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THE CAUSES OF THE DAGUERREOTYPE IMAGE.

IT is matter of satisfaction to perceive that the attention of so many philosophers of eminence is turned to this interesting subject. Moser, Becquerel, and others, both in this country and on the continent, have arrived at facts of great beauty and importance, tending to throw a flood of light not only on the more immediate object of their investigation, but on a variety of other phenomena.

It has been ascertained that if an iodized silver plate be left in the camera obscura for a sufficient time, it will receive an impression visible at once without the aid of the mercurial vapour, and what is not a little singular, the lights will be all dark and the shadows light.

Becquerel has .proved, that if an iodized plate be placed in the camera for a period too short to admit of the image being brought out by the mercurial vapour, and then exposed to the action of the sun's rays through a red glass, it will become sensible to the action of the mercury, and will give out the picture. From this experiment it has been argued, that there are two classes of solar rays,—exciting and continuing rays. M. Gaudin found that a yellow glass produced a similar effect, but in a much shorter space of time. One remarkable result arrived at by him is, that if the plate be exposed in the camera for the usual time to make it sensible to the mercurial action, and then be placed behind the yellow glass, a positive picture of remarkable delicacy will come out, without the use of mercury at all. A curious modification of this fact is stated by Moser. If the plate be removed from the camera, just before it has been there a sufficient time to give out an image with mercury, and be placed under the yellow glass, a negative image will form; but it will quickly disappear, and its place will be supplied by a positive image in ten or fifteen minutes. He also found that green glass gave a positive image.

The result of Moser's experiments on the action of the solar rays is, that none, except the violet and blue rays, have any effect on a fresh iodized plate. After either of these, however, has acted for a short space of time, the plate becomes sensitive to the operation of the red and orange rays, but not to the yellow rays. The plate must be exposed to the blues and violets for a longer time than is required to make it sensitive to the red and orange; and just before it is time to remove it to the mercurial box, it becomes capable of being acted upon by the yellow and green rays.

If an iodized plate be left above an hour in the camera, exposed to objects illuminated by the sun, it will receive a negative image, the lights being all dark; and if it be then removed and placed in the direct sunlight, this image will disappear, and its place be supplied by a positive one.

The effect of polarized light is the same as that of common light in the production of images.

M. Moser succeeded in obtaining pictures of the coloured rings in crystals by polarized light, and states that under all circumstances the images were the same as those visible to the eye. These experiments are, however, not original, for not only were impressions of the rings obtained, but all the phenomena of polarization were produced, with the invisible chemical rays alone, by Dr. Sutherland, of Liverpool, in the year 1840[a].

There is another class of facts of extreme interest bearing upon the subject, some of which, though familiar, did not particularly attract attention until very lately. If any polished surface have characters traced upon it with any substance, even although no apparent marking may have been produced, the traces will become visible if breathed upon. Thus, if a surface of mercury or glass be breathed on, and characters be traced immediately on it with a clean hair pencil, and if the moisture be allowed to evaporate, the characters will appear when the breath is again blown on them. In the case of mercury, they may be revived in this way for several days. These may be considered as elementary facts, which are capable of being exhibited in a variety of forms. Thus, if an irregular flat object be laid on a glass plate and breathed upon, it will be found that the simple contact of the two bodies will have been sufficient to cause such a change on the surface of the glass, that the image of the object may be revived by again breathing on the place where it was laid. This is an important experiment, and admits of an adequate explanation, by the supposition of M. Daguerre and M. Regnault, that the small quantity of greasy matter which is deposited on the glass, either by the object or by the breath, is sufficient to ensure a different disposition of the minute vesicles of vapour on different portions of the surface of the glass.

Other vapours besides that of the breath will bring out the image. Iodine and mercury have been found to possess this power, and where the former cannot do it by itself, the latter, if then made use of, will accomplish the object.

