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Vessel volume as a factor in ceramic quantification: the case of African Red Slip Ware

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3.1 Introduction

This paper suggests that by consistently overlooking the rôle of vessel size as a factor in assemblage formation, archaeologists may sometimes have misinterpreted patterns in the ceramic record. Using the example of African Red Slip Ware, it is shown that a pattern, which up until now has been interpreted as an economic decline in the middle of the production, may in fact be merely the result of a move to communal eating. It is concluded that although research on techniques of quantification is certainly desirable, it is to the actual manner of use of ceramics where more attention should be directed.

3.2 Ceramic quantification

The quantification of archaeological ceramics is a well established part of the discipline, certainly in Britain, and increasingly elsewhere in Europe. Most archaeologists are at least aware of the distinctions between sherd and weight counts, and many are also familiar with Estimated Vessel Equivalents (EVEs). The reasons for counting pots are equally familiar: as everybody knows, pots are counted to provide information on trade, demography, site status and so on. However, there may be a potential problem in the making here; at the same time that there is complacency with regard to the reasons for quantification, and general acceptance that it is probably a good thing on the whole, there is also a move towards ever more sophisticated methods for actually doing the counting. Orton *et al.* (1993) provide an overview in layman's terms of some of the more exotic methods. The consensus seems to be that the way to get the pots to yield more information, or more accurate information, is to apply more complex techniques to them. Yet by doing this we are in danger of taking it for granted that we already understand the causes of variation in ceramics. It is assumed that the more accurate information provided by the different counting methods can be readily interpreted in terms of trade, demography, or whatever the particular study is interested in. It is the aim of this paper to demonstrate that this complacency is misguided, and that far from already understanding the nature of the ceramic record and its relationship with quantification, we may in some cases be wildly off the mark. Specifically, it is argued that the role of vessel volume, or vessel capacity, has been ignored and that it may be much more important for understanding the results of ceramic quantification than is generally recognised.

3.3 African Red Slip Ware and economics

African Red Slip ware (ARS) is a particularly common later Roman fineware, current from the late first century AD to approximately the seventh. It was made in the area of modern Tunisia and was exported all over the Mediterranean. It is orangey-red in colour and the form series consists mainly of bowls, plates and dishes. The standard work of reference remains Hayes' *Late Roman Pottery* (Hayes 1972, 1980), although this is partially supplemented by the *Atlante* (Carandini 1981). The British excavations at Carthage have yielded important, if controversial dating evidence for the later wares (Fulford & Peacock 1984).

The importance of ARS to Roman archaeology lies in its abundance and the relative ease with which it can be dated. This has been of invaluable use to field survey in the west Mediterranean in particular, as it has allowed field-walkers to reconstruct settlement patterns. In recent years, however, quantification of ARS from sites all around the western Mediterranean has suggested that similarities in the relative quantities found may be related more to economic patterns within Africa than to local economics (Cambi & Fentress 1989; Fentress & Perkins 1988). One of the original conclusions of the South Etruria Survey (Potter 1979), that there was a decline in settlement in central Italy in the third century, can not be taken too seriously now as it has been shown that the same pattern occurs elsewhere at the same time (Millett 1991). Moreover, as Fentress & Perkins (1988) have shown, these fluctuations in quantity are paralleled by changes in the rate of urban construction in Africa. Figures 3.1 and 3.2 show the quantities of ARS through time on consumer sites in the west Mediterranean and building inscriptions from Africa. The correlation seems clear, as this pattern in the inscriptions is only an African phenomenon (Duncan-Jones 1990). Interestingly, a similar pattern is also seen in the funerary inscriptions of Africa (Fig. 3.1; Meyer 1990). Again, this is only an African phenomenon. The evidence therefore would seem to point to an economic crisis in Africa.

This conclusion, that there was an economic crisis is the most obvious one, given the preoccupations of Roman ceramicists in particular, and ceramic quantification in general. It will be argued here, however, that in fact it is not economics which is the culprit but eating habits, represented by changing vessel capacity.

3.4 Data manipulation

The methodology used to create the graphs in this paper is the same as that used by Fentress & Perkins (1988, ftn. 12). This involves the analysis of field survey data: as survey data is less affected by stratigraphy than excavation data, its use avoids the problem with excavations whereby, for example, fifth century pottery could be over represented simply because more fifth century earth has been excavated. The dating of the recovered ceramics therefore comes from the stylistic features of the pots themselves.

