

ON THE SUBSTANCES EMPLOYED IN FORMING THE TESSELLÆ  
OF THE CIRENCESTER PAVEMENTS, AND ON THEIR CHRO-  
MATIC ARRANGEMENT.

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ALTHOUGH the designs and method of construction of numerous examples of the kind of decoration, known as Tessellated Pavements, have been published from time to time, especially in such works as "Lysons' Roman Antiquities," the "Vetusta Monumenta," "Fowler's Pavements," &c., an examination and classification of the materials, by whose aid these fine works of art have been accomplished, seems still a desideratum.

Under these circumstances, I venture to lay before the Institute the result of my observations upon this subject, in the many examples of mosaic pavements which I have had occasion to examine in Cirencester and its neighbourhood.<sup>1</sup> Tracings of the best of these have been laid before the Society. The choice of materials with which to execute the designs of pavements appears to have been a matter of great importance, and to have been carefully studied, as may be seen from many instances of gradual shading off, observed in the various frets, and in the strong contrasts when bold relief was intended. Besides this, the general design appears to owe its effects not only to the arrangement of the *minor* bits of colouring, but also to the disposal of the masses of colour, so as to produce an harmonious whole. This is admirably shown in the fine pavements discovered in Ciren-

and accompanied with the rude tools of the fabricators, proving them to be the work of the aboriginal races, destitute of metallurgic arts, and supplying their simple wants with imperfect implements of horn and flint."

The reader will find the account of an interesting discovery of a canoe in the alluvial deposits of Forfarshire, by Sir Charles Lyell, in Geological Transactions, vol. ii. p. 87; being one of the earliest contributions of this eminent philosopher to the science, which he has since so greatly

advanced by his genius and labours. In my Wonders of Geology, vol. i., p. 64, a similar fact is recorded; and in Lewes Levels (p. 61), rude single-trunk canoes and coffins have been found, imbedded at great depths in the blue clay, associated with bones of cetacea, deer, horse, &c.

<sup>1</sup> A full account of discoveries recently made in that locality will be found in the volume recently published, "Illustrations of the Remains of Roman Art in Cirencester, the site of the ancient Corinium." London, G. Bell, 1850.

cester, during the past year;<sup>2</sup> as in them we have figures and their ornaments wrought with an attention to detail, which is not only highly finished as to the filling up, but presents "a grandeur, dignity of character, and great breadth of treatment," to use the words of Mr. Westmacott, the eminent sculptor, "which strongly reminds us of the finest Greek schools." These are arranged in medallions and surrounded by a framework of the twisted guilloche, in which the colours are remarkably subdued. These again and the designs, as a whole, are surrounded by another guilloche, in which *bright colours* prevail; the whole surrounded by a wide border of a neutral grey, so that we cannot help observing that the brightness and freshness of each medallion is greatly enhanced by the prominence given to it by the grey border; whilst the pavement, as a whole, is admirably brought out by a bright guilloche, which serves the like purpose as a gold frame to a picture; the broader external border relieving the entire pavement, and thus giving it a prominence in the centre of the room, which contributed greatly to its general effect. Thus, while each picture is satisfactory, viewed separately, there seems to be an unity of purpose in the whole design which could only have been brought about by accurate study and refined taste.

The effects here glanced at are the more extraordinary, when we examine the means by which they were attained. Small portions of natural rocks and potsherds, both of various shades of colour, were with few exceptions the only materials used; and these viewed as mere dead elements, when the forms which they animated are broken up, are portions of stone and pottery of all sizes, from an inch square to pieces no larger than a pea, which appear to have been merely chipped off from larger fragments, and to have undergone little, if any, polishing before being used in the mosaic design. The upper surfaces only are smooth, so that there is little doubt a last polish was given to the floor, when the designs were completed.

As these materials consist of natural rocks, pottery and glass, I shall proceed to describe the nature and origin of the different substances which I have observed, according

<sup>2</sup> A beautiful series of drawings, the result of the skill and industry of Mr. Cox, an artist of Cirencester, were exhibited

to the Institute during the Oxford Meeting, in the Collection formed at the Divinity School.

to the following list, under the heading—Natural and Artificial Tessellæ.

*Natural Tessellæ.*

- |                           |           |   |
|---------------------------|-----------|---|
| 1. White                  | . . . . . | Formed of Chalk.  |
| 2. Cream-colour           | . . . . . | Hard, fine-grained Freestone,<br>from the great Oolite. |
| 3. Grey                   | . . . . . | The same, altered by heat.                              |
| 4. Yellow                 | . . . . . | Oolite; Oolitic and Wiltshire<br>pebbles.               |
| 5. Chocolate              | . . . . . | Old Red Sandstone.                                      |
| 6. Slate-colour, or black | . . . . . | Limestone bands of the Lower<br>Lias.                   |

*Artificial Tessellæ.*

- |                      |             |                        |
|----------------------|-------------|------------------------|
| 7. Light red         | } . . . . . | Formed of Terra Cotta. |
| 8. Dark red          |             |                        |
| 9. Black             |             |                        |
| 10. Transparent ruby | . . . . .   | Glass.                 |

1. *The Natural Tessellæ.*

The tessellæ, by this list, will be seen to be derived mostly from the immediate district.

