ARTINITE FROM LUNING, NEVADA

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Abstract

At Luning, Nevada, veins cutting massive brucite are made up of hydromagnesite, granular brucite and acicular artinite. This is the second reported locality for artinite in the United States. Unit cell dimensions are: $a_0=16.54$ Å, $b_0=3.14$ Å, $c_0=6.18$ Å; $\mu=81°4'$ determined by the optical goniometer. New optical properties: $Z \wedge c=30°$, $2V=60°$. Composition: MgO 41.81%, CO_2 22.8%, H_2O 35.46%. Differential thermal analysis curves of artinite and hydromagnesite are given.

Introduction

In the fall of 1942 Mr. Alan B. Shaw brought to the Department of Mineralogy at Harvard University a suite of specimens collected from the then recent workings of Basic Magnesium Inc. at Luning, Nevada. Most of these were brucite similar to that mined and shipped for calcining to MgO. In addition to the massive brucite there were several specimens of vein material. Mineralogically the veins proved to be made up of hydromagnesite, brucite and artinite.

The sections of the veins available for examination are from three to five centimeters across and in general are zoned parallel to the wall as shown in Fig. 1. The hydromagnesite in contact with massive brucite

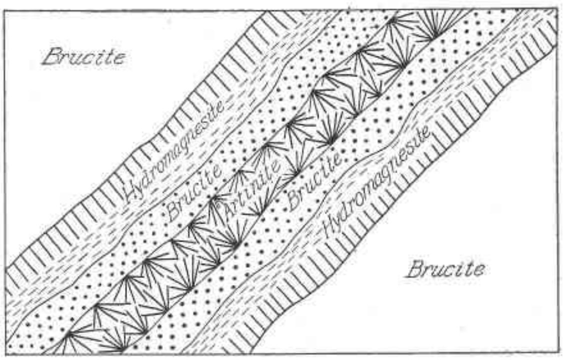

Fig. 1. Artinite vein.

is coarsely fibrous with the fibers standing at right angles to the vein walls. Between three and six millimeters from the walls the fibrous hydromagnesite grades into a fine granular hydromagnesite. In some specimens this textural break is the locus of small discontinuous open spaces. A sharp but irregular contact exists between the granular hydromagnesite and the narrow zone of fine granular brucite. There is no textural break at this contact and the distinction between the two minerals in the hand specimen is made only by the slight color difference. Hydromagnesite is chalky white, while the brucite is grayish with a slightly greasy luster.

At places in the center of the veins the two narrow bands of brucite meet, but elsewhere open spaces exist in which artinite is present. The artinite forms delicate radiating aggregates of acicular crystals having a maximum length of one centimeter. The crystals are rhombic in cross section with a maximum width of about 0.08 millimeter. One specimen about one centimeter thick and ten centimeters in diameter appears to have been broken from the center of a vein and is made up entirely of a compact aggregate of artinite fibers crossing one another at various angles.

A thin section across the vein shows artinite fibers growing into the open center of the vein and at the same time replacing the adjacent granular brucite. A few grains of magnesite are present between the fibers.

Crystal Measurements

An effort was made on many artinite crystals to obtain angular measurements using the two-circle goniometer. The crystals were mounted so that the long dimension [010], was the axis of rotation. Artinite is monoclinic elongated on the *b* crystal axis and for this reason for many years was believed to be orthorhombic. No readings could be made on the terminal faces and the only satisfactory readings obtained were on the forms {100} and {001}. The angle between these two forms as measured on ten crystals varied from 80° 56′ to 81° 11′, with an average of 81° 3′. Highly perfect cleavage is parallel to {100} and a cleavage only slightly less perfect is parallel to {001}. The angle between the cleavages as measured on the optical goniometer is 81° 4′. This cleavage angle, in very close agreement with the average of the interfacial measurements, is believed to be the best measurement and is used in subsequent calculations. However, it compares poorly with an angle of 80° 15′ reported by Heritsch (1940) from *x*-ray measurements.

Unit Cell and Space Group

Rotation and zero and first layer line Weissenberg *x*-ray photographs were taken rotating about the axis of elongation. The dimensions of the unit cell thus obtained check closely similar data given by Heritsch (1940) on artinite from Kraubath, Styria. His data are listed for comparison.

DIMENSIONS OF UNIT CELL

Nevada	Styria
$a_0=16.54$ Å	$a_0=16.66$ Å
$b_0=$ 3.14 Å	$b_0=$ 3.14 Å
$c_0=$ 6.18 Å	$c_0=$ 6.20 Å
$\mu=81°4'$	$\mu=80°15'$

The Weissenberg photographs show a base centered lattice with *C*2, *Cm* and *C*2/*m* possible space groups.

COMPOSITION

A chemical analysis of artinite from Nevada made by Mr. Forest Gonyer yields the following:

MgO 41.81%, CO_2 22.82%, H_2O 35.46%.

This corresponds closely to analyses of artinite from other localities and to the theoretical composition given by the formula $MgCO_3 \cdot Mg(OH)_2 \cdot 3H_2O$. The unit cell contains two molecules.