All data used here began as rim sherd counts, as it is rare to find much more in the average Mediterranean survey report. However, an attempt has been made to convert these figures into crude vessel equivalents by calibrating the sherd counts by the average breakage rate for each form (Fig. 3.3). This breakage rate has been calculated from over 500 sherds from Carthage and Lepcis Magna (data from the latter site kindly lent by M. Attree). This vessel data has been used for the final analysis presented here; otherwise sherd data has been used. Once the sherds are identified and dated, the number of sherds of each form are divided by the duration of that form in years. Thus if a form lasts 50 years and has 100 sherds, there will be two sherds per year. This is done for all forms, and totals are summed. This was done using a spreadsheet divided into five year periods.

This is very crude, but as Cambi & Fentress (1989, p. 76) have noted, the data is simply not sophisticated enough for more complicated analysis. The suggestion that it may be more realistic to use a weighted distribution to divide up the sherds per form per year (Fentress & Perkins 1988, ftn. 12) is impractical given the crudeness of the dating: many forms are still only dated to half or quarter centuries, which, combined with a centrally biased distribution, for example, would have the effect of producing regular lumps and troughs on the graphs, centred on quarter and half century points. It is sufficient to use the methodology as it stands, as here we are only interested in very broad, general patterns.

3.4.1 Explaining the patterns

The results of counting sherds in this way are shown in Figure 3.1. This is the mean of seven survey sites. The point of particular interest is the period from the late second through to the early fourth century. At this time there is a very definite peak, drop and then recovery in the frequency of sherds. This occurs at almost all sites in the west Mediterranean which were receiving ARS. As noted, this pattern has been interpreted as resulting from an economic crisis. Here it is argued that it makes more sense if seen as the result of a change in the size of the vessels.

3.5 Vessel capacity

Vessel capacity is a particularly under-studied aspect of archaeological ceramics. It has been looked at from several predictable angles, such as a means of classifying vessels (Rice 1987, pp. 219–25) and as a factor in vessel standardisation (Röttlander 1966, 1967). Peacock & Williams (1986), looking at Roman amphorae have considered it as a factor related to vessel efficiency in terms of the ratio of vessel capacity to weight. Yet it seems that it has never been connected to changes in vessel frequency in studies such as that of Fentress & Perkins (1988). This is perhaps strange given that the connection seems obvious: if pots become very large, it is only to be expected that fewer will be needed. This point is returned to below when a critique of the current philosophy behind quantification will be presented, but for now it is sufficient to consider the more prosaic aspects of capacity.

The vessel capacities used in this study were calculated using the AutoCAD Advanced Modelling Extension. This makes the task of capacity calculation considerably easier than would be the case if the paper and pencil methods suggested by Rice (1987) were used; indeed, the lack of appropriate software immediately to hand for most archaeologists must be a very significant factor prohibiting its more general study. The capacity was calculated for each form in the series, over 100 in all.

3.5.1 Vessel capacity and ARS sherd counts

The change in mean vessel capacity for the ARS form series is shown in Figure 3.4. A comparison with the sherd count, Figure 3.1, is interesting. It can clearly be seen that the drop in sherds in the third century is almost exactly matched by a rise in average vessel capacity. The reason for this dramatic change in capacity is that in the third century the dominant form becomes the very large, flat based dish (Fig. 3.6), whereas in the second century the most common form was the small bowl (Fig. 3.5). The change is very dramatic indeed: the second century forms averaged

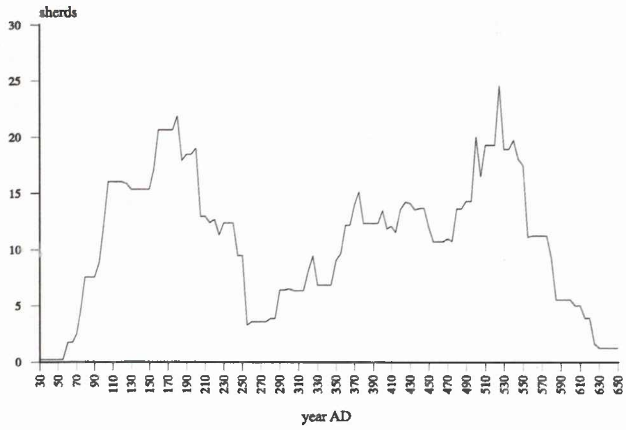

Figure 3.1: Sherd count.

