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## THE IDENTITY OF GILPINITE AND JOHANNITE\*

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In 1917 Larsen and Brown<sup>1</sup> described a hydrous uranium sulfate with some copper, iron and soda, from Gilpin County, Colo., and Cornwall, England. The chemical analysis of this mineral was different from that of johannite and other described uranium minerals and the data on the optical and other physical properties of the latter minerals were almost entirely lacking, hence, the Colorado mineral was believed to be a new species and the name "gilpinite" was proposed for it.

At that time, no reliably labelled specimen of johannite could be found for optical data but recently a specimen labelled johannite from Joachimsthal that appeared to fit the original description was found in the Harvard Collection and a determination of the optical properties of this material showed so close a similarity with those of "gilpinite" as to leave no doubt as to the identity of the two. Crystallographic measurements on the Joachimsthal mineral and on the Colorado "gilpinite," though only fair, confirm the identification of the johannite, show its identity with "gilpinite" and establish the triclinic symmetry of the mineral.

The name johannite has the priority and should be retained for the species but the chemical composition and physical properties given for "gilpinite" are much to be preferred and should be assigned to johannite.

The physical properties of the mineral from different localities are given in Table 1. All are greenish-yellow to canary yellow, and are strongly pleochroic with X=colorless, Y=very pale yellow, Z=pale greenish yellow or canary yellow. They have a hardness of about 2. All show polysynthetic twinning in two directions, resembling those of plagioclase. The formula assigned to johannite is  $\text{CuO} \cdot 3\text{UO}_3 \cdot 3\text{SO}_3 \cdot 4\text{H}_2\text{O}$  but the analyses of the Colorado "gilpinite" agrees rather closely with the formula

\* Seventh contribution to Mineralogy from the Department of Mineralogy and Petrography, Harvard University.

<sup>1</sup> Larsen, E. S., and Brown, G. V.: Gilpinite, a new Uranium Mineral from Colorado, *Am. Min.*, 2, 75-79 (1917).

$(\text{Cu,Fe,Na}_2)\text{O}\cdot\text{UO}_3\cdot\text{SO}_3\cdot 4\text{H}_2\text{O}$  and should be accepted for the species.

TABLE 1. THE OPTICAL PROPERTIES OF JOHANNITE

	1. "Gilpinité" Colorado	2. "Gilpinité" Colorado	3. "Gilpinité" Cornwall	4. Johannite Joachimsthal
Opt. Char.	+	-	+	-
$2V_{\text{Na}}$	near $90^\circ$	near $90^\circ$	near $90^\circ$	near $90^\circ$
Disp. of $2V$	$\rho < \nu$ Strong	$\rho > \nu$ Strong	$\rho < \nu$ Strong	$\rho > \nu$ Strong
$\alpha$	1.577	1.575	1.575	1.572
$\beta$	1.597	1.594	1.592	1.595
$\gamma$	1.616	1.611	1.612	1.614
Habit	Laths (010)	Laths (010)	Laths (010)	stout crystal
Opt. Orient.	X near $b$	X near $b$	X near $b$	
	$Y \wedge \text{elong.} = 5\frac{1}{2}^\circ$	$Y \wedge \text{elong.} = 8^\circ$	$Y \wedge \text{elong.} = 5^\circ$	

The close agreement between the optical properties of johannite from different localities is noteworthy. Most of the secondary uranium minerals show a rather unusual uniformity in the optical properties of specimens from different localities, indicating rather definite chemical compositions with little solid solution. The minerals carnotite and tyuyamunite are striking exceptions to this, probably due to variable content in water. The optical properties of the uranium minerals are also characteristic and they commonly serve to quickly and accurately determine the minerals on a very minute amount of material. As yet the data on some of the species is incomplete and careful study should bring to light a number of new species.

## CRYSTALLOGRAPHIC DATA

In the latest discussion<sup>2</sup> of the crystallography of johannite from the Joachimsthal, Ježek referred the mineral to the monoclinic system although it was admittedly triclinic in its optical character. In the monoclinic orientation the mineral was considered as

<sup>2</sup> B. Ježek: *Bull. Internat. de l'acad. des Sci. de Boheme*, No. 21 (1915).

elongated in the direction of the *b*-axis with the prismatic faces in the orthodome zone (Fig. 1). The optical properties of the mineral do not permit this orientation because the extinction is not parallel to this direction. If the mineral is considered triclinic and the orientation shown in Table 2 is used, the ambiguity is removed and the angular relations somewhat simplified. In the gnomonic projection (Fig. 2) the triclinic character of this new orientation is graphically illustrated.



Fig. 1. Johannite, Joachimsthal.