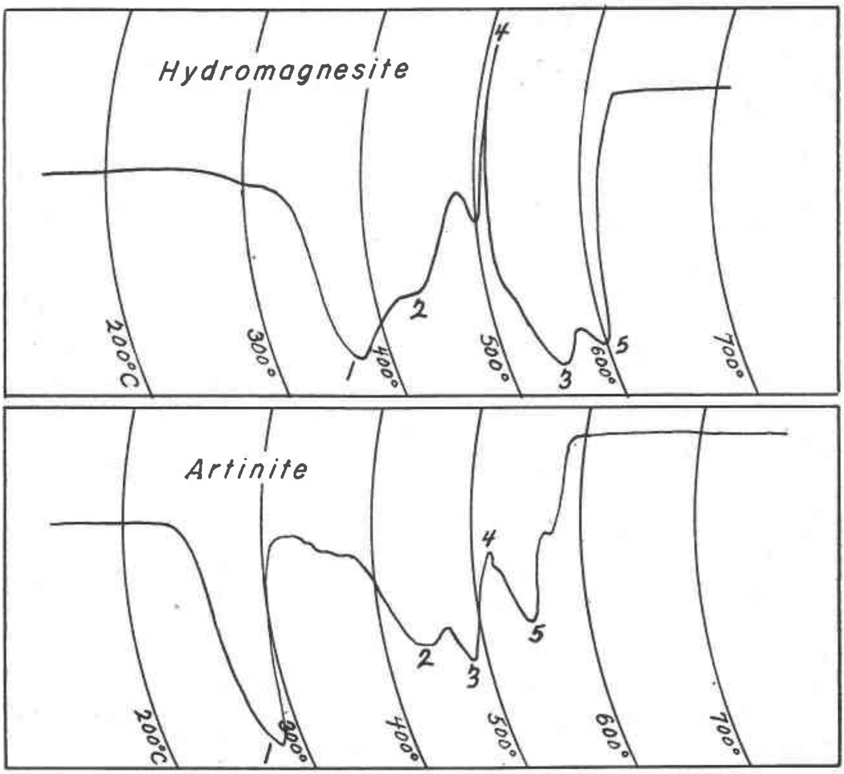

FIG. 2. Differential thermal analysis curves of hydromagnesite and artinite.

In Fig. 2 is reproduced a differential thermal analysis curve of artinite with one of hydromagnesite, $3MgCO_3 \cdot Mg(OH)_2 \cdot 2H_2O$, for comparison. These were made by Mr. Carl W. Beck on recording equipment he designed in connection with a thesis problem at Harvard University. The numbered peaks on the two curves correspond to one another. The loss of H_2O (1) is at a lower temperature in artinite than in hydromagnesite; (2) is the loss of (OH); and (3) and (5) are the losses of CO_2. All of these peaks indicate endothermic reactions. Peak (4) on both curves indicates an exothermic reaction and is interpreted as the inversion of amorphous MgO to periclase.

Optical Properties

The optical properties of artinite can be summarized as follows:

$n_{Na} \pm 0.001$	
$X = 1.488$	Opt. (−)
$Y = 1.534 = b$	
$Z = 1.556 \wedge c = 30°$	$2V = 60°$.

The plane of the optic axes is at right angles to the b axis, the zone of elongation. The optical orientation is such that an optic axis emerges

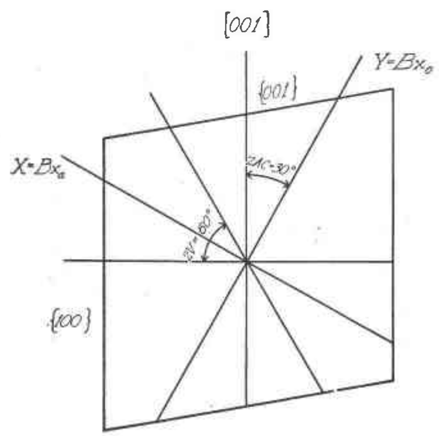

Fig. 3. Optical orientation of artinite.

perpendicular to the better cleavage {100} as shown in Fig. 3, and thus the optical character is easily obtained.

Occurrence of Artinite

This occurrence at Luning, Nevada, is the second reported locality for artinite in the United States.* The other locality is at Hoboken, New Jersey, where radiating crystals are in veins in serpentine. Specimens from Hoboken labeled hydromagnesite were reported by Ferrari and Ghiron (1931) to be artinite. An examination of specimens in the Harvard Museum from Hoboken labeled hydromagnesite has shown that only about half of them are correctly labeled and that the others are actually artinite. It is probable that other collections also have artinite from Hoboken incorrectly labeled.

Outside of the United States artinite has been reported only from Styria and from Italy, where it occurs at several localities associated with serpentine.

References

Ferrari, A., and Ghiron, D. (1931), Sopra una artinite di Hoboken, N. J.: *Periodico Min. Roma.*, **2**, 286–288.

Heritsch, H. (1940), Gitterkonstanten und Raumgruppe des Artinites: *Zentr. Min.*, Abt. **A**, 25–31.

* Since this manuscript was submitted for publication, artinite has been reported by Clifford Frondel at a mine of the Vermont Asbestos Co. near Eden Mills, Vt. Here it is found in serpentine associated with pyroaurite.