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AIALYSIS OP PRODUCTION

The Broomhey farm kiln dump contained 431 vessel equivalents of sherds. These were used by kind permission of Mr A. Miles to provide the data base for examining production in a quantitative manner.

Form/fabric correlation

The analysis revealed very sharp differences between each fabric with regards to the forms in which they are found (fig. 88). S6 is revealed to be primarily a beaker fabric, mostly limited to 2C6 vessels. SI was principally employed for jars, largely of form 3H; this is the local 'grey ware'. Any vessel form which is burnished falls under fabric Sib and this is the norm for dishes and bowls. Fabric S3 relates mainly to the first period of production at Cooling (c. AD 50-70) and therefore represents the typical cross-section of an early site. Dishes were less popular than they would later become and jars outnumber bowls by four to one. Most of the 'other' vessels in fig. 88 are lids. Lids of all periods seem to be in a coarser fabric than contemporary jars, so an S3 lid need not be as early as a S3 jar.

The major Cooling fabrics SI/6b and Sl/6bs have been combined in fig. 89. The proportion of dishes (46%) equates with that of burnished jars (25%) and bowls (21%) combined. The flasks are mainly of class IB, a continuation of jar form 3A. Fabric S5 gives similar results to SI but only a small quantity was present on the Cooling site (9.90 eves) so the results are not statistically useful.

An examination of "BB2"

Thameside black burnished ware, when manufactured at Cooling has a very narrow range of forms (fig. 89). Two features are immediately apparent: the dish 5D makes up only 0.6% of the fabrics Sib and Slbs combined. These are probably all residual. The third-century flanged dish 5A does not feature in the table at all: a few sherds are included in the 1% 'other' forms and come from the sites latest features. These facts give a neat date bracket for the main Cooling dump and indicate that a gap existed between the phasing out of 5D and the introduction of 5A. The modest proportion (16%) of latticed 'cooking pots' 3J is reflected on sites throughout the region, where the form is less numerous than might be supposed. The S-profile bowl, seen by Pollard (in Catherall 1983, 123) but by few others as an integral part of the BB2 range is more common. The 'pie dish* 5C was marginally more popular than the 'dog dishes' 5E and 5F. The forms 3A and IB have been combined in the graphs.

Figure 90 examines the variations on fabric Sl/6 to investigate the nature of what is perceived to be 'BB2'.
x = vessel not burnished
b = vessel burnished
v = vessel burnished to a high gloss
bs = vessel burnished and slipped
vs = vessel slipped and burnished to a high gloss.

