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CHARLES F. CHANDLER, Ph.D., F.C.S.,

AND

W. H. CHANDLER, Ph.D., F.C.S.

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ON CHALCOPHANITE, A NEW MINERAL SPECIES.

BY GIDEON E. MOORE, PH.D.

In course of the work of exploration conducted by the Passaic Zinc Company, on their calamine ore deposit at Stirling Hill, Ogdensburg, N. J., a deposit has been found, overlying the calamine ore, and consisting mainly of water-worn fragments and grains of quartz, masses of more or less decomposed franklinite, and other substances, evidently the debris of the neighboring deposits of franklinite, willemite, and zincite ores. This material is full of fissures and cavities, which are, to a large extent, lined with a crystallized mineral, which possesses strongly marked peculiarities and traits distinguishing it from the minerals hitherto met with at this locality.

Immediately subsequent to the opening of this deposit, *i. e.*, about three months prior to the date of this paper, a specimen of the mineral was submitted for examination to the writer by the Passaic Zinc Company. The peculiar morphological characters of the specimen led to the suspicion that it might probably prove to be a new species, a supposition which was strengthened by the results of a blowpipe examination. Owing, however, to the difficulty of obtaining enough of the pure crystallized mineral for analysis, and partly owing to the pressure of professional occupations, the completion of the work has been delayed until the present date.

The mineral occurs in druses of handsome and lustrous but minute crystals, and in foliated aggregates lining the walls of the cavities in the matrix or grouped to stalactitic and plumose forms. The lamellar structure is perpendicular, or nearly so, to the surface upon which the crystals are implanted, or, in the stalactitic forms, to the direction of the latter.

In the stalactitic forms the crystals are grouped around a central core of an amorphous manganiferous mineral, intermixed with occasional patches of hydrous ferric oxide.

On account of the minute size of the crystals and the fact that it is quite rare to find individuals giving distinct reflections from the lateral faces, much difficulty was experienced in determining the crystalline form. After a prolonged search, however, a few crystals were obtained upon which the following measurements were made, which, although they possess few pretensions to great accuracy, may nevertheless be considered as being approximately correct, and, in default of more exact data, sufficient to decide the system to which the crystals belong.

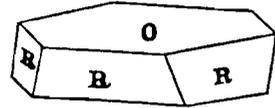
Crystallization: Rhombohedral. Combination: O; R.
Habit: Tabular, owing to preponderance of O.

VI.—1

	Found.	Calculated.
R : R	114° 30'	
R : O	104° 13'	103° 48'

whence we have $\alpha = 3.5267$.

The following figure represents a type of frequent occurrence among the more perfect crystals:—



The face O possesses a brilliant lustre and gives perfect reflections, the rhombohedral faces are far less brilliant and are often deeply striated parallel to the basal plane.

The crystals are often flattened out to the thinnest scales, and these are in some cases grouped together parallel to O, forming aggregates which often bear a strong resemblance to combinations between a hexagonal prism and the basal plane. The prismatic faces, however, reveal their composite character by the absence of lustre and the frequent striæ parallel to the basal plane.

Cleavage: Basal; perfect. Structure: Foliated; micaceous. Thin laminæ, very slightly flexible.

Hardness = 2.5. Cuts with a smooth surface like graphite. Specific gravity = 3.907. Lustre: Metallic; splendid on the basal plane, usually dull on the other faces except in the more perfect crystals. Color, bluish-black, in the larger and more perfect crystals verging on iron-black. Streak chocolate-brown, dull. Opaque even in the thinnest lamellæ.

Before the blowpipe turns of a color varying from pale yellowish-bronze to copper-red, exfoliates slightly, and on continued heating darkens in color, and shows traces of fusion on the edges of thin laminæ. In the closed tube gives off water and oxygen, exfoliates slightly, and changes to a mass of loosely coherent laminæ of a golden-bronze color, and metallic lustre, greatly resembling in appearance certain varieties of the mineral enstatite (*var. bronzite*). With borax a strong manganese reaction, the button becoming cloudy in the reducing flame. On charcoal with soda and borax a coating of oxide of zinc. Soluble in muriatic acid, with evolution of chlorine on warming.

Each of the leading varieties of the mineral was separately analyzed with the following results, *viz.*:—

I. *Distinct Crystals.*

The two varieties of the crystals were separately analyzed. In Analysis I. the sample possessed the form of hexagonal tables, resembling combinations between the hexagonal prism and the basal plane. In Analysis II. the crystals presented the combination R : O, as shown in the preceding figure. In each case the crystals were broken up and carefully freed from extraneous impurities by selection under the lens.

