

Carbonate-cyanotrichite

$\text{Cu}_4\text{Al}_2(\text{CO}_3, \text{SO}_4)(\text{OH})_{12} \cdot 2\text{H}_2\text{O}$

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Crystal Data: n.d. *Point Group:* n.d. Individual platelets and acicular crystals, to 5 mm, typically in radiating fibrous crusts and spherules.

Physical Properties: Hardness = < 2 $D(\text{meas.}) = 2.66(1)$ $D(\text{calc.}) = \text{n.d.}$

Optical Properties: Semitransparent. *Color:* Pale blue to azure-blue. *Luster:* Silky. *Optical Class:* Biaxial (+). *Pleochroism:* Strong; X = colorless; Z = bright blue. *Orientation:* Negative elongation, parallel extinction. *Dispersion:* $r > v$, strong. $\alpha = 1.616(2)$ $\beta = \text{n.d.}$ $\gamma = 1.677(2)$ $2V(\text{meas.}) = 55^\circ\text{--}60^\circ$

Cell Data: *Space Group:* n.d. $Z = \text{n.d.}$

X-ray Powder Pattern: Balasauskandyk deposit, Kazakhstan.
4.21 (100), 10.13 (93), 5.03 (60), 3.33 (58), 2.01 (53), 2.51 (52), 2.77 (45)

Chemistry:	(1)		(1)
	SO_3	4.05	ZnO
	CO_2	5.20	CaO
	SiO_2	2.98	MgO
	V_2O_4	0.16	H_2O^+
	Al_2O_3	18.10	H_2O^-
	CuO	44.40	
		Total	100.67

(1) Balasauskandyk deposit, Kazakhstan; after deducting quartz 2.98%, dolomite 0.88%, calcite 0.50%, and H_2O^- 0.80%, corresponds to $(\text{Cu}, \text{Zn})_{3.70}\text{Al}_{2.30}(\text{C}_{0.67}\text{S}_{0.33})_{\Sigma=1.00}[\text{O}_{2.98}(\text{OH})_{1.02}]_{\Sigma=4.00}(\text{OH})_{12} \cdot 2\text{H}_2\text{O}$.

Occurrence: A rare secondary mineral in the oxidized zone of copper-bearing deposits.

Association: Volborthite, malachite, azurite, aurichalcite, pseudomalachite, spangolite, gibbsite, allophane (Balasauskandyk deposit, Kazakhstan); volborthite, tangeite, malachite, brochantite, langite (Menzies Bay, Canada).

Distribution: From the Balasauskandyk, Kurumsak, and other vanadium deposits, Kara-Tau Mountains, Kazakhstan. On Mt. Dzhebagly, Talass Alatau Range, and from Sary-Dzhas, Terskii Alatau Range, Kyrgyzstan. In the USA, from the Engels mine, north of Taylorsville, Plumas Co., California; in several mines at Bisbee, Cochise Co., Arizona; at the Gold Quarry mine, near Carlin, Maggie Creek district, Eureka Co., Nevada; from the Jomac mine, White Canyon district, San Juan Co., Utah; at the Emery mine, Chester, Hampton Co., Massachusetts. From Menzies Bay, Vancouver Island, British Columbia, Canada. In France, from the Cap Garonne mine, near le Pradet, Var, and in the Valcroze mine, Alzon, Gard. On the west flank of Cherbadung [Pizzo Cervandone], Binntal, Valais, Switzerland. From South Wheal Crebor, Tavistock, Devon, England. In the Wedding Cave mine, Bwlchgwyn, Clwyd, Wales. From the Maharahara mine, near Woodville, New Zealand. A few other minor localities are known.

Name: As the *carbonate*-dominant analog of *cyanotrichite*.

Type Material: Mining Museum, St. Petersburg, 1396/2–3; Vernadsky State Geological Museum, Moscow, 49844; A.E. Fersman Mineralogical Museum, Academy of Sciences, Moscow, Russia, 65618, 65619.

References: (1) Ankinovich, E.A., I.I. Gekht, and R.I. Zaitseva (1963) A new variety of cyanotrichite – carbonate-cyanotrichite. *Zap. Vses. Mineral. Obshch.*, 92, 458–463 (in Russian). (2) (1964) *Amer. Mineral.*, 49, 441–442 (abs. ref. 1). (3) Read, A.J. (1986) Chalcophyllite and other rare hydroxy-sulfates from Maharahara, New Zealand. *Mineral. Record*, 17, 199–204. (4) Pekov, I.V. (1998) Minerals first discovered on the territory of the former Soviet Union. *Ocean Pictures*, Moscow, 56–57.

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