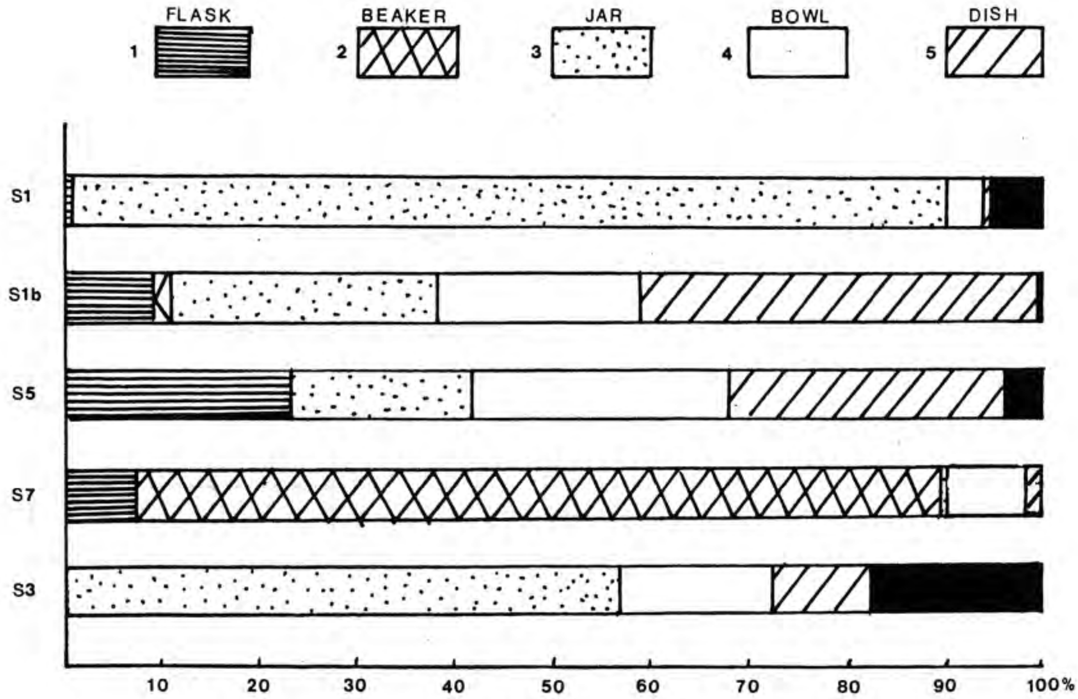

FLASK
1
BEAKER
2
JAR
3
BOWL
4
DISH
5
S1
S1b
S5
S7
S3
10
20
30
40
50
60
70
80
90
100%

Fig 88

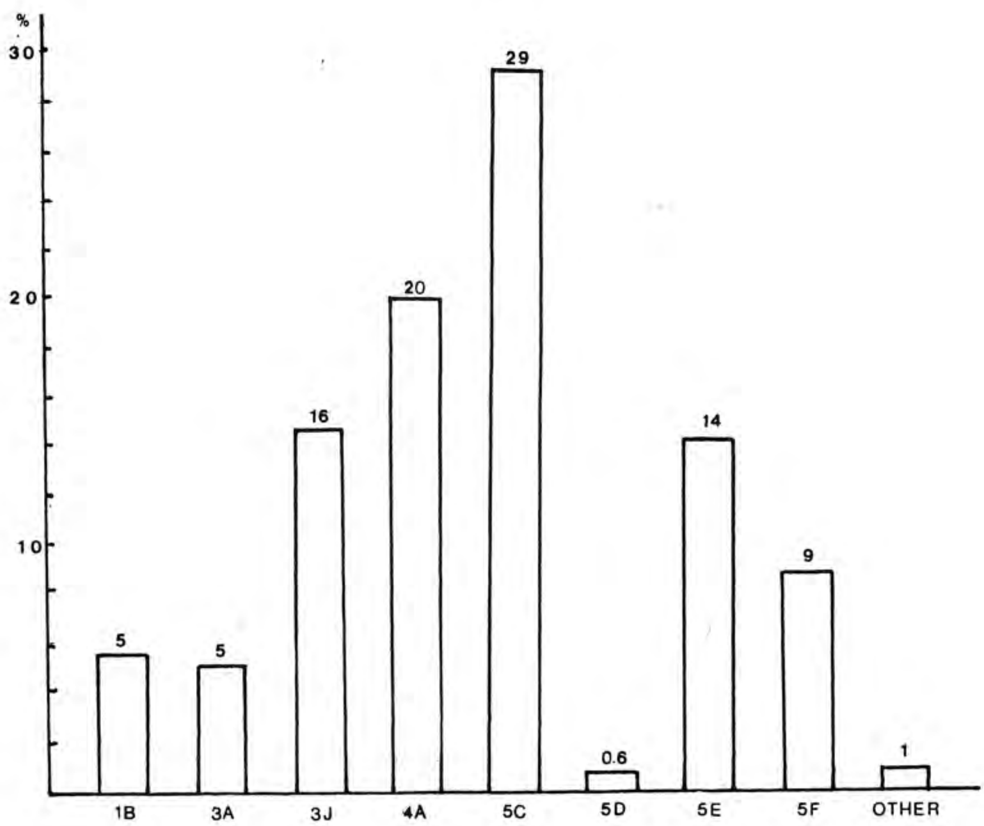

%
30
20
10
5
5
16
20
29
0.6
14
9
1
1B
3A
3J
4A
5C
5D
5E
5F
OTHER

Fig 89

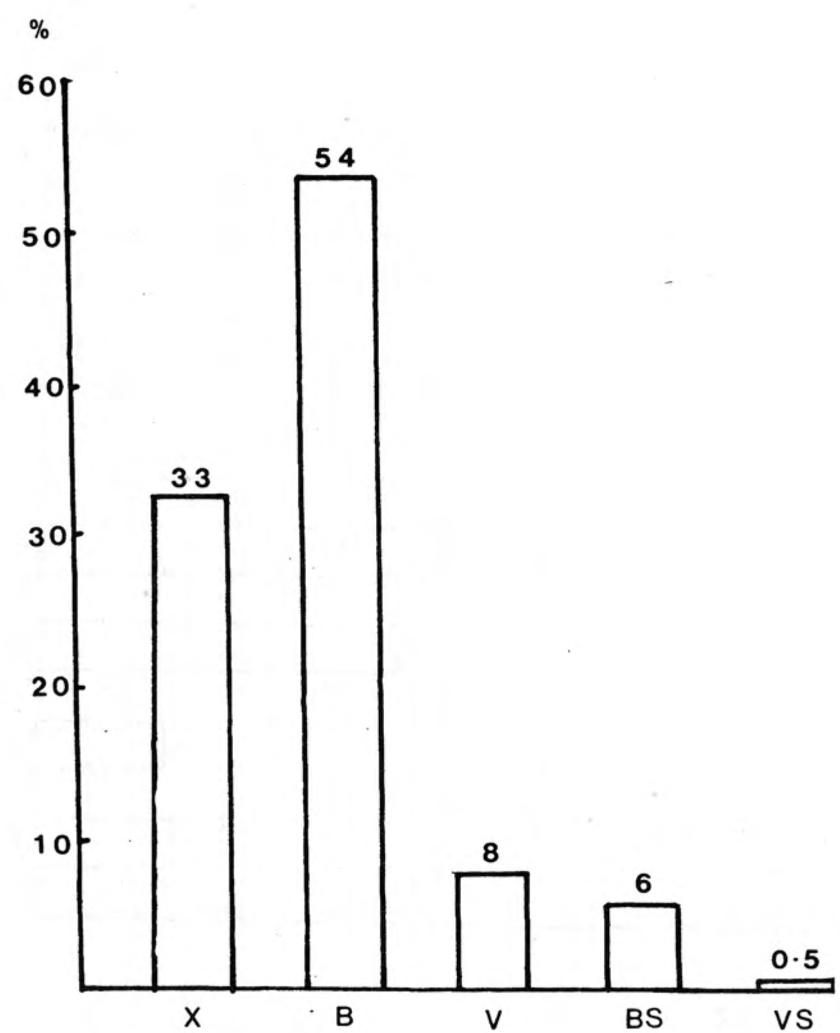

%
60
50
40
30
20
10
33
54
8
6
0·5
X
B
V
BS
VS

Fig 90

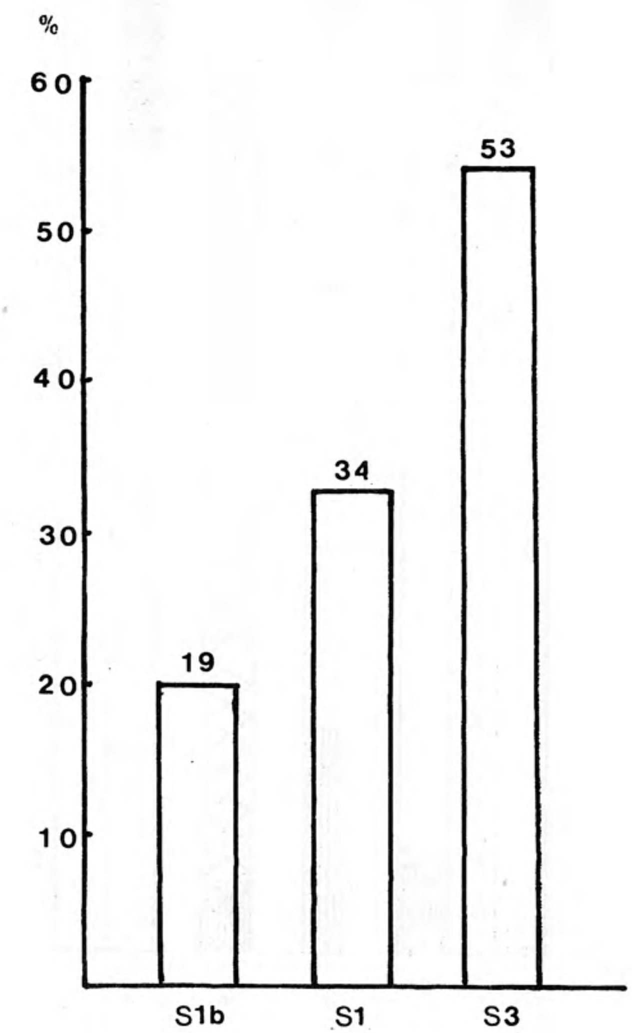

%
60
50
40
30
20
10
19
34
53
S1b
S1
S3

Fig 91

A third of the output is not burnished; this has been separated out as fabric Sl/6. Of the remaining vessels, all are either classified as SI/6b or Sl/6bs.

