BISMOCLITE FROM GOLDFIELD, NEVADA*

WALDEMAR T. SCHALLER, *Geological Survey, Washington, D. C.*

ABSTRACT

The oxidized bismuth mineral from Goldfield, Nevada, previously described as "bismite," proves on re-examination to be bismoclite, BiOCl. The described and illustrated hexagonal crystals, thought to be "bismite," are probably iodyrite.

The oxidized bismuth mineral occurring in several mines of the Goldfield district, Nevada, as pearly scales of brilliant and almost metallic luster, was described as bismite by Ransome and Schaller[1] with the suggestion that its formula might be $Bi(OH)_3$ or $Bi_2O_3 \cdot 3H_2O$, a formula approximated by an analysis of a gray bismuth ocher from Pala, California.[2] At the suggestion of Dr. Harry Berman, the mineral from Nevada was re-examined in an attempt to harmonize the discrepancies reported in the literature under the name of bismite. As the sample originally analyzed contained nearly 80 per cent of quartz gangue, an attempt was made to concentrate the bismuth mineral by flotation of the gangue in methylene iodide. Although the quantity of gangue was thereby reduced, the sample reanalyzed still contained about 35 per cent of foreign material.

Preliminary tests showed that the mineral contained chlorine, previously missed, and the analysis agrees with that of the recently described bismoclite.[3] The new analysis of the mineral from Nevada (from type specimen previously described, U. S. Nat. Mus. Coll. no 86847) is shown in Table 1.

Spectrographic examination of the analyzed sample by George Steiger showed the presence of Ag, Sn, Cu, Pb, and Sb, and the absence of As, B, Be, Cd, W, and Zn.

Comparative tests made of the silver halide precipitated from a nitric acid solution of the bismoclite from Nevada with the silver halides precipitated from solutions of potassium chloride, bromide, and iodide demonstrate that the halide in the bismoclite is chlorine. These tests are the color (and change of color on exposure to light) of the precipitate and closed tube tests with bisulfate and with galena.

---

* Published by permission of the Director, Geological Survey.

[1] Ransome, F. L., The geology and ore deposits of Goldfield, Nevada: *U. S. Geol. Survey, Prof. Paper* **66,** 121–123 (1909); Schaller, W. T., and Ransome, F. L., Bismite: *Am. Jour. Sci.*, 4th ser., **29,** 173–176 (1910), Schaller, W. T., Bismite from Nevada: *U. S. Geol. Survey, Bull.* **490,** 33–36 (1911).

[2] Schaller, W. T., Bismuth ochers from San Diego County, California: *Jour. Am. Chem. Soc.*, **33,** 164 (1911).

[3] Mountain, E. D., Two new bismuth minerals from South Africa (Bismoclite from Steinkopf, Namaqualand, Cape Province): *Mineral. Mag.*, **24,** 59–62 (1935).

TABLE 1. ANALYSIS OF BISMOCLITE

	Nevada		Africa	BiOCl
	Analysis	Same with impurities deducted and reduced to 100 per cent	Analysis	Calculated
Bi_2O_3	57.67	88.53	88.49	89.41
Cl	8.15	12.51	13.00	13.67
H_2O-	0.13	0.20	0.42	—
H_2O+	1.03	1.58	0.45	—
Fe_2O_3	0.28	—	0.12	—
Insoluble	34.81	—	0.77	—
	102.07	102.82	103.25	103.08
Less $O=Cl_2$	1.84	2.82	2.93	3.08
	100.23	100.00	100.32	100.00

It is not known whether the per cent and a half of H_2O+ in the new analysis indicates a trend towards daubreeite, or whether the H_2O belongs to the gangue. The quantity of available material is too limited to prepare a sample suitably free from gangue for such a determination. The water determinations were made by loss, using sodium tungstate as a retaining flux.

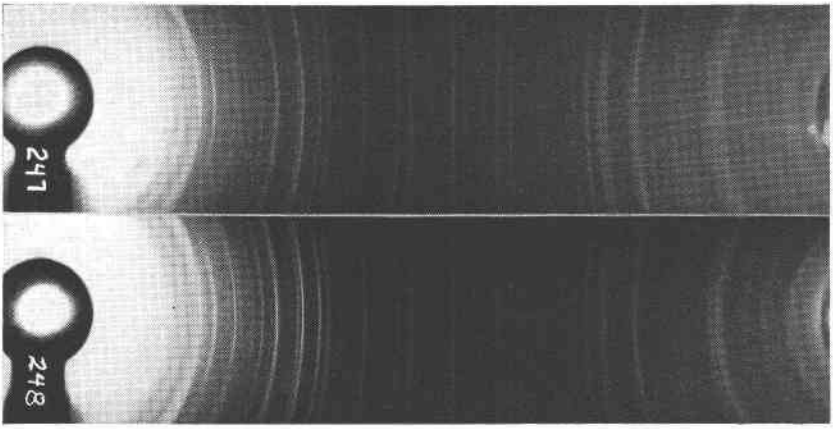

FIG. 1. *X*-ray powder photographs of artificial BiOCl (247) and of bismoclite from Nevada (248).

