AML Report 3761
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TECHNOLOGICAL SAMPLES FROM THETFORD, NORFOLK

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The material examined comprised Ancient Monuments Laboratory Numbers 821767 and 814595. It consisted of a few bronze fragments, fragmented and whole crucibles, moulds (most for making coin pellets) and fired clay from hearth linings. Only some of the material bore visible traces of metals, and x-ray fluorescence analysis was used on all the material to detect, and determine the composition of any metals present. X.R.F is a qualitative form of analysis and can only give an approximate measure of the proportions of each element in an alloy.

The table (below) gives the peak heights detected for each element on every sherd that was analysed. The absolute numbers are meaningless as they depend on how much metal was present on any one sherd, but ratios can be compared from one sherd to the next. It should be noted that different elements fluoresce more or less strongly, so the same signal size does not mean the same amount of each element.

It should also be noted that the apparently high signals for lead and zinc may in part be due to their preferential retention on the sherds, as they can act as glass forming elements, and so become chemically bound in the vitreous surface of the fired clay. The samples were all supported on sellotape, which itself gives a weak signal for zinc. This is the most likely explanation for its universal presence, but in some cases the amounts detected suggest its deliberate inclusion in the alloy being melted.

The crucibles were all made of a grey, reduced-fired clay fabric. They had a triangular shaped top, coming into a pointed base. The fragments seem to belong to three different sizes of crucible. The smallest (which was the only size of which there was a complete example) was about 5.5 cm high, with a diameter of 4.75 cm and walls 0.8 cm thick. The brimful volume of this size would be approximately 22cc. Slightly larger crucibles would have been about 6 cm in diameter, with a height of 7 cm and a wall thickness of 1 cm. No estimate of the size of the largest crucibles

can be made, as no complete sides remain intact; however the wall thickness of 1.6 cm suggests that they would have been considerably bigger than the others.

Three of the crucible samples analysed have no traces of metals. Several sherds bore only traces of copper and zinc, but the majority had traces of copper, zinc, tin and lead, with tin as the major alloying element; this indicates the melting of bronze. Some of the signals for lead are strong enough to suggest that it may have been deliberately added to the alloy. The same suite of elements were detected on both large and small crucibles.

The bronze fragments were mainly composed of copper and tin. The signals for zinc and lead are not strong enough to indicate that they were significant constituents of the alloys.

The coin pellet moulds were all very similar in appearance; they were made of grey, reduced-fired clay, with numerous small depressions in which to melt the metals. A good description of their use is given in Tylecote (1976, 50-51). Signals for copper, zinc, tin and lead were given by all of them, but none of the zinc signals were very strong; it was not a significant element in the alloy being melted. However, several of the pellet moulds did give a relatively high signal for lead, indicating the production of leaded bronze pellets.

One coin pellet mould (small find 449) gave a very strong silver signal, indicating it was used for the production of silver pellets. Copper, zinc, tin and lead were also detected, but the signals were so weak that they probably only indicate impurities within the silver.

The other moulds gave signals for copper and high counts for tin, with varying zinc and lead counts. Three moulds gave signals for copper and zinc only, in small amounts. This would correspond with the traces of metals found on the crucibles, mainly of bronze, but some of only copper with a little zinc.

The hearth lining fragments were of varying sizes; many were partially vitrified lumps of clay which were also oxidized-fired. These were the samples which most often bore no traces of metals. When signals could be counted, they were mainly copper with tin. None of the hearth lining sherds gave a significant lead signal.

There is no apparant difference in the composition of copper alloys on the material from Iron Age or Roman deposits. The apparent continuity between late Iron Age and Early Roman may just be due to the fact that finds from Roman contexts are in fact all Iron Age material. With the exception of the silver-bearing coin pellet mould, the material suggests bronze working with some leaded-bronze coin pellets being produced as well.

Reference

R F Tylecote (1976) A History of Metallurgy.