The results show that only a small proportion of the 'BB2' produced at Cooling was slipped. This has been observed on other sites in the region. They also indicate that the proposition that slipping enhances the burnish is not strictly true as a higher proportion of unslipped vessels achieve a high burnish.

Colour

When recording the Cooling pottery, each sherd was given a subjective colour for the purposes of computer-coding. Munsell colour charts would have served little purpose but to provide spurious accuracy as a wide range of shades could occur on the same pot.

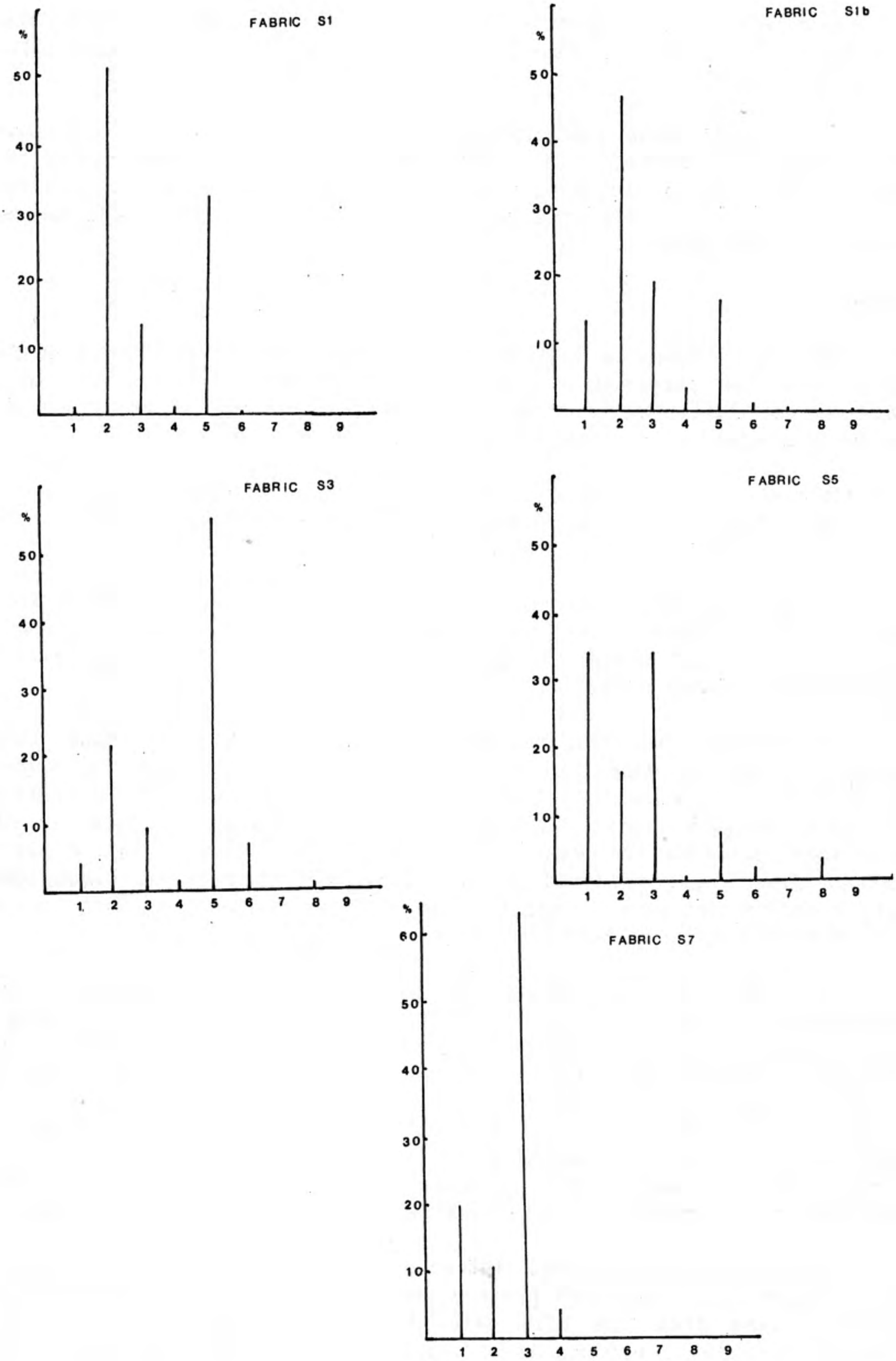
1 = 'black'	4 = 'brown*	7 = 'buff
2 = 'dark grey'	5 = 'orange'	8 = 'yellow'
3 = 'light grey'	6 = 'pink'	9 = 'white'

