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ARTICLE I.

On a new Mineral Substance. By Mr. A. Lévy, MA. of the University of Paris.

(To the Editors of the *Annals of Philosophy.*)

GENTLEMEN,

Newman-street, Oxford-street, Sept. 17, 1814.

MR. HEULAND had put aside a long time since a specimen of Mr. Turner's collection, from the Bank mines, in the government of Ecatherineburgh, in Siberia, considering the small emerald green transparent crystals which are upon it as differing from any described substance. Upon detaching and measuring some of them, I have ascertained that their form was incompatible with those of the arseniates and green carbonate of copper, with which their external characters bear some resemblance, and I am led, therefore, to consider them as belonging to a new mineral species, to which Mr. Heuland proposes to give the name of *Brochantite*, in honour of a mineralogist as well known here as in his own country.

The appearance of the crystals is that of thin rectangular tables, bevelled on the edges with the angles truncated, such as is represented by fig. 7 (Pl. XXXII). Their colours are emerald green, they are transparent, and their hardness is about the same as that of green carbonate of copper. The planes M are blackish and dull; all the others are brilliant and fit for measurement by the reflective goniometer. I have not been able on the very minute crystals I have examined to ascertain the directions of the planes of cleavage, and I have, therefore, assumed as the primitive a right rhombic prism, fig. 6, the lateral planes of which correspond, I believe, with the planes marked M, fig. 7. The planes e^1 and a^1 are then the results, the first of a decrement by four rows on the angles e of the base of the primitive; the other of a decrement by one row on the angle a . The angles I have

measured are the incidences of e^t and a^1 on the base, and it is from these data, and from the supposition that 4 and 1 are the indices of these planes, that the angles and dimensions of the primitive are deduced. I have thus found that the lateral planes of the primitive were inclined to each other at an angle of $114^\circ 20'$, and that the height was to one side of the base nearly in the ratio of 25 to 12. The other angles are $(a', p) = 104^\circ 75'$, $(e^t p) = 148^\circ 30'$.

It may appear strange that in the want of sufficient data to determine the primitive form, and being obliged to make a supposition upon the laws of decrements which produce the faces e^t and a^1 , I have not chosen the simpler hypothesis of each of these faces being the result of a decrement by one row. In that case the lateral planes of the primitive would have been inclined at an angle of $162^\circ 18'$, and had I supposed 2 instead of 4 for the index of the face e^t , the incidence of the lateral planes would have been $145^\circ 25'$. Now though I could not measure the angle of the planes M, fig. 7, their incidence appeared to me much nearer to the angle $114^\circ 20'$, which I have chosen, than any of the other two very obtuse angles; this circumstance added to some indications of cleavage in the direction of the same planes, determined me to adopt the number 4.

The crystals are placed upon mamillated green carbonate of copper lying upon massive red copper.

Upon a specimen of wavellite, from Cornwall, belonging to the same collection, I have observed some minute white transparent crystals in the form of acute rhombic octahedrons, with their summits replaced by a plane, see fig. 8. This form is not incompatible with wavellite, whose primitive form is a right rhombic prism. However, in trying to split some of the crystals, I could not perceive any indication of the cleavages which exist in wavellite. The only means to ascertain whether their form could be derived from that of wavellite was in the following manner. First, it is obvious that, in that case, one of the parallelograms ABCD, ABCE, BEDF, must be parallel to the base of the primitive of wavellite. Secondly, one of them must be similar to that base, or at least must be such that when placed in the plane of that base so that its diagonals be parallel to the diagonals of the base, the sides must be found parallel to lines drawn from one of the angles of the base to some simple multiple or part of the opposite sides. If none of these conditions be satisfied, then it may be safely inferred that the two forms are incompatible. But the application of this method supposes that the incidences of the faces of the crystals can be measured with great accuracy, and here the planes were not sufficiently brilliant to answer in the measurements of less than half a degree. Dr. Wollaston kindly undertook an examination of this substance, and the results of his observations were as

follow. His experiments were performed upon two or three small crystals, the largest of which weighed about 1-80th part of a grain. The only substances he could detect in them are alumina and fluoric acid. He also measured the refractive power comparatively with that of wavellite, and found the index of refraction to be 1.47, whilst that of wavellite is 1.52. He is, therefore, of opinion that these crystals belong to a distinct species, for which he proposes the name of *Fluellite*. He also measured the crystals, and found

$$(b, b') = 144^\circ \quad (b, b'') = 109^\circ \quad (b, b) = 82.$$

Hence the primitive form may be assumed to be a right rhombic prism, the lateral planes of which are inclined to each other at about 105° .

I shall conclude this short paper by mentioning, that upon a specimen from Mendip, near Churchill, Somersetshire, I have found a white laminary substance which cleaves with great facility, and brilliant surfaces parallel to the lateral planes and shorter diagonal of a rhombic prism of $102^\circ 25'$, and thus differs from sulphate of lead to which it bears a great resemblance, and is very likely the substance, from the same locality analyzed by Berzelius, a notice of which was inserted in the number of the *Annals of Philosophy* for August last. I could find no cleavage in the direction of the base.

Examination of the preceding Mineral by the Blowpipe, &c.

