

# Pargasite



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**Crystal Data:** Monoclinic. *Point Group:*  $2/m$ . As stout prismatic crystals, to 3 cm; granular. *Twinning:* Simple or multiple twinning  $\parallel \{100\}$ , common.

**Physical Properties:** *Cleavage:* Perfect on  $\{110\}$ , intersecting at  $56^\circ$  and  $124^\circ$ ; partings on  $\{100\}$ ,  $\{001\}$ . *Tenacity:* Brittle. Hardness = 5–6  $D(\text{meas.}) = 3.04\text{--}3.17$   $D(\text{calc.}) = 3.209$

**Optical Properties:** Transparent to translucent. *Color:* Bluish green, grayish black, light brown, bright green (chromian); in thin section, very light brown, bluish green.

*Luster:* [Vitreous.]

*Optical Class:* Biaxial (+). *Pleochroism:*  $X =$  colorless, greenish yellow;  $Y =$  light brown, bluish green, green;  $Z =$  light brown, bluish green. *Orientation:*  $Y = b$ ;  $Z \wedge c \simeq 26^\circ$ . *Dispersion:*  $r > v$ , weak.  $\alpha = 1.613\text{--}1.65$   $\beta = 1.618\text{--}1.66$   $\gamma = 1.635\text{--}1.67$   $2V(\text{meas.}) = 90^\circ\text{--}120^\circ$

**Cell Data:** *Space Group:*  $C2/m$ .  $a = 9.910(1)$   $b = 18.022(1)$   $c = 5.312(1)$   $\beta = 105.78(1)^\circ$   $Z = 2$

**X-ray Powder Pattern:** Pargas, Finland. (ICDD 23-1406). 3.124 (100), 8.43 (40), 3.269 (35), 2.930 (35), 2.698 (30), 2.805 (25), 2.155 (20)

Chemistry:	(1)	(2)	(3)	(1)	(2)	(3)
SiO <sub>2</sub>	48.10	41.50	42.47	CaO	12.50	11.87
TiO <sub>2</sub>	0.10	1.66	0.26	Na <sub>2</sub> O	2.54	2.40
Al <sub>2</sub> O <sub>3</sub>	11.05	14.40	17.81	K <sub>2</sub> O	1.24	0.69
Fe <sub>2</sub> O <sub>3</sub>	0.67		0.92	F	1.90	
Cr <sub>2</sub> O <sub>3</sub>			0.89	H <sub>2</sub> O <sup>+</sup>	0.71	1.78
FeO	1.65	12.60	4.49	H <sub>2</sub> O <sup>-</sup>	0.11	
MnO		0.12	0.15	P <sub>2</sub> O <sub>5</sub>		0.05
MgO	20.60	11.88	16.33	–O = F <sub>2</sub>	0.80	
				Total	100.37	96.35 [100.11]

(1) Pargas, Finland; corresponds to  $(\text{Na}_{0.69}\text{K}_{0.22})_{\Sigma=0.91}\text{Ca}_{1.88}(\text{Mg}_{4.32}\text{Al}_{0.59}\text{Fe}_{0.19}^{2+}\text{Fe}_{0.07}^{3+}\text{Ti}_{0.01})_{\Sigma=5.18}(\text{Si}_{6.76}\text{Al}_{1.24})_{\Sigma=8.00}\text{O}_{22}[\text{F}_{0.84}(\text{OH})_{0.67}]_{\Sigma=1.51}$ . (2) Sanbagawa schists, Ehime Prefecture, Japan; by electron microprobe, corresponds to  $(\text{Na}_{0.93}\text{K}_{0.06})_{\Sigma=0.99}\text{Ca}_{1.70}(\text{Mg}_{2.64}\text{Fe}_{1.52}^{2+}\text{Al}_{0.72}\text{Ti}_{0.19}\text{Fe}_{0.05}^{3+}\text{Mn}_{0.02})_{\Sigma=5.14}(\text{Si}_{6.19}\text{Al}_{1.81})_{\Sigma=8.00}\text{O}_{22}(\text{OH})_2$ . (3) Merkerstein, Tanzania; original total given as 100.19%, corresponds to  $(\text{Na}_{0.66}\text{K}_{0.13})_{\Sigma=0.79}\text{Ca}_{1.81}(\text{Mg}_{3.46}\text{Al}_{1.04}\text{Fe}_{0.53}^{2+}\text{Fe}_{0.10}^{3+}\text{Cr}_{0.10}\text{Ti}_{0.03}\text{Mn}_{0.02})_{\Sigma=5.28}(\text{Si}_{6.05}\text{Al}_{1.95})_{\Sigma=8.00}\text{O}_{22}(\text{OH})_{1.69}$ .

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

**Mineral Group:** Amphibole (calcic) group:  $\text{Mg}/(\text{Mg} + \text{Fe}^{2+}) \geq 0.7$ ;  $\text{Fe}^{3+} \text{ Al}^{\text{vi}}$ ;  $(\text{Na} + \text{K})_{\text{A}} \geq 0.5$ ;  $\text{Na}_{\text{B}} < 0.67$ ;  $(\text{Ca} + \text{Na})_{\text{B}} \geq 1.34$ ;  $\text{Si} < 6.25$ ;  $\text{Ti} < 0.5$ .

**Occurrence:** A common component of “hornblendes” in skarns metamorphosed from siliceous limestones; schists and amphibolites; also from andesitic volcanic and altered ultramafic rocks.

**Association:** Diopside, phlogopite, corundum, spinel, calcite (skarn); “hypersthene,” augite, plagioclase (metabasalts and andesitic volcanics).

**Distribution:** Many localities, but rarely in good crystals. At Parainen (Pargas), Finland. From Långban, Värmland, Sweden. On the Saualpe, Carinthia, Austria. At Vesuvius, Campania, Italy. From Franklin, Sussex Co., New Jersey, USA. At Wolfe Lake, Ontario, Canada. In Pakistan, from Aliabad, Hunza Valley.

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**Name:** For the locality at Parainen (Pargas), Finland.

**References:** (1) Dana, E.S. (1892) Dana's system of mineralogy, (6th edition), 385–398. (2) Deer, W.A., R.A. Howie, and J. Zussman (1963) Rock-forming minerals, v. 2, chain silicates, 263–314. (3) Leake, B.E. (1971) On aluminous and edenitic hornblendes. *Mineral. Mag.*, 38, 389–407. (4) Charles, R.W. (1980) Amphiboles on the join pargasite-ferropargasite. *Amer. Mineral.*, 65, 996–1001. (5) Makino, K. and K. Tomita (1989) Cation distribution in the octahedral sites of hornblendes. *Amer. Mineral.*, 74, 1097–1105.