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Ancient Monuments Laboratory
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ANALYSIS OF COPPER ALLOY WASTE FROM HAUGHMOND ABBEY, SHROPSHIRE.

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Summary

Samples of copper alloy waste in the form of amorphous lumps and some possible offcuts were analysed to look for any variations in composition. The majority of the samples analysed were bronzes with minor levels of lead. The material could be divided into two chronological groups, one group of twelth century date associated with the early church, and the other of mid-sixteenth century date associated with the dissolution. There did not appear to be any significant difference between the composition of the two groups of samples.

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ANALYSIS OF COPPER ALLOY WASTE FROM HAUGHMOND ABBEY, SHROPSHIRE

Over forty samples of copper alloy waste (AML No. 895416), in the form of amorphous lumps and some possible offcuts, were submitted for analysis. The samples came from three main areas of the site: a demolition layer of the early church and the makeup/construction layer for the later cloister dated to about 1200 AD; the fill of a grave dated to between 1200 and 1500 AD; and a pit probably associated with the dissolution and demolition of the cloister about 1540 AD. Qualitative analysis using energy-dispersive X-ray fluorescence equipment was undertaken to identify the composition of the alloys. The elements recorded were copper (Cu), zinc (Zn), lead (Pb) and tin (Sn).

Other than conservation treatment, no surface preparation was carried out on the waste fragments and as XRF is a method of surface analysis the results will have been affected by surface contamination, corrosion and the depletion of elements from the surface that this can produce. The results should nevertheless give an indication of the alloys used.

The XRF data for each element is presented in Table 1 as a ratio to the copper peak to allow easier comparison between analyses. In XRF analysis the peak heights for each element cannot be directly compared between elements as the height bears little relation to the proportion of that element present in the sample. Different elements are excited with varying efficiencies by the primary X-rays, eg tin is excited far less than zinc or lead so the peak heights will be a lot lower even when the amounts present are similar.

Three samples (SF Nos. 517, 532, 547) are pure copper which only contain very minor levels of the other elements. The other samples with significant additions to the copper are plotted in the form of a ternary diagram in Figure 1 which shows that they are all bronzes (copper-tin alloys), containing varying minor quantities of lead. Two samples contain significant quantities of lead and these are described as '(leaded) bronzes' in Table 1.

Four of the samples (SF Nos. 49, 77, 526, 594) had traces of a white metal coating on the surface and from the analyses it is likely that these were all tinned as no traces of silver were found. These samples may have been fragments of copper alloy objects which were coated, though the small size of the fragments precludes any positive identification.

There are no compositional differences between the three areas on the site where the waste was found. Despite the compositional similarity, the contextual evidence suggests it is unlikely that all the waste originates from the same activity on the site. The composition of the copper alloy waste found is similar to that used in bell founding and it is possible that the material found in the early phase is the waste product of bell founding that was undertaken at the site. Two stone moulds for copper alloy working were found on the site, one of which was associated with the production of stirrup-shaped rings dated to the late twelth century AD. Also a Romanesque candlestick was found on the site which was particularly poorly made and it has been suggested that it may have been locally made. It is therefore possible that copper alloy working was being undertaken at the site and the later waste material, associated with the dissolution phases, may be related to copper alloy working at that time.

