

ADDITIONAL NOTES ON COPPER ARSENATES AND ASSO-
CIATED MINERALS, FROM UTAH.

BY RICHARD PEARCE.

At the last meeting of the Society I partially described a series of minerals from the Mammoth mine, Tintic District, Utah. Since that time I have had further opportunity of studying the species then mentioned and in the new material available have found still other minerals of the same group.

1. *Tyrolite.*

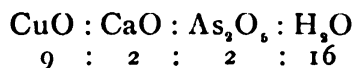
The mineral which I supposed to be tyrolite has been found in larger quantities and in better development than that first examined. A chemical analysis of 200 milligrams of carefully selected material gave :

CuO	42.60
As ₂ O ₅	27.87
CaO	9.10
Fe ₂ O ₃ (Al ₂ O ₃)	0.97
SO ₃	2.45
H ₂ O	16.23
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	99.22

If we regard the sulphuric acid to be in combination with lime, and exclude this, together with the ferric oxide and alumina, as impurities we have the following percentage composition for the remainder:

CuO	45.3
CaO	7.7
As ₂ O ₅	29.6
H ₂ O	17.4
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	100.0

which yields the ratio :



From these figures it would seem that the mineral in question differs somewhat from the tyrolite of the text-books in having no carbonic acid, though it is by no means proven that this is an essential constituent of the mineral in any instance.

2. *Erinite.*

A mineral found during the past month is thought to be erinite, as it agrees in chemical composition and physical character with that rare species. It occurs as a crystalline coating of dark green color associated with clinoclase and olivenite. 132 milligrams of the substance gave:

	I.	II.
CuO	56.56	57.43
CaO	0.43	
Fe ₂ O ₃	0.85	
As ₂ O ₅	32.07	32.54
SO ₃	trace	
H ₂ O	6.86	7.67

The second analysis figured to 100. gives the following:

CuO	58.82
As ₂ O ₅	33.32
H ₂ O	7.86

This gives a ratio very near to:

CuO	As ₂ O ₅	H ₂ O
5	1	3

which agrees quite closely with that of erinite. The species is a rare one, having until now been found in but a single locality, in Cornwall.

3. *New Mineral.*

Associated with the other arsenates from the Mammoth mine is a mineral occurring in most delicate tufts of fine hair-like needles, having a pale green or whitish color. These tufts appear in small cavities, and have a beautiful silky lustre. Only 48 milligrams could be ob-

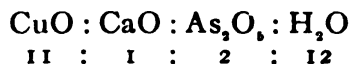
tained for chemical analysis, and this contained some foreign matter, chiefly ochreous oxide of iron, entangled in the delicate fibres so intimately that it could not be entirely separated. The analysis is as follows:

CuO	50.50
CaO	3.19
As ₂ O ₅	27.50
H ₂ O	12.55
	93.74

The Fe₂O₃ and some Al₂O₃ known to be present were lost, together with a little insoluble matter. These impurities would no doubt have brought the total of the analysis nearly to 100. The constituents given may be taken as representing the composition of the mineral, and these calculated on the basis of 100 become:

		Calculated.
CuO	53.87	54.40
CaO	3.40	3.48
As ₂ O ₅	29.33	28.65
H ₂ O	13.40	13.45

This gives very nearly the ratio:



from which the formula $6(\text{Cu}, \text{Ca})\text{O} \cdot \text{As}_2\text{O}_5 \cdot 6\text{H}_2\text{O}$ requiring the calculated percentages given above.

I have not been able to find any described mineral corresponding to the above, and should its composition be expressed by the analysis given, I am inclined to believe that the species is new to science.

4. *Chalcophyllite.*

Another mineral lately observed in association with those already described seems to agree in outward appearance with the copper-mica, chalcophyllite. As yet it has been found in too small quantity to afford material for

chemical analysis. The mineral occurs in apparently hexagonal or possibly orthorhombic plates of a pale apple green color, approaching to emerald green in the thicker tablets. It is readily distinguished from tyrolite by the color, though the tabular form of the crystals is nearly the same.

Discussion. Mr. Whitman Cross stated, that, at the request of Mr. Pearce, he had made a microscopical examination of the supposed new mineral and had also considered the question of its chemical composition. The needles are very slender, with a length of more than 1^{mm} in some cases, by a thickness of less than 0.05^{mm}. They are deeply striated vertically, and the crystal system could not be determined, although the extinction in polarized light makes a reference to the tetragonal, the hexagonal, or the rhombic system necessary. The index of refraction is high. Pleochroism distinct, the colors observed being, for the thicker crystals, a (and b) sea green, c sky blue.

In regard to the chemical composition but little could be said at present, but it was considered worthy of note that if Mr. Pearce's formula be correct, and one-half the water be assumed as basic, the mineral would appear to be the hydrate of the clinoclasite molecule. Thus

$6RO, As_2O_5 + 6H_2O =$
 $2(ROH)_3AsO_4 + 3H_2O, \text{ or,}$
 $(ROH)_3AsO_4 + 1\frac{1}{2}H_2O, \text{ while}$

clinoclasite is $(ROH)_3AsO_4$ according to the tables of Prof. Groth.