

Englishite **$\text{K}_3\text{Na}_2\text{Ca}_{10}\text{Al}_{15}(\text{PO}_4)_{21}(\text{OH})_7 \cdot 26\text{H}_2\text{O}$**

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Crystal Data: Monoclinic. *Point Group:* $2/m$ or m . As plates, in subparallel aggregates, in crusts to 1 mm thick; as friable masses.

Physical Properties: *Cleavage:* On $\{001\}$, perfect, micaceous. *Tenacity:* Flexible. Hardness = ~ 3 $D(\text{meas.}) = 2.65\text{--}2.68$ $D(\text{calc.}) = 2.69$

Optical Properties: Transparent. *Color:* White to colorless, grayish green; colorless in transmitted light. *Luster:* Vitreous, pearly on cleavages. *Optical Class:* Biaxial (-). *Orientation:* $X = c$; $Y \simeq a$; $Z \simeq b$. $\alpha = 1.570(5)$ $\beta = 1.572(5)$ $\gamma = 1.573(5)$ $2V(\text{meas.}) = \text{Small}$.

Cell Data: *Space Group:* $A2/a$ or Aa . $a = 38.43(2)$ $b = 11.86$ $c = 20.67$ $\beta = 111^\circ 16'$ $Z = 4$

X-ray Powder Pattern: Fairfield, Utah, USA.
8.94 (10), 17.66 (9), 2.84 (8), 5.57 (6), 2.96 (6), 2.68 (6), 1.71 (5)

Chemistry:	(1)	(2)	(3)
P_2O_5	41.6	41.0	41.97
Al_2O_3	21.5	21.8	21.54
FeO	0.0	2.5	
MgO	0.1	0.1	
CaO	15.5	15.8	15.79
Na_2O	1.6	0.9	1.75
K_2O	4.0	3.6	3.98
H_2O	15.1	[14.9]	14.97
Total	99.4	[100.6]	100.00

(1) Little Green Monster mine, Utah, USA; by electron microprobe, H_2O by the Penfield method, average of three analyses; corresponds to $\text{K}_{3.01}\text{Na}_{1.83}(\text{Ca}_{9.79}\text{Mg}_{0.09})_{\Sigma=9.88}\text{Al}_{14.94}(\text{PO}_4)_{20.77}(\text{OH})_{7.11} \cdot 26.14\text{H}_2\text{O}$. (2) Tip Top mine, South Dakota, USA; by electron microprobe, H_2O from stoichiometry. (3) $\text{K}_3\text{Na}_2\text{Ca}_{10}\text{Al}_{15}(\text{PO}_4)_{21}(\text{OH})_7 \cdot 26\text{H}_2\text{O}$.

Occurrence: In variscite nodules (Little Green Monster mine, Utah, USA); in a complex granite pegmatite (Tip Top mine, South Dakota, USA).

Association: Variscite, montgomeryite, wardite, millisite, crandallite (Little Green Monster mine, Utah, USA); montgomeryite, eosphorite–childrenite, tiptopite, roscherite, pahasapaite, parafransoletite, robertsite, mitridatite, whitlockite (Tip Top mine, South Dakota, USA).

Distribution: In the USA, from the Little Green Monster mine, Clay Canyon, about nine km west of Fairfield, Utah Co., Utah; in the Tip Top mine, 8.5 km southwest of Custer, Custer Co., South Dakota; at the Gold Quarry mine, near Carlin, Maggie Creek district, Eureka Co., the Mickle mine, Lynn district, Elko Co., and the Redhouse barite mine, Potosi district, Humboldt Co., Nevada.

Name: To honor George Letchworth English (1864–1944), New York City, New York, USA, American mineral dealer and collector.

Type Material: Harvard University, Cambridge, Massachusetts, USA, 95494.

References: (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 957–958. (2) Dunn, P.J., R.C. Rouse, and J.A. Nelen (1984) Englishite: new chemical data and a second occurrence from the Tip Top pegmatite, Custer, South Dakota. Can. Mineral., 22, 469–470. (3) Moore, P.B. (1976) Derivative structures based on the alunite octahedral sheet: mitridatite and englishite. Mineral. Mag., 40, 863–866.

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