No one can fail to be struck with the resemblance which exists between this last case and the Daguerreotype process. To bring the analogy still closer, an iodized silver plate may be used to lay the object on, and the mercurial vapour will at once bring out the image. It is a curious circumstance, that light is not necessary to the production of these effects, for the experiments succeed equally well in its entire absence, and if the object be laid on the iodized plate, and then removed, and the plate exposed to the light, the image will immediately appear in great perfection. The presence of iodine is even not essential. A polished silver plate will give an image if exposed to mercurial vapour after an object has been laid upon it.

Experiments with coloured glasses, similar to those already described, have also been successfully made. Iodized plates, after having had objects placed in contact with them, have been exposed under such glasses to the solar rays; and Moser has observed, that the red and yellow gave only traces of the object, while a violet-coloured glass afforded a well marked image.

In pursuing the subject still further, it was found that absolute contact between the plate and the object was not necessary. A highly polished plate of silver was exposed to the solar light for several days, behind, but not in contact with, a black screen, through

which some characters had been cut, and on exposing the plate to mercurial vapour, a perfect representation of the characters was obtained. The same result was obtained by using a bright plate of copper, and then exposing it to iodine vapour.

We have seen that the presence of light is not necessary to produce images by contact, and neither is it so in the present instance. Numerous experiments have proved this, and have led Moser to state as a law, that when two bodies are sufficiently close to each other, they impress their image the one upon the other.

Vapour appears not to be indispensable to the bringing out of the image, which will sometimes show itself on iodized plates that have been placed before an object to be copied in perfect darkness. An engraved metal plate has been copied, by placing it in contact, for a short time, with a plate of polished silver, and then exposing the latter to the vapour of Iodine, and afterwards to that of mercury. It has also been shown, that contact is not necessary to the success of the experiment.

Numerous facts of a similar kind have been ascertained in this country by Mr. Hunt and others, especially in connexion with the effects of difference of temperature in the production of the image; but these have been so often before the public, that it does not appear needful to repeat them again. Since they were made known, M. Knorr, apparently in ignorance of what has been done by English philosophers, has laid claim to the discovery of a new department of science, which he denominates Thermography. There appears, however, to be no essential difference between his facts and those alluded to, although his processes have not yet been published. The effect of heat has also been observed by M. Moser.

M. Rauch, a German sculptor, found that an engraving of one of Raphael's paintings, which had been in a frame for many years, left a copy of itself on the glass, with which it had never been in contact. In this case it is evident that no vapour had been needed to cause the image. Direct experiment has also succeeded in producing similar effects on plates of different metals, by placing engravings before them, at the distance of about one fortieth of an inch. These images are all capable of being obliterated by rubbing.

There are three theories of the origin of these singular phenomena. First, that they are produced by the effects of radiant heat. Secondly, by the deposition of organic matter, which is constantly being dissolved by the atmospheric moisture from all objects, and deposited whenever a variation of temperature occurs. Thirdly, that they are occasioned by the radiation of latent light.

These opinions are so much at variance with each other, that it may be questioned whether there be yet a sufficiency of evidence to warrant the formation of a distinct theory, although at the same time it is not to be denied, that there is much semblance of truth in all of them. The facts ascertained by M. Knorr certainly go to prove, that it is possible to obtain images by the simple action of heat, without any apparent condensation of vapour upon the surface exhibiting them; but we have, as yet, no proof that there was an entire absence of organic matter on the plates employed.

We have, on the contrary, strong experimental evidence, that if due care be taken to cleanse the plates and objects from all organic matter, there is no image whatever produced. M. Daguerre has shown, that if the two bodies to be placed in apposition be carefully washed with boiling water, and kept at the same temperature as the atmosphere, they will give no impression. And so thoroughly is he convinced that the effects arc due to organic matter, that he has described it us atmospheric slime, which is everywhere dissolved by the moisture of the air, and deposited on all changes of temperature. He therefore entertains the opinion, that Moser's images are due to this cause; and M. Figeau

[Fizeau?—edit.] has laid down the following propositions in regard to it. First, that most bodies operated on have their surface covered with a thin layer of organic matter analogous to grease, and volatile, or at least susceptible of being taken up by the moisture of the atmosphere. Secondly, that when a vapour is condensed upon a polished surface, if the different parts of the surface are unequally soiled by foreign bodies, even in extremely minute quantity, the condensation takes place in a manner visibly different on the different parts of the surface. From these two propositions it follows, that if any body, whose surface is not perfectly equal and smooth all over, be placed close to a clean polished plate, the organic matter will be taken up by the atmosphere unequally from the former, and deposited unequally on the latter, so as to form a sort of image; and if a vapour be condensed upon the bright plate, it will adhere differently at different parts, and so exhibit a picture of the object.

