# MICRO COMPUTER ANALYSIS OF ROMANO-BRITISH COIN LOSS

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ABSTRACT

Despite being eminently suited to a quantitative approach, the analysis of coin finds from Romano-British sites has, with a few notable exceptions, failed to progress far beyond the visual comparison of histograms. As a result, the socio-economic explanation of the patterning within this data set has yet to do justice to the sound empirical framework provided by our numismatic colleagues. This paper describes a suite of micro computer programs which facilitate the collection and manipulation of coin loss data, and reports some initial results of a research project which aims to examine such patterning.

## 1. INTRODUCTION

The identification of roman coinage from the time of the emperor Augustus (i.e. from 27 B.C.) is conventionally made by reference to the major catalogue Roman Imperial Coinage (RIC) [Mattingley & Sydenham (eds), 1923...]. For coins issued prior to the reforms of Diocletian in 294 A.D., this catalogue classifies coins by the individual emperor or other authority responsible for their minting. Subsequently, this system becomes inappropriate as the same type of coin is frequently minted on behalf of each of the co-reigning rulers of the eastern and western empires. To avoid unnecessary duplication these coins are classified by the mints at which they were struck.

A further complication is introduced by the fact that this catalogue has yet to be completed; vol.8, the most recently published volume, appeared as recently as September 1981 and vol.10 has yet to appear. Thus the great majority of published coin lists have necessarily been produced with the supplementary aid of other catalogues. Before the publication of Late Roman Bronze Coinage [Carson, Hill & Kent, 1965], much use was made of outdated and inadequate catalogues.

The consistent use of catalogue references lends itself well to an encoded system of data storage and manipulation by computer, and avoids the need to record such details as the obverse and reverse inscriptions as this information is contained in the catalogues. However, the coding system used must be able to accomodate the full range of possible catalogues and their differing reference systems. The ultimate aim here is to include a facility for automatic cross-referencing between catalogues and translation of any coin reference to its RIC equivalent.

The task of designing such a coding system was made easier by earlier work in this direction by Dr. Richard Reece. The system which he devised has been modified to allow some extra

information to be included, notably in the form of free-text comment where this is required, and the rationalisation of the coding of reference volumes and catalogue numbers. A simple computer program written in the PASCAL language has been prepared to allow translation of any coinlist recorded under the earlier system to the new format.

In order to minimise some of the problems referred to above, sites excavated during the last twenty to thirty years are used whenever possible. Many of the coin lists published in earlier years require extensive reworking and are used only where there is a shortage of more recent material. Coin lists are selected by systematically searching both local and national archaeological journals, choosing all sites with a total of more than twenty coins. This may appear to be a rather small minimum number, but their inclusion is necessary in order that estimates of minimum required sample sizes may be made.
This systematic approach to data collection is compatible with the twin objectives of investigating inter-site and inter-regional variability in coin loss, in that localised inter-site variability may be investigated whilst data is being gathered from adjacent regions.
The initial survey area has been selected to be a square of 40,000 sq.Km. defined by the National Grid coordinates SY250750 and TL250750. It is intended to collect coin lists from all sites in this area which fit the above criteria. The present paper deals with results obtained from a sample of 35 sites within this area, with a strong geographical bias towards Somerset, Avon and Gloucestershire.

## 2. MICRO COMPUTER PROGRAMS

A package of micro computer programs intended to be of general use in the preparation of coin lists for analysis and publication has been written, and is used to produce basic summary statistics for each coin list and to prepare data for subsequent, more detailed analysis. In its current form there are three main programs: COINSORT, COINTYPE and COINHIST.

Progam COINSORT.
This is the main data input program. Data reprresenting the details of each coin found on a site is input from either a disc file or interactively via the computer console. Whilst the facility for interactive entry is provided, in this application data is normally entered on coding sheets for card punching by data preparation staff. These cards are then fed into the ICL 2960 mainframe computer, the data being transferred to the RML 380Z micro computer as required.
COINSORT produces an output file of coin data sorted by reference catalogue for use by other programs, and printed output may be obtained sorted by ruler, mint, denomination or any other field as required.

