\circ 31'$	$74^\circ 30'$	$74^\circ 22'$	8'
$C : o = (001) : (111)$	5	$34^\circ 19' - 34^\circ 22'$	$34^\circ 20'$	$34^\circ 21'$	1'
$B : o = (010) : (111)$	9	$73^\circ 58\frac{1}{2}' - 74^\circ 10\frac{1}{2}'$	$74^\circ 5'$	$74^\circ 3'$	2'
$q : n' = (011) : (\bar{1}21)$	2	$40^\circ 26' - 40^\circ 33'$	$40^\circ 31'$	$40^\circ 31'$	0'
$n' : m = (\bar{1}21) : (\bar{1}10)$	2	$53^\circ 29' - 53^\circ 31'$	$53^\circ 30'$	$53^\circ 27'$	3'
$A : o = (100) : (111)$	2	$44^\circ 3'$	$44^\circ 3'$	$43^\circ 56'$	7'
$o : q = (111) : (011)$	8	$29^\circ 31' - 29^\circ 52'$	$29^\circ 45'$	$29^\circ 47'$	2'
$q : o' = (011) : (\bar{1}11)$	2	$40^\circ 35\frac{1}{2}' - 40^\circ 47'$	$40^\circ 41'$	$40^\circ 37\frac{1}{2}'$	$3\frac{1}{2}'$
$m' : o' = (120) : (\bar{1}21)$	13	$78^\circ 1' - 78^\circ 22'$	$78^\circ 9'$	$78^\circ 10'$	1'
$n' : k' = (\bar{1}21) : (201)$	13	$44^\circ 41' - 45^\circ 0'$	$44^\circ 51'$	$44^\circ 50'$	1'
$k' : m' = (201) : (\bar{1}20)$	21	$56^\circ 29\frac{1}{2}' - 57^\circ 14'$	$57^\circ 3'$	$57^\circ 0'$	3'
$C : n' = (001) : (\bar{1}21)$	1	$55^\circ 18'$	$55^\circ 18'$	$55^\circ 14'$	4'
$B : n' = (010) : (\bar{1}21)$	3	$52^\circ 19' - 52^\circ 24'$	$52^\circ 22'$	$52^\circ 16'$	6'
$n' : o' = (\bar{1}21) : (\bar{1}11)$	2	$16^\circ 33'$	$16^\circ 33'$	$16^\circ 34'$	1'
$m : k' = (\bar{1}10) : (201)$	3	$45^\circ 28\frac{1}{2}' - 45^\circ 35'$	$45^\circ 33'$	$45^\circ 31'$	2'

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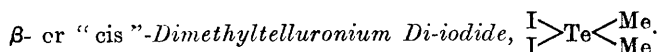
Habit.—Short, prismatic, terminated at either end by a large macrodome, k , and by a variable number of smaller domes and pyramids (Fig. 1).

Cleavage.—None observed.

Specific Gravity.—Determined by weighing in water, D_4^{14} 3.338 (corrected).

Topic Axes.— $\chi : \psi : \omega = 4.537 : 8.133 : 3.506$.

Optical Characters.—Refractive index, high. By immersion method, greater than 1.74. On looking through a crystal perpendicular to B , strong pleochroism was observed, the colour changing from light red to very dark red. The maximum absorption of light takes place for vibrations parallel to the extinction direction, which makes an angle of $4\frac{1}{2}^\circ$ with the vertical axis, Z , in the acute axial angle. It was not possible to obtain an optic picture in convergent light owing to the great absorption.



This was prepared from the β -base and crystallised from methyl alcohol. The crystals examined were small, but well defined. In reflected light they had a black, metallic lustre.

Crystal System.—Monoclinic. Class: holohedral. Axial angle = $76^\circ 52'$. Axial ratio: $a : b : c = 0.5465 : 1 : 0.4222$.

Forms Observed.

$A = \{100\}$, $B = \{010\}$, $C = \{001\}$, $m = \{110\}$, $q = \{011\}$, $o' = \{\bar{1}11\}$, $n' = \{\bar{1}21\}$.

Table of Angles.

Angle measured.	No. of measurements.	Limits.	Mean observed.	Calculated.	Difference.
$A : C = (100) : (001)$	7	$76^\circ 50' - 77^\circ 31'$	$77^\circ 16'$	$76^\circ 52'$	$24'$
$B : m = (010) : (110)$	18	$61^\circ 48' - 62^\circ 8'$	$61^\circ 59'$	*	—
$C : q = (001) : (011)$	9	$22^\circ 5\frac{1}{2}' - 22^\circ 34'$	$22^\circ 18'$	$22^\circ 21'$	$3'$
$q : n' = (011) : (\bar{1}21)$	5	$38^\circ 23\frac{1}{2}' - 39^\circ 20'$	$38^\circ 55'$	$39^\circ 8\frac{1}{2}'$	$13\frac{1}{2}'$
$n' : m = (\bar{1}21) : (\bar{1}10)$	5	$51^\circ 6' - 51^\circ 25'$	$51^\circ 15'$	*	—
$C : n' = (001) : (\bar{1}21)$	6	$52^\circ 53' - 53^\circ 59'$	$53^\circ 27'$	$53^\circ 31'$	$4'$
$B : n' = (010) : (\bar{1}21)$	18	$53^\circ 21' - 53^\circ 47\frac{1}{2}'$	$53^\circ 37'$	*	—
$n' : o' = (\bar{1}21) : (\bar{1}11)$	8	$15^\circ 55\frac{1}{2}' - 16^\circ 10'$	$16^\circ 2\frac{1}{2}'$	$16^\circ 8\frac{1}{2}'$	$6'$
$A : n' = (100) : (\bar{1}21)$	5	$67^\circ 2' - 67^\circ 14'$	$67^\circ 7\frac{1}{2}'$	$66^\circ 50'$	$17\frac{1}{2}'$