It was assumed that each fabric would have a target shade and that this would manifest itself in a peak on fig. 92. S3 has a heavy bias around the 'orange' shade whilst the rest of the fabrics are revealed to be principally reduced wares.

It is clear that when the Cooling potters fired their kilns, they had certain colour in mind for their finished product. Figure 91 shows the proportion of vessels that have been oxidised in three sandy fabrics. In the first century fabric S3, 53% of jars are oxidised compared to 34% of its later equivalent SI. When one considers the burnished fabric Sib, only 19% of finds were oxidised. This indicates that grey or black was the target colour for both SI and Sib but that more care was taken to achieve the objective with the burnished fabric.

The semi-sunken kilns of the region were a prerequisite for the production of reduced pottery (Swan 1984, 53 and 85). The fact that roughly half the first century pottery was oxidised and half reduced indicates that the early potters either had little concern about the colour of their products or little control over it. During the latter part of the first century AD there was a shift from this casual attitude to a deliberate policy of attempting to produce reduced wares, adopting the Roman norm of having grey kitchen wares. Roman tastes are similarly reflected in the production of black beakers and white-coated flagons.

S1 appears to have been intended - literally - as a grey ware. The high proportion of oxidised pottery probably represents misfires and would decrease away from the kiln site. It is noticeable that with Sib, an attempt is made to produce true 'black' pots, although these only make up some 13% of the total. 'Dark grey' appears to have been an acceptable approximation and is the shade of roughly half the fabric.



FABRIC S1
%
50
40
30
20
10
1 2 3 4 5 6 7 8 9
FABRIC S1b
%
50
40
30
20
10
1 2 3 4 5 6 7 8 9
FABRIC S3
%
50
40
30
20
10
1 2 3 4 5 6 7 8 9
FABRIC S5
%
50
40
30
20
10
1 2 3 4 5 6 7 8 9
FABRIC S7
%
60
50
40
30
20
10
1 2 3 4 5 6 7 8 9

Fig 92

The graph for S5 is curiously warped, with a lack of oxidised vessels supporting the suggestion that it was not part of the kiln waste and was made elsewhere - probably at Cliffe. The peak for S6 around 'light grey' can be understood by considering the fabric in detail. Most of its 13.40 vessel equivalents could be reconstructed to form 2C6 beakers, which are all very similar. All of these appear to have been misfired and probably represent the produce of a single kiln firing. It is therefore impossible to tell what the target colour was other than to infer that it was probably black. Fabrics S2 and S4 did not appear in any significant quantity.

Colour control appears to have been very important. Much of the Cooling dump material does not seem to have any flaw other than being the wrong colour. The sandwiched section of Sl/6 is explained by considering the need to obtain the correct hue on the finished vessel: grey bands represent periods when the kiln had a reducing atmosphere, orange lines show that at some time oxidising conditions prevailed. The normal black-orange-grey-orange-black section shows that oxidation only set in towards the end of firing and for an insufficient time to turn the core orange. The potters were obviously aware of this and ensured that reduction took place in the final stages producing a black outer layer. It is rare at Cooling to find a vessel with a black surface and totally oxidised core which suggests that attention was paid to maintaining the required kiln atmosphere throughout the firing. Some equivalent fabrics from other industries are basically oxidised, with a last-minute reduction to create a thin black layer at the surface. The Greenhithe fabric is often like this. Exactly the opposite priorities were observed in the production of orange-pink flagons in H4/ls, with their typical reduced interior face.

The rejected SI/6b was supposed to be black, but at the end of the firing process, oxygen was accidentally admitted to the kiln to produce a very light rust-red dusting on their otherwise reduced surfaces. Where the vessels had been burnished, the colour of the red was much deeper. Burnishing brings fine particles to the surface of the vessel and these include particles of iron oxides. The resultant high density of iron produced the more intense red. The unburnished yet slipped parts of vessels remained a dark grey, indicating that the last period of oxidation was brief. The slip would be less dense than the body of the pot and would therefore be more susceptible to penetration by free carbon. This did not have time to burn out in the Cooling examples. Where the vessels were both slipped and burnished, they turned as red as those parts which were just burnished.

The handmade shelly fabric Hl/4h is found in various shades of blue-grey and orange-brown. The vessels often exhibit patchy colouration and there does not seem to have been much, if any, control over this. This supports the idea that this pottery was fired in clamps or simple surface kilns.

