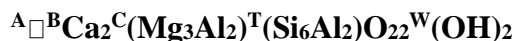


**Ferro-tschermakite**

**Crystal Data:** Monoclinic. *Point Group:* 2/m. As bladed to acicular crystals. *Twinning:* [Simple or multiple twinning  $\parallel \{100\}$ .]

**Physical Properties:** *Cleavage:* [Perfect on  $\{110\}$ , with intersections at  $\sim 56^\circ$  and  $\sim 124^\circ$ ; partings on  $\{100\}$  and  $\{001\}$ .] *Tenacity:* [Brittle.] *Hardness =* [5-6] *D(calc.) =* 3.260

**Optical Properties:** Translucent. *Color:* Dark green. *Streak:* Dark green. *Luster:* Vitreous. *Optical Class:* Biaxial (-).  $\alpha = 1.666(2)$   $\beta = 1.680(2)$   $\gamma = 1.690(2)$   $2V(\text{meas.}) = 84(1)^\circ$   $2V(\text{calc.}) = 79.8^\circ$  *Orientation:*  $X \wedge a = 9.5^\circ$  (in  $\beta$  acute),  $Y \parallel b$ ,  $Z \wedge c = 24.3^\circ$  (in  $\beta$  obtuse). *Dispersion:* Medium;  $r > v$ . *Pleochroism:*  $X =$  pale yellow-green,  $Y =$  olive green,  $Z =$  blue green.

**Cell Data:** *Space Group:* C2/m.  $a = 9.7598(6)$   $b = 18.0220(11)$   $c = 5.3299(3)$   
 $\beta = 104.826(1)^\circ$   $Z = 2$

**X-ray Powder Pattern:** Calculated pattern.

8.359 (100), 2.708 (84), 3.098 (55), 2.552 (43), 2.595 (41), 2.330 (33), 2.159 (27)

<b>Chemistry:</b>	(1)	(2)		(1)	(2)
SiO <sub>2</sub>	41.32	39.61	NiO	0.01	
TiO <sub>2</sub>	0.37		ZnO	0.02	
Al <sub>2</sub> O <sub>3</sub>	18.13	22.41	CaO	10.58	12.32
Cr <sub>2</sub> O <sub>3</sub>	0.02		Na <sub>2</sub> O	1.61	
V <sub>2</sub> O <sub>3</sub>	0.05		K <sub>2</sub> O	0.45	
FeO <sub>total</sub>	17.55		H <sub>2</sub> O	[1.96]	1.98
FeO	[15.66]	23.68	F	0.12	
Fe <sub>2</sub> O <sub>3</sub>	[2.09]		<u>-O = F<sub>2</sub></u>	<u>0.05</u>	
MgO	6.94		Total	99.47	100.00
MnO	0.20				

(1) La Clarté, Perros-Guirec, Brittany, France; average of 10 electron microprobe analyses, H<sub>2</sub>O calculated for 2(OH,F) apfu, Fe<sup>3+</sup>/Fe<sub>total</sub> calculated from stoichiometry and structure; corresponds to  $A^{(Na_{0.29}K_{0.08})\Sigma=0.37}B^{(Ca_{1.69}Fe^{2+}_{0.11}Mn^{2+}_{0.02}Na_{0.18})\Sigma=2.00}C^{(Fe^{2+}_{1.84}Mg_{1.54}Al_{1.33}Fe^{3+}_{0.24}V^{3+}_{0.01}Ti_{0.04})\Sigma=5.00}T^{(Si_{6.15}Al_{1.85})\Sigma=8.00}O_{22}^W(OH_{1.94}F_{0.06})\Sigma=2.00$ . (2)  $A^{\square}B^{\square}Ca_2^C(Mg_3Al_2)^T(Si_6Al_2)O_{22}^W(OH)_2$ .

**Polymorphism & Series:** Forms a series with tschermakite.

**Mineral Group:** Calcium amphibole group;  $B^{(Ca+\Sigma M^{2+})/\Sigma B} \geq 0.75$ ,  $B^{Ca}/\Sigma B \geq B^{\Sigma M^{2+}}/\Sigma B$ .

**Occurrence:** A rock-forming mineral in granitic pegmatite in a batholith. In a variety of metamorphic rocks (amphibolite, metacarbonate, schist, gneiss).

**Association:** Plagioclase, staurolite, almandine, biotite, chlorite.

**Distribution:** Granite quarries, Ploumanac'h Granitic Complex, La Clarté, Perros-Guirec, Brittany, France. Also confirmed from Ovala, Gabon; Waits River, Vermont and Joyceville, Massachusetts, USA; Lake Kutemajärvi and Permiö, Finland; and the Frood Mine, Sudbury, Canada.

**Name:** For *ferrous* iron in its composition and relation to *tschermakite*.

**Type Material:** Mineral Museum, University of Pavia, Italy (2016-02).

**References:** (1) Oberti, R., M. Boiocchi, F.C. Hawthorne, and M.E. Ciriotti (2018) Ferro-tschermakite from the Ploumanac'h granitic complex, Brittany, France: mineral description. *Eur. J. Mineral.*, 30(1), 171-176. (2) (2018) *Amer. Mineral.*, 103, 2040-2041 (abs. ref. 1). (3) Hawthorne, F.C., R. Oberti, G.E. Harlow, W.V. Maresch, R.F. Martin, J.C. Schumacher, and M.D. Welch (2012) Nomenclature of the amphibole supergroup. *Amer. Mineral.*, 97, 2031-2048.