

Gainesite

$\text{Na}_2(\text{Be, Li})(\text{Zr, Zn})_2(\text{PO}_4)_4 \cdot 1-2\text{H}_2\text{O}$

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Crystal Data: Tetragonal. *Point Group:* $4/m\ 2/m\ 2/m$. Crystals are steep tetragonal bipyramids, to 2 mm, with prominent $\{111\}$ and tiny $\{001\}$.

Physical Properties: *Fracture:* Conchoidal. Hardness = 4 D(meas.) = 2.94(2)
D(calc.) = 2.89

Optical Properties: Transparent. *Color:* Pale bluish lavender; nearly colorless in transmitted light. *Luster:* Vitreous.

Optical Class: Uniaxial (+). $\omega = 1.618(2)$ $\epsilon = 1.630(2)$

Cell Data: *Space Group:* $I4_1/amd$. $a = 6.567(3)$ $c = 17.119(5)$ $Z = 2$

X-ray Powder Pattern: Nevel quarry, Maine, USA; close to mccrillisite.
6.068 (100), 3.265 (90), 3.023 (50), 2.881 (40), 4.240 (30), 2.165 (30), 2.012 (30)

Chemistry:	(1)	(2)	(1)	(2)
P_2O_5	45.0	45.0	CaO	0.86
SiO_2	0.59	0.1	SrO	0.15
ZrO_2	33.0	33.0	Li_2O	1.7
HfO_2	n.d.	0.7	Na_2O	6.82
Al_2O_3	1.21	0.5	K_2O	1.45
FeO	0.54	1.0	Rb_2O	0.11
MnO	0.83	0.7	Cs_2O	1.93
ZnO	4.11	< 0.1	F	< 0.1
BeO	2.8	2.3	H_2O	n.d.
MgO	0.30	0.35		4.3
			Total	101.4
				101.95

(1) Nevel quarry, Maine, USA; by electron microprobe, total Fe as FeO, total Mn as MnO; corresponds to $(\text{Na}_{0.38}\text{Li}_{0.06}\text{Mn}_{0.04}^{2+}\text{Fe}_{0.02}^{2+})_{\Sigma=0.50}(\text{Na}_{0.30}\text{K}_{0.10}\text{Cs}_{0.05}\text{Ca}_{0.05})_{\Sigma=0.50}\text{Li}_{0.22}(\text{Be}_{0.35}\text{Li}_{0.08}\text{Al}_{0.07})_{\Sigma=1.00}(\text{Zr}_{0.83}\text{Zn}_{0.15}\text{Mg}_{0.02})_{\Sigma=1.00}[(\text{P}_{0.99}\text{Si}_{0.01})_{\Sigma=1.00}\text{O}_4]_4$. (2) Do.; by electron microprobe, Zn, Be, Li by LA-ICP-MS and ion microprobe, H_2O by ion microprobe, total Fe as FeO, total Mn as MnO; corresponds to $\text{Na}_{1.00}(\text{Na}_{0.59}\text{K}_{0.32}\text{Cs}_{0.10}\text{Rb}_{0.01})_{\Sigma=1.02}(\text{Be}_{0.58}\text{Li}_{0.34}\text{Mg}_{0.06}\text{Al}_{0.06})_{\Sigma=1.04}(\text{Zr}_{1.69}\text{Fe}_{0.09}\text{Ca}_{0.08}\text{Mn}_{0.06}\text{Hf}_{0.02})_{\Sigma=1.94}[(\text{P}_{1.00}\text{Si}_{0.01})_{\Sigma=1.01}\text{O}_4]_4 \cdot 1.5\text{H}_2\text{O}$.

Occurrence: A very rare accessory mineral in a granite pegmatite.

Association: Roscherite, eosphorite, albite.

Distribution: From the Nevel quarry, Newry, Oxford Co., Maine, USA.

Name: To honor Dr. Richard Venable Gaines (1917–1999), American mineralogist, economic geologist, and mineral collector, of Earlysville, Virginia, USA, for his interest in beryllium minerals.

Type Material: Harvard University, Cambridge, Massachusetts, 119133; National Museum of Natural History, Washington, D.C., USA, 114848, 137843.

References: (1) Moore, P.B., T. Araki, I.M. Steele, G.H. Swihart, and A.R. Kampf (1983) Gainesite, sodium zirconium beryllophosphate: a new mineral and its crystal structure. *Amer. Mineral.*, 68, 1022–1028. (2) Foord, E.E., M.E. Brownfield, F.E. Lichte, A.M. Davis, and S.J. Sutley (1994) Mccrillisite, $\text{NaCs}(\text{Be, Li})\text{Zr}_2(\text{PO}_4)_4 \cdot 1-2\text{H}_2\text{O}$, a new mineral species from Mount Mica, Oxford County, Maine, and new data for gainesite. *Can. Mineral.*, 32, 839–842.