

Crystal Data: Monoclinic. *Point Group:* 2/m. As bladelike to prismatic crystals, to 7 mm, with {120}, {130}, {101}, {293}, {2 $\bar{9}$ 3}. *Twining:* Coarse polysynthetic twins of undetermined law observed only in transmitted light under crossed polars.

Physical Properties: *Fracture:* Conchoidal. *Tenacity:* Brittle. Hardness = ~2.5
D(meas.) = 7.0(1) D(calc.) = 7.15 Decomposed by H₂O.

Optical Properties: Transparent. *Color:* Colorless. *Streak:* White.
Luster: Subadamantine.

Optical Class: Biaxial (+). *Orientation:* X = c; Y = a; Z = b. *Dispersion:* r < v, weak.
 $\alpha = 1.872(5)$ $\beta = 1.873(5)$ $\gamma = 1.897(5)$ 2V(meas.) = Very small. 2V(calc.) = 23°

Cell Data: *Space Group:* A2/a. a = 8.667(1) b = 4.4419(6) c = 14.242(2)
 $\beta = 107.418(2)^\circ$ Z = 4

X-ray Powder Pattern: Grand Reef mine, Arizona, USA.
3.159 (100), 3.116 (90), 3.084 (80), 1.806 (60), 2.281 (50), 1.824 (50), 1.370 (50b)

| Chemistry: | (1) | (2) |
|---------------------|-------|--------|
| SO ₃ | 13.8 | 14.60 |
| PbO | 82.9 | 81.39 |
| F | 7.1 | 6.93 |
| -O = F ₂ | 3.0 | 2.92 |
| Total | 100.8 | 100.00 |

(1) Grand Reef mine, Arizona, USA: by electron microprobe, absence of H₂O confirmed by IR spectroscopy, corresponds to Pb_{2.07}S_{0.96}O_{3.92}F_{2.08}. (2) Pb₂(SO₄)F₂.

Occurrence: A rare secondary mineral in isolated vugs in the oxidized portions of a breccia-hosted hydrothermal Cu-Pb-Ag deposit.

Association: Pseudograndreefite, laurelite, aravaipaite, galena, fluorite, anglesite.

Distribution: From the Grand Reef mine, about six km northeast of Klondyke, Aravaipa district, Graham Co., Arizona, USA.

Name: For the Grand Reef mine, Arizona, USA.

Type Material: Natural History Museum, Los Angeles, California, USA, 33608; National Museum of Natural History, Washington, D.C., USA, 166055.

References: (1) Kampf, A.R., P.J. Dunn, and E.E. Foord (1989) Grandreefite, pseudograndreefite, laurelite, and aravaipaite: four new minerals from the Grand Reef mine, Graham County, Arizona. *Amer. Mineral.*, 74, 927-933. (2) Kampf, A.R. (1991) Grandreefite, Pb₂F₂SO₄: crystal structure and relationship to the lanthanide oxide sulfates, Ln₂O₂SO₄. *Amer. Mineral.*, 76, 278-282.