

Tobermorite

Ca₅Si₆(O, OH)₁₈•5H₂O

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Crystal Data: Orthorhombic or monoclinic, pseudo-orthorhombic. *Point Group:* 2. As minute laths resembling fibers; as fibrous bundles, rosettes or sheaves, radiating or plumose, to 6 cm; fine granular, massive.

Physical Properties: *Cleavage:* Perfect on {001}, imperfect on {100}. *Hardness* = n.d. *D*(meas.) = 2.423–2.458 *D*(calc.) = [2.49]

Optical Properties: Transparent to translucent. *Color:* Pale pinkish white, white, brown; colorless in thin section. *Luster:* Vitreous, silky in fibrous aggregates.

Optical Class: Biaxial (+). *Orientation:* X = c; Y = b; Z = a. *Dispersion:* Weak.

$\alpha = 1.570(2)$ $\beta = 1.571(2)$ $\gamma = 1.575(2)$ $2V(\text{meas.}) = \text{n.d.}$

Cell Data: *Space Group:* $P2_1$ (14 Å hydrate). $a = 11.17$ $b = 7.38$ $c = 27.94$
 $\beta = [90.0^\circ]$ $Z = [4]$

X-ray Powder Pattern: Crestmore, California, USA. (ICDD 29-331).

14.0 (100), 3.076 (65), 3.001 (45), 1.835 (35), 2.812 (30), 5.50 (25), 2.798 (13)

Chemistry:	(1)	(2)	(1)	(2)	
SiO ₂	46.51	48.08	CaO	33.40	35.24
Al ₂ O ₃	2.40	3.96	Na ₂ O	0.36	0.03
Fe ₂ O ₃	1.14		K ₂ O	1.45	0.03
FeO	1.85	0.01	H ₂ O	12.61	[12.62]
MgO	0.47	0.03	Total	100.19	[100.00]

(1) Tobermory, Scotland. (2) Portree, Scotland; by electron microprobe, H₂O by difference; corresponds to (Ca_{4.30}Mg_{0.01}Na_{0.01}K_{0.01})_{Σ=4.33}(Si_{5.47}Al_{0.53})_{Σ=6.00}[O, (OH)]₁₈•nH₂O.

Mineral Group: A group name including the 9-Å, 10-Å, 11-Å, and 14-Å hydrates; dimorphous with clinotobermorite.

Occurrence: A hydrothermal alteration product of calcium carbonate rocks, due to contact metamorphism and metasomatism; filling vesicles and cavities in basaltic rocks.

Association: Zeolites, ettringite, portlandite, calcite.

Distribution: In Scotland, on the Isle of Mull, around Tobermory; on the Isle of Skye, at Dunvegan and Portree; and at Ardtornish Bay, Morvern, Argyllshire. From Ballycraigy, near Larne, Co. Antrim, Ireland. In Germany, on the Zeilberg, near Maroldsweisach, Bavaria. From the Hatrurim Formation, Israel. In the Güneyce-İkizdere area, Trabzon Province, Turkey. From Fuka, near Bicchu, Okayama Prefecture, Japan. At Golden Gully, Tokatoka district, about 150 km north of Auckland, New Zealand. In the USA, from Crestmore, Riverside Co., California. At Concepción del Oro, and in the Noche Buena mine, Mazapil, Zacatecas, Mexico. Large masses from the Wessels mine, near Kuruman, Cape Province, South Africa. A few additional minor occurrences are known.

Name: For the type locality, Tobermory, Isle of Mull, Scotland.

Type Material: The Natural History Museum, London, England, 1937,1490; National Museum of Natural History, Washington, D.C., USA, 119008.

References: (1) Dana, E.S. (1892) Dana's system of mineralogy, (6th edition), 570. (2) Heller, L. and H.F.W. Taylor (1956) Crystallographic data for the calcium silicates. H.M. Stationary Office, London, 30–45. (3) Livingstone, A. (1988) Reyerite, tobermorite, calcian analcime and bytownite from amygdals in a Skye basalt. *Mineral. Mag.*, 52, 711–713. (4) Hamid Rahman, S. and H. Beyrau (1988) Die Bestimmung der Kristallstruktur von einem natürlichen 14 Å-Tobermorit mit Hilfe von Röntgen- und Elektronenbeugung. *Zeits. Krist.*, 182, 114–116 (in German).

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