

Orthojoaquinite-(Ce)

NaBa₂Ce₂Fe²⁺Ti₂Si₈O₂₆(OH, F)·H₂O

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Crystal Data: Orthorhombic. *Point Group:* $2/m\ 2/m\ 2/m$ or $mm2$. Bent flakes, to 1 mm, in banded gneissic or irregular masses; as intimate intergrowths with joaquinite-(Ce).

Physical Properties: *Cleavage:* {001}. *Hardness* = 5–5.5 *VHN* = 350–430
D(meas.) = 4.1 D(calc.) = [4.14]

Optical Properties: Transparent. *Color:* Brown. *Luster:* Silky.
Optical Class: Biaxial (+). *Pleochroism:* Strong in yellow-greens. $\alpha = 1.754$ $\beta = 1.760$
 $\gamma = 1.797$ $2V(\text{meas.}) = 40^\circ$

Cell Data: *Space Group:* $Ccmm$, $Ccm2_1$, or $Cc2m$. $a = 10.48$ $b = 9.66$ $c = 22.26$
 $Z = [4]$

X-ray Powder Pattern: Ilímaussaq intrusion, Greenland.
2.80 (100), 5.58 (68), 2.95 (17), 1.596 (13), 2.91 (11), 3.00 (9), 2.232 (8)

Chemistry:	(1)	(2)		(1)	(2)
SiO ₂	34.97	33.82	CaO	0.21	
TiO ₂	11.83	9.20	SrO	3.20	
ThO ₂	0.27	0.38	(Ca, Sr)O		0.03
Y ₂ O ₃	0.70		BaO	22.44	21.46
RE ₂ O ₃	18.46	22.59	Na ₂ O	1.87	2.41
Fe ₂ O ₃		0.39	K ₂ O	0.03	0.22
Nb ₂ O ₅		2.31	F		0.38
FeO	4.09	4.78	H ₂ O	[1.88]	1.50
MnO	0.00	0.70	–O = F ₂		0.16
MgO	0.05		Total	[100.00]	100.01

(1) San Benito Co., California, USA; by electron microprobe, average of six points on five grains, intergrown with joaquinite-(Ce) of presumably nearly identical composition; RE₂O₃ = La₂O₃ 2.14%, Ce₂O₃ 10.69%, Pr₂O₃ 1.25%, Nd₂O₃ 3.21%, Sm₂O₃ 0.70%, Gd₂O₃ 0.26%, Dy₂O₃ 0.21%, Er₂O₃ 0.00%, H₂O by difference; corresponds to Na_{0.83}K_{0.01}Ba_{2.01}Ca_{0.05}Mg_{0.02}(Ce_{0.90}RE_{0.72}Sr_{0.42})_{Σ=2.04}Fe_{0.78}Ti_{2.04}Th_{0.02}Si_{8.00}O_{24.68}(OH)_{3.32}. (2) Ilímaussaq intrusion, Greenland; RE = La 44.5%, Ce 41.6%, Pr 4.4%, and Nd 9.5%.

Polymorphism & Series: Dimorphous with joaquinite-(Ce).

Mineral Group: Joaquinite group.

Occurrence: In a natrolite vein cutting a glaucophane schist inclusion in a serpentinite body (San Benito Co., California, USA); in nepheline-sodalite syenite pegmatites (Ilímaussaq intrusion, Greenland).

Association: Joaquinite-(Ce), benitoite, neptunite, natrolite (San Benito Co., California, USA); joaquinite-(Ce), natrolite, analcime, sodalite, steenstrupine, riebeckite (Ilímaussaq intrusion, Greenland).

Distribution: At the Gem mine, San Benito Co., California, USA. In southern Greenland, in the Ilímaussaq intrusion, along the Narssaq River, near Kvanefjeld.

Name: For its ORTHOrhombic symmetry, and relation to *joaquinite*-(Ce).

Type Material: n.d.

References: (1) Wise, W.S. (1982) Strontiojoaquinite and bario-orthojoaquinite: two new members of the joaquinite group. *Amer. Mineral.*, 67, 809–816. (2) Laird, J. and A.L. Albee (1972) Chemical composition and physical, optical, and structural properties of benitoite, neptunite, and joaquinite. *Amer. Mineral.*, 57, 85–102. (3) Dowty, E. (1975) Crystal structure of joaquinite. *Amer. Mineral.*, 60, 872–878. (4) Semenov, E.I., V.I. Bukin, Y.A. Balashov, and H. Sørensen (1967) Rare earths in minerals of the joaquinite group. *Amer. Mineral.*, 52, 1762–1769.

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