

THE PHOTOGRAPHIC NEWS.

Vol. VII. No. 250.—June 19, 1863.

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NOTE ON THE RESULTS OF MR. GLAISHER'S PHOTOMETRIC OBSERVATIONS.

BY JOHN SPILLER, F.C.S.

AFTER reading the interesting account of Mr. Glaisher's last balloon ascent, as given by him in the *Times* of the 22nd April last, I was induced to make some experiments with the view of imitating, if possible, the extraordinary conditions under which that gentleman observed, at an altitude of three miles, and in the clear atmosphere above the clouds, that surfaces of sensitized photographic paper were not so much darkened in the course of half-an-hour's exposure to direct sunshine as were similar sheets by one minute's solar action within the grounds of the Royal Observatory, Greenwich. Several causes have been assigned by way of accounting for these remarkable results, and some useful suggestions followed the announcement of the full particulars by Mr. Glaisher at the meeting of the London Photographic Society, on the 5th May. It was on this occasion stated that the thermometer indicated 21° Fahr., and that the dew point was below zero at the time of exposure. These conditions, at the altitude mentioned, are indicative of an exceedingly dry and rare atmosphere, in which rapid evaporation must occur, and the cold would be sufficiently intense to freeze very quickly any traces of water still lingering in the pores of the paper. Absence of hygroscopic moisture appears then the probable explanation of the facts observed. The verification of this opinion is, I believe, contained in the experimental results which have now to be described.

Sheets of albumenized and plain salted paper were sensitized respectively on nitrate of silver in the usual manner, and, when air-dried, were cut into slips for comparison.

1. Exposed to bright diffused daylight in a glass globe filled with air at the ordinary pressure.
2. The same arrangement; the air in the globe being exhausted by the aid of an ordinarily good air-pump, until the vacuum gauge stood within half an inch of the height of the barometric column.
3. Similar experiment to No. 2 in all respects, excepting that a piece of moistened filter paper was placed near, but not in contact with, the sensitized paper inside the glass globe.
4. Also similar to No. 2, but with a supply of chloride of calcium to absorb water from the rarefied air.
5. Without pumping out the air the paper was kept for two hours in the dark under a glass receiver, within which was a shallow dish containing sulphuric acid to absorb the moisture. At the end of that time, exposed to light beside the ordinary paper under glass for comparison.
6. The papers were kept some time in an atmosphere dried by quicklime; then exposed to light as before.
7. Slips of the paper were dried thoroughly by the application of heat, and then exposed to light under pressure between two plates of glass; similar papers in ordinary hygroscopic condition serving for comparison.

The results were as follows:—

No. 2 darkened more slowly than No. 1, and exhibited, in the case of albumenized paper, a pale lilac tint, instead of a rich chocolate or purple brown.

No. 3, in the moist vacuum, was affected by light in the same manner, and as quickly, as No. 1.

No. 4. The action of light was very much retarded, more so than in No. 2.

Nos. 5, 6, and 7, were but slowly affected, the colour of the papers being generally similar to No. 4.

The plain chloride of silver paper, and other sheets prepared with Swedish filtering paper, exhibited, in different degrees, the same general result as the albumenized surfaces.

The effect of exposure to intense cold, or artificial freezing mixtures, remains yet to be investigated, and it cannot be said that the effects observed in the course of my experiments were so decisively marked, although doubtless of the same character, as those described by Mr. Glaisher. The influence of moisture in increasing the sensitiveness of these photographic surfaces has been many times pointed out by others as well as myself, and was particularly alluded to in my "Description of a Desiccating Box for Preserving Sensitized Paper," read on the 5th March, 1861, at a meeting of the London Photographic Society. In using this apparatus I found that the sheets of sensitized paper could not be employed for printing in the unusually dry state in which they were taken from the box, but that a short interval, for re-absorption of hygroscopic moisture, must be permitted before laying them in contact with the negative.

The addition of nitrate of zinc as a deliquescent agent was tried under the impression that this substance would have furnished a more uniformly sensitive paper under all circumstances; but the result of such admixture has not proved this to be the case. The use of a bath of fluoride of silver, instead of the nitrate, for sensitizing the paper would doubtless have the effect of retarding the evaporation of water from the prepared surface, and might thus afford a means of producing papers of more definite character. I am now engaged in investigating this point, and will, if successful, communicate the results.

In the course of these experiments I have had many opportunities of noting the remarkable degree of expansion which coincides with the absorption of moisture. The dimensions of the paper frequently varied as much as one-fiftieth in the transition from moist to dry, a point which does not appear to have been sufficiently considered in attempting photometrical determinations upon paper tablets.

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June 9, 1863.

PHOTOGRAPHIC CHEMICALS:

THEIR MANUFACTURE, ADULTERATION, AND ANALYSIS.

URANIUM is of value in optical researches, not only on account of the sensitiveness of some of its salts to light, but