AML Rpot 3762
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TECHNOLOGICAL SAMPLES FROM BECKFORD, HEREFORDSHIRE

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The material from Beckford comprised Ancient Monuments Laboratory numbers 812986-8 and 813702, (also one unnumbered piece of slag which was extracted from the main bulk of slag by J G McDonnell). It consisted of fragmented crucibles, broken moulds, pieces of hearth lining, and fragments of bronze. Only pieces which had visible traces of metal were analysed using X-ray Flourescence (X.R.F.). This qualitative analysis determined which elements were present, and in what sort of proportions. All the metal traces were of copper alloys. The apparently high counts of lead and zinc are due to their ability to react with the clay upon heating, becoming chemically bound in the vitrified surfaces. A small signal for zinc is also given by the sellotape used to support the samples, so only particularly high readings should be considered significant. All the results are given in the table below.

The crucibles were all made of a reduced-fired grey fabric. None have survived intact, but the shape of the fragments suggests they were probably triangular at the top, with a pointed base. The thickness of the crucible fragments varies between 0.8 and 1.2 cm, the thinner pieces having a finer fabric. Twenty two sherds from different samples were analysed. More than half of these contained traces of a copper alloy, with a high enough tin signal to consider it a major alloying element. A further five gave a slightly lower count, but were still basically copper and tin with traces of lead and zinc. In five of the samples the only strong signal was for copper, with zinc, lead and tin giving only weak signals.

The bronze fragments were drops, lumps, small pieces of worked metal and dribbled bits of metal. The fourteen fragments analysed were very similar in their composition. They were all alloys of copper with a significant amount of tin, and traces of lead and zinc, indicating they were all bronzes. This corresponds with the analysis of metals on the crucible fragments, confirming that copper and tin were the major elements in the metal worked.

The broken moulds showed some traces of metal on the moulded surface, mainly a purple colour. However, probably due to washing, the tin signals were weak to non-existant, and the copper signals were far weaker than on the crucibles. The lead and zinc peaks were not high enough to indicate anything more than impurities.

The hearth lining clay had very low counts of metals, compared with the crucibles. With the exception of find number 5619, the copper peaks were little more than twice the height of the background counts. Tin and lead were not detected, and the zinc count may be explained by the sellotape used to support the sample. The single fragment of slag had traces of a copper tin alloy.

One may conclude that bronze was being worked at Beckford and that it contained only minor traces of lead and zinc. The crucibles and bronze fragments illustrate this well, whilst the washed moulds and baked clay hearth linings bore only traces of metals.

TABLE OF RESULTS

A.M. No	Site No	XRF Peak Heights			
		Copper	Zinc	Lead	Tin
A. Crucible Fragments					
812988	6407	1765	145	127	178
"	65634	501	87	-	48
"	5596	10471	139	170	22
"	75962A	404	69	-	28
"	75966A	1857	87	213	177
"	55106A	2326	82	51	141
"	65758	1626	356	94	66
"	75080A	2368	165	101	163
"	5436	1545	87	172	90
"	54122	1758	97	75	74
"	4848A	4115	144	92	355
"	4847B	3127	96	37	81
"	65004	2002	138	153	178
"	4846C	913	78	54	60
"	65233	387	70	-	58
"	4860	3456	109	49	90
"	5619	1974	85	225	182
"	55106B	5382	200	167	84
"	65113B	70	73	58	49
"	4846A	2563	95	-	-
"	4830	1347	83	-	-
"	4847A	4070	95	54	74
B. Bronze Fragments					
813702	5415	933	62	61	61
"	5619	4931	-	75	104
"	65073	8582	105	90	177
"	5415	7982	131	66	159
"	54120	9124	116	214	143
"	5500A	2929	76	33	123
"	65048	5364	81	33	171
"	65234	2796	73	36	57
"	75305B	4360	91	51	145
"	75036	1359	63	51	56
"	4860	575	62	46	126
"	5590A	2546	58	38	126
"	65786	6256	101	149	176
"	6418	2117	67	37	99

AM Lab. No.	Site Number	XRF Peak Heights			
		Copper	Zinc	Lead	Tin
C. Moulds					
812987	65751 (1)	85	83	40	36
"	5433	75	88	49	-
"	4836B	81	82	50	-
"	65725D	74	128	-	-
"	65751 (2)	61	72	52	-
D. Hearth Lining					
812986	74110	73	89	71	-
"	4820A	52	66	-	-
"	4830	71	71	-	-
"	4636	60	79	-	-
"	65726A	63	74	-	-
"	5619	1208	75	50	51
"	4802	50	71	-	-
E. Slag					
?	65229A	3279	117	-	151

Notes to Table

Different elements fluoresce more or less strongly so peak heights cannot be directly related to concentrations. The relative peak heights, eg tin/copper ratio, give numbers that can be roughtly compared, but the absolute values recorded depended on the total amount of metal on the object and the length of time for which the analysis was made.

MORE TECHNOLOGICAL SAMPLES FROM BECKFORD, HEREFORDSHIRE (ADDENDUM TO AML REPORT NO. 3762)

The material examined consisted of fragmented crucibles, slag and some bronze fragments. The material was very similar to that examined earlier.

The crucibles were of varying thickness, the fabric being grey reduced fired and fairly coarse. Two of the more complete crucibles were of the triangular type, tapering to a pointed base. Metals on the surface of the fragments were analysed using X-ray fluorescence (XRF). The metal was bronze; copper with tin as the major alloying element, plus traces of lead and (?) zinc. The XRF peak heights are given in a table below. It should be remembered that peak heights are not a direct measure of the amount of an element present as some elements fluoresce far more strongly than others.

The bronze fragments were of a very similar composition to those examined in the earlier groups of material. There were also two fragments of fuel ash slag which bore no traces of any metals, and some pieces of iron smithing slag.

TABLE OF RESULTS

Site No

	XRF Peak Heights				
A. Crucible Fragments	Copper	Zinc	Lead	Tin	
1521 26	No trace of metals				
1521 27	410	67	30	51	Bronze
1521 18	No traces of metal				
383932	No trace of metals				
380934	1945	103	54	56	Bronze
152116	549	90	43	71	Bronze
385011	268	87	53	286	High Tin Bronze
200103	No trace of metal				
152123	126	48	20	10	Bronze
152124	1927	75	57	144	Bronze
152117	No trace of metals				
380907	302	51	29	35	Bronze
152119	112	75	27	20	Bronze
383209	647	40	34	43	Bronze
276501	No trace of metals				
380291	65	Traces of copper only			
381803	713	55	30	5	Bronze
152120	1244	72	48	126	Bronze
289407	No trace of metals				
152115	909	59	21	52	Bronze
298430	No trace of metals				
152125	No traces of metals				
B. Bronze Fragments					
152114	4229	59	36	107	Bronze

D. Hearth Lining

6408 Fuel ash slag - part vitrified red clay

E. Slag

4846A iron smithing slag

4831 fuel ash slag - no trace of metals

4819A iron smithing slag