

**Crystal Data:** Orthorhombic. *Point Group:* 2/m 2/m 2/m. As acicular to hair-like crystals, to 2mm, combined in bunches or radial spherulitic clusters to 4 mm. Rarely as prismatic crystals to 3 mm, elongated on [001]. *Twinning:* Common, cross-like interpenetration twins by 90° rotation || [001].

**Physical Properties:** *Cleavage:* Good on (001), assumed based on structure data.

*Fracture:* Uneven to stepped. *Tenacity:* Brittle. Hardness = ~3 D(meas.) = n.d. D(calc.) = 2.45

**Optical Properties:** Transparent. *Color:* Colorless to white (aggregates). *Streak:* n.d.

*Luster:* Vitreous.

*Optical Class:* Biaxial (+).  $\alpha = 1.557(2)$   $\beta = 1.562(2)$   $\gamma = 1.671(3)$   $2V(\text{meas.}) = 30(10)^\circ$   $2V(\text{calc.}) = 25^\circ$  *Dispersion:* None observed. *Orientation:* XZ is coplanar to cleavage; if cleavage is on (100), then  $Y = a$ . *Extinction:* Straight. *Elongation:* Positive.

**Cell Data:** Space Group: *Ibam*.  $a = 16.0989(11)$   $b = 16.2399(9)$   $c = 7.0135(4)$   $Z = 8$

**X-ray Powder Pattern:** Alcaparrosa mine, Calama, El Loa province, Antofagasta region, Chile. 8.10 (100), 5.04 (55), 3.417 (27), 3.787 (26), 2.943 (20), 2.895 (20), 3.619 (18)

Chemistry:	(1)	(2)
Na <sub>2</sub> O	18.21	18.34
K <sub>2</sub> O	0.06	
Fe <sub>2</sub> O <sub>3</sub>	1.58	
TiO <sub>2</sub>	21.80	23.64
SO <sub>3</sub>	48.25	47.36
H <sub>2</sub> O	[10.74]	10.66
Total	100.73	100.00

(1) Alcaparrosa mine, Calama, El Loa province, Antofagasta region, Chile; average of 8 electron microprobe analyses supplemented by FTIR spectroscopy, Fe<sup>3+</sup> determined from color reactions with potassium hexaferricyanide and potassium hexaferrocyanide, H<sub>2</sub>O calculated from structure analysis; corresponds to Na<sub>1.97</sub>(Ti<sub>0.92</sub>Fe<sup>3+</sup><sub>0.07</sub>)<sub>Σ=0.99</sub>S<sub>2.02</sub>O<sub>9</sub>·2H<sub>2</sub>O. (2) Na<sub>2</sub>TiO(SO<sub>4</sub>)<sub>2</sub>·2H<sub>2</sub>O.

**Occurrence:** A secondary mineral in the weathering zone of a pyrite deposit. The result of the oxidation of pyrite under the extremely arid conditions of the Atacama Desert.

**Association:** Coquimbite, römerite, metavoltine, tamarugite, halotrichite, szomolnokite, rhomboclase, ferrinatriite, krausite.

**Distribution:** From the Alcaparrosa mine, Calama, El Loa province, Antofagasta region, Chile.

**Name:** For *Calama* commune and *Calama* city, the capital of El Loa province, where the first specimens were collected.

**Type Material:** A.E. Fersman Mineralogical Museum, Russian Academy of Sciences, Moscow, Russia (95619).

**References:** (1) Pekov, I.V., O.I. Siidra, N.V. Chukanov, V.O. Yapaskurt, D.I. Belakovskiy, A.G. Turchkova, and G. Möhn (2018) Calamaite, a new natural titanium sulfate from the Alcaparrosa mine, Calama, Antofagasta region, Chile. *Eur. J. Mineral.*, 30(4), 801-809. (2) (2019) *Amer. Mineral.*, 104(9), 1361-1362 (abs. ref. 1).