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Ancient Monuments Laboratory
Report 21/91

X-RAY FLUORESCENCE ANALYSIS OF GRAVE GOODS FROM THE ANGLIAN CEMETERY AT CASTLE DYKE, BARTON ON HUMBER, EXCAVATED 1982-83.

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Summary

About fifty non-ferrous objects were analysed using surface X-ray fluorescence analysis. Most of the metals were bronze. Other alloys identified included gunmetals, brass and gold.

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X-ray fluorescence analysis of grave goods from the Anglian cemetery at Castle Dyke, Barton on Humber, excavated 1982/3

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(The text of the original report has been lost, except for Appendices 1 and 2, included below)

Analysis was performed on the surfaces of *c.*50 objects by non-destructive X-ray fluorescence (XRF), by Paul Wilthew, in 1985 or 1986. This method detects elements present at percentage levels and is also excellent for deciding which sorts of surface treatment were used, *eg* to coat areas (silvering, tinning, gilding) or to detect soldering. The surface composition of an object is often quite different to the interior composition, due to deliberate coatings, to corrosion and other post-deposition effects. The results are strictly qualitative and approximate.

From Appendix 1, we may conclude that the metals analysed were mostly copper alloys. Most were bronzes (copper-tin), a small proportion were gunmetals (copper-tin-zinc) and one brass (copper-zinc). Lead is relatively easily detected by XRF due to its high atomic weight (it was detected in all samples from this site). Only alloys with moderately high values (++ or +++ in Appendix 2) should be considered as being 'leaded', and then only in cases which were not noted to have coatings or soldering.

One annular brooch (Grave 10) has such high levels of lead and tin that it may have been coated with a tin-lead alloy (soldering might be a possibility); similar patterns of elemental concentration were noted on other objects, *eg* the knob of a cruciform brooch (Grave 29) and a replacement catch plate (Grave 43). There is one piece of gold, alloyed with high levels of silver and smaller amounts of copper.

These results seem to conform to the general picture we already have of alloy use in the Anglian period, *ie* that copper alloys were normally bronze-like but often had significant levels of zinc as well (Mortimer 1990).

To make a more significant contribution to our knowledge in this field, quantitative analysis should be carried out on a selected range of artefacts, preferably on pieces with archaeological significance. For instance, in this case, one might select pieces which are well-dated or provenanced, which belong to diagnostic or unusual grave assemblies, which have parallels whose chemical compositions have been already investigated or which have a specific question attached to them (*eg* of workshop production). Such work could help in the establishment of regional and chronological components within non-ferrous metal alloying traditions.

The potential for such work could be assessed with respect to other analyses done on contemporary metalwork, specifically work done by Nigel Blades on Anglo-Saxon material from north-east England (West Heslerton, Sancton etc) and smaller datasets from other sources. Useful work could be achieved by doing quantitative analyses both on the material concerned in this report and on any finds from the recent excavation that seem relevant.

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Mortimer C 1990 'Some aspects of early medieval copper-alloy technology, as illustrated by a study of the Anglian cruciform brooch' DPhil (Oxford)

Appendix 1 - Composition of the objects

Grave	Find No.	Description	Composition
	u.3	Girdle hanger	Gunmetal
	u.5		Bronze
	u.12	Rod fragment	Brass
	u.13	Strip	Bronze
	u.14	Pin	Bronze
	u.15	Strap tag	Bronze
3	1	Penannular brooch	Bronze
6	2	Buckle	Brass
10	1	Annular brooch	Probably tin-lead alloy coated brass or gunmetal
10	(3)-1	Spiral wrist clasp	Gunmetal
10	(3)-2	Spiral wrist clasp	Gunmetal
10	(3)-3	Spiral wrist clasp	Gunmetal
10	7	Girdle ring	Bronze
10	8	Tweezers	Gunmetal
11	1	Wire	Gold (heavily debased with silver)
13	1	Annular brooch	Bronze
13	2	Annular brooch	Bronze
15	1	Pin	Bronze
15	(2)-1	Lace tag	Bronze
15	(2)-2	Lace tag	Bronze
16	1	Suspension device	Bronze
17a	2	Pin	Bronze
17b	4	Strap plate	Plate - Bronze Rivet - Gunmetal
17b	6	Ferrule	Bronze
18	9	Staple	Gunmetal
18a	3	Buckle	Bronze
22	1	Annular brooch	Bronze
25a	1	Annular brooch	Gunmetal
25a	2	Annular brooch	Gunmetal
25a	5	Strapend	Gunmetal
29	1	Cruciform brooch	Brooch - Gunmetal Knobs were tin-lead alloy coated, but the base metal of the one on the right side contained a significantly higher level of zinc.
29	2	Annular brooch	Gunmetal
29	3	Annular brooch	Bronze
30	2	Strip	Gunmetal
31	4	Buckle	Plate - Bronze
31	5	Cup-mount	Bronze
32	1	Annular brooch	Bronze