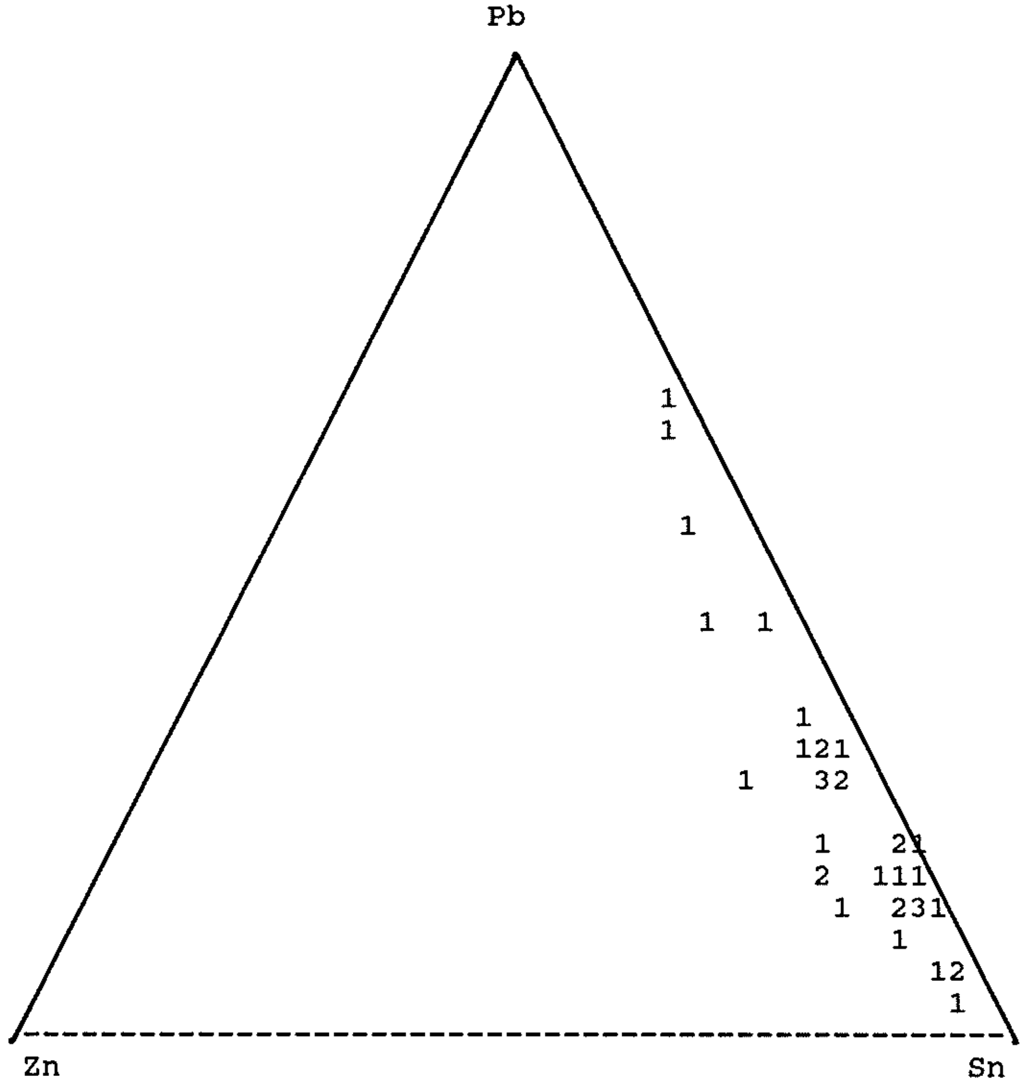
Table 1

Results of XRF analyses presented as ratios to copper

SF No.	Zn	Pb	Sn	Alloy
49	0.04	0.04	0.16	bronze (coated)
52	0.06	0.07	0.08	bronze
77	0.05	0.09	0.14	bronze (coated)
164	0.05	0.09	0.12	bronze
462	0.13	0.68	0.56	(leaded) bronze
516	0.06	0.05	0.04	bronze
517	0.05	0.02	0.01	copper
521	0.04	0.06	0.03	bronze
524	0.05	0.08	0.05	bronze
526	0.04	0.21	0.06	bronze (coated)
532	0.04	0.04	0.01	copper
535	0.05	0.13	0.06	bronze
537	0.06	0.16	0.17	bronze
538	0.05	0.03	0.02	bronze
539	0.05	0.36	0.04	bronze
540	0.04	0.08	0.04	bronze
541	0.04	0.07	0.12	bronze
543	0.04	0.04	0.02	bronze
544	0.08	0.66	0.07	(leaded) bronze
547	0.04	0.06	0.01	copper
554	0.04	0.05	0.03	bronze
555	0.05	0.08	0.05	bronze
556	0.05	0.08	0.02	bronze
558	0.04	0.03	0.05	bronze
584	0.04	0.05	0.03	bronze
585	0.05	0.11	0.06	bronze
586	0.05	0.03	0.03	bronze
587	0.03	0.07	0.03	bronze
588	0.05	0.02	0.08	bronze
590	0.09	0.36	0.06	bronze
594	0.05	0.14	0.13	bronze (coated)
596	0.06	0.03	0.04	bronze
597	0.05	0.04	0.02	bronze
598	0.04	0.01	0.10	bronze
599	0.05	0.03	0.03	bronze
601	0.05	0.05	0.08	bronze
602	0.08	0.25	0.13	bronze
603	0.05	0.02	0.05	bronze
604	0.05	0.03	0.15	bronze
612	0.04	0.05	0.09	bronze
630	0.05	0.13	0.15	bronze
658	0.04	0.21	0.21	bronze

Figure 1

Ternary diagram showing composition of copper alloy waste



The figures on the graph represent the number of points within the area covered by that figure.