

Ancient Monuments Laboratory
Report 46/93

ANALYSIS OF EARLY ANGLO-SAXON
BROOCHES FROM CASTLEDYKE,
BARTON ON HUMBER,
SOUTH HUMBERSIDE

Catherine Mortimer BTech DPhil

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Summary

Eight cruciform brooches and a small long-brooch were analysed quantitatively. Brasses and bronzes with low-zinc concentrations were shown to be unusually frequent and it is suggested that some regional patterning may be discernable, when the data is compared with information from a large dataset.

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Analysis of early Anglo-Saxon brooches from Castledyke, Barton on Humber, South Humberside

Catherine Mortimer

The Anglian inhumation cemetery of Castledyke¹ was excavated in two seasons, during 1982-3 (Site code BNK82/3) and 1990 (Site code CS90). The excavation revealed more than 160 graves, with the typical range of Anglian grave goods, including eight cruciform brooches. The cruciform brooch is a relatively common form of cast bow brooch. It has three knobs on a rectangular headplate and a foot which terminates in an animal head design; they were mostly made and used during the fifth-sixth centuries AD. A small-scale analytical study of these particular brooches could be usefully carried out, since a large comparative dataset was available.² The compositions of cruciform brooches at this site can be compared with those of brooches from other areas, *eg* the Anglian 'heartland' of East Anglia, and also with other brooches in the relevant typological groups. A small-long brooch from Grave 128 has some typological similarities with some small cruciform brooches and shares some of the technical and archaeological attributes; this brooch is analysed and discussed with the cruciform brooches, below.

Method

Small drilled samples were taken from discrete areas at the back of each of the brooches, two samples, from different areas, being taken in one case (G135). These were mounted in clear resin, polished to 1μ and coated in carbon before X-ray analysis in a Cambridge S200 Scanning electron microscope. At least three pieces from each sample were analysed and the average values calculated (Table 1). The results of analysis on four copper alloy standards³ are also presented here (Table 2) and show reasonable agreement with the expected values. Values for zinc and tin may be slightly overestimated (by up to 0.7% (4.7% relative) and 0.3% (4.1% relative) respectively), where there are high levels of these elements; values for copper are corresponding lower than expected (by up to 3.4% (4.9% relative)).

¹ To be published by Humberside Archaeological Unit.

² Mortimer C 1990 *Some aspects of early medieval copper-alloy technology, as illustrated by a study of the Anglian cruciform brooch* Unpublished DPhil thesis, Oxford

³ The standards are small blocks of solid metal, mounted in resin, polished and analysed in the same way as the samples.

Results

Analysis shows that the brooches are made of copper alloys. Eight of the ten alloys tested may be allocated to two groupings, brasses - high in zinc (in this case, $\geq 9.6\%$) and relatively low in tin ($\leq 4\%$) and bronzes - low in zinc ($\leq 3.1\%$) but high in tin ($\geq 7\%$).⁴ The two samples taken from the cruciform brooch from Grave 135 (one from a sideknob and one from the brooch itself) are of interest. They are both bronze-like with tin contents of 7% and 9.5% and rather high levels of zinc (3.1% and 2.1%), but the sample from the knob is sufficiently low in tin and high in zinc to be classed as a zinc bronze. Compositional variability within such objects (*ie* testing to see how much variation occurs between different areas on one brooch) has not been assessed experimentally because most excavators are loath to allow multiple sampling. It is therefore difficult to assess whether the compositions are similar enough to suggest that both knobs and brooch could have been cast from the same melt. When compared with the other Castledyke analyses, these two analyses seem relatively similar, but when considered in the light of other cruciform brooch compositions,⁵ they are not particularly similar. The brooch from G156 has a brass-like composition but a rather low zinc content (7.6%) and moderate tin content (3.4%), and is therefore classed as a gunmetal.⁶ These two compositions (G135 (sideknob) and G156) therefore belong to mixed-alloy types (in which zinc and tin are both present at significant levels) which were relatively common at this time.

