**Jamesite** $\mathbf{Pb_2ZnFe_2^{3+}(Fe^{3+},Zn)_4(AsO_4)_4(OH)_8(OH,O)_2}$



**Crystal Data:** Triclinic. *Point Group:* $\overline{1}$. As crystals, tabular on {010} and elongated along [100], to 0.5 mm; in spherical radial aggregates.

**Physical Properties:** Hardness = ∼3 D(meas.) = n.d. D(calc.) = 5.084

**Optical Properties:** Transparent. *Color:* Red-brown. *Streak:* Pale brown.
*Luster:* Subadamantine.
*Optical Class:* Biaxial (–). *Pleochroism:* Strong; $X = Y$ = pale brown; $Z$ = deep red-brown.
*Orientation:* $Y \wedge a \simeq 5°$ on (001); $Y \wedge a = 15°$ on (010). *Dispersion:* $r > v$. $\alpha = 1.960(5)$ $\beta = 1.995(5)$ $\gamma = 2.020(5)$ 2V(meas.) = 75(5)°

**Cell Data:** *Space Group:* $P\overline{1}$. $a = 5.583$–$5.622$ $b = 9.542$–$9.593$ $c = 10.219$–$10.279$ $\alpha = 109.80°-109.81°$ $\beta = 90.54°-90.57°$ $\gamma = 97.69°-97.71°$ Z = 1

**X-ray Powder Pattern:** Tsumeb, Namibia.
3.40 (10), 3.04 (9), 9.67 (8), 4.70 (8), 3.26 (8), 2.92 (6), 2.04 (6)

**Chemistry:**

| | (1) | (2) |
|---|---|---|
| $SO_3$ | trace | |
| $As_2O_5$ | 36.2 | 27.94 |
| $Al_2O_3$ | | 0.09 |
| $Fe_2O_3$ | 25.5 | 23.30 |
| $Ga_2O_3$ | | 0.27 |
| MnO | trace | |
| CuO | trace | 0.21 |
| ZnO | 11.1 | 10.39 |
| PbO | 27.1 | 27.40 |
| $H_2O$ | n.d. | [5.06] |
| Total | 99.9 | [94.66] |

(1) Tsumeb, Namibia; by electron microprobe, total Fe as $Fe_2O_3$, $(OH)^{1-}$ assumed for charge balance; corresponding to $Pb_{1.92}Zn_{2.15}Fe^{3+}_{5.06}(AsO_4)_{4.00}(OH)_{11.32}$. (2) Do.; by electron microprobe, average of two analyses, total Fe as $Fe_2O_3$, $H_2O$ calculated by crystal-structure analysis; corresponds to $Pb_{2.01}Zn_{1.00}Fe^{3+}_{2.00}(Fe^{3+}_{2.78}Zn_{1.09}Ga_{0.05}Cu_{0.04}Al_{0.03})_{\Sigma=3.99}(AsO_4)_{3.99}[(OH)_{9.20}O_{0.80}]_{\Sigma=10.00}$.

**Occurrence:** A secondary mineral in oxidized lead ore in a dolostone-hosted hydrothermal polymetallic ore deposit.

**Association:** Duftite, tsumcorite, goethite.

**Distribution:** From Tsumeb, Namibia.

**Name:** Honors Christopher James, one of the first mining engineers at the Tsumeb mine, Namibia.

**Type Material:** Institute for Mineralogy and Crystal Chemistry, University of Stuttgart, Stuttgart, Germany, NM05; National Museum of Natural History, Washington, D.C., USA, 143995.

**References:** (1) Keller, P., H. Hess, and P.J. Dunn (1981) Jamesit, $Pb_2Zn_2Fe^{3+}_5O_4(AsO_4)_5$, ein neues Mineral von Tsumeb, Namibia. Chem. Erde, 40, 105–109 (in German with English abs.). (2) (1981) Amer. Mineral., 66, 1275 (abs. ref. 1). (3) Cooper, M.A. and F.C. Hawthorne (1999) Local $Pb^{2+}-\square$disorder in the crystal structure of jamesite, $Pb_2ZnFe^{3+}_2(Fe^{3+}_{2.8}Zn_{1.2})(AsO_4)_4(OH)_8[(OH)_{1.2}O_{0.8}]$, and revision of the chemical formula. Can. Mineral., 37, 53–60.