In the analysis the water was determined by the

direct method, at the strongest heat a good Bohemian glass tube would bear. The residue of this operation was transferred from the platinum boat to a small platinum crucible, and ignited until the weight remained constant. Deducting from the total loss in weight by ignition the weight of water found, the amount of oxygen lost by the oxides of manganese in the mineral during their conversion into the state of protosequioxide was found to be 6.39 per cent. The total oxygen of the peroxide was found by Bunsen's method to be 22.05 per cent. The manganese and zinc were separated by hydrogen sulphide in acetic acid solution; the manganese, being weighed as manganoso-manganic oxide, gave Mn_2O_3 , 59.67 per cent. The zinc was determined in duplicate. The duplicate determination of the manganese was lost by accident, the limited amount of pure material at my command having made a repetition of the analysis for the present impossible. From these figures the mineral will be seen to possess the following composition:—

	I.	II.	Mean.	Oxygen.	
Mn,		59.94	59.94	22.05	} 5.76
Mn,		6.58	6.58	1.48	
Zn,	21.67	21.74	21.70	4.28	
Fe	.25	trace.	.25		
H	11.58		11.58	10.29	
			100.05		

The loss in oxygen which would attend the conversion of the manganese compounds indicated by the analysis into the state of manganoso-manganic oxide would be 6.84 per cent. The conversion by ignition into the compound $(ZnMn)Mn$ would be attended by the loss of 6.02 per cent. of oxygen.

Discarding the iron as an accidental contamination from the highly ferruginous gangue, we have for the oxygen ratios of the peroxide, protoxides, and water, the proportion 22.05 : 5.76 : 10.29 or 4 : 1 : 2, nearly.

II. *Stalactitic Aggregates, possessing a lamellar radiate structure.*

The crystals could not be entirely freed from the central core, hence the material analyzed was not absolutely pure.

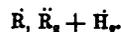
In this analysis the oxygen of the peroxide was determined by Pattinson's modification of Otto's method. The manganese was separated from the zinc by hydrogen sulphide in acetic acid solution, and the manganese weighed as pyrophosphate. The water was determined directly with the calcium chloride apparatus as in the analysis of the pure crystals.

	I.	II.	Mean.*	Oxygen.	
Mn	61.71	61.44	61.57	22.65	} 5.15
Mn	4.38	4.44	4.41	1.04	
Zn	20.82	20.78	20.80	4.11	
Fe	1.01	1.20			
H	12.83		12.66	11.14	
			99.44		

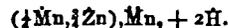
* After deducting Fe 1.10 and H 1.17 = 1.27 Limonite; the state in which the iron occurs in the gangue.

From this analysis we have the oxygen ratios of the peroxide to the protoxides and water 22.65 : 5.15 : 11.4 = 4.39 : 1 : 2.16, or, with due regard to the probable presence of a small quantity of hydrous manganese dioxide as an accidental admixture, 4 : 1 : 2.

The simplest general formula for the species is, therefore—



The oxygen ratio of the manganous oxide to the zinc oxide in the analysis of the pure crystals = 1.48 : 4.28 is approximately = 1 : 3, whence we have the specific formula—



as the simplest expression of the analytical results.

This formula is, however, exceptional in respect to being formed by the union of two molecules of peroxide with one of protoxides, nor is it possible that a saturated compound should thereby result. In view, however, of the hexagonal crystallization it seems but reasonable to conclude that one of the molecules of water possesses a basic character, and that the formula should be written—



equivalent to—



which would bring it in accord with Dana's law of the relations between crystalline form and chemical constitution,* and would also admit of the construction of a formula on the basis of $o = 16$.

The species is hence closely related to psilomelane and wad, which it also resembles in the fact of its recent origin; being evidently a product of the decomposition of franklinite and other manganiferous and zinciferous minerals.

In allusion to the change in color which the mineral undergoes by ignition I propose for it the name chalcophanite, from χαλκος, brass, bronze, and φαίνω, I appear.

JERSEY CITY, July 12, 1875.

DISINFECTANTS AND DISINFECTION.

BY ELWYN WALLER, B.M., PH.D.

The only reliable and certain method of disinfection implies a knowledge of the nature of infectious matter, and of the action of certain substances known as disinfectants upon that matter.

These points are at present but imperfectly understood, and therefore at this time our knowledge of disinfection does not approach that certainty which is desirable. These problems are, however, being constantly investigated, and it is to be hoped that the necessary knowledge will soon be acquired. Some points have been established, and from these some conclusions may be drawn, which may give assistance in solving the question.

Diseases which are the effects of infection are known, and it is also known that infection is most frequent,

* J. D. Dana, Am. Journ. Sci., xlv., July, 1867, pp. 89 et seq.