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On submitting them to Mr. Slack, he at once indicated their remarkable analogy to the common blue mould, or mildew.

The cells appear to be hollow; they do not blacken with sulphuric acid. An attempt to render their structure more apparent, by injecting with isinglass and vermilion, met with only partial success. In many cases the ends of the fibres are surrounded by an apparently vacuous space; it is therefore probable that the fungi actually grew after the partial solidification of the jelly; observations are, however, being continued in this direction. In natural mocha stones, the dendritic forms are not dissimilar, but when examined microscopically, they are distinctly angular and crystalline. It is possible that in natural agates many cellular structures may have been produced, as indicated above, and subsequently filled in with mineral matter. As early as 1814, Dr. M'Culloch described some undoubtedly organic forms in the agates of Dunglas.

Dr. Carpenter has also recorded the *growth* of fungi in the shells of the anomia.

I should apologise for bringing so small a matter before the Society, but I considered it might be of interest at a time when the microscope is becoming an indispensable aid in petrological research.

XXXII.—*Chemical Researches on New and Rare Cornish Minerals.*

By A. H. CHURCH, M.A., Professor of Chemistry in the Royal Agricultural College, Cirencester.

V. *Cornwallite.*

Is cornwallite a good species? The experiments given below were undertaken in order to see whether chemical analysis could afford an answer to this question.

Cornwallite was named by Zippe, basing the species on two analyses by Lerch, which gave the following percentages:—

	CuO.	As_2O_5.	P_2O_5.	H_2O.
I.	55·00	29·78	2·54	12·68
II.	54·22	30·65	1·77	13·36

From these numbers the generally accepted formula $Cu_3 2AsO_4 . 2CuH_2O_2, 3Aq.$ was deduced.

The physical characters of cornwallite, as originally given, are quite distinctive. It is by no means a common mineral. I have obtained a few small specimens in Cornwall at different times, but my two best and largest pieces were purchased in London, and had formerly been in an old Cornish collection of minerals. Occasionally, specimens have been offered to me as cornwallite, which were merely varieties of the cupric *phosphate* known as prasine, in which a portion of the P_2O_5 had been replaced by As_2O_5. One of these gave, on analysis, the following percentages:—

CuO	68·44
P_2O_5	20·38
As_2O_5........	2·42
H_2O	8·20
	99·44

Now this specimen was accompanied by torberite, while the true cornwallite, as noticed by Zippe, is associated with olivenite. The two specimens of which I now purpose giving an account, were partially coated on their surface and in their cavities with very delicate, nearly white, silky prisms of olivenite. In other respects also, as will be seen presently, they corresponded very closely with the original description of this species.

The hardness of my specimens was 4·5; the density of one of them was found to be 4·17. The colour is a very rich verdigris green, passing into a blackish green. The fracture of the more compact parts of the specimen is distinctly conchoidal. The minute botryoïdal character of some portion of the mass is, however, very marked, and then the minute chains of bead-like globules serve to show the translucency and characteristic colour of the mineral very clearly.

The new analyses, given below, of cornwallite, were made with every care. The copper was always determined *finally* by Brown's volumetric method; it is probably slightly in excess of the truth, in consequence of a trace of iron in the solutions experimented with.

ANALYSES OF CORNWALLITE: Synopsis of Results.

	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.
Substance taken ..	·5675	1·703	·5605	·5305	·511	·6005	·171	1·5395	·4187
SiO_2	·004	·0115	·004	·002	·004	·006	·002	·023	·0035
Hygroscopic H_2O .	·0065	·0195	·006	·006	·0058	·01	—	·0065	0065
H_2O	—	—	—	—	—	·048	—	—	—
CuO	·3354	1·01182	·33084	·31246	·29776	·34922	·10109	—	—
$MgNH_42AsO_4,H_2O$	·284	—	—	—	—	—	—	·746	·206
$Mg_2P_2O_7$	·024	—	—	—	—	—	—	—	—

Analyses I to VI were made with one sample; analyses VII to IX with another sample of cornwallite. When these results are calculated into percentages, after deduction of the intruding silica and the hygroscopic water, they give very accordant numbers. In a carefully prepared sample for analysis the silica does not exceed half a per cent., and is shown by microscopic examination to be an accidental admixture, due to minute veins of quartz in the mineral. I have considered the water lost at 100° C. merely hygroscopic, because it varies from day to day with the dampness of the atmosphere, and because in vacuo over oil of vitriol, the same loss of moisture ultimately occurs as at 100° C.

The following are the percentages deduced from the above analyses:—

	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	Mean.
CuO ..	60·21	60·52	60·09	59·80	59·40	59·85	59·76	—	—	59·95
As_2O_5 .	30·86	—	—	—	—	—	—	29·98	30·58	30·47
P_2O_5 ..	2·71	—	—	—	—	—	—	—	—	2·71
H_2O ..	—	—	—	—	—	8·23	—	—	—	8·23

It will be seen that the above analyses differ from the older ones of cornwallite only in the percentages of CuO and H_2O. In fact, I find 5 per cent. more cupric oxide, and 5 per cent. less water; a comparison of the old and new theoretical and experimental percentages will at once show, either that the old view of the constitution of cornwallite is untenable, or that the mineral now under review is a new species. But I have already pointed out why my mineral seems to be the true cornwallite, and, if so, to some accidental cause must be attributed the larger amount of water given in the former analyses. It is evident that in Lerch's analyses one ingredient was determined by difference; if this constituent should have been either the cupric oxide or the water, the discrepancy alluded to admits of explanation.

Here are the old and new analytical results translated into mean percentages, and placed for comparison beside the theoretical numbers:—

	Lerch.		Church.	
	Experiment. (Mean.)	Theory. ($5CuO.As_2O_5.5H_2O$.)	Experiment. (Mean.)	Theory. ($5CuO.As_2O_5.3H_2O$).
CuO ..	54·61	55·42	59·95[*]	58·33[*]
As_2O_5 .	30·21	32·06	30·47	33·75
P_2O_5 ..	2·16	—	2·71	–
H_2O ..	13·02	12·54	8·23[†]	7·92[†]
	100·00	100·02	101·36	100·00

The formula for cornwallite may then be written $Cu_32AsO_4.2CuH_2O_2$.aq., making this species stand to erinite, $Cu_32AsO_4.2CuH_2O_2$, among the arseniates, as ehlite, $Cu_32PO_4.2CuH_2O_2$.aq., stands to dihydrite $Cu_32PO_4.CuH_2O_2$, among the phosphates. But, in fact, many of the hydrated native arseniates and phosphates require a most searching re-investigation. A complete classification of this group of minerals is not yet possible.

XXXIII.—*On the Regenerative Gas Furnace as applied to the Manufacture of Cast Steel.*

[A Lecture delivered before the Fellows of the Chemical Society, May 7th, 1868.]

By C. W. SIEMENS, F.R.S., Mem. Inst. C.E.

IN responding to your call to deliver a lecture to your Society, on a subject of applied chemistry, I feel that I have undertaken a very responsible task, a responsibility which is only balanced by the honorary distinction conferred by your call.

It is a hopeful sign of the advancement of science that your

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[*] The greater part of the excess of the experimental over the theoretical percentage of CuO is due to the partial replacement of As_2O_5 by P_2O_5 in this mineral; of course cupric phosphate contains a much higher percentage of CuO than the arseniate.

[†] The water in the experiment is rather high; in other and subsequent determinations the percentages obtained were 7·45 and 8·16.