

## THE PROPERTIES AND ASSOCIATED MINERALS OF GILLESPIITE.

WALDEMAR T. SCHALLER, *U. S. Geological Survey.*

In the description of gillespite,  $\text{Fe}''\text{BaSi}_4\text{O}_{12}$ , published<sup>1</sup> some years ago but brief mention was made of some of its properties and of its associated minerals. Only a single small specimen was then available (now in the U. S. National Museum) and it was hoped that more of it might be found, thus furnishing abundant material for investigation. As such a hope has been in vain, the results obtained on the original material and not previously published are here presented.

The mineral is tetragonal as rectangular cleavages are developed on the base. Two cleavages are present: basal, well developed, and pinacoidal  $a(100)$ , much poorer. There is in some flakes a suggestion of a very poor third cleavage after  $m(110)$ . Thin sections of the specimen and isolated fragments of the mineral show that the following crystal forms are present:  $c(001)$ ,  $a(100)$ ,  $m(110)$ . Redetermination of the refractive indices gave values practically identical with those first determined.  $\epsilon$  (red) = 1.618,  $\omega$  (colorless or pink in thick pieces) = 1.619. The pleochroism of gillespite in a thin section is most striking. It forms a remarkable example of that class of minerals whose pleochroism (in thin pieces) varies from colorless to a strong color.

The glistening silica scales which retain the shape of the original mineral when it is treated with HCl, have lost all the iron and barium of gillespite and have taken on some water. Examined optically, they are seen to be uniaxial, negative, with some scales showing a slight opening of the axial bars. The refractive indices are somewhat variable,  $\epsilon$  being determined as 1.441 and 1.455 and  $\omega$  as 1.449 and 1.465. The mean index is about 1.45. Analysis of such silica scales, air-dried for several days, gave:  $\text{SiO}_2$ , 83.7;  $\text{H}_2\text{O}$ , 15.9; non-volatile with HF, 0.3; total 99.9. Another determination made by J. G. Fairchild, of this laboratory, gave an ignition loss of 15.73 per cent.

The water content of these silica scales is not constant but varies slightly from day to day and even during a single day, the variation amounting to about one per cent. Over concentrated  $\text{H}_2\text{SO}_4$  in a

<sup>1</sup> Schaller, W. T.; Gillespite, a new mineral: *Journ. Washington Academy Science*, vol. 12, p. 7 (Jan. 4), 1922.

desiccator, the total loss is 4.4 per cent, nearly all of which is re-absorbed on exposure to the air.

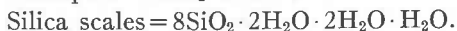
Mr. J. G. Fairchild made some dehydration determinations on these silica scales, at different temperatures, finding that some water was retained by the scales even at 400°.

LOSS OF WATER OF SILICA SCALES

Temperature C°	Percentage of total water loss	Temperature C°	Percentage of total water loss
65°	4.47	260°	10.58
90°	5.24	300°	11.83
110°	5.92	350°	12.13
150°	6.35	400°	13.10
200°	9.85	Ignition	15.73

The total ignition loss, obtained by Fairchild (I obtained 15.9 per cent on another sample) corresponds to the water percentage (15.72) in the formula  $8\text{SiO}_2 \cdot 5\text{H}_2\text{O}$ . Of these five molecules of water, practically 2 pass off at 110° (loss at 110° = 5.92 per cent, whereas 2 molecules water = 6.28 per cent), the third around 200°, and the fourth and fifth above 200°. Even a temperature of 400° does not quickly drive off all the water.

It is to be noted that the water content is nearly the same, on a ratio basis, as that of the iron and barium of gillespite. Thus:



There is a slight excess of water which may be adventitious, especially as the silica scales do not maintain constant weight during the day.

The associated minerals are: white celsian, grayish-green hedenbergite (previously called diopside), colorless quartz, and a few specks of several undetermined minerals observed in thin section. The approximate mineral composition of the specimen, calculated from the weights of the separated minerals (heavy solution and electro-magnet), is: gillespite 64, celsian 15, hedenbergite 15, quartz 6.

The analyses of these associated minerals are as follows, all being only approximate, and made on small quantities of material perhaps from 90 to 95 per cent pure.

## ANALYSES OF ASSOCIATED MINERALS

	Celsian	Hedenbergite	Quartz
SiO <sub>2</sub>	33.9	50.8	94.4
Al <sub>2</sub> O <sub>3</sub>	25.6	2.9	.....
FeO	.....	18.1	.....
CaO	.....	22.2	.....
BaO	37.7	0.0	.....
MgO	.....	6.6	.....
Insol. HCl	0.4	.....	.....
Total	97.6	100.6	94.4

The celsian fills in the spaces between the gillespite and partly between the gillespite and the hedenbergite. Alkalies were not determined but the barium determination shows the mineral to be nearly pure celsian. The optical properties also indicate a nearly pure celsian. They are:  $\alpha=1.584$ ,  $\beta=1.589$ ,  $\gamma=1.596$ .  $2V$  close to  $90^\circ$ .  $Z \wedge a$  axis =  $30^\circ$  approx. Definitely positive.

The hedenbergite, from the analysis, is about  $2/3$  CaO·FeO·SiO<sub>2</sub> and  $1/3$  CaO·MgO·SiO<sub>2</sub>. Larsen determined its optical properties as follows:  $\alpha=1.704$ ,  $\beta=1.714$ ,  $\gamma=1.735$ . Positive,  $2V$  medium large, dispersion  $\rho > \nu$ . The hedenbergite is largely in the form of nearly equant grains scattered through the celsian and the gillespite and to a smaller extent it occupies the spaces between these two minerals.

The undetermined minerals, noted only as specks and small masses scattered through the specimen are briefly described. There are three of them. The most abundant is fibrous (probably a secondary alteration product) with strong pleochroism-parallel to the elongation, blue with intense absorption (almost black); and normal to the elongation a yellow with almost no absorption. The third direction is almost colorless to very pale yellow. Extinction is parallel or nearly so, and elongation is positive. Birefringence moderate, estimated at about .02 to .03. The refractive indices are less than those of celsian. The second mineral is also strongly pleochroic from blue to yellow-brown but is not fibrous but forms short prismatic or irregularly shaped masses, with apparently parallel extinction and similar moderate birefringence. It may be the same as the fibrous mineral. A third mineral, strong-

ly pleochroic from yellow to deep brown with moderate birefringence has a shape similar to the second mineral, but is much scarcer, only a few fragments being noted. The very limited quantity of available material has prevented the more complete determination of the properties of these rare associated minerals.