

**Crystal Data:** Monoclinic. *Point Group:*  $2/m$ . Crystals are elongated, to 2 cm, commonly in subparallel aggregates.

**Physical Properties:** *Cleavage:* Prismatic, imperfect. *Fracture:* Uneven. *Tenacity:* Brittle. Hardness = 3 VHN = 108–117, 111 average (100 g load).  $D(\text{meas.}) = 5.71(23)$   
 $D(\text{calc.}) = 5.77$

**Optical Properties:** Transparent to opaque. *Color:* Colorless to white; in reflected light shows abundant colorless internal reflections. *Streak:* White. *Luster:* Adamantine.

*Optical Class:* [Biaxial.]  $\alpha = \text{n.d.}$   $\beta = \text{n.d.}$   $\gamma = \text{n.d.}$   $2V(\text{meas.}) = \text{n.d.}$  *Anisotropism:* Weak to moderate. *Birefractance:* Moderate, gray to dark gray.

$R_1$ – $R_2$ : (400) 14.2–14.8, (420) 14.0–14.6, (440) 13.8–14.4, (460) 13.7–14.1, (480) 13.4–13.9, (500) 13.2–13.7, (520) 13.1–13.5, (540) 12.9–13.4, (560) 12.8–13.2, (580) 12.7–13.1, (600) 12.6–13.0, (620) 12.5–12.9, (640) 12.5–12.9, (660) 12.4–12.8, (680) 12.3–12.8, (700) 12.3–12.7

**Cell Data:** *Space Group:*  $P2_1/m$ .  $a = 4.2043(8)$   $b = 9.199(2)$   $c = 16.663(3)$   
 $\beta = 91.82(1)^\circ$   $Z = 2$

**X-ray Powder Pattern:** Bounds Cliff, England.

4.02 (10), 2.296 (8), 2.377 (6), 4.16 (5), 2.108 (4), 3.79 (3), 3.045 (3)

**Chemistry:**

	(1)	(2)
$\text{CO}_2$	4.10	3.93
$\text{PbO}$	81.30	79.75
$\text{Cl}$	18.67	19.00
$\text{H}_2\text{O}$	1.61	1.61
$-\text{O} = \text{Cl}_2$	4.21	4.29
Total	101.47	100.00

(1) Bounds Cliff, England; by electron microprobe, Pb and Cl average of three analyses, C and H by CHN analyzer, presence of  $(\text{CO}_2)^{2-}$  and  $\text{H}_2\text{O}$  confirmed by IR; original elemental analysis here converted to oxides; corresponds to  $\text{Pb}_{4.02}(\text{CO}_3)_{1.03}[\text{Cl}_{5.82}(\text{OH})_{0.16}]_{\Sigma=5.98} \cdot 0.90\text{H}_2\text{O}$ .  
(2)  $\text{Pb}_4(\text{CO}_3)\text{Cl}_6 \cdot \text{H}_2\text{O}$ .

**Occurrence:** A rare reaction product of sea water with a metal-bearing vein exposed at sea level (Bounds Cliff, England); produced by the action of sea water on lead-bearing slag (Laurium, Greece; Baratti Beach, Italy); a corrosion product of lead object (Mahdia, Tunisia).

**Association:** Phosgenite, galena, jamesonite, cerussite, pyrite, sphalerite, chalcopryrite, dolomite, quartz (Bounds Cliff, England).

**Distribution:** From Bounds Cliff, St. Endellion, Cornwall, England. Large crystals at Laurium, Greece, in slag. At Baratti Beach, Tuscany, Italy, in slag. In the Kairakty polymetallic barite deposit, central Kazakhstan. From a shipwreck near Mahdia, Tunisia.

**Name:** Honors Richard William Barstow (1947–1982), mineral collector and dealer of Cornwall, England.

**Type Material:** The Natural History Museum, London, England, 1990,25 and E.1353.

**References:** (1) Stanley, C.J., G.C. Jones, A.D. Hart, P. Keller, and D. Lloyd (1991) Barstowite,  $3\text{PbCl}_2 \cdot \text{PbCO}_3 \cdot \text{H}_2\text{O}$ , a new mineral from Bounds Cliff, St Endellion, Cornwall. *Mineral. Mag.*, 55, 121–125. (2) (1992) *Amer. Mineral.*, 77, 670 (abs. ref. 1). (3) Kutzke, H., H. Klapper, S. Merlino, M. Pasero, N. Perchiazzi, and G. Eggert (2000) The crystal structure of barstowite,  $\text{Pb}_4\text{Cl}_6(\text{CO}_3) \cdot \text{H}_2\text{O}$ , determined on crystals from Etruscan slag and from a Late-Hellenistic shipwreck. *Zeits. Krist.*, 215, 110–113.

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