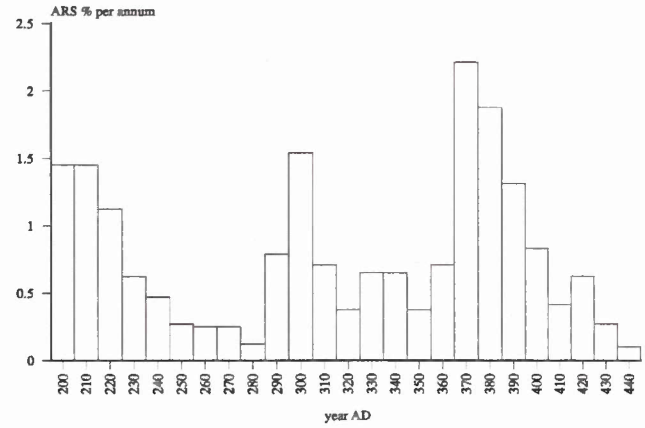

Figure 3.2: Building inscriptions in Roman Africa, by year. After Fentress & Perkins (1988, Fig. 4).

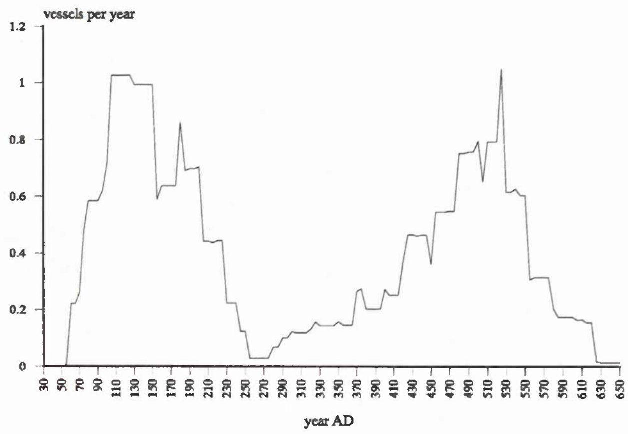

Figure 3.3: Vessels per year.

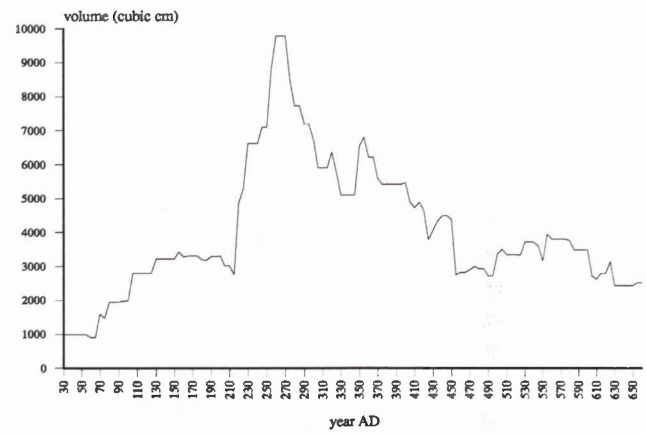

Figure 3.4: Mean vessel volume.

around 20cm in diameter with an average capacity of *c.* 3 litres, those of the third were frequently up to half a metre in diameter, with an average capacity of around 10 litres. These parameters are remarkably rigid: of around two dozen second century forms, only one approaches the third century sizes, and of the ten or so late third century forms only two have variants which are sometimes found in second century sizes. The pattern in the fourth to seventh centuries is less clear-cut, as there is a mixture of forms and sizes, but the peak of sherds in the earlier sixth century does correspond to a time of increased use of smaller bowls, even though this is not apparent from Figure 3.4. This is the subject of work in progress.

The most obvious question to ask next is: what sort of statistical interplay exists between sherd counts, vessel breakage rates and vessel capacity? Data is still being collected on vessel breakage rates in order to answer this question with complete confidence, but at present the analysis of over 500 rim sherds indicates that breakage rates are, for the first three centuries AD at least, less significant in explaining variation in sherd frequencies than vessel capacity.

