

III. Corrective Note by MESSRS. DE LA RUE, STEWART, and LOEWY to their Paper "On some recent Researches in Solar Physics &c." *

The erroneous date given in our paper for one of Professor Wolf's maxima has already been corrected by us, and we give in the subjoined little Table the corrections of the few numerical data which are necessitated by the error of fixing the date of maximum at 1846·6 instead of 1848·6.

Professor Wolf's ratio $\frac{A}{B}$ (p. 86).

Erroneous figures given previously.		Corrected figures.	
	Differences.		Differences.
I. 1·265 } Mean 2·093	-0·728	1·265 } Mean 1·548	+0·283
II. 2·615 }	+0·522	1·478 }	+0·073
III. 2·400 }	+0·307	1·900 }	+0·352

The differences derived from our own results are respectively +0·061, -0·107, and +0·047, that is, they are still much smaller, and agree singly better with the mean, than if Professor Wolf's ratio were adopted; hence our conclusion is quite unaffected by this correction.

The remark made by us with reference to this maximum (*vide* p. 85) will remain in force even with the corrected date. We stated there that this particular maximum showed alone an appreciable difference from the dates fixed by ourselves, for it will be found that Professor Wolf's date differs still by about $\frac{3}{4}$ of a year from ours.

IV. "The Action of Oxygen on Copper Nitrate in a state of tension."

By J. H. GLADSTONE, Ph.D., F.R.S., and ALFRED TRIBE, F.C.S. Received March 14, 1872.

In our experiments on the action between copper and nitrate of silver in solution, we frequently noticed that the tips of the silver crystals became red, as though coated with a thin layer of metallic copper.

This apparent deposition of a positive on a more negative metal of course raised our curiosity, and led us to look closely into the circumstances under which it occurred. We found that it took place only when the nitrate of silver was exhausted, and only on those silver crystals which remained in metallic connexion with the copper. We found, too, that the cupreous coating formed most readily where air had the freest access, and, in fact, that it would not form at all in vessels from which oxygen was excluded, nor on those white crystals which were far below the surface of the liquid, though they might be in immediate contact with the copper plate. When an inverted jar was filled with nitrate-of-copper solution and silver crystals resting on branches of copper, and the liquid was displaced by oxygen gas, it was found that the tips of the crystals became red, and

* *Supra*, p. 82.

the solution gradually filled the jar again by the absorption of the gas. In the same way the oxygen was absorbed from air, or from its mixtures with hydrogen or carbonic anhydride.

This action was further studied by employing plates of the two metals instead of copper covered with silver crystals. When the two plates, connected by a wire, were partially immersed in an ordinary aqueous solution of copper nitrate, it was found that a slight yellowish deposit made its appearance speedily all over the silver plate, and went on increasing for a day or two, while at the air-line there was a thicker deposit, which gradually grew and extended itself a little below the surface. This deposit changed from yellowish to red, and under the microscope presented a distinctly crystalline appearance.

Thinking that this slight crust all over the silver plate was due to air dissolved in the solution itself, we took advantage of the reaction to prepare copper nitrate absolutely free from dissolved oxygen. An ordinary solution of the salt mixed with some silver nitrate was placed in a narrow cylinder, with a long piece of copper-foil arranged somewhat spirally, so as to retain the deposited silver on its surface, and allowed to rest for twenty-four hours. The solution thus obtained was exposed to the action of the conjoined copper and silver plates; but even after some hours there was no dimming of the lustre of the silver plate, except at the air-line, which was sharply defined. The same solution, shaken for some time in the air, produced a yellowish deposit on the white metal in three minutes.

The colour and general appearance of this crust, together with its formation only where oxygen can be absorbed, showed that it was not metallic copper, but the suboxide. This was further proved by the action of dilute sulphuric acid, which resolves it at once into red metallic copper and copper sulphate. There is also another curious reaction, which can only be properly observed under a microscope. When treated with a solution of silver nitrate, this cupreous deposit does not give the ordinary crystals of the white metal; in fact it is only slowly acted upon; but presently there shoot forth thin threads of silver, which run through the liquid, often twisting at sharp angles, while the yellowish crystals change to black. This also was found to be a property of the suboxide of copper.

This deposition of oxide on the silver is accompanied by a corresponding solution of copper from the other plate. Thus, in an experiment made with nitrate-of-copper solution that had been exposed to air, and which was allowed to continue for four days, there was found:—

Gain of silver plate 0·016 grm.

Loss of copper plate 0·015 grm.

The copper necessary for the production of 0·016 grm. of suboxide would be a little above 0·014 grm.

The wire connecting the two plates in this experiment is capable of deflecting a galvanometer. The current takes place through the fluid from

copper to silver, that is, in the same direction as if the copper had been dissolved by an acid and hydrogen evolved on the silver plate.

If the two plates have their sides parallel, the suboxide is deposited not merely on that side of the silver plate which faces the copper, but after about a minute on the other side also, showing that in this, as in other cases, the lines of force curve round.

It became interesting to consider what started this electric current. The original observations convinced us that it was not due to the action of oxygen on the copper; but, to make the matter more certain, bright copper and silver plates in conjunction were immersed, the copper in a pure, *i. e.* deoxygenized, solution of nitrate of copper, the silver in an oxygenized solution: the two liquids communicated through the diaphragm of a divided cell. In half an hour the silver plate was covered with a reddish film, while not a trace of tarnish was perceptible on the copper. On continuing this experiment for three hours, it was found that the copper plate lost 0.003 grm., and the silver plate was increased by 0.004 grm. On cleaning the plates, and reversing their position, the copper was covered with a film of oxide, while the silver remained free from cupreous deposit. We believe therefore that, through the simultaneous action of the two metals, the dissolved salt is put into such a state of tension that oxygen brings about a chemical change which otherwise would be impossible, and that this change is initiated in close proximity to the more negative metal.

Though we have examined only this particular reaction, we have satisfied ourselves that it is not an isolated fact. Each of the elements concerned may be replaced by others: thus, the sulphate may be substituted for the nitrate of copper, or platinum may be used instead of silver; chlorine may take the place of oxygen, with the production of the subchloride instead of the suboxide; and zinc may be employed as the positive metal, with zinc chloride as the salt in solution, in which case copper may be taken as the negative metal, and on its surface will form a deposit of oxide of zinc.

April 18, 1872.

WILLIAM SPOTTISWOODE, M.A., Treasurer and Vice-President,
in the Chair.

The following communications were read:—

I. “On the *Connexion* between Explosions in Collieries and Weather.”

By ROBERT H. SCOTT, M.A., F.R.S., and WILLIAM GALLOWAY, Esq., Mining Engineer. Received March 19, 1872.

The gas commonly called “Fire-damp,” to the mixture of which with atmospherical air the formation of the explosive mixture in coal-mines is due, exudes from the coal at a certain pressure; so that the rate of its escape must, to some extent, depend on the pressure of the atmosphere,