Armstrongite $CaZrSi_6O_{15}·2.5H_2O$

Crystal Data: Monoclinic. *Point Group*: 2/*m*. As columnar crystals elongated along [010], to 2 cm, and as tangled-fibrous aggregates. *Twinning*: Polysynthetic, by rotation about [100].

Physical Properties: *Cleavage*: Perfect on {001}, good on {100}. *Tenacity*: Very brittle. Hardness = 4.6 VHN = 310-330 D(meas.) = 2.562-2.593 D(calc.) = 2.71

Optical Properties: Semitransparent. *Color*: Dark to pale brown, colorless. *Luster*: Vitreous. *Optical Class*: Biaxial (-). α = 1.563 β = 1.569 γ = 1.573 2V(meas.) = n.d. *Orientation*: *Z* = *b*; *Y* ^ *c* = 5°-7°. *Dispersion*: *r* < *v*.

Cell Data: Space Group: *C*2/*m*. *a* = 14.0178(7) *b* = 14.1289(6) *c* = 7.8366(3) β = 109.436(3)° Z = 4

X-ray Powder Pattern: Khan-Bogdo massif, Mongolia.
4.26 (100), 3.05 (100), 6.60 (90), 3.80 (90), 7.05 (50), 2.995 (50), 1.947 (50)

Chemistry:	(1)	(2)	(3)
SiO_2	60.12	62.5	61.64
TiO_2	0.12	0.03	
ZrO_2	19.80	20.9	21.07
Al_2O_3	0.60	0.02	
$(Y,RE)_2O_3$	0.55	0.45	
Fe_2O_3	1.31		
MgO	0.19		
MnO		0.04	
CaO	9.15	9.2	9.59
Na_2O	0.18	0.03	
K_2O	0.14	0.01	
H_2O	7.90	6.2	7.70
P_2O_5	0.20		
Total	100.26	99.38	100.00

(1) Khan-Bogdo massif, Mongolia. (2) Khan-Bogdo massif, Mongolia; electron microprobe analyses supplemented by FTIR spectroscopy, H_2O from structure; corresponds to $(Ca_{0.96}Ce_{0.01}Yb_{0.01})_{\Sigma=0.98}Zr_{0.99}Si_6O_{14.97}·2.02H_2O$. (3) $CaZrSi_6O_{15}·2.5H_2O$.

Occurrence: In schlieren of alkalic granite pegmatite, at the contact of arfvedsonite-bearing granite with xenoliths of felsic volcanic rock.

Association: Elpidite, quartz, microcline, albite, aegirine, arfvedsonite, monazite, synchesite, titanite, other titanosilicates (Khan-Bogdo); elpidite, gittinsite (Strange Lake).

Distribution: In the Khan-Bogdo granitic massif, southern Gobi desert, Mongolia. In the Strange Lake alkaline complex, southeast of Lac Brisson, Quebec and Labrador, Newfoundland, Canada.

Name: Honors Neil Alden Armstrong (1930-2012), American astronaut, first man to walk on the Moon.

Type Material: A.E. Fersman Mineralogical Museum, Russian Academy of Sciences, Moscow, Russia.

References: (1) Vladykin, N.V., V.I. Kovalenko, A.A. Kashaev, A.N. Sapozhnikov, and V.A. Pisarskaya (1973) A new mineral of calcium and zirconium, armstrongite. Doklady Acad. Nauk SSSR, 209, 1185-1188 (in Russian). (2) (1974) Amer. Mineral., 59, 208 (abs. ref. 1). (3) Mesto, E., E. Kaneva, E. Schingaro, N. Vladykin, M. Lacalamita, and F. Scordari1 (2014) Armstrongite from Khan Bogdo (Mongolia): Crystal structure determination and implications for zeolite-like cation exchange properties. Amer. Mineral., 99, 2424-2432.