Hiärneite $Ca_2Zr_4Mn^{3+}SbTiO_{16}$

Crystal Data: Tetragonal. *Point Group*: 4/*m* 2/*m* 2/*m*. As prismatic grains to 200 μm and in aggregates to 500 μm. Typically poikiloblastic with abundant mica inclusions.

Physical Properties: *Cleavage*: None. *Tenacity*: n.d. *Fracture*: n.d.
Hardness = ~7 VHN = 1254 (50 g load). D(meas.) = n.d. D(calc.) = 5.44 Nonfluorescent.

Optical Properties: Translucent. *Color*: Bright red, colorless to gray in reflected light with yellow internal reflections. *Streak*: n.d. *Luster*: n.d.
Optical Class: Uniaxial (+). ω(calc.) = 2.12(2) ε'(calc.) = 2.16(2)
Pleochroism: Weak, orange and yellow-orange. Weakly anisotropic.
R_1-R_2: (400) 14.5-13.4, (420) 14.2-13.3, (440) 14.1-13.2, (460) 14.0-13.1, (480) 13.8-13.0, (500) 13.7-12.9, (520) 13.6-12.8, (540) 13.5-12.8, (560) 13.5-12.8, (580) 13.5-12.8, (600) 13.5-12.8, (620) 13.5-12.8, (640) 13.4-12.8, (660) 13.4-12.8, (680) 13.4-12.8, (700) 13.3-12.7

Cell Data: *Space Group*: $I4_1/acd$. a = 15.264(1) c = 10.089(2) Z = 8

X-Ray Diffraction Pattern: Långban deposit, Filipstad, Sweden.
2.92 (100), 1.792 (90), 1.534 (80), 2.539 (60), 3.45 (40), 3.38 (30), 2.168 (30)

Chemistry:

	(1)
Na_2O	0.59
MgO	0.09
CaO	9.15
MnO	[4.01]
Mn_2O_3	[3.71]
TiO_2	4.66
ZrO_2	53.94
Sb_2O_5	22.87
Fe_2O_3	0.81
HfO_2	0.5
Total	100.33

(1) Långban deposit, Filipstad, Sweden; one electron microprobe analysis, Hf by energy-dispersive X-ray spectrometry, Mn^{2+}/Mn^{3+} for charge balance; average of several analyses corresponds to $Na_{0.17}Ca_{1.57}Mn^{2+}_{0.62}Zr_{4.19}Hf_{0.02}Sb^{5+}_{1.37}Ti_{0.59}Mn^{3+}_{0.36}Mg_{0.02}Fe_{0.09}O_{16}$.

Mineral Group: Calzirtite group.

Occurrence: In an iron-manganese skarn deposit. Formed by metasomatic reactions of Sb-, Mn-rich fluids with previously Si-depleted volcanite, followed by metamorphism under conditions of high oxygen fugacity, silica undersaturation, and relatively high T.

Association: Phlogopite, calcite, fluorapatite, svabite, jacobsite, magnetoplumbite, bindheimite, pyrophanite.

Distribution: From the Långban deposit, Filipstad, Sweden.

Name: Honors Urban *Hiärne* (1641-1724), a pioneer in Swedish geology.

Type Material: Swedish Museum of Natural History, Stockholm, Sweden (920766).

References: (1) Holtstam, D. (1997) Hiärneite, a new, Zr-Sb oxide mineral isostructural with calzirtite, from Långban, Sweden. Eur. J. Mineral., 9, 843-848. (2) (1998) Amer. Mineral., 83, 401 (abs. ref. 1). (3) Miyawaki, R., F. Hatert, M. Pasero, and S.J. Mills (2022) IMA Commission on New Minerals, Nomenclature and Classification Newsletter 64. Mineral. Mag., 86, 182.