Discussion

These analytical results fall within the wide range of copper alloys known to have been used for casting early Anglo-Saxon brooches.⁷ In particular, they illustrate that the brasses employed at this time tend to contain a few percent tin and that the bronzes have up to 2% percent zinc in them. Even the known negative correlation between zinc and tin contents⁸

⁴ 'Brass' and 'bronze' are used here as convenient shorthand for the types of copper alloy found in archaeological objects of this period. The definitions used here are those used in Mortimer 1990 *op cit* and Mortimer C 1991 *A Descriptive Classification of early Anglo-Saxon copper-alloy compositions; Towards a general typology of early medieval copper alloys* *Medieval Archaeology* 35; 104-107. The terms are used in a different way in conventional metallurgy and in other archaeological science publications.

⁵ Mortimer 1990, *op cit*.

⁶ Despite the dark glossy surface of this piece, no precious metals were detected in the analysis of this piece cf Bayley J and McDonnell G 1990 *The Analysis of the Black Surface of a Sub-Roman Bracelet* (Paper given at 'Surface Colouring and Plating of Metals' conference at British Museum 1990). Gold and silver contents were similarly below detectable levels for non-destructive X-ray fluorescence in a cruciform brooch from Barrington, Cambs, which has a similar dark, glossy surface (Ashmolean Museum, accession no. 1909.263; Reichstein J 1975 *Die kreuzförmige fibel* (Neumünster), catalogue number 768, *Taf* 84,9; analysed by the author). The appearance may instead be due to deliberate surface enrichment techniques (see *eg* Meeks N 1987 *Artefacts, surfaces and the SEM* Black J (ed) 'Recent Advances in the Conservation of Artifacts' (London); 409-410) or to unusual corrosion dynamics during burial.

⁷ *Eg* Mortimer 1990 *op cit*; Brownsword R, Ciuffini T and Carey R 1984 *Metallurgical analyses of Anglo-Saxon jewellery from the Avon Valley* in *West Midland Archaeology* 27: 101-112

⁸ Mortimer 1991, *op cit*.

can be seen in a plot of the Castledyke data (Fig 1).

The balance of alloy types used within the group is more surprising. Four brasses (including the non-cruciform brooch from G128) is much higher than would be predicted if a random sample were taken from the overall cruciform brooch dataset. When the chemical composition of 323 cruciform brooches were split into alloy-type groups, bronzes were the predominant alloy type (c. 50%) and only 9% were brasses.⁹

This balance of alloy use can be investigated in several ways. The results of analyses of cruciform brooches from Humberside, including the new Castledyke data, can be compared with those of brooches from Lincolnshire, Yorkshire and East Anglia (*ie* Cambridgeshire, Norfolk, Suffolk and Essex). From this, it is clear that brasses are more common in Humberside and Yorkshire than in the central distribution area for cruciform brooches (Table 3; Fig 2). Data¹⁰ from brooches found at two nearby Anglian and mainly sixth-century cemeteries can be considered; the alloy prevalences at Fonaby, Lincolnshire¹¹ are similar to those at Castledyke, but brasses were not used for any of the brooches found at Cleatham, South Humberside¹² (Fig 3). Two mixed alloy brooches were discovered at Cleatham. This patterning is interesting since Fonaby and Castledyke are about 20km apart; Cleatham on the other hand is less than 5km from Castledyke. All the brooches (except G135 and G156, Castledyke (see below)) are roughly contemporary (sixth-century). Hence regional characterisation of alloy use cannot be clearly identified, when data is considered at a site by site level; larger datasets have to be examined.

Some of the regional patterning may be a reflection of chronological biases in the artefacts available for analysis in each of the regions. Although early brooches do occur in the northerly distribution areas, they are less common here than further south and few of them have so far been analysed; most of the analytical information for the northern distribution comes from brooches thought to have been made later in the sequence. Clearly, the chronological attributes of the brooches should be considered.

The cruciform brooch has been given considerable prominence in attempts to date archaeological material from this period and several typologies have been constructed for the form.¹³ The Castledyke brooches can be placed in a typological framework¹⁴ and their chemical dataset can then be compared with that from brooches with similar formal characteristics.

Most of the Castledyke brooches can be placed in the middle in the typological sequence of cruciform brooches, being relatively large, with broad headplates and some elaboration at the foot (animal head) but without significant zoomorphic decoration. Only two brooches (G135 and G156) have any early stylistic characteristics. The brooch from G135 is simpler than the majority of the brooches at the site, with less expansion at the headplate, a solid bow cross-

⁹ Mortimer 1990 *op cit*, 347-353.

¹⁰ Mortimer 1990, *op cit*, Appendix 4.2.

