degree similar ? The motive with which the small urns were deposited in the larger ones, with the remains of the deceased, may have been for preparing their food during the transit to another world ; and the arrow-heads may have been designed to give them the means of obtaining it, as well as to enable them to follow their favourite pursuit ? The remarks of an eminent antiquary, Mr. Wilson, on flint-flakes, thus deposited, the *raw material* for the supply of missiles, are highly interesting. (Archaeology of Scotland, p. 120.)

The discovery of the bronze arrow-head in the barrow (No. 3) is an unusual occurrence ; short daggers or knives of that metal are indeed found in cists and urns, where the interment was by cremation or otherwise. But arrow-heads of bronze are seldom found in barrows of the Stone Period. The shape of this singular relic being so different to that of the flint arrow-points, may seem to indicate that it might have been obtained from some tribe or people in a more advanced state than themselves.

These simple relics, the sole objects here discovered in the urns accompanying the cinereal deposit, appear, it must be admitted, to be regarded rather as the appliances of the peaceful hunter of the forest, than as evidence of his prowess in conflict. The urns themselves, on the other hand, indicate no slight skill in fictile manufacture, as compared with many early specimens, from other parts of England. It may be hoped that the future examination of other vestiges of the Primeval Age, and especially the researches prosecuted recently with so much energy and success by the antiquaries of Yorkshire, may throw light upon the antiquities of the north-eastern district of England, and lead to their scientific classification.

ARTHUR TROLLOPE.

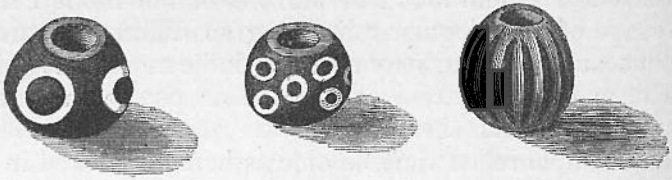
ON THE CHEMICAL COMPOSITION OF SOME ANTIENT BRITISH AND ROMAN BEADS.

BY PROFESSOR BUCKMAN, F.L.S., F.G.S., &c.

I RECEIVED, some time since, from Dr. Thurnam a glass bead, discovered in an antient British tumulus, in Wilts, with the request that I would institute a chemical analysis of it ; I was induced, accordingly, to seek the kind co-opera-

tion of my friend, Professor Voelcker, who readily undertook to render every aid his chemical skill and good laboratory offered. As the results are somewhat interesting in a chemical point of view, and I think such inquiries might, if not in a single case, yet by multiplied examinations, be made of great value to the scientific antiquary, I am inclined to lay a few notes upon the subject before the members of the Institute.

The bead, (only a single specimen could be spared,) was of a Prussian-blue coloured glass, having three circular grooves at equal distances around its surface, which had been filled with a white paste or enamel. (See woodcut, No. 1.)



1. British: blue, with rings of white paste. 2. British: blue, with circlets of opaque glass. 3. Roman: light green.

The analysis was performed in the usual mode; the alkalis—Potash and Soda—were determined separately, by fusing the finely powdered glass with an excess of Carbonate of Barytes. It fused with great difficulty when exposed to a very strong heat, in this respect resembling the hard Bohemian glass, which is manufactured into combustion-tubes for chemical purposes.

A qualitative analysis showed that the glass of which the bead was formed contained the following substances :—

Silica,	Alumina, in small quantity,
Potash,	Lime, }
Soda,	Magnesia, } some traces,
Oxide of Iron,	Oxide of Copper.

In this analysis, two circumstances are especially worthy of attention,—

1stly. The absence of Lead : and

2ndly. The presence of Oxide of Copper.

The absence of Lead best explains the difficulty with which the glass was fused; on this account, and the almost impossi-

bility of its solution under ordinary circumstances, we can readily explain why leadless glass should be employed in chemical manipulation.

Now, in respect to hardness and freedom from decomposition, I have long fancied that I could remark a difference in British and many Roman beads. I have before me examples of the latter, which are of a light bluish-green colour, much corroded, and powdered over with a white substance. In these the colouring matter is still the same, namely, Copper; but the white powder, on analysis, proves to be Lead. Now Lead, under the combined agencies of atmospheric causes and carbonic acid, becomes converted into a carbonate of that base, and hence the greater amount of corrosion and decomposition observable in these examples of Roman or leaded beads, when compared with the British or leadless ones.

With respect to the colouring matter, it is now known that Copper, in the form of protoxide, was used by the antients to impart a variety of tints to their glass, the variations of which the same substance is capable being produced by the difference of combination and manipulation; hence yellow, ruby,[1] green, and blues, of various shades, can be obtained from the same basis. It is a curious fact that Sir Humphry Davy did not find Copper in any specimen of antient blue glass, but always Cobalt.

In a paper, "On the Colours used in Painting by the Antients," he says,—"I have examined many pastes and glasses which contain Oxide of Copper; they are all bluish-green, or of an opaque watery blue. The transparent blue vessels which are found with vases in Magna Græcia, are tinged with cobalt; and on analysing different antient transparent blue glasses, which Mr. Milligan was so good as to give me, I found cobalt in all of them."

And further he remarks,—"I have examined some Egyptian pastes, which are all tinged blue and green with Copper; but, though I have made experiments on nine different specimens of antient Greek and Roman transparent blue glass, I have not found Copper in any, but cobalt in all of them."

In all the examples of Roman blue glass which I have obtained from *Corinium*, inclusive of the example under consideration, being antient glass of the British period, the

[1] See Analysis of Ruby glass, in Illustrations of Roman Remains of *Corinium*, p. 55.

colour is entirely due to Copper,[1] and Dr. Voelcker assures me, that all the examples of antient blue glass examined by him owe their colour to Oxide of Copper.

These facts seem to show that there is a real difference in chemical composition, in glass-fictilia from different sources, and that these variations cannot at all times be appreciated by a mere external examination; hence, then, it is probable that an extensive chemical investigation of these, may materially tend to throw light upon the origin of the different kinds of glass, brought under the notice of the archæologist, so as to show whether such objects were of native fabrication, or imported. Chemistry may also tend, in the matter of glass, as also in other remains of antiquity, to make us more intimately acquainted with the progress of Art and Invention in times past. Such knowledge moreover, would doubtless assist, in no small degree, in the recovery of lost Arts, or the improvement and advancement of modern manufactures.[2]

THE CASTLE, AND 'THE PROVISIONS OF OXFORD.'

When the Conqueror's survey was made, it does not appear that there existed any military building at Oxford. The mill has continued probably on the same spot down to the present time, from the days of Edward the Confessor; but the castle adjoining it, is the erection of a later reign. The town was walled round in the middle of the eleventh century, and so were some of the houses, termed *mansiones murales*, perhaps from being dwellings with the exterior protection of an enclosure by walls. As helping to contribute by this means to the general defence of the place, their occupiers were exempted from the payment of geld, and of all taxes excepting murage, or of attending the King in his expeditions. In endeavouring to ascertain the exact date of the castle, we must first of all inquire whether there is any official record of the Crown that will throw any light as to

[1] Several specimens of blue Roman glass have been examined by myself, and I am indebted to my friend Mr. Alexander Williams, M.R.C.S., for analyses of some other examples, the result in all being alike as regards the presence of copper.

[2] A very interesting series of antient beads, in the collection of Mr. B. Nightingale, is figured in Archaeologia, vol. xxxiv., pl. 5. This is almost the first attempt to display the beautiful variety of these ornaments.—*Ed.*