Flaws

Most types of human error and pre-firing defects are known from the region. A common effect due to temperature is the partial smelting of iron oxide inclusions producing the 'iron-spotting' which ruins the surface of over fired vessels in Ml. This occurs around 800 °C, which may have been the practical maximum temperature attained as there are no known examples of vessels melting due to excessive overheating. Overheating also causes the loss of shine on burnished vessels. Very fine fabrics, M1-S4 tend to blister more than heavily-tempered fabrics.

When allowed to cool, the temperature in the outer layers of the pot falls more rapidly than in its interior. This can lead to spalling: differential shrinkage and flaking of the pots surface. The effect is particularly noticeable on vessel bases where the fabric is thickest and can result in the base detaching from the body. It is the major flaw found in heavy, early vessels in fabrics Fl, F2 and S3 and probably explains the need to knife-trim the vessel bases.

The main post-conquest fabric of the region, S1 does not yield many identifiable wasters, showing it to have been a practical and robust fabric. Most wasters seem to have merely lost their shine or their colour during firing. Some examples are known that are warped, blistered and spalled. The dish forms seem to have been almost immune to physical failure, very few wasters being known.

In an earlier work, reference was made to possible "ritual damage" (Monaghan 1983a, 201). It is now clear that on some vessels, this damage is due to spalling (i.e. on 3G1.1 and 3G1.2). A considerable number of vessels from all the antiquarian collections do however posses punctured bases with no technical cause. The fact that most were employed as grave goods does suggest deliberate spoiling, whether truly ritual or simply prudent.

Popularity of variants

The frequency of occurrence of each variant of a vessel class is illustrated in figs. 93-97. Where any code ends in zero, for example 4A0, this means that although the class could be determined, the variant could not.

Class 5C had three main variants, 5C4, 5C1, and 5C3. All these have essentially rounded rim profiles, as compared with the uncommon triangular rimmed 5C2 (fig. 93). Most rims of 5D vessels noted are of the analogous variant 5D2. The dish form 5F did not justify a graph of its own because nearly all the vessels recorded were of variant 5F3.

Two graphs are shown for dish form 5E, as it is manufactured in both Cooling production phases, first in S3/6, later in SI/6b (figs. 96 and 97). It is clear that 5E4 is an early form which is not represented, even as a handful of aberrant sherds in SI/6b. 5E2 is more common than 5E1 in the early fabric, but the positions are reversed in SI/6b. This shows that 5E2 had an early start along the Thames, pre-dating the advent of the ‘BB'

