Bortolanite $Ca_2(Ca_{1.5}Zr_{0.5})Na(NaCa)Ti(Si_2O_7)_2(OF)F_2$

Crystal Data: Triclinic. *Point Group*: $\bar{1}$. As elongate aggregates, to 1.5 cm, of lathlike, prismatic, poikilitic crystals. Shows complex compositional zoning with and is visually indistinguishable from götzenite.

Physical Properties: *Cleavage*: Perfect on {100}. *Tenacity*: Brittle. *Fracture*: Uneven. Hardness = 5 D(meas.) = n.d. D(calc.) = 3.195 Fluoresces weak yellow under UV (100-280 nm).

Optical Properties: Translucent. *Color*: Pale yellow to brown. *Streak*: Pale yellow to beige. *Luster*: Vitreous.
Optical Class: Biaxial (+). α = 1.673(2) β = 1.677(2) γ = 1.690(2) 2V(meas.) = 56(2)8° 2V(calc.) = 58.48° Non-pleochroic.

Cell Data: *Space Group: P*$\bar{1}$. a = 9.615(3) b = 5.725(2) c = 7.316(2) α = 89.91(1)° β = 101.14(1)° γ = 100.91(1)° Z = 1

X-Ray Diffraction Pattern: Bortolan quarry, Poços de Caldas massif, Minas Gerais, Brazil.
2.975 (100), 3.086 (61), 1.908 (31), 2.639 (30), 1.829 (26), 2.510 (24), 1.704 (22)

Chemistry:

	(1)	(2)		(1)	(2)
Nb_2O_5	1.07		La_2O_3	0.65	
HfO_2	0.20		Y_2O_3	0.31	
ZrO_2	6.70	8.45	FeO	0.59	
TiO_2	9.94	10.96	MnO	1.46	
SiO_2	32.49	32.96	CaO	31.15	34.61
Gd_2O_3	0.12		Na_2O	8.36	8.50
Nd2O3	0.37		F	6.95	7.82
Ce_2O_3	1.25		- O = F	2.93	3.29
			Total	98.68	100.00

(1) Bortolan quarry, Poços de Caldas massif, Minas Gerais, Brazil; average electron microprobe analysis; corresponds to $(Ca_{1.88}La_{0.03}Ce_{0.06}Nd_{0.02}Gd_{0.01})_{\Sigma=2}[Ca_{1.56}(Zr_{0.41}Hf_{0.01}Y_{0.02})_{\Sigma=0.44}]_{\Sigma=2}(Na_{0.85}Ca_{0.15})_{\Sigma=1}(Na_{1.18}Ca_{0.60}Mn_{0.16}Fe^{2+}_{0.06})_{\Sigma=2}(Ti_{0.94}Nb_{0.06})_{\Sigma=1}(Si_{4.07}O_{14})(O_{1.24}F_{0.76})_{\Sigma=2}F_2$.
(2) $Ca_2(Ca_{1.5}Zr_{0.5})Na(NaCa)Ti(Si_2O_7)_2(OF)F_2$.

Mineral Group: Seidozerite supergroup, rinkite-group.

Occurrence: Of late magmatic origin, in the matrix of evolved subvolcanic phonolites and nepheline syenite pegmatites.

Association: Götzenite, nepheline, alkali feldspar, aegirine, natrolite, analcime, manganoan pectolite.

Distribution: From the Bortolan quarry, Poços de Caldas massif, Minas Gerais, Brazil.

Name: For the locality, *Bortolan* quarry, where the studied material was collected.

Type Material: Canadian Museum of Nature, Ottawa, Ontario, Canada (CMNMC 88727).

References: (1) Maxwell, C.D., E. Sokolova, F.C. Hawthorne, L. Horváth, and E. Pfenninger-Horváth (2022) Bortolanite, $Ca_2(Ca_{1.5}Zr_{0.5})Na(NaCa)Ti(Si_2O_7)_2(OF)F_2$, a new rinkite-group (seidozerite supergroup) TS-block mineral from the Bortolan quarry, Poços de Caldas massif, Minas Gerais, Brazil. Can. Mineral., 60(4), 699-712.