

others. For showing the popular class-room experiment of burning phosphorus in oxygen, I was in the habit of using a little cup of chalk made deeper and with smaller rim than the brass cups usually made for the purpose. The object of this was to limit the too rapid outburst of combustion. I noticed that a cup which had been used several times was coated on the inside with a hard, glassy enamel, which I supposed to be phosphate of lime. To test this, the cup was thrown into some hydrochloric acid and dissolved bodily, but I found at the bottom of the beaker an insoluble residue of crystalline particles. What were these? Could it be possible that the carbonic acid driven off by heating the chalk had, on reaching the heated phosphorus, become dissociated, its oxygen combining with the phosphorus, and its carbon thrown down as veritable diamond? To test this startling theory, I collected the particles and rubbed them between a glass pestle and mortar. They appeared hard enough to scratch the glass, but were too small for further examination. To obtain a better supply, I dissolved some phosphorus in bisulphide of carbon, pounded some chalk and made it into a paste with the solution, then filled a porcelain crucible with this and fired the mass by heating it over a Bunsen burner. It blazed magnificently, throwing out eruptive jets of flame. Here, in the absence of surrounding oxygen, the carbonic acid had every opportunity of becoming dissociated or reduced by the heated phosphorus. The residue was treated with hydrochloric acid, and this time I found at the bottom of the beaker quite a respectable quantity of crystalline grains. These left unmistakable scratches on the glass pestle and mortar, and seemed to make some fine scratches on an agate pestle and mortar. I next examined them under a microscope, and found that they were more like pebbles than crystals, so much so as to suggest another theory of their composition and origin, viz., that they were miniature chalk flints formed by the fusion and aggregation of the siliceous cuticles of fossil diatoms, or such-like organisms of which chalk appears to be in some degree made up.

To test this, I precipitated some pure carbonate of lime, soaked it with the solution of phosphorus and fired as before, then treated with hydrochloric acid; when, alas! my *Eldorado* of dissociated carbonic dioxide melted into thin air as the effervescent liquid gradually cleared itself and showed no traces of crystalline residue.

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Solar Phenomenon

ON the afternoon of the 18th ult., in company with Herr Lohse, of this observatory, I was occupied in adjusting a spectroscope attached to the 15-inch refractor. The sun was disappearing behind the ridge of the hill of Fare, about five miles distant. To utilise the last rays of the sun, I was directing the telescope on the gradually lessening segment of the sun's disk, while Herr Lohse was looking through the spectroscope. Under these circumstances it will be understood that we were both standing near the inner vertical surface of the drum-shaped dome, close to where it was lit up by the sunlight coming through the opposite vertical opening, which is 40 inches wide. It may be well to add that the dome is made of corrugated iron, painted slate-colour, the corrugations of the wall being vertical. Under the impression that the sun had wholly disappeared, I looked at the inner wall of the dome to see if it was actually shaded by the distant hill.

To my great surprise, the still illuminated surface was crossed by a number of distinct, horizontal, black lines, which ascended at a uniform pace about a foot and a half in a second. The lines were, on an average, about $\frac{1}{4}$ inch thick, while the intervals may have been mostly some $2\frac{1}{2}$ inches, but I do not think that the intervals were uniform. Herr Lohse, on turning from the spectroscope, also saw the lines; but while he feels sure that some of them terminated in points, I am under the impression that all the lines crossed the entire illuminated space.

The lines had a distinct quivering motion, which, combined with their uniform ascent, gave the whole phenomenon a most beautiful appearance. We both independently estimated the number of lines seen at about thirty, and the duration of the phenomenon at half a minute from the time when we first saw it. It was, however, certainly fully developed when first caught sight of. These lines seem to be closely allied to those repeatedly seen at the beginning or end of the total phase of a solar eclipse. See particularly *Astronomische Nachrichten*, Nos. 1,921 and 1,922, and "Le Soleil" (German edition), p. 301, *et seq.*

Some of the observers referred to speak of the lines as undulating; in this case it is difficult to say if the lines were quite straight or not, because of the corrugations of the surface on which they were thrown. My own impression is that they were straight except in so far as they were affected by the quivering before mentioned.

It would be remarkable indeed if this is the first time they have been seen at the daily disappearance or reappearance of the sun.

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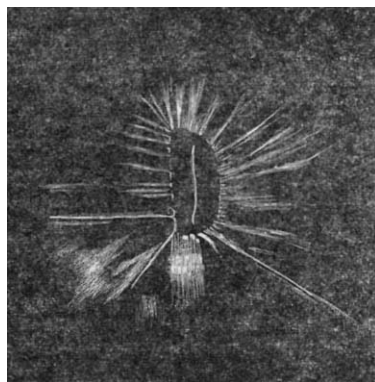
The Observatory, Dunecht, Aberdeen, December 23, 1879

Carbon and Water Figures

THE separation of clear water from a uniformly diffused mixture with soot is so remarkable that it seems worth attention, especially in connection with the behaviour of charcoal powder in water, which is always streaky after any amount of shaking.

For some months I have observed and recorded these figures, as shown in a large white basin of sooty rain water, which is left undisturbed for twelve to twenty-four hours; they only appear occasionally, perhaps once in a week, are not constant when formed, and are entirely destroyed by stirring or mixing the water. They always consist of lines, planes, or patches of clearer water, sometimes not containing certainly more than a quarter of the proportion of soot around them; no aggregation of sooty water, or soot, has ever been seen. These quasi vertical planes are very thin, sometimes the clearest part as little as $\frac{1}{80}$ th inch wide, and the extreme thickness $\frac{1}{2}$ th, the other dimensions being $\frac{1}{2}$ to 1 inch deep, and 1 to 5 long. Most usually only one plane appears, the azimuth of which is quite irregular; occasionally it is curved; sometimes a row of quasi-parallel planes or lines appear—once as many as six, at irregular intervals averaging .8 inch; once a clear circular spot about $1\frac{1}{2}$ inch across appeared.

The last form I found was by far the most complex, and is here given from a careful sketch.



The lines were not as thin as usual, only one or two being as little as $\frac{1}{80}$ inch wide. They were very bright, probably not containing $\frac{1}{4}$ of the average soot around them; the water was unusually dark. The central semicircular space was 3.6 inches long \times 1.7 inch; when first seen this space was uniformly grey, but in a few minutes, after slightly disturbing the water, the bright sharp plane across it appeared, inclined at about 5° to vertical. Some of the other planes were inclined 15°. The most striking point was the sharp definition of the central space, all the lines ending abruptly at its regular outline.

The depth of these figures bears strongly on their cause. They are never at the surface, but usually on the bottom. The water is about 2 inches deep, and the upper limit of these planes is $\frac{1}{4}$ to $1\frac{1}{2}$ inch from the top. In the above figure the lines or planes appeared to lie on the bottom, and to turn upwards at the edge of the central space, leaving it untouched, thus forming a bright edge to it. I have also, on disturbing water, seen apparently that a clear layer existed below a uniformly sooty surface.

The conclusions are, that water tends to separate from the finely divided carbon, in a clear bottom layer (or lines) of uncertain thickness (though lamp-black sinks if diffused in water), and that parts of this layer are (by convection?) turned