Hydrobiotite

$[K(Mg,Fe^{2+})_3(Al,Fe^{3+})Si_3O_{10}(OH,F)_2]\cdot[(Mg,Fe^{2+},Al)_3(Si,Al)_4O_{10}(OH)_2\cdot 4H_2O]$

Crystal Data: [Monoclinic] (by analogy to biotite and vermiculite). *Point Group:* [2/*m*.] In cleavage plates and flakes.

Physical Properties: *Cleavage:* [{001}, perfect.] *Tenacity:* [Brittle to flexible, elastic.] Hardness = [~2] D(meas.) = 2.49–2.64 D(calc.) = n.d.

Optical Properties: Semitransparent. *Color:* Blackish, brownish; golden yellow, pinkish. *Luster:* [Dull.]
Optical Class: Biaxial (–). *Pleochroism:* X = light brown; $Y = Z$ = brown. *Absorption:* $X > Y = Z$. α = n.d. β = 1.560–1.562; 1.575 γ = 1.565–1.567 2V(meas.) = 10°–13°

Cell Data: *Space Group:* [$C2/m$.] a = n.d. b = n.d. c = 24.5–25.5 β = n.d. Z = n.d.

X-ray Powder Pattern: Northeastern Transvaal, South Africa.
12.23 (60), 3.493 (50), 4.909 (30), 2.725 (20), 2.041 (16) 3.071 (15), 24.3 (7)

Chemistry:

	(1)	(2)		(1)	(2)
SiO_2	35.60		SrO	0.01	
TiO_2	1.13		BaO	0.17	
Al_2O_3	11.85		Na_2O	0.16	
Fe_2O_3	10.28		K_2O	3.17	
Cr_2O_3	0.03		Rb_2O	0.01	
FeO	0.81		F	0.21	
MnO	0.08		H_2O^+	7.56	
MgO	20.17		H_2O^-	7.20	
CaO	1.44		P_2O_5	0.07	
			$-O = F_2$	0.09	
			Total	99.86	

(1) Libby. Montana; corresponds to $(Mg_{2.38}Fe^{3+}_{0.61}K_{0.32}Ca_{0.12}Ti_{0.07}Fe^{2+}_{0.05}Na_{0.03}Ba_{0.01})_{\Sigma=3.59}(Si_{2.82}Al_{1.18})_{\Sigma=4.00}O_{10}[(OH)_{1.95}F_{0.05}]_{\Sigma=2.00}\cdot 3.01H_2O$.

Polymorphism & Series: A 1:1 regular interstratification of biotite and vermiculite.

Mineral Group: Mica group.

Occurrence: As an alteration product of other micas.

Association: Vermiculite, biotite, apatite, zircon.

Distribution: Perhaps at Křemže, Czech Republic. A few other localities for well-characterized material include: in the USA, in the Rainy Creek complex, near Libby, Lincoln Co., Montana, and from the Enoree area, Spartanburg Co., South Carolina. At Phalaborwa, Transvaal, South Africa.

Name: For its resemblance to *biotite*, but hydrated.

References: (1) Dana, E.S. (1892) Dana's system of mineralogy, (6th edition), 632 [biotite], 664 [vermiculite]. (2) Gruner, J.W. (1934) The structures of vermiculites and their collapse by dehydration. Amer. Mineral., 19, 557–575. (3) Boettcher, A.L. (1966) Vermiculite, hydrobiotite, and biotite in the Rainy Creek igneous complex near Libby, Montana. Clay Minerals, 6, 283–296. (4) Brindley, G.W., P.E. Zalba, and C.M. Bethke (1983) Hydrobiotite, a regular 1:1 interstratification of biotite and vermiculite layers. Amer. Mineral., 68, 420–425.