¹¹ Cook A 1981 *The Anglo-Saxon Cemetery at Fonaby, Lincolnshire*, Occasional papers in Lincolnshire History and Archaeology, 6

¹² Excavation by K Leahy, report in preparation.

¹³ Shetelig H 1906 *The Cruciform Brooches of Norway* (Bergen); Åberg N 1926 *The Anglo-Saxons in England during the early centuries after the invasion* (Uppsala); Reichstein *op cit*; Mortimer 1990 *op cit*.

¹⁴ The author's typology is used here (Mortimer 1990 *op cit*, Chapter 2).

section, a relatively long catch and separately-cast, circular cross-section sideknobs. These are all characteristics of early brooches, although the large size indicates that the brooch form should be placed no earlier than the mid- to late-fifth century.¹⁵ The tiny foot fragment from G156 may also have early connotations, in view of comparable brooches abroad,¹⁶ but only a small proportion remains for examination and it is difficult to be sure.

The compositions for both the brooches with early characteristics are unusual within the site dataset, being nearer to 'mixed-alloy compositions' as noted above. In contrast, the later brooches are either bronzes or brasses. If we accept that the early stylistic characteristics suggest an early date, the data from Castledyke do not conform to the pattern generally observed within the cruciform brooch dataset. In general, mixed-alloy compositions are more prevalent amongst the later brooches, and purer alloys are more prevalent amongst the earlier brooches. The two mixed-alloy brooches at Cleatham were sixth-century forms, roughly contemporary with the bulk of the Castledyke brooches.

From this research, it seems that a distinctive system of metal supply/use may have been operating at Castledyke (possibly in Humberside as a whole), during the early Anglo-Saxon period, when compared with other cruciform-brooch making regions. This would not be unexpected, since there may be differentials in the date of arrival of Anglo-Saxon individuals or influences in each of the regions and in the accessibility to metal resources. Alternatively, since some of the early features noted in G135 were retained for occasional use during later production,¹⁷ the apparently-early Castledyke brooches may be contemporary with the main grouping at the site. However, the existence of several such features on one brooch does seem strong cause to give an early date; further research is required into regionality in the rate of adoption of particular features.

The results of chemical analysis on this relatively small group of artefacts have stimulated discussion on a number of fronts; by feeding the chemical information back into the archaeological consideration, further topics for research were distinguished.

¹⁵ The burial may be considerably later than the date of brooch manufacture itself, since the brooch was heavily worn at the time of burial. Wear is evident in two classic (for cruciforms) positions - the lower right-hand side edge of the headplate and at the foot. Many early cruciform brooches appear to be more heavily-worn at the time of burial than later brooches.

¹⁶ Eg Unpublished examples from Ribe, Gudme and Lindholm Høje (Nord) in Denmark (National Museum, Copenhagen).

¹⁷ Mortimer 1990, *op cit*, Chapter 3.

Table 1: Brooch compositions

Brooch	Weight percentage					
	Cu	Zn	Sn	Pb	Fe	Total
G29	83.9	0.5	9.9	2.6	0.3	97.2
G43	82.9	9.6	2.2	2.2	0.2	97.1
G74	78.6	0.6	15.0	1.6	0.1	95.3
G115	83.2	0.9	10.2	2.8	0.1	97.2
G128 (small-long brooch)	76.9	14.9	2.6	1.9	0.2	97.9
G135 (brooch)	88.2	2.1	9.5	1.0	0.3	101.1
G135 (sideknob)	89.1	3.1	7.0	1.6	0.8	101.5
G137	77.4	14.7	3.3	2.3	0.3	98.0
G156	85.2	7.6	3.4	0.9	0.2	97.3
G163	84.0	10.6	4.0	1.1	0.1	99.8

Table 2: Weight percentages for copper alloy standards, comparing given concentrations and calculated concentrations

Elements	Stds:	C71*08		BCS207		C30*08		AC23	
	Given	SEM	Given	SEM	Given	SEM	Given	SEM	
Fe	0.1	0.1	0.1	0.1	-	nd	-	nd	
Ni	1.0	na	0.1	na	-	na	-	na	
Cu	84.5	82.1	86.8	84.7	85	83.8	70	66.6	
Zn	4.5	4.7	2.5	2.4	15	15.7	30	30.4	
As	-	na	0.1	na	-	na	-	na	
Pb	5.0	5.9	0.4	0.3	-	tr	-	nd	
Sn	5.0	5.3	9.8	10.2	-	tr	-	0.3	
Totals	100	98.1	99.8	97.7	100	99.5	100	97	

na = not analysed, nd = not detected, tr = trace detected

Table 3: Percentage frequency of alloy types, by region.

