Keplerite

Crystal Data: Hexagonal. Point Group: 3/m. As ovoidal to cloud-shaped grains to 50 μm (meteorites) or to ~0.2 mm (paralava).

D(meas.) = n.d. D(calc.) = 3.122

Optical Class: Uniaxial (-). \( \omega = 1.622(1) \) \( \epsilon = 1.619(1) \) Nonpleochroic.

Cell Data: Space Group: R3c. \( a = 10.3330(4) \) \( c = 37.0668(24) \) \( Z = 6 \)

X-ray Powder Pattern: Calculated pattern.
2.8544 (100), 2.5833 (64), 3.1772 (46), 1.7123 (28), 5.1665 (25), 3.4245 (24), 1.9153 (22)

Chemistry:

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CaO</td>
<td>48.87</td>
<td>48.39</td>
</tr>
<tr>
<td>MgO</td>
<td>3.90</td>
<td>3.73</td>
</tr>
<tr>
<td>Na₂O</td>
<td>0.86</td>
<td></td>
</tr>
<tr>
<td>FeO</td>
<td>1.33</td>
<td></td>
</tr>
<tr>
<td>P₂O₅</td>
<td>46.24</td>
<td>45.85</td>
</tr>
<tr>
<td>Total</td>
<td>100.34</td>
<td>98.83</td>
</tr>
</tbody>
</table>

(1) Marjalahti pallasite meteorite; average electron microprobe analysis; corresponding to \( \text{Ca}_{9.00} (\text{Ca}_{0.33} \text{Fe}^{2+}_{0.20} \text{Fe}^{3+}_{0.47}) \text{Mg}_{1.04} \text{P}_{6.97} \text{O}_{28} \). (2) Hatpurim Basin, northern Negev Desert, Israel; average electron microprobe analysis; corresponding to \( \text{Ca}_{9.00} (\text{Ca}_{0.35} \text{Na}_{0.30}) \text{Mg}_{1.00} (\text{PO}_4)^7 \).

Polymorphism & Series: The isomorphous series merrillite-keplerite represents the main reservoir of phosphate phosphorus in the solar system.

Mineral Group: Whitlockite group.

Occurrence: In some pallasite and angrite meteorites. In brecciated, altered pyroxene paralava (fused sediments) by pyrometamorphism (Israel). An indicator of high-temperature environments characterized by extreme depletion of sodium.

Association: Troilite-orthopyroxene vermicular intergrowths, olivine, Fe-Ni metal (meteorites); fluorapatite, maghemite, stanfieldite (Israel).

Distribution: From a hill, near Arad, Hatpurim Basin, northern Negev Desert, Israel. Studied material from the Marjalahti pallasite meteorite [TL].

Name: Honors Johannes Kepler (1571-1630), a prominent German naturalist, for his contributions to astronomy and crystallography.

Type Material: Mining Museum, St. Petersburg Mining University, St. Petersburg, Russia (MM74/2-1).

References: (1) Britvin, S.N., I.O. Galuskina, N.S. Vlasenko, O.S. Vereshchagin, V.N. Bocharov, M.G. Krzhizhanovskaya, V.V. Shilovskikh, E.V. Galuskin, Y. Vapnik, and E.V. Obolonskaya (2021) Keplerite, \( \text{Ca}_{9.00} (\text{Ca}_{0.50} \text{Mg}_{0.50}) (\text{PO}_4)^7 \), a new meteoritic and terrestrial phosphate isomorphous with merrillite, \( \text{Ca}_{9.00} \text{NaMg}(\text{PO}_4)^7 \). Amer. Mineral., 106, 1917-1927.