Phoxite  \((\text{NH}_4)\text{Mg}_2(\text{C}_2\text{O}_4)(\text{PO}_3\text{OH})_2(\text{H}_2\text{O})_4\)

**Crystal Data:** Monoclinic.  *Point Group: 2/m.*  As blades to 0.4 mm, elongated and striated along [001], flattened on {100}, and exhibiting {100}, {120}, {110}, {011}, and {111} ; commonly in composite intergrowths.

**Physical Properties:** *Cleavage:* Fair on (100).  *Fracture:* Irregular.  *Tenacity:* Brittle.  
Hardness = 2.5  
D(meas.) = 1.98(2)  
D(calc.) = 1.965

**Optical Properties:** Transparent.  *Color:* Colorless (light brown to beige from inclusions).  
*Streak:* White.  *Luster:* Vitreous to oily.  
*Optical Class:* Biaxial (-).  \(\alpha = 1.499(1)\)  \(\beta = 1.541(1)\)  \(\gamma = 1.542(1)\)  
2V(meas.) = 16(1)\(^\circ\)  
2V(calc.) = 17.2\(^\circ\)  
*Dispersion:* Slight, \(r < v\).  
*Orientation:* \(Y = b, X \wedge a \approx 9^\circ\) in obtuse \(\beta\).

**Pleochroism:** None.

**Cell Data:**  
Space Group: \(P2_1/c\).  
\(a = 7.2962(3)\)  
\(b = 13.5993(4)\)  
\(c = 7.8334(6)\)  
\(\beta = 108.271(8)^\circ\)  
\(Z = 2\)

**X-ray Powder Pattern:** Calculated pattern.  
6.17 (100), 5.57 (85), 2.914 (72), 2.275 (63), 3.799 (60), 3.377 (59), 2.425 (37)

**Chemistry:**

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>((\text{NH}_4)\text{O})</td>
<td>[10.44]</td>
<td></td>
<td>11.92</td>
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<tr>
<td>K(_2)O</td>
<td>2.74</td>
<td>2.45</td>
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<tr>
<td>MgO</td>
<td>20.43</td>
<td>18.25</td>
<td>18.46</td>
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<tr>
<td>P(_2)O(_5)</td>
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<td>32.15</td>
<td>32.50</td>
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<tr>
<td>C(_2)O(_3)</td>
<td>16.31</td>
<td>16.49</td>
<td></td>
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<tr>
<td>H(_2)O</td>
<td>[20.40]</td>
<td>20.63</td>
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<tr>
<td>Total</td>
<td>100.00</td>
<td>100.00</td>
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</table>

(1) Rowley mine, Painted Rock district, Maricopa County, Arizona, USA; average of 7 electron microprobe analyses supplemented by Raman spectroscopy and CHN analysis, \((\text{NH}_4)\text{O}, \text{C}_2\text{O}_3,\) and H\(_2\)O calculated from structure; corresponds to \([((\text{NH}_4)\_2\_\text{K}_{0.03}\_\text{Mg}_{2.06}\_\text{C}_2\text{O}_4\_\text{P}_2\text{O}_5\_\text{H}_2\text{O})_\text{a}]\).

(2) Do., Normalized.  (3) \((\text{NH}_4)\_2\_\text{Mg}_2(\text{C}_2\text{O}_4)(\text{PO}_3\text{OH})_2(\text{H}_2\text{O})_\text{a}\).

**Occurrence:** In a hot and humid area of an abandoned Cu-Pb-Au-Ag-Mo-V-barite-fluorspar mine in an unusual bat-guano-related, post-mining assemblage in portions of the interiors and rims of circular masses, presumably related to relatively recent/fresh bat excrement.

**Association:** Antipinite, aphanithitalte, bassanite, struvice, thenardite, weddellite.

**Distribution:** From depth (125 feet) in the Rowley mine, near Theba, Painted Rock district, Maricopa County, Arizona, USA.

**Name:** Reflects the fact that the mineral contains essential phosphate (ph) and oxalate (ox) groups.

**Type Material:** Natural History Museum of Los Angeles County, Los Angeles, California, USA (66697, 66698, 66699, and 66700).

**References:** (1) Kampf, A.R., A. J. Celestian, B.P. Nash, and J. Marty (2019) Phoxite, \((\text{NH}_4)\_2\_\text{Mg}_2(\text{C}_2\text{O}_4)(\text{PO}_3\text{OH})_2(\text{H}_2\text{O})_\text{a}\) the first phosphate-oxalate mineral.  Amer. Mineral., 104(7), 973-979.