

# Girvasite

# $\text{NaCa}_2\text{Mg}_3(\text{PO}_4)_2[\text{PO}_2(\text{OH})_2](\text{CO}_3)(\text{OH})_2 \cdot 4\text{H}_2\text{O}$

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**Crystal Data:** Monoclinic. *Point Group:*  $2/m$ . Rare prismatic crystals, elongated along [100], to 1 mm; in spherulites.

**Physical Properties:** *Cleavage:* On {001}, perfect. *Tenacity:* Very brittle. *Hardness* = 3.5  
D(meas.) = 2.46(2) D(calc.) = 2.42

**Optical Properties:** Transparent. *Color:* Colorless, creamy white. *Streak:* White.

*Luster:* Vitreous, silky in aggregates.

*Optical Class:* Biaxial (-). *Orientation:*  $Y = b$ ;  $Z \wedge a = 31^\circ$ .  $\alpha = 1.541(2)$   $\beta = 1.557(2)$

$\gamma = 1.565(2)$   $2V(\text{meas.}) = 60(5)^\circ$   $2V(\text{calc.}) = 71^\circ$

**Cell Data:** *Space Group:*  $P2_1/c$ .  $a = 6.522(3)$   $b = 12.25(3)$   $c = 21.56(2)$   $\beta = 89.48(5)^\circ$   
 $Z = 4$

**X-ray Powder Pattern:** Kovdor massif, Russia.

10.72 (100), 3.57 (80), 2.016 (35), 3.08 (32), 2.108 (32), 3.42 (26), 2.817 (26)

## Chemistry:

	(1)	(2)
$\text{P}_2\text{O}_5$	32.6	33.84
$\text{CO}_2$	[7.4]	7.00
FeO	1.2	
MnO	0.1	
MgO	18.5	19.22
CaO	16.7	17.83
$\text{Na}_2\text{O}$	5.0	4.93
$\text{H}_2\text{O}$	18.0	17.18
Total	[99.5]	100.00

(1) Kovdor massif, Russia; by electron microprobe,  $\text{H}_2\text{O}$  by coulometry and TGA,  $\text{CO}_2$  by difference between total weight loss and  $\text{H}_2\text{O}$ ; corresponds to  $\text{Na}_{1.05}\text{Ca}_{1.95}(\text{Mg}_{3.00}\text{Fe}_{0.11}^{3+}\text{Mn}_{0.01})_{\Sigma=3.12}(\text{PO}_4)_2[\text{PO}_2(\text{OH})_2](\text{CO}_3)_{1.10} \cdot 4.53\text{H}_2\text{O}$ .

(2)  $\text{NaCa}_2\text{Mg}_3(\text{PO}_4)_2[\text{PO}_2(\text{OH})_2](\text{CO}_3)(\text{OH})_2 \cdot 4\text{H}_2\text{O}$ .

**Occurrence:** A low-temperature hydrothermal mineral filling solution cavities in dolomite carbonatite in a differentiated alkaline massif.

**Association:** Bobierite, pyrite, dolomite.

**Distribution:** From the Zheleznyi iron mine, Kovdor massif, Kola Peninsula, Russia.

**Name:** For Lake Girvas, northwest of the Kovdor massif, Kola Peninsula, Russia.

**Type Material:** Geology Museum, Kola Branch, Academy of Sciences, Apatity, 5948; Mining Institute, St. Petersburg, 2025/1; A.E. Fersman Mineralogical Museum, Academy of Sciences, Moscow, Russia, 87981.

**References:** (1) Britvin, S.N., Y.A. Pakhomovskii, A.N. Bogdanova, and Y.V. Sokolova (1990) Girvasite – a new carbonate-phosphate of sodium, calcium and magnesium from carbonatites of the Kovdor massif (Kola Peninsula). *Mineral. Zhurnal*, 12(3), 79–83 (in Russian with English abs.). (2) (1992) *Amer. Mineral.*, 77, 207 (abs. ref. 1). (3) (1990) Y.V. Sokolova and Y.K. Yegorov-Tismenko (1990) Crystal structure of girvasite. *Doklady Acad. Nauk SSSR*, 311, 1372–1376 (in Russian).