

The identity of jurupaite and xonotlite.

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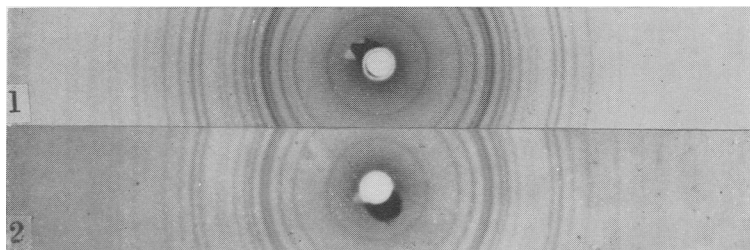
JURUPAITE was discovered at Crestmore, California, by A. S. Eakle¹ in 1921. The mineral was found in a quarry which was rapidly being enlarged, and Eakle stated that it was probably represented only by the one specimen which he had collected. He showed that it was a hydrated calcium silicate containing magnesia, with the composition $2(\text{Ca},\text{Mg})\text{O} \cdot 2\text{SiO}_2 \cdot \text{H}_2\text{O}$, the ratio of lime to magnesia being approximately 7:1.

This specimen passed into the keeping of Professor A. Pabst, who kindly made a portion available to the writer. He confirmed that it was unlikely that any other specimen existed. The jurupaite consisted of rosettes of white needles or fibres, about a centimetre in diameter. A brown discoloration was observed on the exposed outer surfaces of the specimen, but not on freshly cut surfaces. Calcite was present in contact with the jurupaite. Under the microscope, the material was seen to consist of aggregates of fibres, sometimes in approximately parallel orientation and showing parallel extinction and positive elongation; α 1.576, γ 1.583, both ± 0.005 . Due to the small size of the individual crystals, the true extinction angle and optic sign could not be determined. These observations agree with the original description.

X-ray oscillation and rotation photographs about the fibre axis, and also a powder photograph (fig. 1) were obtained. The fibre photographs confirmed that the material consisted of aggregates of very small crystals, having their needle axes approximately parallel but oriented at random around this axis. Nearly all of the reflections could be indexed on a cell having a 8.50, b 7.32, c 7.05 Å., orthorhombic or monoclinic with β $90 \pm 1^\circ$; marked pseudo-halving of b , which is the needle direction. A few weak reflections on the first layer-line could not be indexed on these axes, and the above cell is therefore probably a pseudo-cell rather than the true cell. Unfortunately, due to the fibrous nature of the material, the latter could not be determined.

¹ A. S. Eakle, Amer. Min., 1921, vol. 6, p. 107. [M.A. 1-253.]

Comparison of the X-ray photographs with corresponding ones of other hydrated calcium silicate minerals indicated identity with xonotlite ($3\text{CaSiO}_3 \cdot \text{H}_2\text{O}$). The specimen of xonotlite that was used came from the type locality, Tetela de Xonotla (or Tetela del Oro), state of Puebla, Mexico, and was kindly provided by the Building Research Station, Watford, Hertfordshire. It consisted of tough, white material, made up of interlaced fibres with parallel extinction and positive elongation;



FIGS. 1-2. Powder photographs of jurupaite and xonotlite. 1. Jurupaite, Crestmore, California; original specimen collected by A. S. Eakle. 2. Xonotlite, Tetela de Xonotla, Mexico. Both photographs were taken using a 6 cm.-diameter camera with filtered copper radiation, $\text{Cu-K}\alpha$, 1.542 \AA . (Reproduced same size.)

α 1.581 , γ 1.590 , both ± 0.005 . As in the case of the jurupaite, the true extinction angle and optic sign could not be determined. These data agree with those given previously for xonotlite from the same locality by E. S. Larsen.¹ The X-ray powder photograph (fig. 2) is identical with that of jurupaite, and gave data agreeing with those reported earlier for xonotlite from Puebla by W. T. Schaller;² closely similar data for xonotlite from other sources have been recorded by several other investigators. X-ray oscillation and rotation photographs about the fibre axis agreed closely with those of jurupaite, but showed even less orientation of the crystals within each fibre. The odd layer-lines were weaker relative to the even ones than in the case of jurupaite, suggesting that disorder existed also within the crystals. With the same exceptions, which in this case were extremely weak, the reflections could be indexed on the same cell or pseudo-cell (a 8.50 , b 7.32 , c 7.05 \AA , β $90 \pm 1^\circ$) as was found for jurupaite. These dimensions agree closely with those (a 8.55 , b 7.34 , c 7.03 \AA , monoclinic with $\beta \approx 90^\circ$) found by H. Berman³ for xonotlite from Franklin, Sussex County, New Jersey.