Program COINTYPE
This program uses the sorted coin list produced by COINSORT to update a master file of coin types and the quantity of each per site. A list of cointypes which have not previously ocurred is produced, and the user is requested to input information on the date of minting, obverse and reverse inscriptions etc. In this way, a catalogue of observed coin types is built up which allows other programs to select coins by year of minting, reverse type etc. In addition, a further file containing details of the sites from which coin lists are taken is updated.

Program COINHIST
Whilst the above two programs are used once only in processing a coin list, and indeed warn the user should he attempt to process the same list twice, COINHIST may be used many times. Its purpose is to produce summary statistics of the number of coins of each status (i.e. regular,copy,illegible etc.) and to display or print histograms and other graphical output. Histograms of coin loss per year of issue can be produced for each status and for any of the major producing mints.
At its simplest level, the program simply assigns coins lost to their year of issue, but a facility whereby the user may specify the algorithm used to assign coins to any given year is under development. In this way, models of coin loss which include such variables as velocity of circulation and lifetime of issues as legal tender may be tested.
In addition to this graphical output, COINHIST will, if required, produce output files of annual coin 'loss' data which may form the basis of more detailed analysis on either mainframe or micro computer.

## 3. ANALYSIS

The overall pattern of coin loss in the north western provinces has been described by Dr Reece [1974,1979]. For reasons that have yet to be satisfactorily explained, Britain shows a considerable increase in coin loss in the later third and fourth centuries, a pattern which is apparently quite different from that in nearby provinces. Thus there is a great difference in the size of available samples before and after 260 A.D. For this reason, and the changes in coinage brought about by Diocletian's reforms, it has been decided that initial analytical work will be confined to coins issued between the years 294 and 402 A.D. In this way, reasonable sample sizes may be obtained from most sites and analytical techniques tried on these larger samples before attempting to apply them to the data of the earlier period.
Two general lines of enquiry have been pursued; firstly, it has been necessary to determine the general pattern of coin loss on British sites in order to provide a background against which to set the second stage, the analysis of inter-site variation.