Region	n	Bronze	Zinc bronze	Gunmetal	Brass	Copper
East Anglia	203	119 (59%)	29 (14%)	16 (8%)	32 (16%)	7 (3%)
Lincs	62	41 (66%)	8 (13%)	6 (10%)	7 (11%)	0 (0%)
Yorks	10	5 (50%)	2 (20%)	0 (0%)	3 (30%)	0 (0%)
Humbs	21*	6 (29%)	5 (24%)	2 (9%)	7 (33%)	1 (5%)

* Including the new Castledyke data.

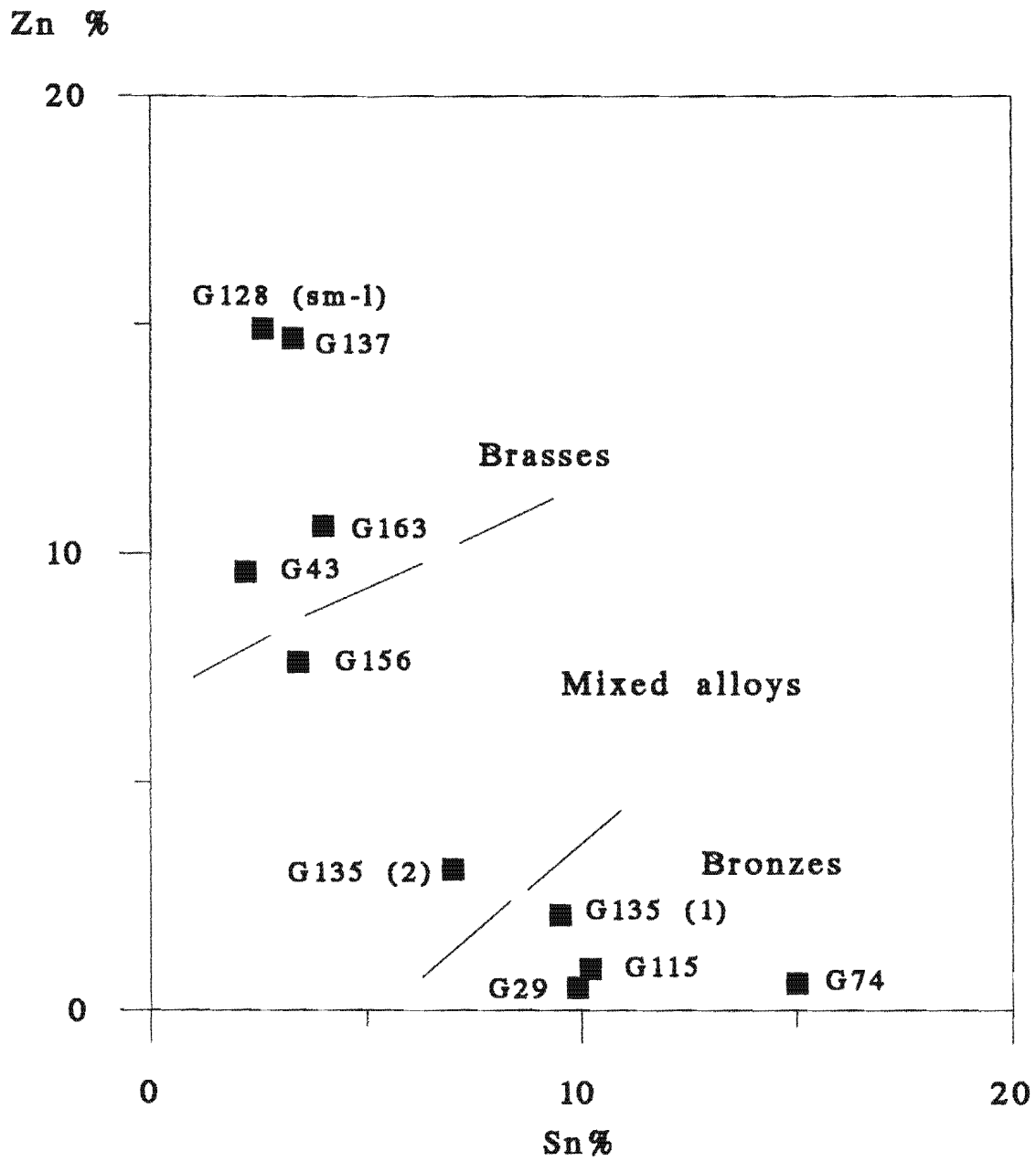


Figure 1: Castledyke copper alloys

Percentage frequency

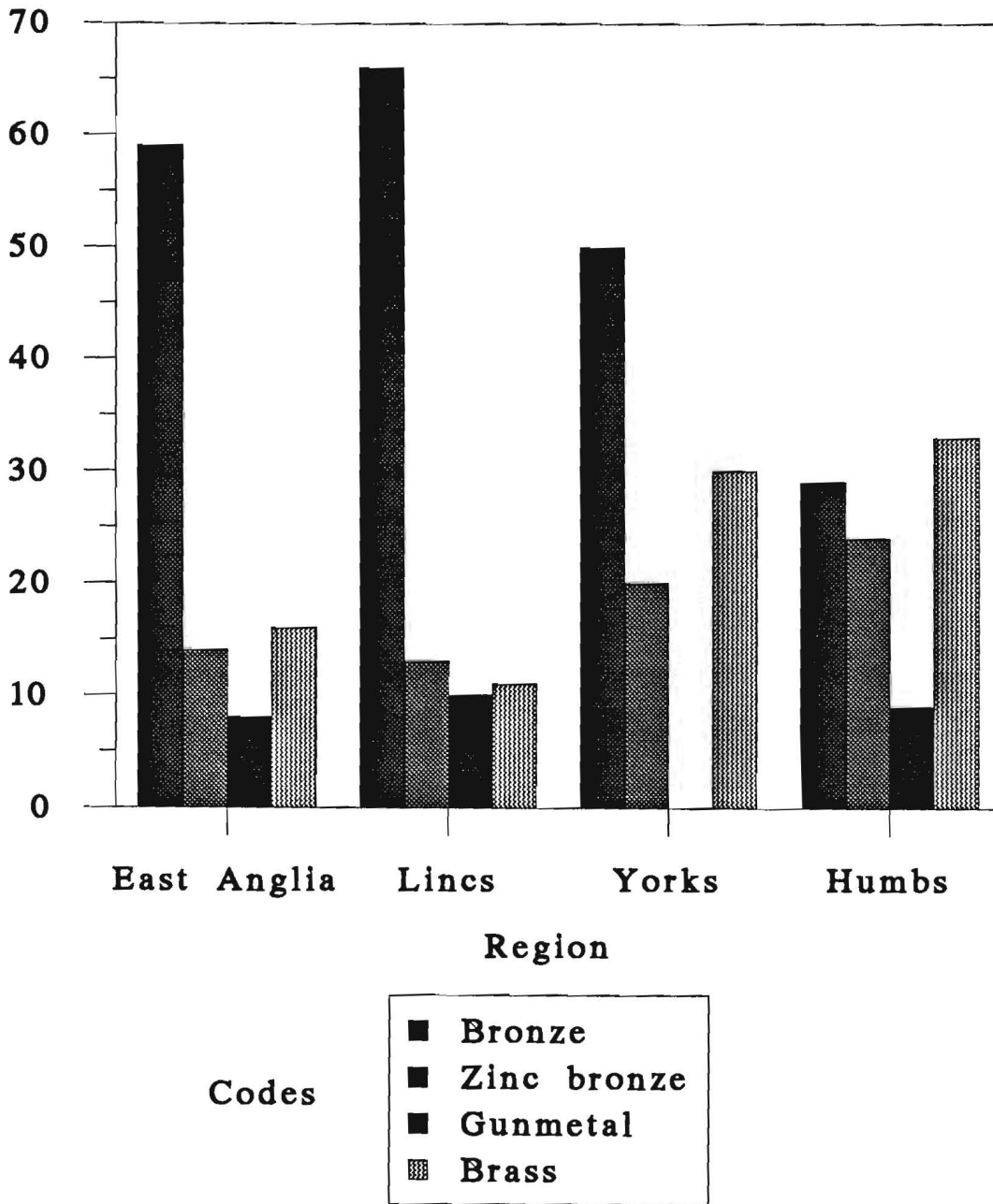