If we consider the whole period first, the following partial correlations may be observed:

	capacity	sherds	break
capacity	1.000	−0.648	0.331
sherds	−0.648	1.000	0.087
break	0.331	0.087	1.000

Substantially more variation in the sherd frequency is explained by capacity than by the breakage rate. In fact, the breakage rate does not seem to play much part at all. This is borne out by Figure 3.7, which shows that the average breakage rate fluctuates little over time. In contrast, capacity has a strong negative correlation, as we would expect from Figures 3.1 and 3.4. Further support for the notion that breakage rate is of little significance comes from the total vessel calculation (*i.e.*, sherds calibrated by breakage rate) shown in Figure 3.3. Comparison with Figure 3.1 shows that there is little difference, with the exception that the later period has less pottery than the earlier. Of considerable interest, however, is the fact that the large gap of the third century remains unchanged by the transformation of sherds into vessels.

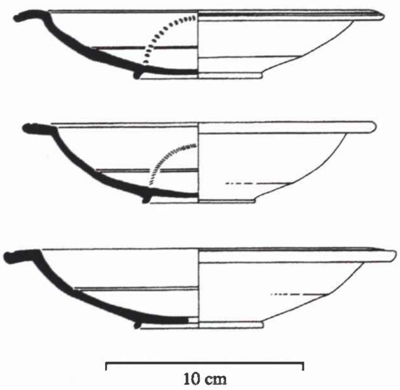

Figure 3.5: Second century bowls. After Hayes (1972, Fig. 3).

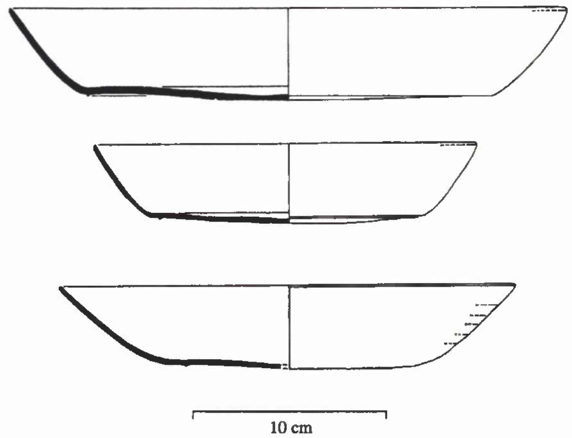

Figure 3.6: Third century dishes. After Hayes (1972, Fig. 12).

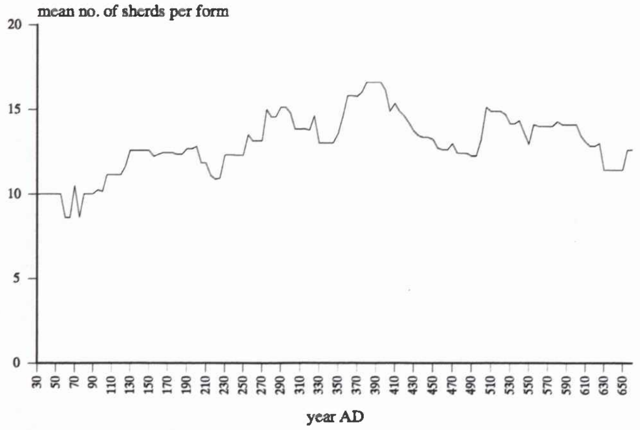

Figure 3.7: Mean breakage rate.

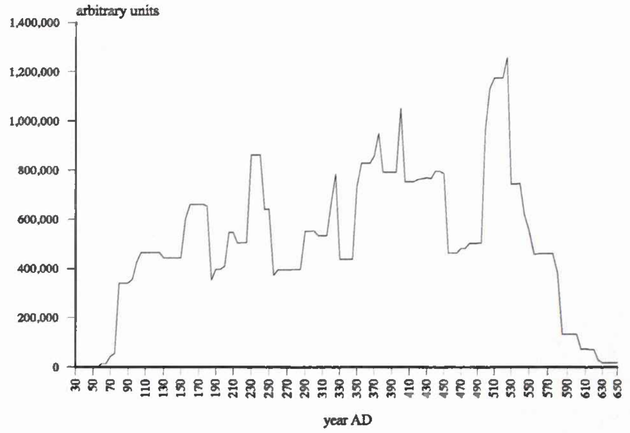

Figure 3.8: Overall volume.