The cream-coloured stones form the groundwork, surrounding the designs, and filling in some of the cords of the borders. This material is a fine-grained *oolitic freestone*, found in the *Great Oolite formation*, around Cirencester, in which it occurs as a bed, about four feet in thickness. It is of a light tint, and does not change colour on exposure. Its appearance in the quarry is so like the other beds of this rock as to have been overlooked; and hence it has been supposed by Lysons, and other authorities, that this particular stone is of foreign origin, and it has by them been named "Polombino marble," which indeed it much resembles. Some pieces of this oolitic stone were found mixed with the rubbish in Dyer Street, at Cirencester, and which there is reason to believe had been brought from a neighbouring quarry to make tessellæ of; we may therefore suppose that the different sized fragments were chipped off as a supply was required.

The grey, marked 3, was the most difficult to refer to any known rock, both from its colour and texture. The latter, however, on close inspection, appeared to be exactly that of the cream-colour, which the microscope proved to be the case. The question as to the difference in tint became one of interest, and upon being made a matter of experiment, it

was discovered that on roasting the cream-coloured tessellæ, they assumed the precise grey required. It was further found, that on roasting the cream-coloured stones, which were found about the Dyer Street villa, they changed to the same tint, and the identity of these with stones procured from the Great Oolite of the district, was proved by subjecting portions of this to the action of fire, when they immediately assumed the grey hue; so that these experiments prove the English origin of the cream-colour and grey, both of which were at first suspected to have been derived from a foreign source.

It next became an object of interest to ascertain the principle upon which this change depended, and chemical analysis further proved that the limestone contained *organic matters* and *iron*. Now the organic matter prevents the iron becoming *peroxidised*, which it would do by heat, and so become *red*,—hence the difference in colour of unbaked and baked bricks; and if we roast in like manner any of the other beds of the oolite, which also contain iron, we shall have a red colour produced on account of a difference in their organic contents.

These observations tend to point out the local nature of the stones, and also lead us to infer that the colours of mosaics of this description could only have been harmonised by careful study and experiment.

The yellow colours are also from oolites, those at the Witcomb and Woodchester villas from the inferior oolite, by which they are flanked; the material used at Cirencester from the great oolite bands, upon which the town rests, the colour in all cases being due to the degree of oxidation of the iron contained in the stone.

Occasional bits of a brighter hue, which occur in all Cirencester pavements, are derived from a pebble drift—the spoil of the “Sarsen stone,” a portion of the Tertiary formation (of which Abury stones are examples) which overspreads a great breadth of the table-land of the South Cotswolds of Gloucester and Wilts.

The different bands of the *lias* of the vale of Gloucester have furnished several useful tints from olive green to slate colour, almost amounting to black; these darker colours are also due to the different states of the iron which is abundantly contained in these *liassic claystones*, and for the most part in

the form of *protoxide*. Trees and foliage have been executed in the olive tints, whilst the darker shades take their part in the borders and frets surrounding designs.

## 2. *The Artificial Tessellæ.*

These consist of red and black pottery, with the exception of the glass, to be presently described. The reds are of several tints, depending much on the nature of the clays, of which they were formed. This might have been the blue clay of different parts of the lias, in which it is known the iron is in a state of *protoxide*, which, on being baked in open kilns, changes to red, by becoming *peroxidised*, as in pottery and other clay fictilia; but the black tessellæ, as also black pottery, as so ably explained by Mr. Artis, though made from the same clay, are the result of a different method of burning; and he has clearly shown that by baking pottery in closed kilns, which he terms "*smother furnaces*," the carbonaceous matter of the fuel is prevented escaping. He would lead us to infer that this black smoke penetrates the ware, and thus colours it; but the real fact is that here again we have *organic matter* preventing the further oxidation of the iron, and besides, heightening the black by entering into combination with that metal.<sup>3</sup>

The employment of coloured glass in the Cirencester pavements is of rare occurrence; in only one instance has it been observed, and that under such curious circumstances as to deserve attention, if only to show that from the nature of the case it might have been in many instances overlooked.

When the medallion, dedicated to Spring—the "*Flora*" of the Dyer-street pavement—was exposed, a colour presented itself in the head-dress and the bunches of flowers, so different from any other that we had examined—being of a bright verdigris green—that its appearance was quite remarkable; and as the tracings were in progress, our drawing of this figure, like the rest, was rigidly imitated in the colours, as these presented them in the freshness they had when first exposed. When, however, this figure was completed, it struck me as being exceedingly inharmonious in colour and effect; we had here an olive and a verdigris green inter-

<sup>3</sup> See Mr. Artis' valuable work on "*Durobrivæ*," Castor in Northamptonshire, and on the remarkable kilns of the Roman potters there discovered.

mixed, thus making very irregular forms ; so that I became convinced that the *verdigris*—for such in reality it is—was the result of some chemical change, and on scraping off a portion from the surface of the tessellæ this proved to be the case ; as when the green coating was removed it was found to conceal a beautifully coloured *ruby glass*. Here, then, the nature of the unsatisfactory colouring was made apparent. On making a new tracing, and putting the bright red—though colour but badly imitates its richness and transparency—the head-dress, a chaplet of flowers, as also the branch held in the hand, were clearly shown to be meant for “ruby gems,” and as such became intelligible, and at the same time struck us as being exceedingly appropriate.

