## Kaliborite $KHMg_2B_{12}O_{16}(OH)_{10}\cdot 4H_2O$



**Crystal Data:** Monoclinic. *Point Group:* $2/m$. Small crystals exhibit {100}, {111}, {110}, with a few additional forms, typically with uneven face development; in powdery aggregates, granular, massive.

**Physical Properties:** *Cleavage:* On {001}, {$\overline{1}$01}, perfect; on {100}, good. Hardness = 4–4.5 D(meas.) = 2.128 D(calc.) = [2.110] Slightly soluble in $H_2O$.

**Optical Properties:** Transparent. *Color:* Colorless to white, uncommonly reddish brown; colorless in transmitted light. *Luster:* Vitreous.
*Optical Class:* Biaxial (+). *Orientation:* $Y = b$; $Z \wedge c = 64°30'$. $\alpha = 1.508$ $\beta = 1.526$–$1.527$ $\gamma = 1.549$–$1.550$ $2V(meas.) = 80°38'$

**Cell Data:** *Space Group:* $C2/c$. $a = 18.572(6)$ $b = 8.466(3)$ $c = 14.689(5)$ $\beta = 100.02(3)°$ $Z = 4$

**X-ray Powder Pattern:** Leopoldshall, Germany.
7.22 (100), 6.215 (100), 3.104 (71), 2.488 (71), 3.837 (50), 3.770 (50), 3.359 (50)

**Chemistry:**

| | (1) | (2) |
|---|---|---|
| $B_2O_3$ | [57.46] | 58.30 |
| MgO | 12.06 | 11.25 |
| $K_2O$ | 6.48 | 6.57 |
| $H_2O$ | 24.00 | 23.88 |
| Total | [100.00] | 100.00 |

(1) Schmidtmannshall, Germany; $B_2O_3$ by difference. (2) $KHMg_2B_{12}O_{16}(OH)_{10}\cdot 4H_2O$.

**Occurrence:** An uncommon component in marine potash deposits; rarely in efflorescences.

**Association:** Boracite, pinnoite, kainite (Germany); anhydrite, halite (Inder deposit, Kazakhstan).

**Distribution:** In Germany, in Saxony-Anhalt, from Schmidtmannshall, near Aschersleben; Neustassfurt and Leopoldshall, in Stassfurt, 34 km south of Magdeburg. At Sallent-Balsareny, Barcelona Province, Spain. From Monte Sambuco, Calascibetta, Sicily, Italy. At the Inder borate deposit, Kazakhstan. In the USA, from the Eagle Borax Spring, Furnace Creek district, Death Valley, Inyo Co., California.

**Name:** For potassium, KALIum, and BORate in the composition.

**References:** (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 367–368. (2) Mrose, M.E. and W.T. Schaller (1965) The identity of paternoite with kaliborite ($K_2O\cdot 4MgO\cdot 11B_2O_3\cdot 18H_2O$). Amer. Mineral., 50, 1079–1083. (3) Burns, P.C. and F.C. Hawthorne (1994) Kaliborite: an example of a crystallographically symmetrical hydrogen bond. Can. Mineral., 32, 885–894.