

Koenenite**Na₄Mg₉Al₄Cl₁₂(OH)₂₂**

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Crystal Data: Hexagonal; a mixed-layer structure. *Point Group:* $\bar{3} 2/m$. In crusts of acute scalenohedra and rhombohedra; as rosettes of tablets; as fibrous inclusions in other salts.

Physical Properties: *Cleavage:* {0001}, perfect. *Tenacity:* Flexible, in thin foliae. Hardness = 1.5–2 D(meas.) = 1.82–2.08, 1.97–1.98 after leaching in cold H₂O. D(calc.) = [1.82] Partially leached by cold H₂O, decomposed by hot H₂O.

Optical Properties: Transparent to translucent. *Color:* Colorless, pale yellow to deep red due to inclusions; reddish brown to colorless in thin section. *Luster:* Pearly on cleavage surfaces. *Optical Class:* Uniaxial (+); may be anomalously biaxial. *Pleochroism:* *O* = red-brown; *E* = colorless. $\omega = 1.52$ $\epsilon = 1.55$ $2V(\text{meas.}) = < 10^\circ$

Cell Data: *Space Group:* $R\bar{3}m$ [Na₄(Ca, Mg)₂Cl₁₂]⁴⁻ with $a = 4.072(2)$ $c = 32.64(0.015)$ and *Space Group:* $P\bar{3}m1$ [Mg₇Al₄(OH)₂₂]⁴⁺ with $a = 3.052(2)$ $c = 10.88(0.005)$ $Z = [1]$

X-ray Powder Pattern: Siegfried-Giesen mine, Lower Saxony, Germany; after partial leaching in cold H₂O.

11.7 (vs), 10.7 (vs), 1.924 (vs), 1.522 (vs), 5.45 (s), 3.68 (s), 3.34 (s)

Chemistry:	(1)	(2)	(3)
SiO ₂		0.63	
Al ₂ O ₃	18.25	23.98	16.74
Fe ₂ O ₃		0.96	
MnO		0.17	
MgO	23.44	32.49	29.78
CaO		0.18	
MgCl ₂	36.85		
Na ₂ O			10.17
Cl		15.52	34.92
H ₂ O	21.46	25.30	16.27
–O = Cl ₂		[3.50]	7.88
Total	[100.00]	[95.73]	100.00

(1) Justus I mine, Germany; recalculated to 100% after removal of alkali chlorides.

(2) Jiangcheng, China; after partial leaching in H₂O, leading to Mg₇Al₄Cl₄(OH)₂₂•H₂O.

(3) Na₄Mg₉Al₄Cl₁₂(OH)₂₂.

Occurrence: In marine evaporite deposits.

Association: Hematite, carnallite, sylvite, halite, kieserite, anhydrite.

Distribution: At the Justus I, Glückauf-Sarstedt, Wathlingen, and other mines in the Zechstein potash beds, Lower Saxony, and at Stassfurt, 34 km south of Magdeburg, Saxony-Anhalt, Germany. From Pilluana, on the Big Huallaga River, about 25 km south of Tarapoto, Peru. In drill cores from the Prairie Evaporite Formation, Saskatchewan, Canada. At Jiangcheng, Yunnan Province, China.

Name: Honors Adolph von Koenen (1837–1915), German geologist of Göttingen, Germany, who discovered the first specimens.

Type Material: n.d.

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