Figure 2: Percentage frequency of copper-alloy types used in brooches, by region

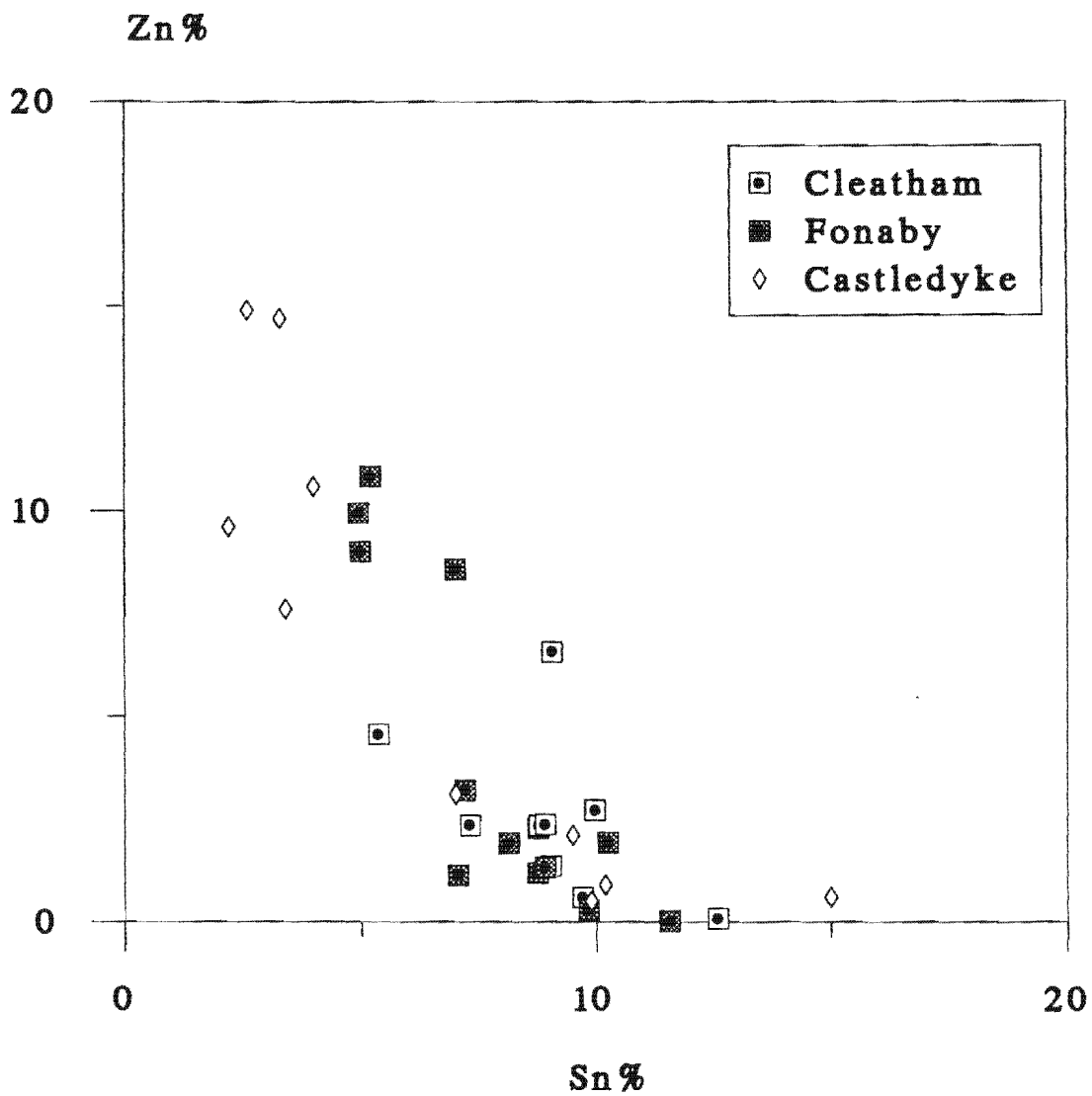


Figure 3: Compositions of brooches from Castledyke, Fonaby and Cleatham