

Though the experiments cannot be quoted as confirming the chemical hypothesis, which I still think to be supported by an overwhelming weight of evidence, it has been thought worth while to describe them, if only to show the extreme difficulty of eliminating the last traces of active matter from the gas employed. That this is the real difficulty in the way of obtaining positive results is well illustrated by the ingenious experiments of C. Christiansen.* He found, among other things, that when the metal (of a pair) near which positive potential is usually observed is exposed, for a minute fraction of a second, to an inactive gas, such as hydrogen, the observed potential difference is very much smaller than when the exposure lasts for a considerable time. The metal exposed by Christiansen was a jet of liquid amalgam, flowing from a drawn out glass tube. Its surface was thus perfectly clean, and the time of exposure to the surrounding gas was merely the interval between the instant at which the amalgam left the nozzle and that at which it broke into drops. The difference of potential observed, when carbon was opposed to a jet of zinc amalgam in hydrogen in this manner, was only 0.15 volt; while in air it was 0.89 volt. If more time had been allowed, the impurities in the hydrogen would have diffused in larger quantity towards the zinc, and given a larger effect, similar in character to that observed in my experiments, where the metals are exposed to the gas for a period amply sufficient for all such action.

“Deposition of Barium Sulphate as a Cementing Material of Sandstone.” By FRANK CLOWES, D.Sc., Emeritus Professor, University College, Nottingham. Communicated by Professor H. E. ARMSTRONG, F.R.S. Received February 7,—Read February 23, 1899.

Some years ago I described the occurrence of a peculiar sandstone over a large area in Bramcote and Stapleford, near Nottingham.† The sandstone was remarkable for its high specific gravity, and chemical analysis, supported by microscopical examination, proved that the high specific gravity was due to the existence in the sandstone of a large proportion of highly crystalline barium sulphate. In the rock itself the percentage of the sulphate varied from 33.3 to 50.1: and it evidently served as the binding or cementing material which held the sand grains together. The occurrence of this sandstone was stated by geologists to be unique in the United Kingdom.

Mr. J. J. H. Teall made an examination of a portion of the sandstone, and stated that after breaking up a portion of the rock, he easily

* ‘Wied. Ann.,’ vol. 56 (1895), p. 644.

† ‘Roy. Soc. Proc.,’ vol. 46, p. 363.

effected a separation of the sulphate from the sand by shaking the powder about in water: the small cleavage flakes thus obtained gave the optical characters of crystallised barium sulphate. Mr. Teall further stated that the barium sulphate occurred in large irregular crystalline patches, which included the sand grains; the sand grains, therefore, interrupted the reflections from the cleavage surfaces of the barium sulphate, giving rise to the appearance generally known as "lustre mottling" in petro-graphic literature.

I had noted this irregular distribution of the barium sulphate. In some parts of the rock the sulphate occurred in reticulated veins inclosing small patches of more or less loose sand grains; while in other parts of the rock the sulphate occurred in spherical or oval masses, between which looser sand was interspersed: occasionally, however, the barium sulphate was uniformly distributed.

The appearance presented by the weathered surface of the rock varied much according to the mode in which the resistant sulphate was distributed. When it was uniformly distributed, it formed an almost complete protection against weathering: this was seen on the cap of the great pillar of this rock, which is locally known as the "Hemlock Stone." The reticulated distribution of the sulphate caused the surface of the weathered rock to present a fretted surface, with the thin veins of sulphate projecting from the surface. When the sulphate had bound together spherical or oval masses in the substance of the sand, these were left in pebble-like forms as soon as the loose sand had been washed out from between them; and the resulting layers of loose sand, inclosing the rounded masses of sand bound together by the sulphate, had been not unnaturally classed by the geologists who had visited the district, as pebble-beds.

In discussing various ways in which this barium sulphate might have been deposited, I drew attention to the frequent deposition of barium sulphate from colliery water in the neighbourhood of Newcastle-upon-Tyne, and described some of these deposits.* And I further pointed out that Dr. Bedson had shown† that barium chloride was a common constituent of the colliery waters in the district in which these barium sulphate deposits occur: and that it was present to the extent of 137·2 parts per 100,000 in some of these waters. It was evidently only necessary that water containing sulphuric acid, or a soluble sulphate should mingle with the barium chloride water in order to explain the deposition of barium sulphate in the positions in which it was found. In colliery districts a frequent source of ferrous sulphate and of sulphuric acid is found in the iron pyrites in the beds of coal and shale. And I suggested that the constant occurrence of fine veins of calcium sulphate throughout the sandstone of the Nottingham district would account

* 'Roy. Soc. Proc.,' June, 1889.

