

## Occurrence of osarizawaite in Argentina

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With 1 figure and 3 tables in the text

CORTELEZZI, C. R.: Occurrence of osarizawaite in Argentina. - N. Jb. Miner. Mh., 1977, H. 1, 39-44, Stuttgart 1977.

**Abstract:** Osarizawaite has been found in a copper deposit of polymetallic meso- to epithermal occurrence with Pb, Zn, Au, and Ag. The powder diagram, infrared spectrum and other physical as well as the chemical properties of the mineral are reported. The results show that the investigated specimen is an osarizawaite variety rich in sodium and potassium.

**Key words:** Osarizawaite, powder diffraction, infrared spectrography, chemical analysis; Argentinian Andes (Capillitas).

The mining district of Capillitas is located 39 km north from Andalgalá, in the province of Catamarca, Argentina. Ortiz Mine was settled at the eastern side of the mentioned district, it belongs to the group of the Nevado del Aconquija, Sierras Pampeanas and its height is 3.350 m a.s.l.

Rocks exposed in this area are mainly granites (GONZÁLEZ BONORINO, 1960) which belong to a granitic batholith, partially divided by metamorphic zones, and forms the crystalline basement of the Capillitas hill. Dykes of granites and pegmatites intrude this crystalline basement. The denudation surface is covered by red, partially calcareous tuffitic sandstones that have been regarded as Calchaquense strata. Intrusive volcanic rocks (Volcanic Complex or Serie Andesítica) lay unconformably over these strata, tuffs, breccias, andesitic, and basaltic tuffs are associated with basalts, andesites and rhyolites.

The deposit occurs in an oval shaped volcanic chimney about 1.500 m long and 900 m wide, composed of rhyolites, tuffs and breccias of the same composition as the dacite neck. Mineralization of Capillitas hill is Cu, Pb, Zn and Ag and it is related to Mio-Pliocene vulcanism. Copper bearing veins occur in an oval shaped body of rhyolitic tuffs. Hypogene mineralization consists of pyrite, enargite, tetrahedrite, chalcopyrite, bornite, pink calcite, sphalerite, galena, wurtzite, and marcasite; while supergene mineralization is represented by blue chalcocite, covellite, malachite, gothite, limonite, pyrolusite, cuprite, copper, etc., in gangue of quartz and rhodochrosite (ANGELELLI et al., 1974) (Fig. 1). The copper deposit is then a polymetallic

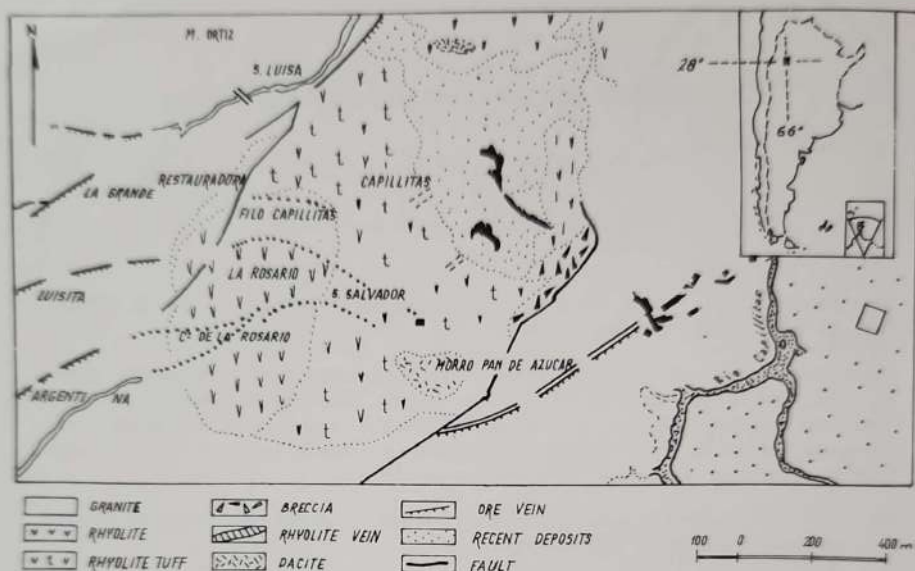


Fig. 1. Geological map from Capillitas District, Andalgalá Province of Catamarca, Argentina (from: ANGELELLI et al., 1974).

meso to epithermal occurrence with Pb, Zn, Au and Ag in a gangue of quartz and manganese carbonate.