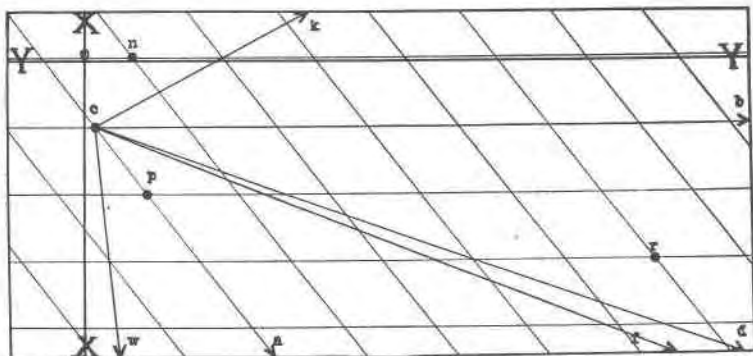


Fig. 2. Gnomonic projection of Johannite showing the forms:  
 $c(001)$ ,  $a(100)$ ,  $b(010)$ ,  $w(2\bar{1}0)$ ,  $d(230)$ ,  $f(10.13.0)$ ,  $k(\bar{1}20)$ ,  $p(101)$ ,  $n(\bar{1}11)$ ,  $r(251)$ .

TABLE 2. ANGLE TABLE—[JOHANNITE]

$\rho_0 = .7075$      $q_0 = .7750$      $\lambda = 86^\circ 23'$      $\mu = 60^\circ 59'$      $\nu = 51^\circ 17'$   
 $a = 1.218$      $c = .6736$      $\alpha = 69^\circ 24'$      $\beta = 124^\circ 56'$      $\gamma = 132^\circ 56'$

No.	Letter	Symbols		Measured		Calculated		Measured Ježek		Symbol Ježek	Letter Ježek	"Gipinite"	
		$p$ $q$	$h$ $k$ $l$	$\phi$	$\rho$	$\phi$	$\rho$	$\phi$	$\rho$			$\phi$	$\rho$
1	<i>c</i>	0	.001	80°32'	35°17'	83°41'	35°07'	84°18'	33°46'	011	<i>x</i>	83°43'	34°45'
												82°31'	40°14'
2	<i>a</i>	$\infty$ 0	100	51°17'	90°00'	51°17'	90°00'	51°56'	90°00'	102	<i>e</i>	51°13'	90°00'
3	<i>b</i>	0 $\infty$	010	0	90°00'	0	90°00'	0	90°00'	100	<i>a</i>	0	90°00'
4	<i>k</i>	$\infty$ 2	120	-27°21'	90°00'	-27°21'	90°00'	-26°39'	90°00'	110.7	<i>k</i>		
5	<i>d</i>	$\infty$ $\frac{3}{2}$	230			18°59'	90°00'	19°54'	90°00'	201	<i>d</i>		
6	<i>f</i>	$\infty$ $\frac{1}{6}$	10.13.0			20°50'	90°00'	21°03'	90°00'	15.0.8	<i>f</i>		
7	<i>w</i>	2 $\infty$	210			83°17'	90°00'	84°18'	90°00'	001	<i>c</i>		
8	<i>p</i>	10	101	65°08'	56°32'	65°08'	56°32'	66°36'	57°22'	124	<i>p</i>		
9	<i>n</i>	-1	111			-2°44'	25°51'	0	25°31'	120	<i>n</i>		
10	<i>r</i>	25	251			19°09'	80°54'	19°54'	79°15'	10.2.5	<i>r</i>		

The crystallographic measurements of johannite and "gilpinitite" were made on crystals of the order of .5 mm in length. Only one of the three crystals measured had sufficient forms to permit the calculation of the axial ratios which was accomplished by the use of the forms  $c$ ,  $a$ ,  $b$ ,  $k$ , and  $p$ , that is, by all of the forms observed on the measured crystal. These forms had each but one face represented on the crystal with the exception of  $b$  and  $a'$ , which had two. The axial ratios obtained in this way fit rather closely the observed values of Ježek, whose angles were not used in the calculations. Table 2 shows the close agreement of the calculated angular values with those observed by him. The forms  $d(230)$ ,  $f(10.13.0)$ ,  $w(2\bar{1}0)$ ,  $n(\bar{1}11)$ ,  $r(251)$ , were not observed by the authors, the angles of these forms are therefore taken from Ježek's paper. The letters used to indicate the various forms are likewise taken from Ježek, with the exception of the three pinacoids  $c$ ,  $a$ , and  $b$ , and the prism  $w$ .

In the last column of Table 2 are listed the observed angles for "gilpinitite" which are seemingly sufficient to establish the crystallographic identity with johannite.

## PURPLE MUSCOVITE FROM NEW MEXICO\*

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Purple muscovite of various shades and presenting unusually attractive and striking color effects occurs abundantly in northern New Mexico as a constituent of pegmatite dikes. The purple color of the mica suggests lepidolite or some mica other than muscovite. The results obtained, however, have shown that this mica is normal muscovite in all its properties except that of color. The pleochroism is strong in basal cleavage pieces and, on comparison, it was found that other strongly colored micas are much more pleochroic in basal sections than commonly recognized. A brief examination, made for comparative purposes, of baddeckite from Nova Scotia, supposed to be a muscovite with considerable iron replacing the alumina, has led to the suggestion that the material analyzed and described was not a mica but a mixture of hematite and a clay.

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