Piypite

\( \text{K}_2\text{Cu}_2\text{O} (\text{SO}_4)_2 \)

**Crystal Data:** Tetragonal. **Point Group:** 4. As acicular to columnar crystals, elongated along [001], to 3 cm, square in section and commonly hollow, in mosslike aggregates. **Twinning:** Assumed found in crystal structure analysis.

**Physical Properties:** **Cleavage:** Perfect, parallel to elongation. **Tenacity:** Brittle. Hardness = 2.5 \( D \text{(meas.)} = 3.0–3.1 \) \( D \text{(calc.)} = 3.0–3.2 \) Soluble in \( \text{H}_2\text{O} \), leaving an insoluble residue.

**Optical Properties:** Transparent to translucent. **Color:** Emerald-green, dark green, black. **Streak:** Yellowish green. **Luster:** Vitreous to greasy. **Optical Class:** Uniaxial (+). **Pleochroism:** Distinct; \( \alpha = \) pale green, yellowish green; \( \epsilon = \) deep green, pale yellowish green. **Orientation:** Positive elongation. \( \omega = 1.583–1.598 \) \( \epsilon = 1.695–1.711 \)

**Cell Data:** **Space Group:** \( I4 \). \( a = 13.60–13.67 \) \( c = 4.94–4.98 \) \( Z = 4 \)

**X-ray Powder Pattern:** Tolbachik volcano, Russia. 9.63 (100), 3.039 (70), 6.79 (40), 3.006 (30), 4.305 (20), 2.666 (20), 1.924 (20)

**Chemistry:** (1) (2) (3) (1) (2) (3)

\[
\begin{array}{ccc}
\text{SO}_3 & 34.2 & 35.88 & 38.73 \\
\text{CuO} & 34.72 & 41.45 & 38.48 \\
\text{ZnO} & 0.62 & & \\
\text{PbO} & 0.27 & & \\
\text{Cu}_2 \text{O} & 3.67 & & \\
\text{Na}_2 \text{O} & 1.12 & 2.89 & \\
\text{K}_2 \text{O} & 20.03 & 17.38 & 22.79 \\
\end{array}
\]

Total \( [99.86] \) \( 100.63 \) \( 100.00 \)

(1) Tolbachik volcano, Russia; \( \text{Na}_2 \text{O}, \text{K}_2 \text{O} \) by flame photometry, \( \text{CuO}, \text{PbO}, \text{ZnO} \) by AA; \( \text{F} \) by fluorine selective electrode, \( (\text{SO}_4)^{2-} \) confirmed by IR, original total given as 99.94%; after deduction of \( \text{CuCl} \) as nantokite, \( \text{NaCl} \) as halite, \( \text{F}, \text{H}_2\text{O}, \) and insoluble tenorite, corresponds to \( \{\text{K}_{1.97}\text{Na}_{0.01}\text{Pb}_{0.01}\}\Sigma=1.99(\text{Cu}_{2.02}\text{Zn}_{0.04})\Sigma=2.06\text{O}(\text{SO}_4)_{1.98} \). (2) Vesuvius, Italy; by electron microprobe, average of four analyses. (3) \( \text{K}_2\text{Cu}_2\text{O} (\text{SO}_4)_2 \).

**Occurrence:** A rare fumarolic sublimate, formed above 500 °C.

**Association:** Halite, sylvite, langbeinite, tenorite, hematite, tolbachite, dolerophanite, urusovite, aplitalitite, ponomarevite, cotunnite, chalcoyanite, sofitie, euchlorine, averievite, fedotovite, alarsite, alunoklyuchevskite, nabokoite, lammerite (Tolbachik volcano, Russia); paratacamite (Vesuvius, Italy).

**Distribution:** From the Tolbachik fissure volcano, Kamchatka Peninsula, Russia. On Vesuvius, Campania, Italy.

**Name:** Honors Boris Ivanovich Piyp (1906–1966), Russian vulcanologist, Director of the Far Eastern Institute of Volcanology, Petropavlovsk-Kamchatskii, Russia.

**Type Material:** Mining Institute, St. Petersburg, Russia, 1331/1.


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