The third opinion is advocated by M. Moser, who holds, that light acts on all bodies in the same manner;—that it so modifies them, that after having been submitted to its action, they condense vapours differently than they would have done before, and that Daguerre's discovery is only a particular modification of this general action;—that the amount of condensation depends on the amount of luminous impression, and on the degree of elasticity of the vapour. All bodies, he believes, radiate light even in complete obscurity; that these rays act on all substances just as the direct sunlight would do; that they are invisible, and have a greater degree of refrangibility than luminous rays, and that they may become latent in bodies, as is the case with heat.

As a consequence of these facts, bodies are constantly tending to impress their image upon each other even in the dark, especially when placed very close,—a condition rendered necessary by the great refrangibility of the rays; and this image, though invisible, may be brought out by vapours, in consequence of the peculiar change above alluded to. The effect produced by the simple condensation of vapour is attributed to the simultaneous condensation of light, which it is presumed is absorbed whenever evaporation is going on, and given out again during condensation.

M. Moser draws some curious inferences from the comparative effects of vapours and coloured glasses. He states, that the latent light of mercurial vapour is yellow, because the same effects are produced by its condensation as arise from the action of yellow light. For the same reason the latent light of the vapour of iodine, chlorine, bromine, or their compounds, is said to be blue or violet; while that of water is neither red, orange, yellow nor green. The action of the iodine on the silver plate is thus attributed to its latent light.

After weighing all the evidence which the experiments now detailed afford, there is still a want that requires to be supplied before a perfect theory can be drawn up. Without doubt two kinds of images arc produced, one by the action of the sunlight, the other owing its origin to a totally different cause; but it does not appear to be proved that both are mere modifications of one general phenomenon. If the phenomena be carefully analyzed, it will be found that the light and shade, which in reality constitute the image in both instances, arise from the manner in which the vapours employed to bring out the image are deposited on the surface of the plate. In the lights of the Daguerreotype, for example, it is obvious that more light is reflected than comes from the shadows, and this evidently arises from the mercury deposited on the lights having a more perfect reflecting surface than it has on the other parts of the picture; a corresponding difference in the reflecting surface occurs in Moser's images. If it be farther inquired why this should be the case, it will be found that any alteration, however produced, on the surface which is to receive the vapour, whether of mercury or of the breath, will determine a deposition of

that vapour more or less perfect, but it will prevent an equal deposition from taking place all over the surface. This alteration, in the case of the Daguerreotype, is produced by the action of light on the iodine coating, and in Moser's experiments, apparently by the deposition of greasy matter derived from the object, as has been already pointed out.

It is not to be denied, however, that there are certain experiments which cannot be explained on this supposition, but which still require further elucidation before they can be brought under a general theory. There can be but one opinion on the practical application of Daguerre's great discovery; namely, that it has opened a new pathway in the arts, the exact termination of which no one can as yet point out. It involves one of those simple principles which seem interwoven with the whole web of the visible creation, and which may yet be applied to purposes of which mankind has very little conception. Σ.

[a] Phil. Mag. July, 1841.

[End of text.]

EDITOR'S NOTES:

The author of this article. "Σ" (sigma). is currently undetermined. The initial/pseudonym was used by Thomas Sharp, Esq., (1770-1841), the "Coventry Antiquary," but this article appears later than Sharp's last publication (1835) and is also outside his range of subject matter.

chemicals used in early photographic processes are extremely toxic and should not be handled without a ***thorough*** knowledge of safe use.

The opinions expressed in this text are solely those of the original author and are not necessarily those of the Archive editor. Some texts may contain derogatory words. Any such word is certainly one that would not be used today. The words remain in the transcription, however, to maintain truthfulness to the original text.
