

Hainite**Na₄Ca₈(Ti, Zr, Mn²⁺)₃Si₈O₂₈F₈**

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Crystal Data: Triclinic. *Point Group:* $\bar{1}$. Crystals, < 1 mm, slender needles and plates, elongated along [001] with {010}, {100}, and $\{\bar{1}10\}$. *Twinning:* On {100}.

Physical Properties: *Cleavage:* {010}, rather perfect; {100}, faint. *Fracture:* Brittle. Hardness = 5 D(meas.) = 3.148 D(calc.) = 3.157

Optical Properties: Semitransparent. *Color:* Wine-yellow, honey-yellow, colorless; light wine-yellow in thin section. *Luster:* Vitreous to adamantine.

Optical Class: Biaxial (+). *Pleochroism:* X = colorless; Z = wine-yellow. *Dispersion:* $r > v$, strong. *Absorption:* $Z > Y > X$. $n = \sim 1.7$, birefringence ~ 0.012 . $2V(\text{meas.}) = \text{Large}$.

Cell Data: *Space Group:* $P\bar{1}$. $a = 5.676(2)$ $b = 7.259(3)$ $c = 9.586(3)$ $\alpha = 101.08(4)^\circ$ $\beta = 101.14(4)^\circ$ $\gamma = 90.27(4)^\circ$ $Z = 1$

X-ray Powder Pattern: Hradiště Mountain, Czech Republic.

2.961 (100), 3.073 (90), 1.896 (70), 3.961 (50), 2.628 (50), 2.493 (50), 1.822 (50)

Chemistry:

	(1)		(1)
SiO ₂	32.07	Nb ₂ O ₅	1.38
TiO ₂	8.06	Ta ₂ O ₅	0.22
ZrO ₂	6.58	MnO	2.06
Al ₂ O ₃	0.03	CaO	32.05
La ₂ O ₃	0.60	Na ₂ O	7.46
Ce ₂ O ₃	1.01	F	12.09
Fe ₂ O ₃	1.25	—O = F ₂	5.09
		<u>Total</u>	<u>99.77</u>

(1) Hradiště Mountain, Czech Republic; by electron microprobe, average of fourteen analyses; corresponds to $(\text{Na}_{3.52}\text{Ca}_{0.48})_{\Sigma=4.00}\text{Ca}_{8.00}\text{RE}_{0.15}(\text{Ti}_{1.52}\text{Zr}_{0.80}\text{Mn}_{0.45}\text{Fe}_{0.25}\text{Nb}_{0.09}\text{Ta}_{0.02}\text{Al}_{0.01})_{\Sigma=3.14}\text{Si}_{7.80}[\text{O}_{27.68}\text{F}_{8.32}]_{\Sigma=36.00}$.

Occurrence: In cavities and embedded in the groundmass of a phonolite.

Association: Aegirine.

Distribution: From Hradiště Mountain, near Mildenau, Czech Republic.

Name: For the locality, formerly named Hoher Hain, in the Czech Republic.

Type Material: Charles University, Prague, Czech Republic, 20530.

References: (1) Dana, E.S. (1899) Dana's system of mineralogy, (6th edition), app. I, 31–32. (2) Vlasov, K.A., Ed. (1966) Mineralogy of rare elements, v. II, 385. (3) Johan, Z. and F. Čech (1989) New data on hainite, $\text{Na}_2\text{Ca}_4[(\text{Ti}, \text{Zr}, \text{Mn}, \text{Fe}, \text{Nb}, \text{Ta})_{1.50}\square_{0.50}](\text{Si}_2\text{O}_7)_2\text{F}_4$ and its crystallochemical relationship with götzenite, $\text{Na}_2\text{Ca}_5\text{Ti}(\text{Si}_2\text{O}_7)_2\text{F}_4$. *Compt. Rendus Acad. Sci. Paris*, 308, 1237–1242 (in French with English abs.). (4) (1990) *Amer. Mineral.*, 75, 936 (abs. ref. 3).