# Metaswitzerite $\qquad$ $Mn_3^{2+}(PO_4)_2 \cdot 4H_2O$

**Crystal Data:** Monoclinic. *Point Group:* $2/m$. As tabular to bladed bent crystals, pseudomorphous after switzerite, to 5 mm.

**Physical Properties:** *Cleavage:* Perfect on {100}; fair on {010}. Hardness = ~2.5 D(meas.) = n.d. D(calc.) = 3.18 Topotactically transforms from switzerite.

**Optical Properties:** Translucent. *Color:* Pale golden brown. *Luster:* Adamantine to pearly. *Optical Class:* Biaxial (–). *Pleochroism:* Pale to dark red-brown. *Dispersion:* $r < v$, distinct. $\alpha = 1.602$ $\beta = 1.628$ $\gamma = 1.632$ 2V(meas.) = 42°

**Cell Data:** *Space Group:* $P2/a$. a = 17.099 b = 12.694 c = 8.282 $\beta = 95.91°$ Z = 8

**X-ray Powder Pattern:** Kings Mountain, North Carolina, USA.
8.55 (100), 2.585 (60), 7.128 (40), 6.775 (40), 3.175 (40), 2.934 (40), 2.842 (40)

**Chemistry:**

|  | (1) | (2) |
|---|---|---|
| $P_2O_5$ | 32.94 | 33.26 |
| $Al_2O_3$ | 0.27 | |
| $SiO_2$ | 0.06 | |
| FeO | 3.60 | |
| MnO | 46.05 | 49.86 |
| MgO | 0.15 | |
| CaO | 0.20 | |
| $H_2O$ | n.d. | 16.88 |
| Total | 83.27 | 100.00 |

(1) Kings Mountain, North Carolina, USA; partial analysis by electron microprobe, average of six analyses, converted to metaswitzerite in the electron beam. (2) $Mn_3(PO_4)_2 \cdot 4H_2O$.

**Occurrence:** Forms by irreversible dehydration of switzerite on exposure to air.

**Association:** Switzerite, vivianite.

**Distribution:** From the Foote Mine, Kings Mountain, Cleveland Co., North Carolina, USA. On Reaphook Hill, near Blinman, from the Spring Creek mine, near Wilmington, Flinders Ranges, and in the Iron Monarch quarry, Iron Knob, South Australia.

**Name:** Emphasizes the close chemical and structural relations to *switzerite*.

**Type Material:** The Natural History Museum, London, England, 1967,407; National Museum of Natural History, Washington, D.C., USA, 120230.

**References:** (1) White, J.S., Jr., P.B. Leavens, and P.F. Zanazzi (1986) Switzerite redefined as $Mn_3(PO_4)_2 \cdot 7H_2O$, and metaswitzerite, $Mn_3(PO_4)_2 \cdot 4H_2O$. Amer. Mineral., 71, 1221–1223. (2) Zanazzi, P.F., P.B. Leavens, and J.S. White, Jr. (1986) Crystal structure of switzerite, $Mn_3(PO_4)_2 \cdot 7H_2O$, and its relationship to metaswitzerite, $Mn_3(PO_4)_2 \cdot 4H_2O$. Amer. Mineral., 71, 1224–1228. (3) Leavens, P.B. and J.S. White, Jr. (1967) Switzerite [metaswitzerite] $(Mn, Fe)_3(PO_4)2 \cdot 4H_2O$, a new mineral. Amer. Mineral., 52, 1595–1602.