Table of analytical results

A.M NO	SMALL FIND NO	COPPER	ZINC	LEAD	TIN	DATE	OBJECT
814595	211	77	70	111	25	?	Mould
"	2229	1736	600	1258	505	E Roman	Crucible
"	1840	64	75	33	19	E Roman	Hearth
"	2638	3738	115	103	231	I Age	Crucible
"	2755	-	-	-	-	I Age	Mould?
"	2756(1)	72	40	49	15	I Age	Crucible
"	2742	359	75	61	100	I Age	Crucible
"	325	64	76	-	37	?	Hearth
"	2649	94	59	58	-	I Age	Crucible?
"	2754	219	98	58	54	?	Mould
"	1020	58	74	-	-	?	Mould
"	2756(2)	43	54	37	20	I Age	Hearth
"	327	-	-	-	-	L Roman	Hearth
"	1025	525	159	128	302	I Age	Mould
"	2755	-	-	-	-	I Age	Hearth
"	2614	106	152	107	86	I Age	Mould
"	2613	117	168	-	93	I Age	Hearth
"	2617	254	133	101	144	?	Crucible
"	1659	88	128	-	-	I Age	Hearth
"	1022	108	186	77	89	E Roman	Hearth
"	404	80	109	232	-	I Age	Hearth
"	434	116	180	114	90	?	Hearth
"	1831	-	-	-	-	I Age	Hearth
"	2747	-	176	-	-	E Roman	Crucible
"	2756(i)	113	58	-	-	I Age	Crucible
"	2756(ii)	86	105	-	-	I Age	Crucible
"	2756(iii)	183	159	95	76	I Age	Crucible
"	2599	188	154	96	68	E Roman	Crucible
"	1836	-	137	-	-	E Roman	Hearth
"	2755	114	136	-	-	I Age	Crucible
"	2608	168	160	74	54	I Age	Mould
"	1094	-	210	-	-	?	?tuyere
"	2639	124	154	-	-	I Age	Crucible
"	5853	262	156	-	-	I Age	Mould
"	1055	135	140	108	-	E Roman	Mould
"	2616	203	181	-	-	?	Mould
"	2755(263)	84	119	-	-	I Age	Crucible?
"	2755(250)	79	109	-	-	I Age	Hearth
"	2243	-	132	-	-	L Roman	Crucible
"	2985	110	115	-	-	I Age	Crucible
821767	3581	58	109	-	51	I Age	Crucible
"	4166	70	67	85	-	I Age	Pellet Mould
"	4054	72	67	58	34	I Age	Pellet Mould
"	3589	71	87	78	31	I Age	Pellet Mould
"	3527	77	87	51	41	I Age	Hearth?
"	3185	61	84	40	13	I Age	Crucible
"	3528	84	64	60	42	Roman	Mould
"	(474)	72	99	78	37	I Age	Crucible
"	4055	62	93	-	-	I Age	Mould
"	4108	75	96	70	47	I Age	Crucible
"	1074	58	108	49	32	I Age	Hearth
"	(460)	56	82	122	29	I Age	Pellet Mould
"	(461)	58	94	54	34	I Age	Pellet Mould
"	4107	104	98	-	-	I Age	Pellet Mould
"	(451)	63	82	87	34	I Age	Pellet Mould
"	(459)	64	46	83	49	I Age	Crucible
"	467	49	100	46	33	I Age	Pellet Mould
"	(456)	62	84	53	44	I Age	Pellet Mould

A.M NO	SMALL FIND NO	COPPER	ZINC	LEAD	TIN	DATE	OBJECT
821767	(458)	72	89	113	39	I Age	Pellet Mould
"	448	58	83	45	34	I Age	Pellet Mould
"	3590	712	84	245	428	I Age	Crucible
"	3589	56	73	50	-	I Age	Crucible?
"	3812	54	87	59	38	I Age	Crucible
"	4055	63	92	53	29	I Age	Crucible
"	1046	56	80	46	53	I Age	**Mould**
"	4168	71	71	60	29	I Age	Pellet Mould
"	1043	89	108	49	-	I Age	Mould
"	4108	77	93	-	-	I Age	Crucible
"	2613	83	64	**34**	29	I Age	Crucible
"	(453)	63	75	113	25	I Age	Pellet Mould
"	325	39	21	15	12	I Age	Crucible
"	3585	265	82	67	68	I Age	Crucible
"	4107	5652	101	49	128	I Age	Bronzefrags
"	(455)	80	86	84	33	I Age	Pellet Mould
"	(452)	59	91	83	20	I Age	Pellet Mould
"	1046	6314	104	48	153	I Age	Bronze frags
"	(457)	76	112	67	40	I Age	Crucible
"	(449)	70	83	190	25	I Age	Pellet Mould
"	Silver 79						