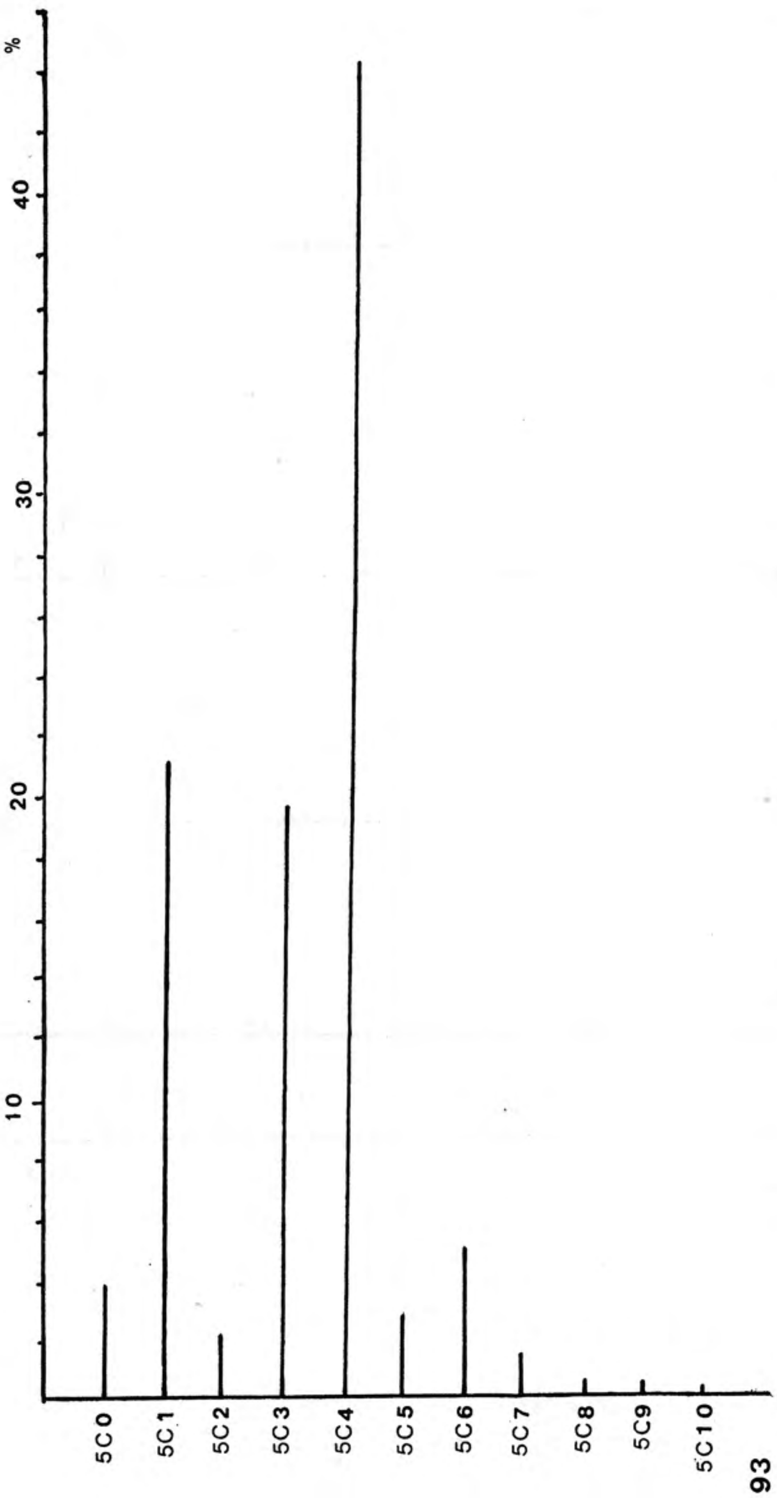

%
10
20
30
40
5C0
5C1
5C2
5C3
5C4
5C5
5C6
5C7
5C8
5C9
5C10

Fig 93

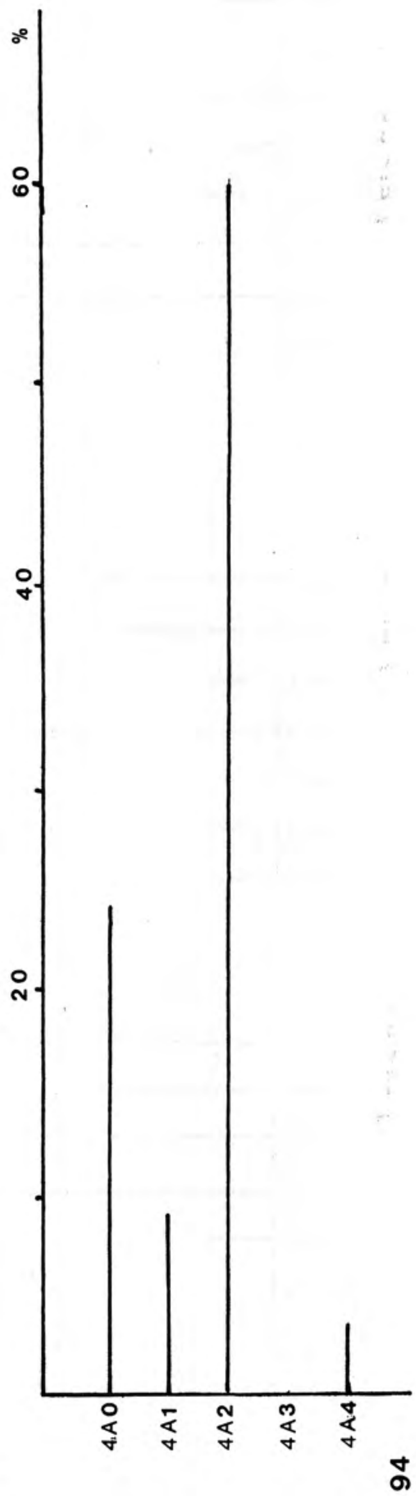

%
20
40
60
4A0
4A1
4A2
4A3
4A4

Fig 94

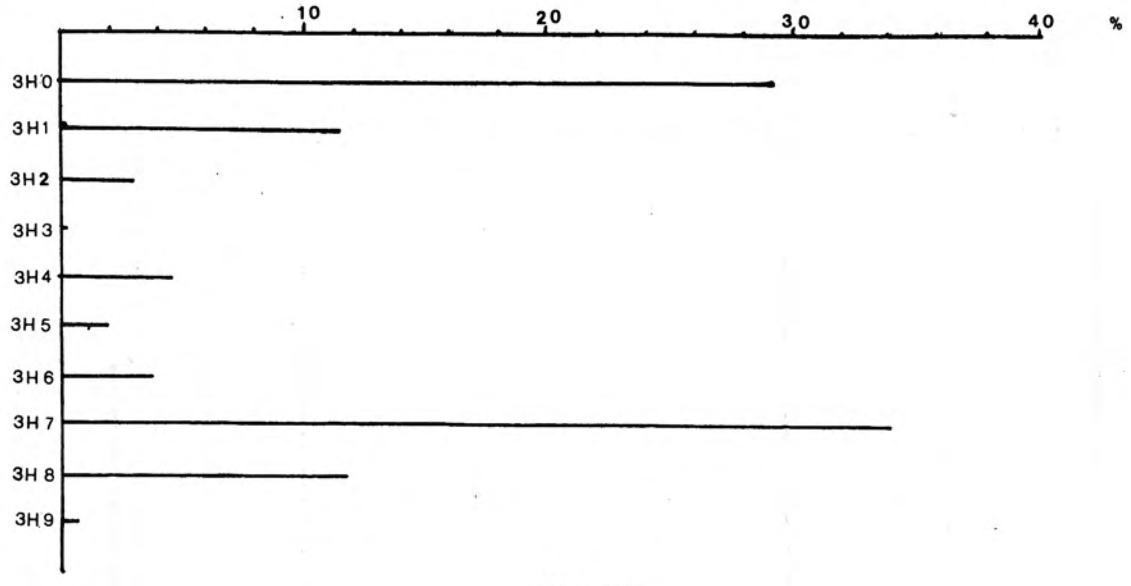


Fig 95

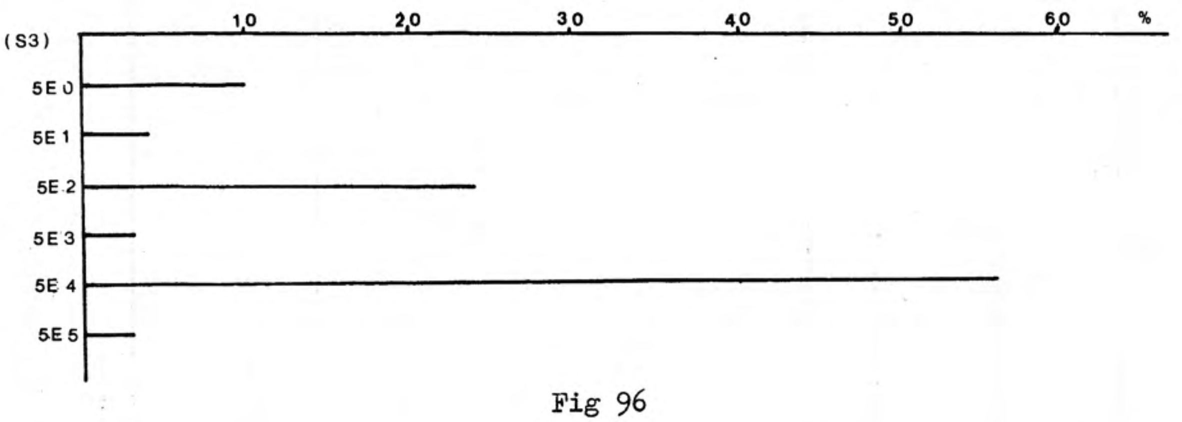


Fig 96

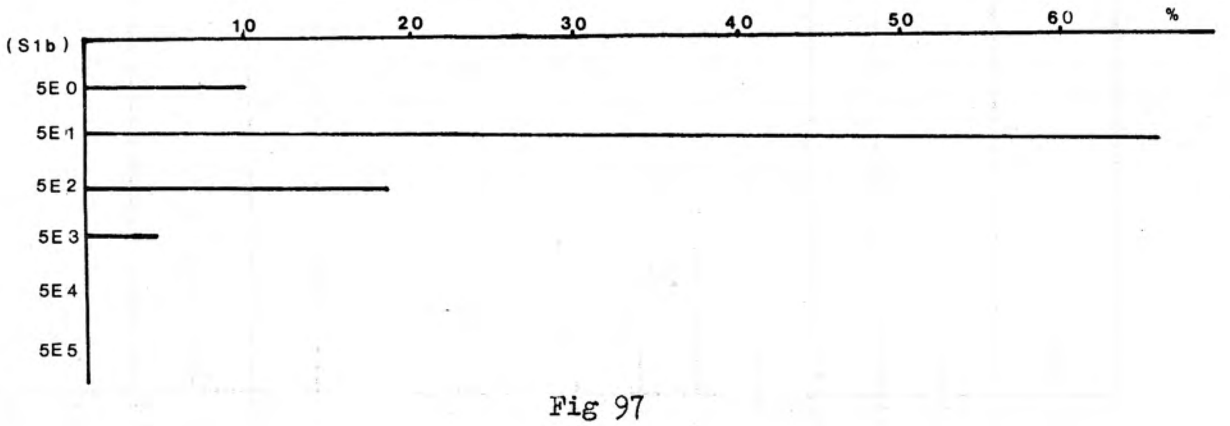


Fig 97

industries. The few '5E1' sherds noted in S3/6 are probably accidental variations on vessels intended to be 5E2.

The main feature of the graph for the jar 3H (fig. 95) is the large peak at 3H7, showing it to be the standard late variant of this class. The scatter of other variants recorded is scarcely relevant because all can be made by accident during the fashioning of 3H7. 3H8 appears to have been a common alternative. Neither of these forms is very common on the earlier sites investigated. The absence of 3H3 shows it to be both an 'early' and an 'Upchurch' form. It was not possible to produce a graph for jar class 3J, as the form tends to break at the neck resulting in unidentifiable rim sherds. Most of the reconstructed Cooling pots were of variant 3J9. 4A2 is shown to be the ubiquitous bowl form of the late second century (fig. 94). Variant 4A3 is conspicuously absent, even from the early deposits which yield 4A1.

