Krettnichite $PbMn^{3+}_2(VO_4)_2(OH)_2$

Crystal Data: Monoclinic. *Point Group*: 2/*m*. As radiating aggregates, to 3 cm, of platy (001) crystals, as acicular to prismatic crystals <1 mm, and as pseudo-rhombohedral crystals showing {001}, {111}, {332}, and {331}. Epitaxic intergrowths with brackebuschite are common, with parallel alignment of the *b* axes of both minerals. *Twinning*: Polysynthetic on (001), common.

Physical Properties: *Cleavage*: Perfect ‖ (001), another distinct set intersecting (001) at a high angle visible in polished section. *Tenacity*: n.d. *Fracture*: n.d. Hardness = 4.5 D(meas.) = > 4.04 D(calc.) = 4.51-4.81

Optical Properties: Opaque, transparent as thin plates. *Color*: Brown to black with red internal reflections, reddish brown in transmitted light. *Streak*: Brown. *Luster*: Adamantine. *Optical Class*: Biaxial. *n*(calc.) = 2.21(1) for R_1 and 2.39(3) for R_2. *Pleochroism* (plane polarized light): Distinct, orange. *Pleochroism* (reflected light): Slight, very light gray to light brownish gray. *Anisotropism*: Strong, dark metallic blue, lighter blue-gray, silver, to light purplish brown-gray. R_1-R_2: (400) 17.2-20.9, (420) 16.8-20.5, (440) 16.5-20.0, (460) 16.1-19.5, (470) 15.8-19.2, (480) 15.7-18.9, (500) 15.4-18.6, (520) 15.2-18.3, (546) 14.8-17.8, (560) 14.7-17.7, (580) 14.5-17.4, (590) 14.4-17.3, (600) 14.4-17.2, (620) 14.3-17.0, (640) 14.1-16.9, (650) 14.1-16.8, (660) 14.0-16.6, (680) 14.1-16.5, (700) 13.8-16.3

Cell Data: *Space Group*: *C*2/*m*. a = 9.275(7) b = 6.284(3) c = 7.682(2) β = 117.97(4)° Z = 2

X-ray Powder Pattern: Krettnich, Saarland, Germany.
3.270 (100), 3.388 (95), 2.4910 (93), 1.6970 (83), 2.946 (51), 2.850 (49), 1.8693 (35)

Chemistry:

	(1)	(2)		(1)	(2)
CaO	0.60		Al_2O_3	0.04	
BaO	0.90		Fe_2O_3	1.25	
SrO	1.48		Mn_2O_3	24.03	27.17
PbO	32.66	38.42	As_2O_5	2.92	
CuO	0.42		V_2O_5	29.26	31.31
CoO	2.22		H_2O	[3.54]	3.10
NiO	0.04		Total	99.36	100.00

(1) Krettnich, Saarland, Germany; average of 54 electron microprobe analyses, H_2O calculated; corresponds to $(Pb_{0.83}Sr_{0.08}Ca_{0.06}Ba_{0.03})_{\Sigma=1.00}(Mn_3{}^{1+}{}_{0.73}Co_{0.17}Fe_{0.09}Cu_{0.03}Al_{0.01})_{\Sigma=2.03}(V_{1.83}As_{0.14})_{\Sigma=1.97}O_{7.71}(OH)_{2.23}$. (2) $PbMn^{3+}{}_2(VO_4)_2(OH)_2$.

Mineral Group: Member of the tsumcorite group.

Occurrence: As a primary accessory ore mineral and as free crystals in vugs within a non-metamorphosed, hydrothermal manganite-quartz vein.

Association: Barite, ankerite, manganite, mottramite, brackebuschite, pyrobelonite.

Distribution: From the historic manganese deposit near Krettnich, Saarland, Germany.

Name: For the locality that provided the first specimens, Krettnich, Germany.

Type Material: Musée Cantonal de Géologie, Lausanne, Switzerland (MGL 65317), and the Natural History Museum, London, England.

References: (1) Brugger, J., T. Armbruster, A. Criddle, P. Berlepsch, S. Graeser and S. Reeves (2001) Description, crystal structure, and paragenesis of krettnichite, $PbMn^{3+}{}_2(VO_4)_2(OH)_2$, the Mn^{3+} analogue of mounanaite. Eur. J. Mineral., 13(1), 145-158. (2) (2001) Amer. Mineral., 86 (11-12) 1535 (abs. ref. 1).