The habit is characterised by the small development of the prism faces, $m\{110\}$, and by the large development of the form $n'\{\bar{1}21\}$. Faces of the forms $C\{001\}$, $o'\{\bar{1}11\}$, and some small dome faces are also present (Fig. 2).

Had the β -crystals alone been under consideration, it would have been natural to regard the faces of the forms $\{\bar{1}21\}$ and $\{\bar{1}11\}$ as prisms having indices $\{120\}$ and $\{110\}$ respectively. In order, however, to bring out the relationship which exists between the α - and β -crystals, it was found necessary to adopt the orientation given above.

Cleavage.—None observed.

Specific Gravity.—Determined by weighing in water, $D_4^{25}=3.305$ (corrected).

Topic Axes.— $\chi:\psi:\omega=4.488, 8.214, 3.468$.

Optical Characters.—Refractive index: high; as found by the immersion method, greater than 1.74. Absorption: very high, the crystals being nearly opaque. Observations as to the pleochroism,

FIG. 1.

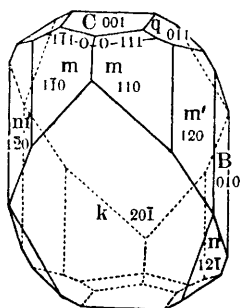
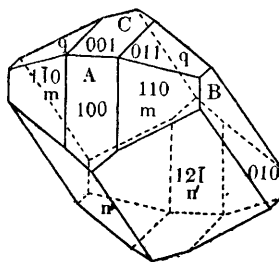
 α -Di-iodide.

FIG. 2.

 β -Di-iodide.

therefore, could not be made, nor could an optic picture be obtained in convergent light.

The chief feature of interest in this investigation is a comparison between the two crystals (Figs. 1 and 2).

Although at first sight the crystals appear very different, this is due entirely to difference of habit. In reality, a large number of forms, $\{001\}$, $\{011\}$, $\{110\}$, $\{010\}$, $\{\bar{1}21\}$, are common to each substance, and the angles in the prominent zones and the axial ratios show striking similarity. This is most marked in the zones $[010,110]$, $[010,011]$, in which the angles are almost identical, and the divergence is greatest in the zone parallel to the diad axis of symmetry, the acute axial angles differing by as much as $4\frac{1}{2}$ degrees. The close similarity of form also finds expression in the topic axes, the values of χ and ω for the β -compound being slightly less, and that of ψ slightly greater, than is the case for the α -compound.

The difference of habit is mainly due to the large development

of $k\{20\bar{1}\}$ in the α -compound and its absence in the β -compound, in which $n'\{\bar{1}21\}$ plays a prominent part.

The similarity of the two forms is so close that they stand to one another much in the same relation as the members of an isomorphous series. The small size of the crystals, their opacity, and high refractive index have precluded a detailed comparison of their optical properties, nor has it been found possible to prepare mixed crystals containing both compounds.

In marked contrast to the similarity in crystalline structure of the α - and β -iodides is the totally different physiological behaviour of the α -haloids as compared to the corresponding β ones.

The iodides were not used for the pharmacological investigation, as they are insoluble in water, but the chlorides and bromides were eminently suitable for this purpose.

Dr. W. E. Dixon, who is still investigating these substances, and will shortly publish a full statement of his results in an appropriate journal, has kindly sent the following note:

"Both these organic compounds of tellurium when taken into the animal body are excreted from the lungs as dimethyl telluride, a substance which exerts little physiological action apart from its odour.

"Before this change occurs in the body, the α - and β -compounds exert specific actions of an entirely different nature. The former slows and weakens the heart, and the blood-pressure falls. It also stimulates plain muscle, particularly that of the uterus and intestine, to increased activity. Its action on the central nervous system is almost negligible.

"The β -compound has the most profound stimulant action on the medulla, giving rise to an increase of blood-pressure and increasing the depth and rapidity of respiration. Generally before the blood-pressure has reached the normal again, a second rise occurs; this is due to the liberation of adrenalin from the suprarenal glands, upon which the β -compound exerts a unique and specific effect not comparable with that produced by any other known chemical. Large doses of the β -compound, such as 60 milligrams to a cat, paralyse the whole nervous system—brain, spinal cord, and motor nerves."

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