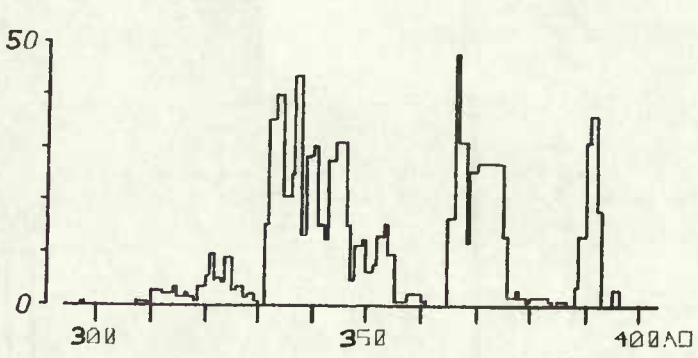


FIG. 1 MEAN COIN LOSS PER YEAR /1000

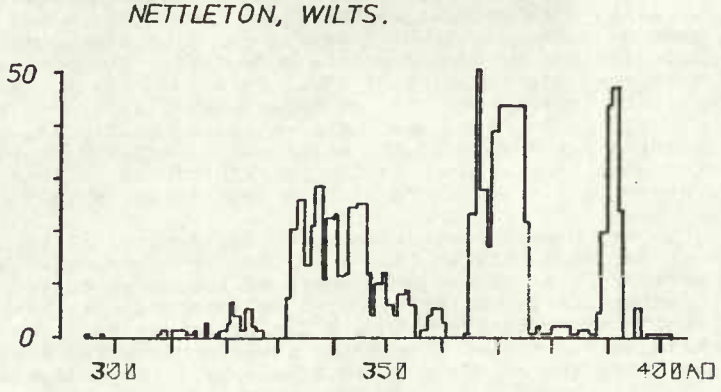


FIG. 2 COIN LOSS PER YEAR /1000

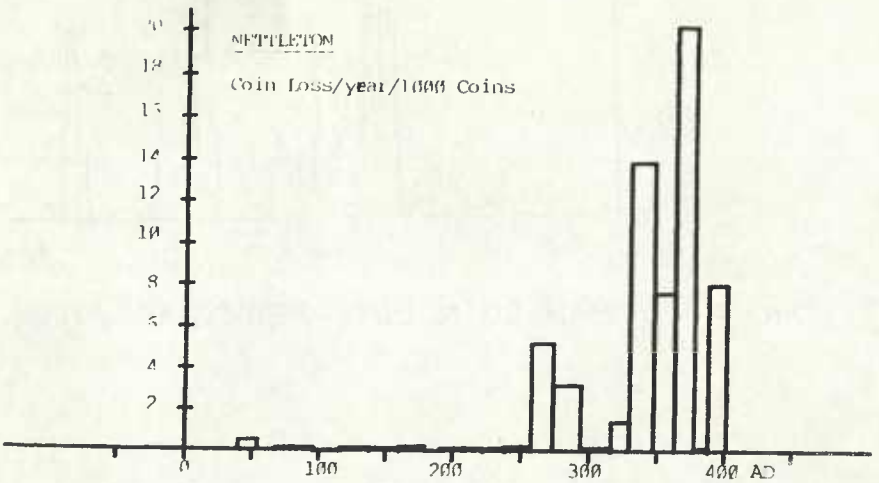


FIG. 3 A CONVENTIONAL COIN LOSS HISTOGRAM

To establish the overall pattern of coin loss throughout the period of interest the mean number of coins lost on the sampled sites and its standard deviation for each year of the period is calculated (Fig. 1). These values are then normalised so as to express units of coins per year per 1000 coins. The factor of 1000 ensures that resultant values may be displayed using axes labelled with integer rather than fractional values and helps to reduce the risks of errors in floating point arithmetic calculations performed on the computer. The same units are used for the display of individual site coin lists, thus allowing direct comparisons to be made between any one site and the overall mean (Fig. 2). Whilst it is anticipated that the mean figures may change as the sample of sites grows, thus reflecting regional variations in the pattern of coin loss, comparisons between sites using the current mean values should remain valid.

It has become conventional for archaeological numismatists to divide coins between 'issue periods' on numismatic grounds. These periods are of unequal length of the order of 10 to 20 years. Greater precision, as employed in this project, has only become a realistic objective with the use of computers. However, it has been questioned whether using these numismatic divisions, based as they are on the political and stylistic criteria which affect

the design of the coins, might mask details of economic and social importance. In short, is there any archaeological justification for grouping coins in this way, and if not, should they be grouped in any other way?

Visual comparison of Figs. 1 & 2 with a conventional coin loss histogram, Fig. 3, clearly shows many details of the coin loss pattern which are obscured by such grouping. The near absence of coins minted between 356 and 364, a feature well known to numismatists but rarely appreciated by archaeologists, is completely masked in the grouped histogram. The dangers of a simplistic use of coin finds as dating evidence or of linking coin loss with historically documented events, whilst frequently stated, can perhaps only be more widely understood if such detailed histograms are presented.

In order to determine whether different groupings of coin issues would provide better descriptions of the coin loss pattern and its variation between sites, it is necessary to go beyond the purely visual comparison of histograms.

The numbers of coins lost in each of the 109 years in the period of interest can be viewed as measures on 109 separate variables contributing to the overall pattern. As we cannot expect such variables to be independant, a principal components analysis was used to help to decide which years may be grouped together for our purposes. How closely do these orthogonal components mirror the numismatic periods?

The analysis was applied to the variance-covariance or dispersion matrix of normalised coin loss data from a sample of 35 sites. Fig. 4 shows the principal component loadings for each year on the first five components, which account for 70% of the observed variance. The conventional issue periods have been superimposed on the diagram.

