

The analysis of some Roman coins from Colchester, Essex

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Four groups of coins were analysed semi-quantitatively by energy dispersive x-ray fluorescence (XRF). The analyses were made on the "as conserved" surfaces. The first group of coins were thought to be orichalcum (brass) while the rest were thought to be copper. Tin could not be detected at low levels in any of the analyses as the part of the spectrum where the tin peak would have been was obscured by a minor copper peak. It is possible however that some (or all) of the coins could have contained a percent or so of tin that was not detectable under the analytical conditions used. The peak heights for copper, zinc, ^{tin} and lead were recorded and the results for the orichalcum coins are presented in the table as ratios of peak heights to allow comparisons between coins to be made more easily.

The two coins in the orichalcum group which contained detectable amounts of tin (Nos 2223 and 3428) are those with the lowest zinc levels; the objects are bronzes rather than brasses.

The analytical results suggest varied compositions among the rest of the orichalcum coins with the XRF ratios suggesting zinc contents ranging from under 10% to over 20% and lead levels of up to several percent. It should be remembered however that the coins have either a patina of corrosion products on their surface or have been chemically stripped. In neither case is the present surface composition likely to be very close to the original bulk metal composition. However, those coins where no lead was detected probably never contained any, at least no more than a fraction of a percent.

It has been shown that the zinc content of Roman brass coinage drops with time, the later issues containing less than the earlier ones, so it may be that the coins analysed illustrate this. Alternatively, some could

be copies made of the right alloy but with the wrong zinc content. The apparent variation in lead content also suggests multiple origins for the metal of which the coins were made. It should be remembered however that the apparent variations in composition detected analytically may be indicating nothing more than the variability in the coins' burial environments and the decay they have undergone.

The three groups of copper coins were just that. In only two cases were any other metals besides copper detected (though the comment about low levels of tin applies as much to these as to the orichalcum coins). No 1721 from the Balcerne Gate site contained a trace of lead (the lead ratio was 3) and the black patinated coin As ① gave definite signals for selenium which was probably applied in recent times as the sulphide to produce the patina.

Technical note

XRF peak heights were recorded for the following lines in the spectrum: Cu K_α , Cu K_β , Zn K_α , Pb L_α , Sn K_α .

The ratios given in the table were calculated as follows:

$$\text{zinc} = (\text{Zn K}_{\alpha} / \text{Cu K}_{\beta}) \times 100$$

$$\text{lead} = (\text{Pb L}_{\alpha} / \text{Cu K}_{\beta}) \times 100$$

$$\text{tin} = (\text{Sn K}_{\alpha} / \text{Cu K}_{\alpha}) \times 1000$$

'zinc' = 100 for brass containing about 20% zinc
 50 " 10% zinc

'lead' = 1-5 for alloys with under 2% lead
 20 " about 10% lead

'tin' = 6-7 for alloys with around 5-7% tin

Objects of known composition have been analysed in the same way as the coins were and it is those results which have been used to provide the approximate calibration for the ratios which is given above.

Table: XRF results for the orichalcum coins

Site Code	Coin No	Condition	XRF ratios		
			zinc	lead	tin
BKC	1862	S	15	-	-
LWC	3629	S	44	10	-
1.81	2630	P	47	3	-
BKC	4708	S	62	2	-
1.81	754	P	111	18	-
1.81	2468	P	113	-	-
LWC	3551	S	88	3	-
LWC	914	S	82	-	-
1.81	2420	P	83	1	-
1.81	2481	P	49	14	-
1.81	2474	P	59	3	-
BKC	3750	S	25	22	-
BKC	4707	S	25	5	-
BKC	1469	S	32	8	-
BKC	1546	S	35	-	-
1.81	2223	P	7	-	6
BKC	4504	S	60	2	-
BKC	3782	S	59	-	-
BKC	3428	S	-	-	7
BKC	4594	S	95	18	-
BKC	5224	S	63	-	-
LWC	3361	S	143	14	-
BKC	2430	S	39	-	-
BKC	911	S	67	-	-
BKC	189	S	70	-	-
BKC	749	S	42	3	-
BKC	3908	S	60	15	-
BKC	1832	S	50	-	-
1.81	2411	P	61	5	-
1.81	907	P	58	3	-

Key

BKC = Balcerne Lane
LWC = Lion Walk
1.81 = Culver Street Phase 1

S = chemically stripped
P = surface patina (green)
- = not detected