This, perhaps, may serve to show us that in many instances Mosaic pavements may have undergone great changes in colour from decomposition ; so that, whenever we see any of these decorations faulty or unsatisfactory in chromatic arrangement, we should in all instances examine the matter more closely, for it may happen, as in the example before us, that the colouring, as first observed, would render the subject confused, when on copying from amended observations all would become plain and harmonious.

But as these changes depend on chemical action, it behoves us to inquire deeper, and with this conviction I requested my friend and coadjutor, Dr. Augustus Voelcker, Professor of Chemistry to the Royal Agricultural College, to undertake a chemical analysis of the only fragment of the glass that could be spared for that purpose ; the result of that inquiry I shall lay briefly before the Society.

The analyses—which were only qualitative, as we had not materials sufficient to determine quantities—resolved themselves into two subjects ; namely, an examination of the green powder on the surface of the glass, and an inquiry into the constituents of the glass itself, which gave the following results :—

1ST. THE GREEN POWDER.

(The soluble part.)

Oxide of lead  
Oxide of copper  
Lime  
Iron (traces of)  
Alumina (traces of)

2ND. THE GLASS.

Oxide of lead  
Protoxide of copper  
Alumina.  
Oxide of iron  
Potash  
Silica.

From this examination the Professor draws the following conclusions, which I give in his own words :—

1st. The external green colour of the glass is due to carbonate of copper.

2nd. The white coating which appeared under the green, chiefly consists of carbonate of lead, or white lead.

3rd. The interior part of the glass, so different in appearance from the exterior, nevertheless contains almost the same elements, but in a different state of combination.

4th. The red colour of the interior part of the glass undoubtedly is produced from protoxide of copper, which is present in considerable quantity, probably in combination with alumina.

5th. The green and white coatings of the glass are the result of a partial decomposition of the glass.

This examination becomes interesting from these facts, not only as showing us the knowledge possessed by the Romans in glass colouring, and therefore being important in an archaeological point of view, but inquiries of this nature are of great importance to the chemist. The art of making ruby glass was lost for a long period, and various have been experiments for recovering it ; and though the method of producing this hue by copper has recently been fully explained by Cooper and Klaproth, it is not too much to say that had analyses of glass of this kind been made by early experimenters, much time and trouble would have been saved, and the comparatively inexpensive method of producing this colour by means of copper, when compared with gold, which has been used since the seventeenth century, would doubtless have superseded that very costly process.

I cannot conclude these remarks, therefore, without stating my conviction that the history of the past may derive much elucidation from modern science, and that the science and art of the present day may in their turn be greatly advanced by a correct examination and a due appreciation of what has been achieved in ancient times. I would also express the hope that antiquaries, whose attention is devoted to the examination of Romano-British remains, may be induced by the foregoing observations to devote a special attention to the nature of the materials employed in the works of decoration or construction, of which so many remarkable examples are almost daily brought to light. The aid of chemical science

has, on the present occasion, been adduced, almost for the first time, in furtherance of such investigations ; and I trust that the interesting results developed by this means may stimulate archaeologists to seek a more intimate acquaintance with the character of ancient remains, and the details of processes in arts or manufactures, which may prove, even in our own times, of no trifling practical advantage.

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NOTICE OF A STAMP USED BY A ROMAN OCULIST OR EMPIRIC,  
DISCOVERED IN IRELAND.

THE little relic of Roman times, here brought under the notice of the archaeologist, belongs to a class of ancient remains bearing inscriptions, of a singular and interesting character, and to which the attention of various able antiquaries has been addressed. The example, hitherto inedited, and represented by the accompanying woodcuts, may be regarded with especial interest, not merely on account of the rarity of objects of this nature, but as presenting one of the very few vestiges of the Roman period, authenticated as having been found in Ireland.

I am not aware that any material facts of more recent discovery have been adduced to controvert the conclusions of Camden in reference to Ireland ;—“ *Animum vix inducere possum, ut hanc regionem in Romanorum potestatem ullo tempore concessisse credam.*” Whilst, however, no solid argument may be grounded on the expressions of certain ancient writers, to whom some poetical license may be conceded, such as the allusion of Juvenal, which might seem to imply that the sway of Rome had been extended even beyond the “ *littora Juvernæ,*” there appears sufficient evidence that intercourse subsisted between the conquerors of Britain and the natives of the adjacent island. Agricola, we are informed, entertained a *regulus* exiled from its shores ; and the statement of Tacitus, that the ports of Ireland were even better known than those of Britain, through the traffic of commerce,<sup>1</sup> would readily account for the casual occurrence in that country of coins or scattered traces of the Roman age.

The discovery of a hoard of Roman coins in the neighbourhood of the Giants' Causeway was communicated to the

<sup>1</sup> Agric. Vita, c. 21.