Huizingite-(Al) $(NH_4)_9Al_3(SO_4)_8(OH)_2 \cdot 4H_2O$

Crystal Data: Triclinic. *Point Group*: $\bar{1}$. Crystals, bladed to tabular on {100}, to ~ 0.25 mm, display {100}, {010}, {001}, and {110}. Typically intergrown in drusy aggregates.

Physical Properties: *Cleavage*: None. *Fracture*: Irregular. *Tenacity*: Brittle. Hardness = 2.5 D(meas.) = n.d. D(calc.) = 2.026 Soluble in water.

Optical Properties: Transparent. *Color*: Light greenish yellow. *Streak*: White.
Luster: Vitreous.
Optical Class: Biaxial (+). α = 1.543(1) β = 1.545(1) γ = 1.563(1) 2V(meas.) = 40(3)°
2V(calc.) = 37° *Dispersion*: Strong; $r > v$. *Orientation:* $X \wedge a = 24°$; $Y \wedge b = 25°$; $Z \wedge c = 27°$.
Pleochroism: X= *Pale* yellow; $Y = Z$ = nearly colorless. *Absorption*: $X > Y \approx Z$.

Cell Data: Space Group: $P\bar{1}$. a = 9.7093(3) b = 10.4341(3) c = 10.7027(8) α = 7.231(5)°
β = 74.860(5)° γ = 66.104(5)° Z = 1

X-ray Powder Pattern: Huron River burn site, Ohio, USA.
3.427 (100), 3.043 (94), 5.037 (69), 3.204 (68), 8.82 (60), 4.122 (41), 3.534 (38)

Chemistry:	(1)	(2)	(3)
$(NH_4)_2O$	[18.57]	19.70	13.34
Na_2O	0.55	0.58	
K_2O	0.09	0.10	
Al_2O_3	6.85	7.27	
Fe_2O_3	8.71	9.24	24.54
SO_3	52.14	55.32	49.21
H_2O	[7.35]	7.80	12.92
Total	94.26	100.00	100.00

(1) Huron River burn site, Ohio, USA; average of 10 electron microprobe analyses supplemented by Raman and IR spectroscopy, $(NH_4)_2O$ and H_2O calculated from structure analysis. (2) Analysis (1) normalized; corresponds to $[(NH_4)_{8.76}Na_{0.22}K_{0.02}]_{\Sigma=9.00}(Al_{1.65}Fe^{3+}_{1.34})_{\Sigma=2.99}(SO_4)_{8.00}(OH)_{1.98} \cdot 4.02\ H_2O$. (3) $(NH_4)_9Al_3(SO_4)_8(OH)_2 \cdot 4H_2O$.

Occurrence: Formed by a natural fire in oil-bearing shale exposed along a cliff.

Association: Adranosite-(Al), anhydrite, boussingaultite, mascagnite, salammoniac.

Distribution: From a cliff (the Huron River burn site 2009-2011) along the Huron River, ~ 6.1 km WSW of Milan, Ohio, USA.

Name: Honors Terry E. Huizing (born 1938) and Marie E. Huizing (born 1939) of Cincinnati, Ohio, USA, recipients of numerous awards for their diverse service to the international amateur and professional mineralogical communities. The '-(Al)' suffix indicates that this mineral is the Al-dominant member of a series with a not-yet-described Fe-dominant counterpart, for which the name huizingite-(Fe) is proposed.

Type Material: Natural History Museum of Los Angeles County, Los Angeles, California, USA (65576).

References: (1) Kampf, A.R., R.P. Richards, B.P. Nash, J.B. Murowchick, and J.F. Rakovan (2016) Carlsonite, $(NH_4)_5Fe^{3+}_3O(SO_4)_6 \cdot 7H_2O$, and huizingite-(Al), $(NH_4)_9Al_3(SO_4)_8(OH)_2 \cdot 4H_2O$, two new minerals from a natural fire in an oil-bearing shale near Milan, Ohio**.** Amer. Mineral., 101, 2095-2107.