The first component, which accounts for 19.8% of the variance, divides the fourth century into two parts, before and after 355. This, as will be seen, appears to be a useful variable in discriminating between site types. The positive values correspond chronologically with the issues of the House of Constantine.

As is clearly shown by the coin loss histograms, the loss of coins minted in periods 12 and 13a (294 - 330) tends to be sporadic in nature and small in quantity. This is reflected in the component loadings, which show few general trends in this phase. The peaks on the curve would seem to correspond with individual coin issues. Presence of these coins does indeed contribute towards a positive score on the first component, but only in the sense mentioned above. Of those illustrated, it is only component 5 which appears to discriminate between these two periods. This suggests that over 60% of the variance may be explained without needing to split this phase into two periods. Period 13b (330 - 348) is quite different. Here, there is a clear division into three 'sub-periods', each of which is treated differently by the five components shown. This would imply that there are three distinct issues whose loss patterns vary between sites. This corresponds with known changes in the coin types.

The remaining periods all show similar evidence of discrimination between shorter time intervals.

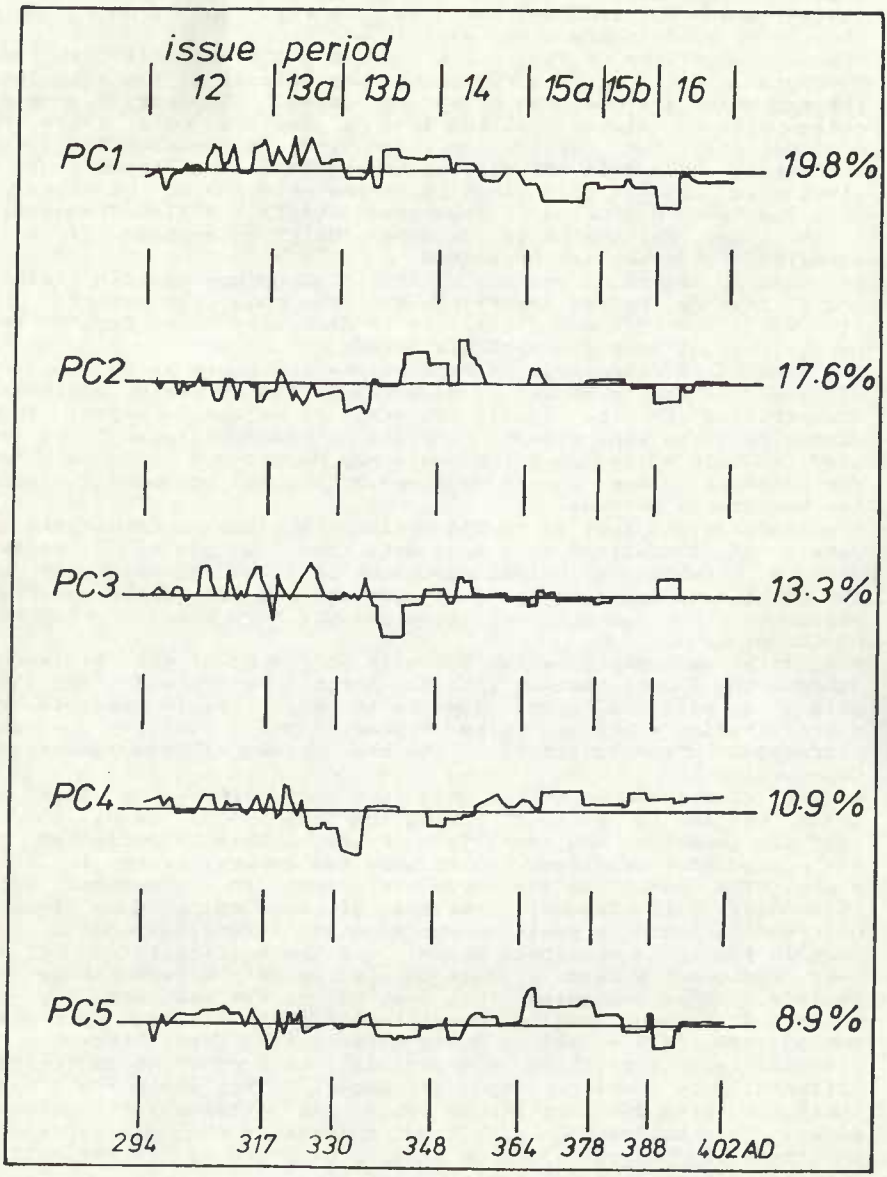


FIG. 4 PRINCIPAL COMPONENT LOADINGS

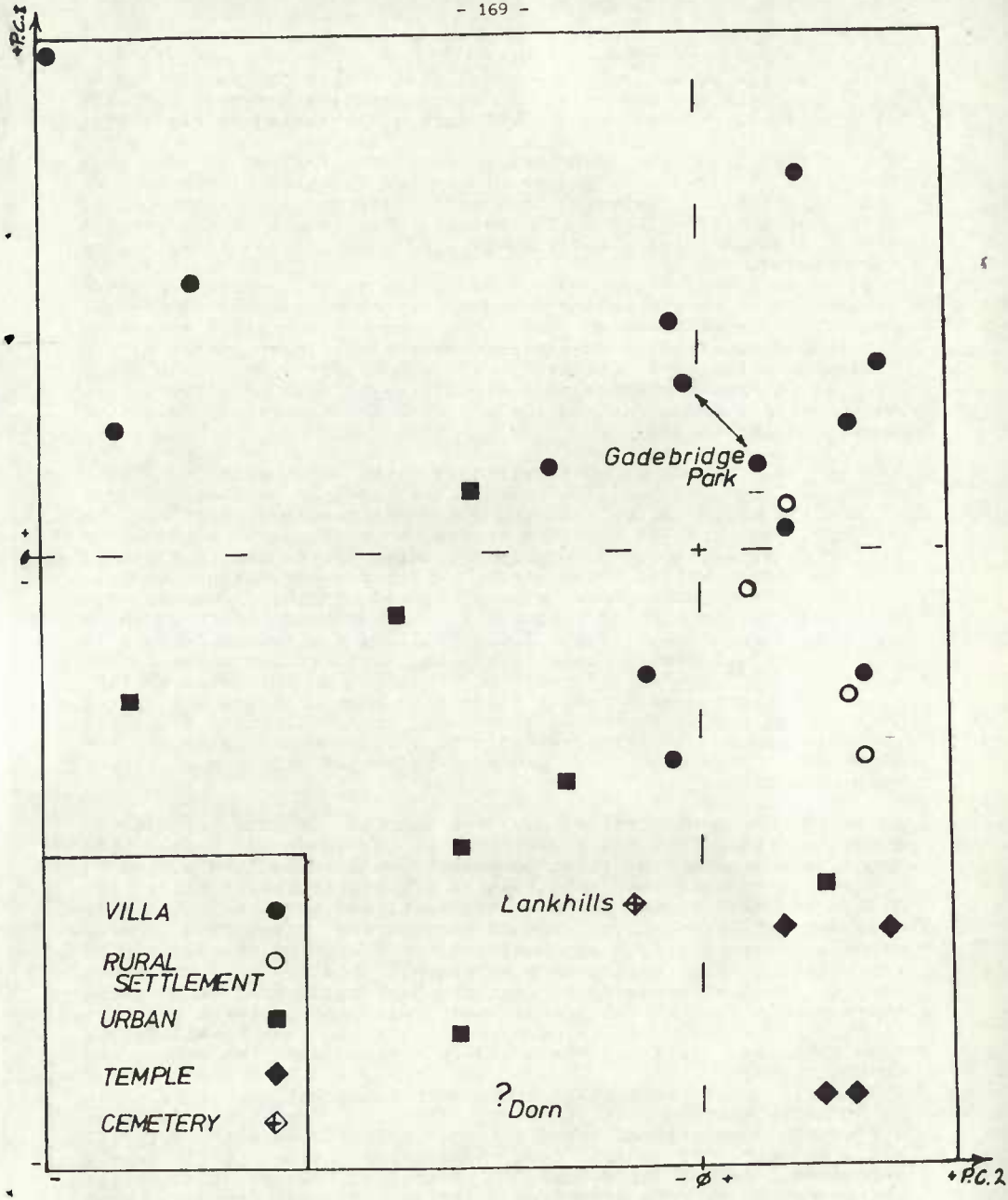


FIG. 5 Scattergram of score on first Principal Component v score on second.

