Paraguanaatite Bi$_2$(Se, S)$_3$

Crystal Data: Hexagonal. Point Group: $\overline{3}2/m$. Intimately intergrown with guanajuatite.

Physical Properties: Cleavage: Perfect on {0001}. Hardness = 2 VHN = 27–50 (10 g load). D(meas.) = 6.2–7.0 D(calc.) = [7.704]


Cell Data: Space Group: $\overline{R}3m$ (synthetic Bi$_2$Se$_3$). a = 4.133 c = 28.62 Z = 3

X-ray Powder Pattern: Synthetic Bi$_2$Se$_3$.
3.03 (100), 2.23 (60), 1.404 (40), 4.80 (30), 2.07 (30), 1.907 (30), 1.320 (30)

Chemistry:

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bi</td>
<td>62.8</td>
<td>63.64</td>
</tr>
<tr>
<td>Se</td>
<td>36.4</td>
<td>30.08</td>
</tr>
<tr>
<td>Te</td>
<td>5.13</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>0.8</td>
<td>1.48</td>
</tr>
</tbody>
</table>

Total 100.0 100.33

(1) Mexico; by electron microprobe, corresponds to Bi$_{1.86}$(Se$_{2.85}$S$_{0.15}$)$_{\Sigma=3.00}$. (2) Kawazu mine, Japan; by electron microprobe, corresponds to Bi$_{1.97}$(Se$_{2.47}$Te$_{0.26}$S$_{0.30}$)$_{\Sigma=3.03}$.

Polymorphism & Series: Dimorphous with guanajuatite.

Mineral Group: Tetradymite group.

Occurrence: Intergrown with guanajuatite in contact metamorphic as well as in hydrothermal veins (Santa Catarina mine, Mexico).

Association: Guanajuatite, bismuthinite, ferroselite (Santa Catarina mine, Mexico).

Distribution: From Mexico, in Guanajuato, in the Santa Catarina [TL] and Leon mines. From Falun, Kopparberg, Sweden. At the Kawazu mine, Shizuoka Prefecture, Japan.

Name: From the supposed relation to guanajuatite.

Type Material: n.d.