Buddingtonite $(NH_4)AlSi_3O_8$

Crystal Data: Monoclinic. *Point Group:* 2 or $2/m$. As crystals similar in habit and interfacial angle to orthoclase, with forms {001}, {010}, {110}, {$\bar{1}$01}, to 0.05 mm. In compact masses pseudomorphous after plagioclase. *Twinning:* Noted.

Physical Properties: *Cleavage:* Good on {001}, distinct on {010}. *Tenacity:* Brittle. Hardness = 5.5 D(meas.) = 2.32(1) D(calc.) = 2.38

Optical Properties: Transparent to translucent. *Color:* Colorless. *Streak:* Light grey, yellow when impure. *Luster:* Vitreous.
Optical Class: Biaxial (+). *Orientation:* $Z = b$; $X \wedge a = 4°$; $Y \wedge c = 19°$. $\alpha = 1.530(2)$ $\beta = 1.531(2)$ $\gamma = 1.534(2)$ 2V(meas.) = n.d.

Cell Data: *Space Group:* $P2_1$ or $P2_1/m$. $a = 8.571$ $b = 13.032$ $c = 7.187$ $\beta = 112°44(1)'$ Z = 4

X-ray Powder Pattern: Sulfur Bank mine, California, USA.
3.81 (100), 6.52 (95), 3.38 (70), 3.23 (70), 4.33 (65), 3.26 (60), 3.01 (40)

Chemistry:

	(1)	(2)		(1)	(2)
SiO_2	66.89	70.06	Na_2O	0.06	
Al_2O_3	20.09	19.82	K_2O	0.65	
MgO	0.22		$(NH_4)_2O$	8.34	10.12
CaO	0.04		H_2O	3.44	
BaO	0.27		Total	[100.00]	100.00

(1) Sulfur Bank mine, California, USA; probably contains a small amount of reversibly hydrated ammonian montmorillonite accounting for the remaining H_2O content; after deductions for TiO_2, FeS_2, and $H_2O^- = 4\%$, recalculated to 100.00%. (2) $(NH_4)AlSi_3O_8$.

Mineral Group: Feldspar group.

Occurrence: A low-temperature hydrothermal replacement of plagioclase in andesite altered by ammonia-bearing hot springs (Sulfur Bank mine, California, USA); in metasomatized rhyolitic ash-flow tuffs (Cedar Mountains, Nevada, USA); in the sedimentary Phosphoria Formation (Idaho, Wyoming, and Montana, USA).

Association: Plagioclase, sulfur, stibnite, pyrite, marcasite, ammoniojarosite, gypsum, barite, anatase, montmorillonite (Sulfur Bank mine, California, USA); illite, albite, montmorillonite, kaolinite (Phosphoria Formation, Idaho, Wyoming, and Montana, USA).

Distribution: In the USA, at the Sulfur Bank mercury mine, Lake Co., and on Sharon Heights, Menlo Park, Santa Clara Co., California; in the Cedar Mountains, 50 km northwest of Tonopah, Nye Co., Nevada; at a number of exposures of the Meade Peak Member of the Phosphoria Formation in Idaho, Wyoming, and Montana. In the Condor oilshale deposit, near Proserpine, Queensland, Australia. From the Toshichi Spa, Iwate Prefecture, Japan.

Name: To honor Emeritus Professor Arthur Francis Buddington (1890–1980), American geologist, Princeton University, Princeton, New Jersey, USA.

Type Material: National Museum of Natural History, Washington, D.C., USA, 116974, 132920, 147604.

References: (1) Erd, R.C., D.E. White, J.J. Fahey, and D.E. Lee (1964) Buddingtonite, an ammonium feldspar with zeolitic water. Amer. Mineral., 49, 831–850. (2) Gulbrandsen, R.A. (1974) Buddingtonite, ammonium feldspar, in the Phosphoria Formation, southeastern Idaho. J. Res. U.S. Geol. Sur., 2, 693–697. (3) Voncken, J.H.L., H.L.M. van Roermund, A.M.J. van der Eerden, J.B.H. Jansen, and R.C. Erd (1993) Holotype buddingtonite: an ammonium feldspar without zeolitic H_2O. Amer. Mineral., 78, 204–209.