X-ray powder photographs, shown in Fig. 1, were made by Dr. W. E. Richmond of the mineral and of artificially prepared crystalline BiOCl. This was obtained as described by Bannister.[4] The pictures show the identity of the so-called bismite from Nevada with bismoclite.

Examination under the microscope of the sample analyzed and of crushed fragments from the very small remaining sample shows many very thin rectangular plates, some of which have the corners truncated by lines at 45°. The mineral and synthetic BiOCl definitely are tetragonal, as described by Mountain and Bannister. Very rarely one or two minute crystals are observed which are definitely hexagonal, as previously described. On one complete hexagonal crystal the angles, as measured under the microscope, gave the values 58°, 61°, 60°, 62°, 61°, 59°. This crystal was found to be optically uniaxial positive, whereas the bismoclite is uniaxial negative. This suggests at once that the hexagonal crystals are a second mineral, intimately associated with the bismoclite.

A consideration of the available information suggests strongly that the hexagonal crystals are iodyrite. They are better developed crystallographically than the plates of bismoclite and so were originally selected for goniometric measurements.

The measurements earlier given on supposed hexagonal crystals of bismite agree well with the angles of iodyrite as shown in the following table, based on $c=0.8196$, as given by Dana. The measurements and "indices given for bismite" are taken from the papers by Ransome and Schaller. If these hexagonal crystals are really iodyrite, then the forms $\{10\bar{1}8\}$, $\{10\bar{1}7\}$, $\{10\bar{1}6\}$, $\{10\bar{1}4\}$, $\{10\bar{1}3\}$ are new for iodyrite. The agreement between the measured and calculated angles is so close that this interpretation is probably correct.

Ransome[5] did not report iodyrite from Goldfield but noted the presence of the silver minerals cerargyrite, petzite, polybasite, and proustite. Iodyrite, however, occurs at Tonopah, about 25 miles north of Goldfield. In their description of iodyrite from Tonopah, Kraus and Cook[6] examined "several thousand isolated crystals" and as type 3 describe crystals of a "tabular habit." Tabular and platy crystals of iodyrite have also been observed by others. Dana[7] describes it, in part, as occurring in "thin plates with a lamellar structure." Hintze[8] lists the habits of iodyrite as prismatic, pyramidal, or platy, and the natural occur-

---

[4] Bannister, F. A., The crystal-structure of the bismuth oxyhalides: *Mineral. Mag.*, **24,** 49 (1935). [5] Ransome, *op. cit.*, p. 108.

[6] Kraus, E. H., and Cook, C. W., Iodyrite from Tonopah, Nevada, and Broken Hill, New South Wales: *Am. Jour. Sci.*, 4th ser., **27,** 213 (1909).

[7] Dana, E. S., *System of Mineralogy*, 6th ed., p. 160 (**1892**).

[8] Hintze, Carl, *Handbuch der Mineralogie*, Band 1, Abth. 2, p. 2309 (**1915**).

COMPARISON OF ANGLES MEASURED ON HEXAGONAL CRYSTALS OF SUPPOSED "BISMITE" WITH THOSE OF IODYRITE

Indices given for bismite	Correct indices for iodyrite	ρ	
		Measured	Iodyrite
0001	0001	—	—
$10\bar{1}6$	$10\bar{1}8$	6°37′ 6 41	6°45′
$10\bar{1}5$	$10\bar{1}7$	7 33 7 36	7 42
$10\bar{1}4$	$10\bar{1}6$	9 31 9 31 8–9	9 03
$10\bar{1}3$	$10\bar{1}4$	12 11 13 18 12 26 12–14	13 19
$20\bar{2}5$ $10\bar{1}2$	$10\bar{1}3$	15 16–20	17 31
$01\bar{1}1$	$30\bar{3}4$	35 35 32½	35 22
$20\bar{2}1$	$30\bar{3}2$	54 54	54 50

rences as commonly laminated and as thin flexible plates. Crystals from Chile are described as in pearly hexagonal plates ("Blättchen") and from New Mexico, rarely as hexagonal plates ("Tafelchen"). Spencer[9] also mentions "Films or thin layers" of iodyrite and states that "in freshly opened cavities the crystals [of iodyrite] are perfectly colorless and transparent . . . , " like those from Nevada.

Schnaebelé[10] likewise describes and illustrates very platy ("très aplate") crystals of iodyrite (his Fig. 6, p. 69) from France.

No more of the hexagonal crystals could be found on the very limited material available so that their identification with iodyrite could not be substantiated.

---

[9] Spencer, L. J., Marshite, miersite and iodyrite from Broken Hill, New South Wales: *Mineral. Mag.*, **13,** 44 (1903).

[10] Schnaebelé, E., L'iodargyrite des Montmins, près Echassières (Allier): *Bull. soc. fr. Minéralogie*, **45,** 68–69 (1922).