**145. Re-examination of Space Group and Cell Dimensions of Enargite.**

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Previously the junior author published a short account regarding the crystal structure of enargite, which was determined by using the several photographs obtained by the Laue, oscillation and rotation methods in CuK radiation. The cell dimensions were given as $a_0=6.41\text{Å}$, $b_0=3.69\text{Å}$ and $c_0=6.14\text{Å}$. The value of $b_0$ was obtained from the layer lines having been distinctly observable on the $[010]$-rotation photograph, though very faint and indistinct reflections were noticed between the 0th layer line and the adjacent distinct layer lines as stated above, only appeared at the two end parts of the film. The neglect of these indistinct reflections to be taken as the first layer lines introduced an erroneous result for the determinations of the cell-dimensions and of the space group. The space group previously determined was $V\delta_h$, as the relations in indices determined formerly were such as $h+l$ is even in $(h0l)$, $h+k$ is even in $(hk0)$ and $h$, $k$ or $l$ is even respectively in $(h00)$, $(0k0)$ or $(00l)$ and also as the crystal was taken as holohedral, on account of the last condition the isomorphic replacement of As with Cu was necessarily considered.

Immediately later, L. Pauling and S. Weinbaum published the cell-dimensions of the crystal and the result was practically the same as our values, except that the value of $b_0$ obtained by them was double that obtained by us. The space group was given as $C_2^\nu$ by them under the conception that the crystal belongs to the hemimorphic class and not to the holohedral, though they make no special mention for this distinction from the mineralogical point of view.

As already stated in our previous paper, the base Laue photograph of enargite shows markedly a pseudohexagonal relation, though its morphological habit is clearly orthorhombic. According to C. D. West, an X-ray powder photograph of enargite can be completely indexed in terms of the hexagonal unit whose dimensions are given as $a_0=3.71\text{Å}$ and $c_0=6.16\text{Å}$, which resemble well those of wurtzite; moreover, the X-ray reflections of enargite are in general similar to those observed and calculated for wurtzite. He added further “The powder data thus permit the conclusion that enargite has a pseudohexagonal close packed structure similar to that of wurtzite.” The space group of wurtzite determined by F. Ulrich and W. Zachariasen is $C_4^\nu$.

1) Proc. 9 (1933), 524.
2) The locality of the crystal is the Kinkwaseki Mine, Formosa.
3) Z. X., B. 88 (1934), 48–53.
Recently we have had an opportunity to re-examine the X-ray reflections obtained by a Weissenberg’s Röntgen-goniometer in using the same crystal rods as were used in the previous experiment and we especially paid attention when the [010]-photograph was taken. From the [010]-photograph thus obtained, we were able to examine many reflections corresponding to the first layer lines in the rotation photograph, though their intensities were much weaker than others, and their indices determined were (319), (410), (610), (710), (013), (213), (114), (116), (216), (215), (211), (312), (511), (611), (612), (613) and (712).

The cell-dimensions determined in this case are $a_0 = 6.39\,\text{Å}$, $b_0 = 7.35\,\text{Å}$ and $c_0 = 6.15\,\text{Å}$ and the number of molecules in a unit cell, the chemical formula being $\text{Cu}_3\text{AsS}_4$, can be given as 2.

**Space group:** The following relations were observed in the indices determined from the several photographs taken by the Röntgen-goniometer:

<table>
<thead>
<tr>
<th>Relation</th>
<th>Indices</th>
</tr>
</thead>
<tbody>
<tr>
<td>In $(h1l)$ and $(h2l),^1$</td>
<td>no special relation can be seen,</td>
</tr>
<tr>
<td>In $(okl),^2$</td>
<td>$h + k = \text{even}$,</td>
</tr>
<tr>
<td>In $(h0l),^3$</td>
<td>no special relation,</td>
</tr>
<tr>
<td>In $(kk0),^4$</td>
<td>no special relation,</td>
</tr>
<tr>
<td>In $(h00),^5$</td>
<td>no special relation,</td>
</tr>
<tr>
<td>In $(ok0),^6$</td>
<td>$k = 4n$, in which $n$ is integer,</td>
</tr>
<tr>
<td>In $(00l),^7$</td>
<td>$l = \text{even}$.</td>
</tr>
</tbody>
</table>

From the indices-relations seen above, we can conclude that the space group must be $\text{Vh}$ or $\text{C}_{2v}$. As it is now definitely known that the crystal belongs to the hemimorphic class from our recent morphological study, the space group of enargite must be $\text{C}_{2v}$.

From the statement given above, we see that our new results are the same as those formerly obtained by L. Pauling and S. Weinbaum. 

1) The indices determined are (121), (122), (123), (124), (125), (126), (223), (225), (226), (322), (324), (325), (326), (521), (522), (523), (524).
2) The indices determined are (011), (013), (023), (024), (026), (042), (044), (046), (051), (073), (082).
3) The indices determined are (103), (104), (105), (106), (201), (202), (203), (204), (205), (206), (207), (301), (304), (306), (401), (402), (403), (404), (405), (406), (501), (503), (504), (602), (603), (604), (702), (802).
4) The indices determined are (110), (120), (130), (140), (150), (160), (170), (180), (240), (270), (280), (310), (320), (330), (340), (350), (360), (370), (410), (420), (430), (470), (510), (520), (560), (610), (620), (630), (640), (650), (710), (720), (730).
5) The indices determined are (100), (200), (300), (400), (500), (600), (700), (800).
6) The indices determined are (040), (080).
7) The indices determined are (002), (004), (006).