¹ E. S. Larsen, *Amer. Min.*, 1923, vol. 8, p. 181. [M.A. 2-253.]

² W. T. Schaller, *Ibid.*, 1950, vol. 35, p. 911. [M.A. 11-187.]

³ H. Berman, *Ibid.*, 1937, vol. 22, p. 342. Same work quoted by C. Palache, Prof. Paper U.S. Geol. Survey, 1935, no. 180, p. 113. [M.A. 6-261.]

TABLE I. Data for jurupaite and xonotlite.

	Jurupaite (Crestmore) (Eakle, 1921).	Xonotlite (St. Inez) (Larsen, 1917).
<i>Optical properties:</i>		
Extinction	31° to elongation	elongation
Sign of elongation	positive	positive
Optic sign	positive	+(biaxial, very low 2V)
$n_{ }$ elongation	1.576 ± 0.002	1.593 ± 0.001
n_{\perp} elongation	1.568 ± 0.002	1.583 ± 0.001
Birefringence	0.007	0.010
<i>Other properties:</i>		
Specific gravity	2.75	2.685-2.705
Hardness	4 approx., across fibres	6½
Fusion	2, to a clear white glass	2.5, to a glass
With dilute HCl	Soluble, no gelatinization	Soluble. SiO ₂ separates without gelatinization
Loss of water	'Held tenaciously'	'Only at a high heat'
<i>Chemical analyses (each mean of two analyses):</i>		
SiO ₂	48.87	50.17
Fe ₂ O ₃	—	1.04
CaO	38.66	45.45
MgO	4.19	trace
H ₂ O	7.89	3.18
	<u>99.61</u>	<u>99.84</u>

Unit-cell or pseudo-cell:

	This investigation		
	Jurupaite (Crestmore).	Xonotlite (Tetela de Xonotla).	Berman, 1937 Xonotlite (Franklin).
a	8.50 Å.	8.50 Å.	8.55 Å.
b	7.32	7.32	7.34
c	7.05	7.05	7.03
β	90° ± 1°	90° ± 1°	90° approx.

The X-ray data thus show that jurupaite and xonotlite are the same species, although in the case of jurupaite part of the calcium is replaced by magnesium. The chemical analyses, cell-dimensions, and optical and other properties reported for jurupaite are compared in table I with representative data for xonotlite. As far as possible, these relate to a single specimen, from 'St. Inez' (Santa Ynez, Barbara County), California, which was chosen because all the required data, except for the cell-dimensions, were available for it.¹ The discrepancies between

¹ E. S. Larsen, Amer. Journ. Sci., 1917, vol. 43, p. 464. [M.A. 1-206.] The material was originally described as 'eakleite' and was later shown to be xonotlite (Larsen, loc. cit., 1923).

jurupaite and xonotlite are mostly small, and the lower indices of jurupaite, at least, can reasonably be attributed to the partial replacement of lime by magnesia.

Some uncertainty exists regarding the water content of xonotlite. The ideal formula, which alone appears compatible with the cell-dimensions and density, is $3\text{CaSiO}_3 \cdot \text{H}_2\text{O}$, as already noted by Berman.¹ Most analyses, however, indicate lower water contents, and the formula $5\text{CaSiO}_3 \cdot \text{H}_2\text{O}$ has often been assigned. In the case of jurupaite, on the other hand, the water content is higher than the ideal value. Further investigation seems desirable. The name xonotlite² has priority.

¹ H. Berman, *Amer. Min.*, 1937, vol. 22, p. 342. Same work quoted by C. Palache, *Prof. Paper U.S. Geol. Survey*, 1935, no. 180, p. 113. [M.A. 6-261.]

² C. F. Rammelsberg, *Zeits. Deutsch. Geol. Gesell.*, 1866, vol. 18, p. 33. The original spelling was 'xonaltit'.
