

Lindbergite, a new Mn oxalate dihydrate from Boca Rica mine, Galiléia, Minas Gerais, Brazil, and other occurrences

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ABSTRACT

The new mineral lindbergite, $\text{Mn}(\text{C}_2\text{O}_4)\cdot 2\text{H}_2\text{O}$, is a secondary mineral in the Lavra da Boca Rica granite pegmatite, Sapucaia do Norte, Galiléia Co., Minas Gerais, Brazil. It occurs as: (1) white short prismatic crystals 0.1 to 0.3 mm in length, interpreted as pseudomorphs after the orthorhombic trihydrate, with faces of $\{100\}$, $\{hk0\}$, $\{010\}$, and $\{0kl\}$ forms, rounded edges, and twinning on (010); and (2) grayish-white aggregates in 0.1 mm thick translucent crusts made up of interlocking irregularly contoured platelets up to 0.03 mm in length. Lindbergite is transparent, has a white streak, vitreous luster, a perfect cleavage parallel $\{010\}$, and is non-fluorescent. The Mohs' hardness is $2\frac{1}{2}$ and its tenacity crumbly. The measured density is $2.10(3)$ g/cm^3 (calculated 2.251 g/cm^3). Lindbergite is biaxial negative, with $n_\alpha = 1.424(3)$, $n_\beta = 1.550(3)$, $n_\gamma = 1.65(1)$ (white light), $2V$ (obs.) = $80(2)^\circ$, $2V$ (calc.) = 77° . Dispersion is not detectable or very weak with $r > v$. Orientation $Y \wedge c = 20^\circ$. The empirical composition is $(\text{Mn}_{1.11}\text{Na}_{0.01}\text{Al}_{0.01})_{\Sigma 1.13}(\text{C}_{1.94}\text{O}_4)\cdot 2.15\text{H}_2\text{O}$. The mineral is monoclinic, $C2/c$, $a = 11.995(5)$, $b = 5.632(2)$, $c = 9.967(7)$ Å, $\beta = 128.34(4)^\circ$, $V = 528.1(5)$ Å³, $Z = 4$. Lindbergite is the Mn analogue of humboldtine and glushinskite. Associated minerals at the type locality are the phosphates triphylite, phosphsiderite, frondelite, strengite, cyrilovite, bermanite, rockbridgeite, huréaulite, tavorite, reddingite, heterosite, laueite, and unidentified minerals. Additional occurrences of lindbergite are from Parsettens, Grisons, Switzerland, the Lecht Mines, Banffshire, Scotland, and the Morefield Pegmatite, Amelia, Virginia. Lindbergite also has been recorded from three localities in the Black Forest, Germany: Clara Mine, Oberwolfach, Wolfach Valley, Baden-Württemberg; Ortenberg near Offenburg; and Gremmelsbach near Triberg, but the natural origin was not firmly established for the last one. An occurrence of orthorhombic $\text{Mn}(\text{C}_2\text{O}_4)\cdot 3\text{H}_2\text{O}$ has been reported at Falotta, Grisons, Switzerland.