† 'J.S.C.I.,' vol. 6, p. 712.

for a sulphate finding its way into the water which had been in contact with the rock. But in the Nottingham district all evidence of barium chloride in solution was wanting.

The occurrence of barium chloride in water from an artesian boring at Ilkeston has, however, recently been pointed out by Mr. John White, and he has described the nature of the strata through which the boring passed, and the results obtained by him in the chemical examination of the water, in 'The Analyst' (February, 1899). The Ilkeston boring has been made in the immediate neighbourhood of the Bramcote and Stapleford sandstone which contains the large proportion of barium sulphate. Since the barium chloride is found to the extent of 40·7 parts per 100,000 in the water from this boring, and seems to be a normal constituent of the water, it would appear that soluble barium salts are still abundant in the district, and may therefore have given rise to the deposition of the barium sulphate in the original sand beds. The crystallisation of the sulphate around the sand grains would then cause it to act as a compact, insoluble cementing material.

It is worthy of note that one of the samples of water from the boring contained a small amount of barium in the presence of a large amount of sodium carbonate; in this case the barium must therefore itself have been present as bicarbonate.

Water containing barium chloride to the extent of about 9 grains per 100,000 has recently been found at Llangammarch in Breconshire.

Since the publication of my original paper on the occurrence of barium sulphate in the Bramcote sandstone, I have continued my examination of samples of sandstone from the basement of the pebble beds of the Bunter, with the object of ascertaining whether the occurrence of barium, either as sulphate or in other forms of combination, was characteristic of the sandstones of that geological period. I have thus far failed to find any similar rock to that at Bramcote, and it therefore seems probable that the occurrence of barium sulphate, although it extends over a very extensive area at Bramcote and Stapleford, must be looked upon as being due to purely local causes.

[*February 22.*—Mr. J. Lomas, in a letter dated 20th instant, draws my attention to a paper read by him and Mr. C. C. Moore before the Liverpool Geological Society, on February 8, 1898, in which the authors draw attention to the occurrence of large proportions of crystallised barium sulphate in triassic sandstones at Prenton and Bidston. Mr. Lomas had previously mentioned the presence of the sulphate in the Bidston sandstone thirteen years ago in a paper to the above Society.

In different specimens of the sandstone the percentage of the sulphate varied from 12·4 to 33·8 per cent. It is colourless and highly

crystalline, and is adherent to the sand grains in such a way as to show that it has been deposited *in situ* subsequently to the sand grains. Mr. Lomas states that the occurrence of barytes in the trias is fairly common, and mentions the following localities, in which its presence is well known :—Beeston, Alderley Edge, Oxtun, Storeton, and Peakstones Rock, Alton. The sulphate is also stated to occur at West Kirby, in Cheshire, and elsewhere as a joint filling, the joints often standing out from the surface of the rock, owing to the resistance of the sulphate to weathering.]

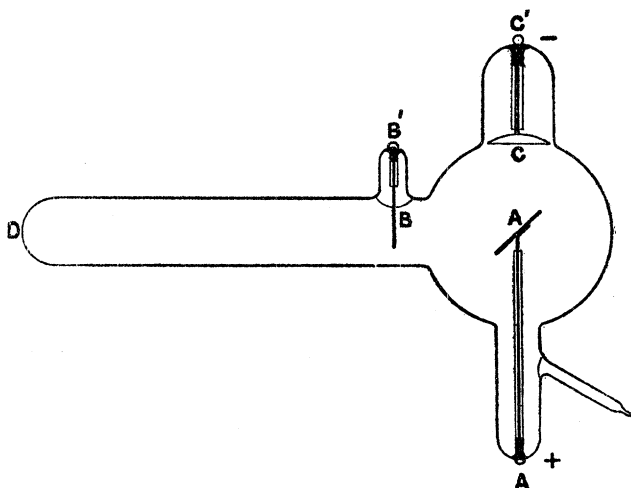
“On the Reflection of Cathode Rays.” By A. A. CAMPBELL SWINTON. Communicated by LORD KELVIN, F.R.S. Received January 25,—Read February 9, 1899.

Preliminary.

There being apparently some doubt as to the exact nature of the rays, named by Professor S. P. Thompson paracathodic rays,* which in a Crookes tube of the focus type proceed from the front surface of the anti-cathode, and cause the green fluorescence of the glass, the writer has made the following investigations :—

Firstly, in order to determine the magnetic deflectibility of the paracathodic rays, a tube was constructed as shown in fig. 1, in which C is the cathode, A the anti-cathode and anode, and B an aluminium wire

FIG. 1.



* ‘Phil. Trans.,’ vol. 190, pp. 480—483.