

We may also, I think, explain the origin of the impressions on the limestone pebbles in the "Nagelflue" in Switzerland, about which so much has been written in Germany and France, without a satisfactory reason having been discovered; and the same explanation accounts for the mutual penetration of the fragments of which some limestones are formed, and for the banded structure of some which possess slaty cleavage. The curious teeth-like projections with which one bed of limestone sometimes enters into another, also to a certain extent indicate a chemical action depending on mechanical force; and probably the same may be said of some of the peculiarities of slickensides and mineral veins. It is also possible that a pressure of several hundred atmospheres may facilitate some of the chemical changes involved in the transformation of water and carbonic acid into the organic compounds met with in animals and plants of low organization found at great depths in the ocean, and thus to a certain extent compensate for diminished light. I, however, most willingly admit that very much remains to be learnt before we can say to what extent the principles I have described are applicable; and yet, at the same time, cannot but think that henceforth they must be taken into account in many departments of the chemical and physical geology, and will readily explain a number of facts which otherwise would be very obscure.

On the Measurement of the Chemical Brightness of various portions of the Sun's Disk. By HENRY ENFIELD ROSCOE, B.A., F.R.S.

From the Proceedings of the Royal Society, No. 56.

The author has applied the method of measurement of the chemical action of sunlight, which Professor Bunsen and he described in a memoir presented to the Royal Society in November last,* to the measurement of the chemical brightness of various portions of the solar disk; and although the observations which have as yet been made, are only preliminary, yet he thinks that the results obtained are of sufficient interest to warrant his bringing them before the Society.

Secchi has shown† that the calorific radiation of the centre of the sun's disk is nearly double that from its borders, and that the equatorial regions are somewhat hotter than the polar, whilst observers have long noticed a great difference in luminosity between the centre and edge of the disk.

For the purpose of obtaining a measurement of the relative chemical brightness of various portions of the solar disk, the image of the sun, of about 4 inches in diameter, obtained by a $3\frac{1}{2}$ inch refractor,‡ was allowed to fall into a camera placed on the instrument, upon a sheet of standard photographic paper prepared according to the method described in the above-mentioned research. The peculiar property of this standard paper is that it can always be prepared of one and the same degree of sensitiveness, and is perfectly homogeneous. The exposure

* Abstract, Proc. Roy. Soc. vol. xii. p. 306; Memoir, Phil. Trans. 1863.

† Astron. Nachr. Nov. 806, 833.

‡ Kindly placed at my disposal by S. W. Williamson, Esq., Manchester.

lasted for from 30 to 120 seconds, the sun's motion being carefully followed by a tangent-screw. After exposure, the shade of tint at several points on the picture was determined by comparison with a graduated photographic strip insolated in the pendulum-photometer, and the chemical intensities corresponding by these shades obtained by reference to the Table given in the memoir above cited. The following numbers give the chemical brightness, thus obtained, at various points on the sun's disk on May 9th, 1863. From these numbers it is seen that the intensity of the chemically active rays at the centre is from three to five times as great as that at the edge of the disk, the chemical rays thus showing a wider variation than the calorific rays exhibited as determined by Secchi. This is doubtless owing to the relatively greater absorption effected by the solar atmosphere on the more refrangible chemical rays.

Chemical Brightness of Sun's Disk on May 9th, 1863.

	1. At centre of Sun's Disk.	2. At 15° from the edge of Sun's Disk.			3. At edge of Sun's Disk.		
		N. Pole.	Equator.	S. Pole.	N. Pole.	Equator.	S. Pole.
No. 1.	100.0	38.8	48.4	58.1	18.7	30.2	28.2
No. 2.	100.0	52.8	. .	56.6	30.5	. .	41.0

Hence it is likewise seen that on May 9th the chemical brightness of the south polar regions was considerably greater than that of the north polar regions, while about the equator the brightness was between that of the poles.

In order to show that the sensitive paper, when exposed to ordinary sunlight, becomes homogeneously tinted, the author appends the readings, taken in the way described, from various portions of a piece of the standard paper used for the sun-pictures exposed for some seconds to direct sunlight.

	Reading.	Deviation from mean.
Portion No. 1.	101.4	+0.93
" 2.	100.7	+0.23
" 3.	98.5	-1.97
" 4.	101.6	+1.13
" 5.	99.9	-0.57
" 6.	100.7	+0.23
Mean,	100.47	

The sun-pictures obtained on the sensitive paper must possess only a slight tint, otherwise the differences in shade cannot be accurately observed; they then exhibit a peculiar coarse mottled appearance, which is not due to imperfections in the paper, or the lenses, nor to the action of the earth's atmosphere.

Perhaps these irregular dark and light patches are owing to clouds in the solar atmosphere, and they may have an intimate connexion with the well-known phenomenon of the red prominences.

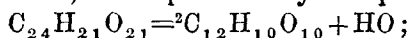
Mr. Baxendell and the author propose to carry out, according to

this method, a regular series of observations of the variation of the relative amounts of brightness on the sun's disk, and they hope before long to be able to present the Society with some further details.

Note on Vegetable Ivory. By DR. PHIPSON, F.C.S., &c.

From the London Chemical News, No. 206.

Vegetable ivory is the fruit of *Phytelephas macrocarpa*, a plant allied to the palm trees, common in South America. At the period of maturity the grain forms a hard mass resembling ivory or bone, and which is manufactured into various kinds of ornaments. According to an analysis by Mulder, its composition may be represented by—



Baumhauer obtained a precisely similar result some years later.

I have found that vegetable ivory takes, in contact with concentrated sulphuric acid, a splendid red color, almost equal to magenta. This color, at first pink, then bright red, becomes much deeper and more purple when the acid has been allowed to act for about twelve hours.

This reaction may sometimes be found useful in order to distinguish small pieces of vegetable ivory from the ivory of the elephant's tusk, or from bone, neither of which take this beautiful red color in contact with sulphuric acid.

The analyses quoted above show that the greater portion of vegetable ivory is pure cellulose, but the reaction produced by sulphuric acid proves that other substances are present, for cellulose does not become red with sulphuric acid. Mr. Connel found in 1845, that vegetable ivory contained 81.34 per cent. of cellulose, and that the other substances were gum 6.73, legumine 3.80, albumine 0.42 (that is 4.22 of albuminous substances), oil 0.73, water 9.37, and ash 0.61, = 100. Filings of vegetable ivory dried at 140° to 150° C. give 1 per ct. of ash.

Payen found that these filings when boiled with caustic soda took a yellow color, a fact confirmed by Baumhauer, who asserts that potash does not produce any color.

The reaction of sulphuric acid on vegetable ivory has enabled me more than once to distinguish immediately between filings of this substance, and bone of ivory filings. It is owing to the well-known action of this acid upon albuminous substances in presence of sugar, and which has been utilized by Raspail in his microscopic researches. But whether the sugar is formed by the action of the acid in the cellulose, or pre-exists already formed in the substance is of little import. I incline, however, to the first opinion, as the color takes a little time to show itself (five or ten minutes), and as Mr. Connel did not find any sugar ready formed.

I have since observed that the white portion of the cocoa-nut presents a similar reaction with sulphuric acid; the color produced is first pink, then red, reddish purple, and finally, in about sixteen hours, a fine violet.

The colors thus produced with vegetable ivory and cocoa-nut disappear gradually in contact with water, like the fine reddish-brown color produced with essence of turpentine and sulphuric acid.