Ortiz Mine has a marked oxidized zone, where the above mentioned minerals are present together with abundant brochantite. The mineral studied in this paper is associated with all the minerals previously mentioned. Osarizawaite was found as poorly compacted fine grained aggregates. Crystals are short, with prismatic to equidimensional habit,  $62 \times 12$  microns in their size and they are optically weakly anisotropic. Refraction index, obtained by immersion liquids in Na-light, are:  $\alpha = 1.72$ ,  $\gamma = 1.73$ . Because of the very small size of the crystals it was not possible to determine the  $2V$  angle.

### Specific gravity

As determined by the Buoyancy Method, hydrostatic weighing, a value of 3.27 was obtained at a temperature of  $19.7^\circ\text{C}$ .

Due to the small amount of sample available, it was necessary to perform a very careful purification of the mineral in order to obtain X-ray and infrared spectra diagrams as well as chemical analysis. After separation under a binocular microscope, the mineral was concentrated, first by means of bromoform  $D = 2.88$  and then with methylene iodide  $D = 3.31$ .

## X-ray powder diagrams

These were recorded with a Philips PW 1013 Diffractometer, using Cu K $\alpha$  radiation (Ni filter). The diagrams could be indexed as pertaining to the hexagonal crystal system and the following unit cell parameters were calculated,  $a_0 = 7.07 \text{ \AA}$ ,  $c_0 = 17.50 \text{ \AA}$ . The complete powder diagram is given in Table 1. The sample of column 2 was taken from TAGUCHI (1961).

Table 1

			1			2	
h	k	l	I	$d\text{\AA}_{\text{obs.}}$	$d\text{\AA}_{\text{calc.}}$	I	$d\text{\AA}_{\text{obs.}}$
0	0	3	25	5.82	5.83	70	5.79
1	0	4	15	3.54	3.55	5	4.98
0	0	5	18	3.49	3.49	60	3.52
1	1	3	70	3.01	3.02	100	3.00
2	0	1	100	2.988	3.014	60	2.87
2	0	2	25	2.875	2.888	20	2.49
0	0	7	<10	2.501	2.499	60	2.28
2	1	1	30	2.286	2.293	30	2.23
2	1	2	10	2.237	2.236	10	2.03
1	0	8	<10	2.062	2.059	30	1.918
3	0	1	<10	2.027	2.026	20	1.762
3	0	3	10	1.925	1.925	20	1.683
2	0	0	<10	1.768	1.766	5	1.660
0	0	10	10	1.749	1.749	10	1.519
2	2	3	<10	1.692	1.690	30	1.500
						5	1.436
						10	1.397
						5b	1.332
						10b	1.298

## I. R. spectrum

The infrared spectroscopical analysis has been carried out with a Perkin Elmer 457 Spectrometer, employing the usual disc technique. The obtained spectral data is shown in Table 2.

For comparative purposes we have also recorded the spectra of osarizawaite supplied by Dr. Y. TAGUCHI to be compared with the Argentine sample.

The analysis of these spectra suggests that:

- The studied minerals belong undoubtedly to the alunite group.
- The I. R. spectra of the studied sample appears more related to that of alunite than to osarizawaite and it has a better defined spectrum.
- Water is absent, but the presence of the (OH)<sup>-</sup> group is evident (bands at ca. 3500 cm<sup>-1</sup>).

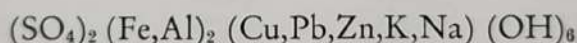
Table 2

Mina Ortiz	Japan
3485 vs	3460 s, b
1215 sh	1220 sh
1160 sh	1150 sh
1080 vs	1065 vs, b
1026 w	1020 sh
676 s	670 m
623 s	615 s
600 s	600 sh
527 m	530 sh
—	470 w
427 s	412 m
361 vs	335 m
329 s	
289 s	280 w

vs: very strong; s: strong; m: medium; w: weak; sh: shoulder; b: broad.