This analysis would seem to suggest that whilst our current issue periods certainly are of use in discriminating between patterns of coin loss, many sources of variation are masked by their use.

Having identified the principal sources of variation in coin loss from the 35 sites, we may return to the question of whether we can discriminate between sites with different functions or of different social and economic status. This aspect of the project is at a comparatively early stage, but the initial results are encouraging.
Fig. 5 is a scattergram of scores on the first component plotted against those on the second. Together, these components account for 37.5% of the observed variation. Most of the sites appear to lie in one poorly defined cluster towards the lower centre of the diagram, with some outliers in the upper part. This main group lies in an area representing low positive to high negative scores on the first component and low positive to moderately negative scores on the second.

It is only when we consider these sites in terms of their presumed socio-economic functions that that the picture becomes clearer. Urban sites are found towards the lower left of the diagram, an area of negative scores on both components. The larger rural settlements appear to cluster in the centre right of the diagram, whilst those sites, which for convenience we call 'villas', are much more widely spread. Both, however, are confined to the area of positive first component scores, which suggests that coinage of the latter half of the fourth century is found only in small quantities on such rural sites. The explanation of the wide dispersion of villas on this diagram is, as yet, unclear; small sample sizes from some of these may be the main cause, but given the wide range of apparent status displayed by this group, it is suggested that socio-economic factors are involved. This hypothesis can only be tested with a much larger sample of sites.

A third group of rural sites, the temples, form a distinctly separate group in the lower right of the diagram where high negative scores on the first component and intermediate scores on the second suggest that coin loss is greatly increased after 355 A.D., in direct contrast with the settlements. The Lankhills cemetery at Winchester appears between the urban and temple groups, suggesting that we should see this area of the diagram as representing a ritual/ceremonial group. Again, an increase in sample size is necessary to test the hypothesis that such sites share common factors which make their coin loss patterns distinct from other sites. It is perhaps significant that Lankhills, a town cemetery, falls in the boundary area between the urban and temple groups.
The inclusion of Lankhills raises methodological questions as it is normally assumed that it is not valid to compare coin lists of differing depositional natures (e.g. site losses with hoards), the majority of coins from cemeteries being deliberately deposited, not casually lost. It appears, however, that whilst there may be factors affecting selection of coin types, those

determining the manner in which the Lankhills coins were selected from the background of coins in circulation were very similar to those which determined the selection of coins lost on temple and some urban sites. That is to say that they are comparable samples of currently circulating coinage.
Support for this view comes from a completely different type of site, the villa at Gadebridge Park near Hemel Hempstead, Herts. Two separate coin lists in the sample come from this site; the first being of those coins found on the main villa site, the second representing a coherent group from the area of the bath or pool adjacent to the villa [Curnow, 1974]. This latter was considered by the excavator and his consultant numismatist to be the contents of a dispersed votive deposit. Both of these lists produce closely similar scores on many of the 33 principal components.

One further site requires specific comment. Dorn, a rectangular enclosure alongside the Foss Way in Gloucestershire, is generally considered to have been a posting station or wayside hostelry, either for the use of the imperial post, or for other travellers. The number of coins recovered from the limited excavations is small, and this alone may be sufficient to account for its seemingly anomalous principal component scores, which place it on the boundary between my suggested urban and temple groups. The nearby settlement at Bourton on the Water appears, as one might expect, in the urban/rural settlement overlap area, so how might we explain the pattern at Dorn?
Without further excavation, or, at least, more coins we may only speculate: was this the site of a roadside temple or shrine?

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