

Tinzenite**(Ca, Mn²⁺, Fe²⁺)₃Al₂BSi₄O₁₅(OH)**

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Crystal Data: Tridlinic. *Point Group:* $\bar{1}$. As aggregates of prismatic crystals, to 5 mm; massive.**Physical Properties:** *Cleavage:* [{100} good; {001}, {110}, {011}, poor] (by analogy to the axinite group). *Fracture:* [Uneven to conchoidal.] *Tenacity:* [Brittle.] *Hardness* = 6.5 *D*(meas.) = 3.355–3.433 *D*(calc.) = 3.455**Optical Properties:** [Transparent to translucent.] *Color:* Yellow, brownish yellow-green; orange to red in thin section. *Luster:* [Vitreous.]*Optical Class:* Biaxial (-). *Pleochroism:* In thick sections, weak; *X* = light brown; *Y* = violet; *Z* = light yellow or colorless. $\alpha = 1.690(2)$ $\beta = 1.698(3)$ $\gamma = 1.705(3)$ $2V(\text{meas.}) = 80^\circ\text{--}84^\circ$ **Cell Data:** *Space Group:* $P\bar{1}$. $a = 7.095\text{--}7.162$ $b = 9.103\text{--}9.129$ $c = 8.874\text{--}8.946$
 $\alpha = 91.35^\circ\text{--}91.90^\circ$ $\beta = 98.27^\circ\text{--}98.68^\circ$ $\gamma = 76.73^\circ\text{--}76.97^\circ$ $Z = 2$ **X-ray Powder Pattern:** Tinzen, Switzerland.

2.812 (10), 3.46 (8), 6.30 (7), 3.14 (7), 2.975 (7), 2.152 (7), 2.008 (7b)

Chemistry:	(1)		(2)	
	(1)	(2)	(1)	(2)
SiO ₂	40.80	41.20	CaO	12.51
TiO ₂		0.08	BaO	0.06
B ₂ O ₃	5.65	4.98	Na ₂ O	0.27
Al ₂ O ₃	16.23	16.20	K ₂ O	0.13
Fe ₂ O ₃	1.59	1.60	H ₂ O ⁺	1.20
MnO	21.19	19.15	H ₂ O ⁻	0.10
MgO	0.17	0.90	Total	99.84
				99.70

(1) Tinzen, Switzerland; corresponds to (Mn_{1.77}Ca_{1.32}Na_{0.05}K_{0.02}Mg_{0.02})_{Σ=3.18}(Al_{1.88}Fe_{0.12}³⁺)_{Σ=2.00}B_{0.96}Si_{4.01}O₁₅(OH)_{0.79}. (2) Gambatesa mine, Italy; corresponds to (Mn_{1.60}Ca_{1.42}Mg_{0.13}Na_{0.07}K_{0.06})_{Σ=3.28}(Al_{1.88}Fe_{0.12}³⁺)_{Σ=2.00}B_{0.85}Si_{4.06}O₁₅(OH)_{0.76}.**Polymorphism & Series:** Forms a series with manganaxinite.**Mineral Group:** Axinite group; Ca < 1.5 per formula unit, Mn > Fe.**Occurrence:** In metamorphosed manganese-bearing ophiolites (Liguria, Italy); in quartz veins in cherts of the greenschist facies (Akatore, New Zealand).**Association:** Braunite, quartz.**Distribution:** From near Tinzen, in the Val d'Err, Graubünden, Switzerland. In the Cassagna and Gambatesa mines, Val Graveglia, near Chiavari, Liguria, Italy. From Akatore, New Zealand.**Name:** For the locality near Tinzen, Switzerland.**Type Material:** Federal Institute of Technology, Zurich, Switzerland, 194804; The Natural History Museum, London, England, 1926,499–501; Harvard University, Cambridge, Massachusetts, USA.**References:** (1) Jakob, J. (1923) Vier Mangansilikate aus dem Val d'Err (Kt. Graubünden). Schweiz. Mineral. Petrog. Mitt., 3, 227–237 (in German). (2) Milton, C., F.A. Hildebrand, and A.M. Sherwood (1953) The identity of tinzenite with manganaxinite. Amer. Mineral., 38, 1148–1158. (3) Deer, W.A., R.A. Howie, and J. Zussman (1986) Rock-forming minerals, (2nd edition), v. 1B, disilicates and ring silicates, 603–623. (4) Basso, R., A. Della Giusta, and G. Vlačić (1973) La struttura della Tinzenite. Period. Mineral., 42, 369–379 (in Italian). (5) (1975) Chem. Abs., 83, 19637 (abs. ref. 4). (6) Lumpkin, G.R. and P.H. Ribbe (1979) Chemistry and physical properties of axinites. Amer. Mineral., 64, 635–645.

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