### Chemical analysis

The results of these analyses are shown in Table 3. The probable formula of the mineral is:



Chemical characteristics are:

1. Soluble in hot water and concentrated  $\text{SO}_4\text{H}_2$ . Partially soluble in ammonium acetate, concentrated  $\text{NO}_3\text{H}$  and  $\text{HCl}$ .
2. The  $\text{PbO}$  content is approximately one half of that found in Japanese and Australian samples.
3. The  $\text{CuO}$  content is slightly lower but the corresponding  $\text{Al}_2\text{O}_3$  is higher.
4. The  $\text{Fe}_2\text{O}_3$  content is similar to that of the Japanese sample, but not to the corresponding Australian mineral.
5. The  $\text{SO}_3$  value is notably higher in the studied sample, while the  $\text{OH}$  content is similar in all the three samples.
6. The  $\text{ZnO}$  content is five times higher than the corresponding value of the Japanese sample, while the Australian mineral does not contain  $\text{Zn}$ .
7. The Argentine sample contains a high proportion of  $\text{K}_2\text{O}$  and only a small amount of  $\text{Na}_2\text{O}$ .

Results of the chemical analysis were submitted to Dr. Y. TAGUCHI, who concluded (personal comm.) that in account of the  $\text{Al}_2\text{O}_3$  content of the analysed sample, the mineral could be classified as a variety close to an alunite, while if the  $\text{Fe}_2\text{O}_3$  content is considered, it should be described as a jarosite. It is, therefore, evident that the chemical composition of the

Table 3

	Wt. %	Mol. prop.	Mol. rat.	Recalc. %	1 %	2 %
PbO	15.8	0.0734	0.34	16.40	33.15	32.72
CuO	8.5	0.1108	0.51	8.82	11.83	11.27
Fe <sub>2</sub> O <sub>3</sub>	3.4	0.0220	0.10	3.52	0.77	4.43
Al <sub>2</sub> O <sub>3</sub>	17.4	0.1771	0.81	18.06	17.51	12.35
SO <sub>3</sub>	33.5	0.4346	2.00	34.77	26.02	22.92
K <sub>2</sub> O	6.0	0.6661	0.30	6.23	—	—
Na <sub>2</sub> O	0.7	0.0113	0.052	0.73	—	—
ZnO	0.7	0.0089	0.04	0.73	—	0.22
MgO	0.0				—	0.00
CaO	0.0				—	0.00
SiO <sub>2</sub>	2.6					2.18
CO <sub>2</sub>						0.45
H <sub>2</sub> O <sup>+</sup>	10.9	0.6283	2.89	11.31	10.42	8.50
H <sub>2</sub> O <sup>-</sup>	0.4				0.09	4.55
Ins.					0.19	
Total	99.9			99.84	99.98	99.09

Recalc.: Recalculated 100 % after deducting impurities.

SiO<sub>2</sub> has been considered as an impurity.

$$\begin{array}{r}
 \text{Fe} = 0.10 \\
 \text{Al} = 0.81
 \end{array}
 \left. \vphantom{\begin{array}{r} \text{Fe} \\ \text{Al} \end{array}} \right\} 0.91
 \qquad
 \begin{array}{r}
 \text{Pb} = 0.34 \\
 \text{Cu} = 0.51 \\
 \text{Zn} = 0.04 \\
 \text{K} = 0.30 \\
 \text{Na} = 0.05
 \end{array}
 \left. \vphantom{\begin{array}{r} \text{Pb} \\ \text{Cu} \\ \text{Zn} \\ \text{K} \\ \text{Na} \end{array}} \right\} 1.24$$

1: Osarizawaite. Mt. Edgar Pastoral Station, Marble Bar, Australia (MORRIS, 1962).

2: Osarizawaite. Osarizawa Mine, Akite Prefecture, Japan (TAGUCHI, 1961).

mineral is not exactly osarizawaite, but a variety of the alunite series with addition of sodium and potassium to the main cations of the mineral. Because of this reason, we will not propose a new name to the analysed mineral, until we have more evidence for the final classification.

### Acknowledgements

To Drs. R. C. MORRIS (Claremont, West Australia) and Y. TAGUCHI (Mitsubishi Mining and Metallurgical Research Laboratory, Japan) for their kind interest, useful comments and discussions. To Mr. R. IASI (Facultad de Cienc. Naturales, La Plata) for the chemical analysis of the investigated samples and to Drs. I. L. BOTTO, P. J. AYMUNINO and E. J. BARAN (Facultad de Cienc. Exactas, La Plata) for the I. R. measurements and also for very fruitfull discussions and suggestions about the work.

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Bei der Schriftleitung druckfertig eingegangen am 10. August 1976.

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