Treating the whole period in this manner masks some more detailed patterns, however. If the series is divided into two halves, with the dividing point being AD 350, then it can be seen that the earlier period is much more strongly influenced by capacity than the later period.

In the later period the correlations of sherds with capacity and breakage rate are almost equal, although the capacity coefficient is still negative. As we would expect in both cases there is a reasonable positive correlation of capacity with breakage rate: as the pots get bigger they get more fragile.

However, the most striking aspect is that which we would not necessarily have expected: that vessel capacity has more explanatory power than the degree of fragmentation of the vessels. This is also supported by regression analysis. If the whole period is considered in a multiple regression, R^2 is 42.7%. This compares with 3.13% for breakage rate on its own in a simple regression. Vessel capacity, on the other hand, accounts for 43.31% of the variation in a simple regression. The figures for each period are shown in Table 3.3.

3.5.2 An alternative explanation of the economics of ARS

This demonstration that vessel capacity correlates strongly with sherd frequency, and that vessel breakage rate is not a major factor, opens the way for new interpretations of the 'economic' patterns outlined at the start of this paper. The most dramatic re-interpretation we may make is that the apparent decline of African exports in the third century is not actually the result of an economic crisis, as Fentress & Perkins (1988, p. 213) and Cambi & Fentress (1989, p. 76) have argued. Instead, we may see it as perhaps resulting from the increasing size of the vessels at this point in time, with the effect that fewer vessels were required to eat the same amount of food as in the second century. However, the analysis thus far does not let us state this with confidence: we know that the increasing capacity is strongly correlated with the declining sherd count, and that this is not a product of the breakage rate, but we cannot be sure that there is not still economic decline, with the increase in capacity insufficient to make up for the drop in the

	capacity	sherds	break
capacity	1.000	−0.738	0.308
sherds	−0.738	1.000	−0.15
break	0.308	−0.15	1

Table 3.1: Partial correlations for early period (AD 100 to AD 350).

	capacity	sherds	break
capacity	1.000	−0.265	0.783
sherds	−0.265	1.000	0.238
break	0.783	0.238	1.000

Table 3.2: Partial correlations for late period (AD 355 to AD 600).

	whole period	early period	late period
multiple R^2	42.70	68.90	3.30
simple capacity r^2	43.31	69.55	1.68
simple breakage r^2	3.13	34.64	0.26

Table 3.3: Regression coefficients for multiple and simple analyses (percentages).

number of vessels. Therefore an additional calculation has been undertaken to address this.

The aim of this new calculation is to see whether the total capacity of all the vessels in the average assemblage changes markedly over time. To do this, the sherd counts for each form were calibrated by the breakage rate to give an approximation of the number of vessels within each form class. This figure was then multiplied by the vessel capacity for each form and run through the allocation-to-years procedure described above. The result is Figure 3.8. This plot is rather spikey, certainly, but it can be clearly seen that in contrast to the sherds or vessels graphs, there is no major gap in the third century. This would seem to support the idea that the increase in vessel capacity was directly responsible for the decrease in the number of vessels.

It remains then to ask what the change in vessel size means, and how could it possibly have such an effect — surely larger plates just means that people ate off larger plates? The answer would seem to lie in the move to communal eating at this point (Carandini 1981, p. 15; Hawthorne 1996, pp. 3–6). Larger plates in this context represent the serving vessels for several people at once. Whereas the second century bowls were small, about the same size as individual bowls found in any British house, the third century dishes were of such a size that they must have been used by several diners at the same time. This communal dining system, where several people eat from the same dish, is well documented for medieval Europe (Hammond 1993; Farb & Armelagos 1980, pp. 204–8; Mennell 1985; Braudel 1973, pp. 124–39). It seems not unreasonable to conclude that such a system would require fewer plates per diner, although of a greater size than individual plates. This would then explain the drop in the number of vessels in the third century.

3.6 Conclusion

It has been argued that one of the most significant factors in explaining change in the quantities of ARS found around the western Mediterranean is the average vessel capacity. This means that the traditional view that a third century economic crisis is represented in the data is open to question; it seems more likely that the data represents merely a change in eating habits, with very large pots indicating a move to communal eating. This demonstration may also have implications for the way in which ceramic quantification is undertaken more generally, as it clearly shows that day-to-day factors like eating habits may influence the results of quantification as much, if not more, than traditional factors such as trade.

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