At Mr. Lévy's request, I have examined the *Brochantite* by the blowpipe, but the quantity which he could supply me with was so very small, not exceeding two-tenths of a grain in all, that I have been unable to obtain satisfactory information as to the true composition of the mineral. The results, however, such as they are, I lay before our readers.

A minute crystal, not half the size of the smallest pin's head, heated alone on charcoal, immediately lost its fine green colour, and became dark brown, slightly inclining to a reddish hue, but did not fuse. The heated particle was not attracted by the magnet. Another particle cemented to the end of a fine platina wire by alumina, in the manner recommended by Mr. Smithson, fused readily, and alloyed with the platina.

With soda on the platina wire, and in the *oxidating flame*, the assay gave a brown opaque globule, which was not perceptibly altered in the *reducing flame*.

With borax, in the oxidating flame, the assay gave a transparent, very deep green glass. When the flux was not in large proportion to the assay, the globule appeared black, from the intensity of the colour. In the interior flame the green colour

quickly disappeared, and the globule became red from reduced copper.

With salt of phosphorus, the same as with borax, except that the green colour was not so intense.

The quantity being so minute, I could not expect to detect the presence of arsenic by its odour. I, therefore, sought for arsenic acid by treating a few minute fragments of the crystals on a slip of glass, with potash and nitric acid, &c. but no indication of its presence was afforded by nitrate of silver. With nitrate of lead, the solution gave a considerable precipitate, insoluble, when largely diluted, in excess of nitric acid.

The crystals dissolved completely in muriatic acid without the slightest effervescence, and the solution, diluted with a large quantity of water, gave a white precipitate with muriate of barytes, apparently perfectly insoluble in excess of acid. To ascertain, however, if phosphoric acid be present, I digested the precipitate by muriate of barytes in diluted muriatic acid with heat, decanted the clear fluid, and added ammonia, but not the least cloudiness, indicative of a phosphate, ensued. To be still more certain, I tried the converse of Dr. Wollaston's beautiful and delicate process for detecting the minutest portion of magnesia; that is, I dissolved a portion of the crystals in nitric acid, and to the clear solution added a solution of nitrate of magnesia, and to the mixture an excess of bicarbonate of ammonia. Letters were then described with a glass rod in the solution on the slip of glass, and the mixture slightly warmed over the lamp, but no traces whatever were discernible on the glass. A comparative experiment made with a similar particle of phosphate of copper gave distinct and strong lines on the first impression of the heat.

As from the experiment with muriate of barytes, a sulphate appears to be present, a portion of the crystals was heated in pure water, and the liquid tested with muriate of barytes, but no precipitate ensued; the water did not appear to have dissolved any thing; the appearance of the crystals was wholly unaltered. I could not detect any trace of lime, magnesia, manganese, or iron, in the crystals, nor any decisive indications of alumina or silica; in short, nothing but copper and sulphuric acid; and yet they appear to be wholly insoluble in water. A particle of a crystal laid in a drop of water on a clean polished bar of iron, and the water evaporated to dryness left no trace of copper, nor any more mark than another drop of the same water evaporated to dryness beside it.

Prussiate of potash indicated nothing in the solutions but copper.

From the insolubility of the crystals in pure water, and their fine green colour, it can hardly be doubted that they must contain something else besides sulphuric acid and oxide of copper;

but what the ingredients may be that have escaped detection, I must leave to future experiments, if hereafter I may obtain a larger supply of the crystals, to determine. J. G. C.

P. S. From some very indecisive appearances that occurred in the examination of the globule with salt of phosphorus, I am inclined to think that alumina or silica, or both, may be constituent parts of the crystals; but I have no means of confirming or disproving the conjecture.

ARTICLE II.

On the Heat produced by firing Gunpowder, and on the intense Heat of Blast-furnaces. By W. T. Haycraft, Esq.*

THE following explanations on these subjects are suggested by Mr. Haycraft, towards the conclusion of his paper on the "Specific Heat of Gases."

The increased capacity of air, when under lesser degrees of atmospheric pressure, has been properly made use of to explain the extreme cold which exists in high regions; and its decreased capacity under mechanical pressure also satisfactorily accounts for the heat evolved under that condition. This principle, so far as I know, has not been used to explain one cause of the intense heat produced during the combustion of gunpowder and other explosive mixtures. If we reflect a moment, however, we shall perceive that the resistance of the pressure of the atmosphere to the expansion of the nascent gases produced by the combustion, will cause them to exist in a state of greater density than when the resistance of the atmosphere has been finally overcome. It is during this state of potential compression, if I may use the term, that the intense heat is produced. After the first explosion, however, the gaseous products will expand, and then there will necessarily be absorption of caloric, and consequently comparative coldness produced. In order to ascertain whether there is a permanent evolution of caloric, occasioned by the combustion of gunpowder, I made the following experiment.

Having a receiver containing 528 cubic inches, filled with water of a temperature of 52°, placed in a pneumatic trough, the surrounding atmosphere being also 52°, I introduced 240 inches of the aeriform fluids, produced during the combustion of that composition of gunpowder which is used for pyrotechnical purposes. After the explosion, the gas in the upper part of the receiver had acquired a temperature of nearly 54°, and the water not so much. This experiment shows that though heat is

* From the Transactions of the Royal Society of Edinburgh.