

**Crystal Data:** Orthorhombic. *Point Group:*  $2/m\ 2/m\ 2/m$ . As prismatic crystals, elongated along [001] and flattened on {010}, to about 2 mm; as scepter-shaped or skeletal crystals; doubly-terminated crystals may exhibit unequally developed equivalent faces; in aggregates of radiating sprays. Also granular, as crusts or pseudomorphs, and massive.

**Physical Properties:** *Cleavage:* Perfect on {010}. *Fracture:* Subconchoidal. *Tenacity:* Slightly sectile. Hardness = 2.5 D(meas.) = 5.80 (synthetic). D(calc.) = [5.91] Somewhat soluble in H<sub>2</sub>O.

**Optical Properties:** Transparent to opaque. *Color:* Colorless to white, pale green, pale yellow; colorless in thin section. *Luster:* Adamantine, silky to pearly.

*Optical Class:* Biaxial (+). *Orientation:*  $X = b$ ;  $Y = a$ ;  $Z = c$ .  $\alpha = 2.199$   $\beta = 2.217$   
 $\gamma = 2.260$   $2V(\text{meas.}) = \text{n.d.}$   $2V(\text{calc.}) = 67^\circ 12'$

**Cell Data:** *Space Group:*  $Pnam$  (synthetic).  $a = 7.6222(5)$   $b = 9.0448(7)$   $c = 4.5348(4)$   
 $Z = 4$

**X-ray Powder Pattern:** Synthetic.

3.579 (100), 3.890 (75), 2.776 (55), 2.510 (45), 3.810 (40), 2.096 (40), 4.057 (35)

<b>Chemistry:</b>	(1)	(2)	(3)		(1)	(2)	(3)
Pb		71.96	74.50	Cl	26.9	25.32	25.50
CuO	0.11			H <sub>2</sub> O	1.08		
ZnO	0.10			-O = Cl <sub>2</sub>	4.07		
PbO	77.04			Total	101.16	97.28	100.00

(1) Tolbachik volcano, Russia. (2) Kolar Gold Fields, India; by electron microprobe. (3) PbCl<sub>2</sub>.

**Occurrence:** A volcanic sublimate or as an alteration of galena in saline environments. Also as an alteration product on leaden archeological objects or slag immersed in seawater.

**Association:** Galena, cerussite, anglesite, matlockite (Caracoles, Chile); tenorite, ponomarevite, sofiite, burnsite, ilinskite, georgbokite, chloromenite, halite, sylvite, gold (Tolbachik volcano, Russia).

**Distribution:** In Italy, on Vesuvius, Campania; in the Niccioleta mine, 40 km southwest of Siena, and along Baratti Beach, Tuscany, in slag. In Germany, from the Christian-Levin mine, near Essen, North Rhine-Westphalia, and at Richelsdorf, Hesse, in slag. At Laurium, Greece, in slag. From Leadhills, Lanarkshire, and Wanlockhead, Dumfriesshire, Scotland. At the Tolbachik fissure volcano, Kamchatka Peninsula, Russia. From the Kolar Gold Fields, Karnataka, India. In Chile, from near Caracoles, Sierra Gorda district, Antofagasta, and at Challacollo, Tarapacá. From the La Pamapa district, Pallasca Province, Peru. In the USA, from the Grand Gulch mine, Grand Wash Cliffs, Bentley district, Mohave Co., Arizona; at Bonanza, Saguache Co., Colorado; from Tintic, Juab Co., Utah; in the Loudville mine, Southampton, Hampshire Co., Massachusetts; at the Minnamax Cu-Ni sulfide deposit, Duluth Gabbro complex, near Hibbing, St. Louis Co., Minnesota.

**Name:** Honors Domenico Cotugno (Cotunnus) (1736–1822), Italian physician and Professor of Anatomy, University of Naples, Naples, Italy.

**References:** (1) Palache, C., H. Berman, and C. Frondel (1951) Dana's system of mineralogy, (7th edition), v. II, 42–44. (2) Sass, R.L., E.B. Brackett, and T.E. Brackett (1963) The crystal structure of lead chloride. *J. Phys. Chem.*, 67, 2863–2864. (3) Nozik, Y.Z., L.E. Fykin, and L.A. Muradyan (1976) Crystal structure of cotunnite PbCl<sub>2</sub> determined more precisely by application of the neutron diffraction method. *Kristallografiya (Sov. Phys. Crystal.)*, 21, 76–79 (in Russian). (4) Semenova, T.F., S.F. Filatov, L.P. Vergasova, V.V. Petukhova, and T.A. Dobroskok (1988) Exhalation-derived cotunnite PbCl<sub>2</sub>. A new find in the USSR. *Mineral. Zhurnal*, 10, 92–96 (in Russian). (5) Safonov, Y.G., A.D. Genkin, V.N. Vasudev, B. Krishna Rao, and G.V. Anantha Iyer (1984) Genetic features of gold ore deposit at Kolar, Dharwar Craton, India. *J. Geol. Soc. India*, 25, 145–154. (6) (1975) NBS Mono. 25, 12, 23.

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