Grave	Find No.	Description	Composition
33	(1)-17	Rings - ?necklace	Gunmetal, or tin-lead coated gunmetal or brass
33	2	Handle - ?bucket	Brass
33	3	Mount - ?cup	Gunmetal or brass with tin-lead solder on one side
35	3	Cup fitting	Bronze
37	1	Buckle loop	Bronze
38	1	Tweezers	Tweezers - gunmetal or brass, possibly tin-lead coated Ring - bronze
40	(2)-1,2	Spiral wrist clasps	Bronze - one fragment probably had a tin-lead alloy coating or solder on it
43	1	Cruciform brooch	Brooch - bronze Catchplate - bronze, with tin-lead solder
43	2	Annular brooch	Bronze
43	3	Annular brooch	Bronze
43	5	Buckle	Loop - high tin Bronze Rivets - tin coated bronze or copper Rest - bronze
46	1	Pin set	Long pin - bronze (probably tin-lead alloy coated) or tin-lead alloy coated copper. Short pin - gunmetal Chain - bronze

Appendix 2 - Analytical results

Notes :

1) The area analysed is only given if the object had more than one component or if some areas of the object were coated

2) Copper was the major element detected in all analyses except that of the gold wire (11 1)

Key : +++ = detected at high levels, often because the element was present in a coating
++ = detected at moderate levels
+ = detected at low levels
tr = just detectable
nd = not detected

Grave	Find No.	Area analysed	Zinc	Lead	Tin	Others
	u.3		+	+	+	
	u.5		+	+	++	
	u.12		+	+	+	
	u.13		+	+	+	
	u.14		+	+	++	
	u.15	Both sides of each plate	tr	+	++	
3	1	Ring	nd	+	++	
		Pin	nd	tr	++	
6	2	Loop	++	+	tr	
		Bar	++	+	tr	
10	1	Ring	++	+++	+++	
10	(3)-1		++	+	+	
10	(3)-2		++	+	+	
10	(3)-3	Ring	++	+	+	
10	7		tr	++	++	
10	8		++	+	++	
11	1	Wire (Gold)	nd	tr	nd	Au Ag Cu
13	1	Ring	tr	++	++	
		Pin	tr	++	++	
13	2	Ring	tr	+	++	
15	1		nd	+	++	
15	(2)-1		tr	+	++	
15	(2)-2		tr	+	++	
16	1		tr	+	++	
16	1		nd	tr	++	
17a	2		nd	tr	+	
17b	4	Plates	nd	+	++	
		Separate rivet	+	+	+	
17b	6		nd	+	++	

Grave	Find No.	Area analysed	Zinc	Lead	Tin	Others
18	9		+	+	++	
18a	3	Loop	nd	+	++	
		Plate	nd	tr	+	
22	1	Ring	+	+	+	
25a	1	Ring	+	+	+	
25a	2	Ring	+	+	+	
25a	5	Broken side 1	+	+	++	
		Broken side 2	++	+	++	
		Unbroken	++	+	++	
29	2	Ring	+	+	++	
29	1	Brooch	+	+	+	
		Right knob	++	+	++	
		Left knob	+	+	++	
29	3	Ring	tr	+	+	
30	2		+	++	+	
31	4	Plate	+	+	++	
31	5		nd	tr	++	
32	1	Thick ring	nd	tr	+	
		Thin ring	nd	tr	+	
33	(1)-17		++	++	++	
33	2		++	+	tr	
33	3	Grey area	++	+++	+++	
33	3	Non-grey area	++	++	++	
35	3		nd	tr	++	
37	1		+	+	+++	
38	1	Tweezers	++	++	+++	
38	1	Ring	+	+	++	
40	(2)-1,2	Fragment with most remaining metal	+	+++	++	
		Other fragments	+	+	+	
43	1	Brooch	+	+	++	
		Catchplate, metal	tr	+	+	
		Catchplate, solder	+	+	++	
43	2	Ring	+	+	+	
43	3	Ring	+	+	++	
		Plate	tr	+	++	
43	5	Loop	+	+	++	
		Pin	tr	+	++	
		Plate	tr	+	++	
		Backplate	+	+	+	
		Rivet on left side	tr	+	+	
		Rivet on right side	tr	+	+	
		Rivet near loop	+	+	++	
46	1	Long pin	tr	++	+++	
		Short pin	+	+	++	
		Chain	nd	+	++	