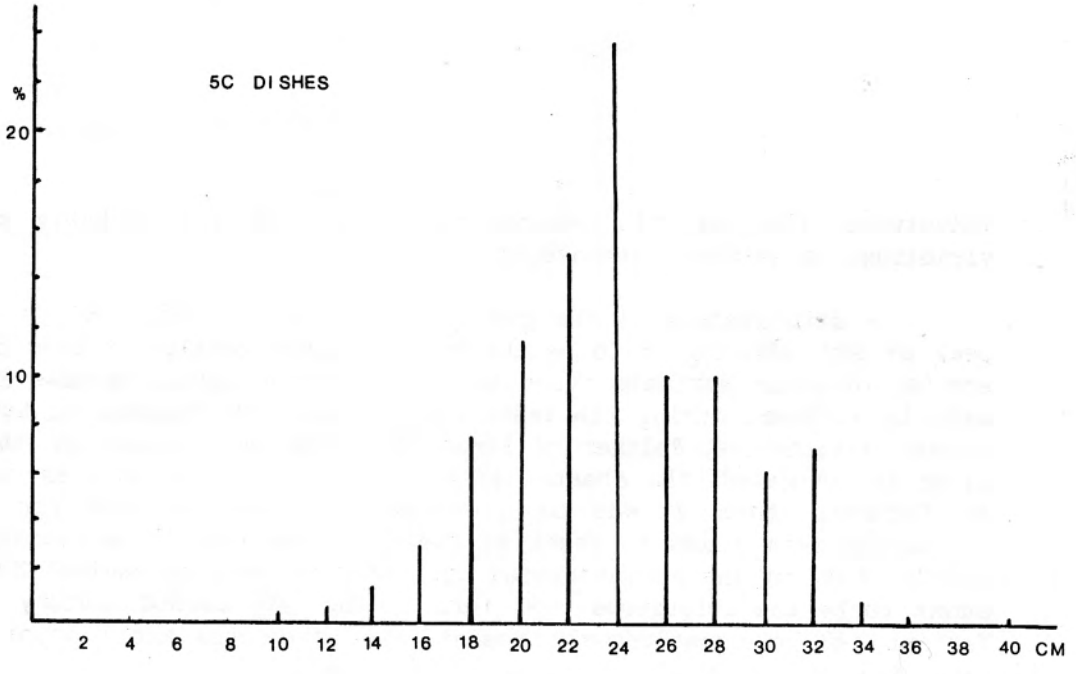
Size

The diameters of vessels were recorded and collated so that the range of sizes that each vessel class occurred in could be examined. These figures were then compared with those which Pollard compiled for the Oakleigh kilns (Catherall 1983, 136). All figures have been rounded up to the nearest two centimetres which was the practical limit of accuracy when measuring small sherds, or larger pieces that may have warped. The information is represented graphically on figures 98-102.

5C dishes appear to be slightly larger than the average 5F (figs 98 and 99). The peak at 24cms corresponds with Pollard's peak at 21-23cms for his gross form III (i.e. 5D). A peak at 22cms for 5F compares with his at 21-23 cms for gross form I (5E and 5F). No figures could be compiled for 5A at Cooling, but at Oakleigh, gross form V had a modal average of 18cms; somewhat smaller than the other classes of dishes. It is unclear why the curve for 5C is erratic in its upper parts. It suggests that there was a limited demand for vessels in the 28-32cms size range in addition to the normally-proportioned vessels.

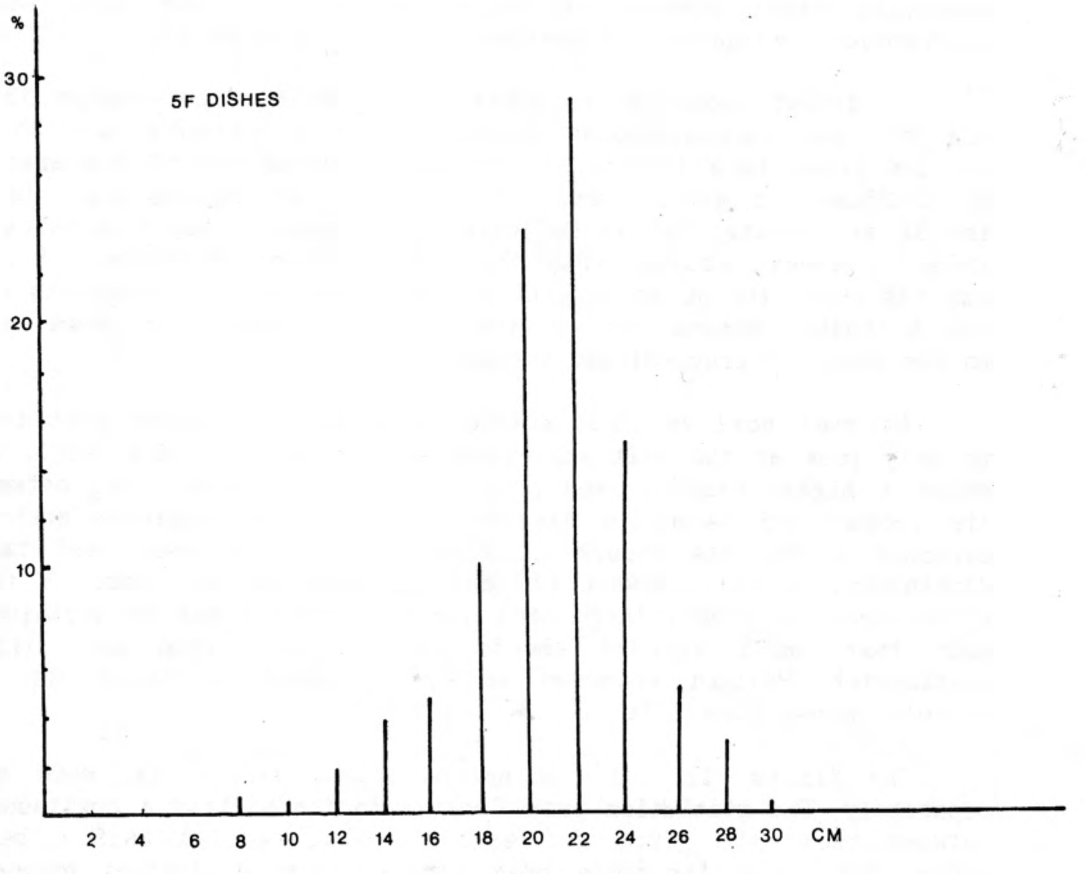
As most bowl variants noticed were 4A2, it seemed most informative to only look at the size variation of this variant (fig. 100). The graph shows a highly standardised product, 63% of vessels being between 20cms (i.e. 19cms) and 24cms in diameter. There is no apparent archaeological explanation for the trough at 22cms. It can be seen that there is a distinction in size between 4A2 and contemporary jar class 3H (fig. 101). A few apparently very large jars and small bowls may be explained by the fact that small abraded sherds of the two types are difficult to distinguish. Pollard recorded an average size of 24cms for class 4A vessels (gross form XlVa).

The flasks, IB and the narrow-necked jars, 3A, were quantified separately. The statistics from Cooling indicated that a continuum existed between them; the graph for each vessel resembled half a bell-shaped curve. They have therefore been combined for analytical purposes (fig. 102). When utilising this information in the typology, 1B7 was recognised



5C DISHES
%
20
10
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 CM

Fig 98



5F DISHES
%
30
20
10
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 CM

Fig 99

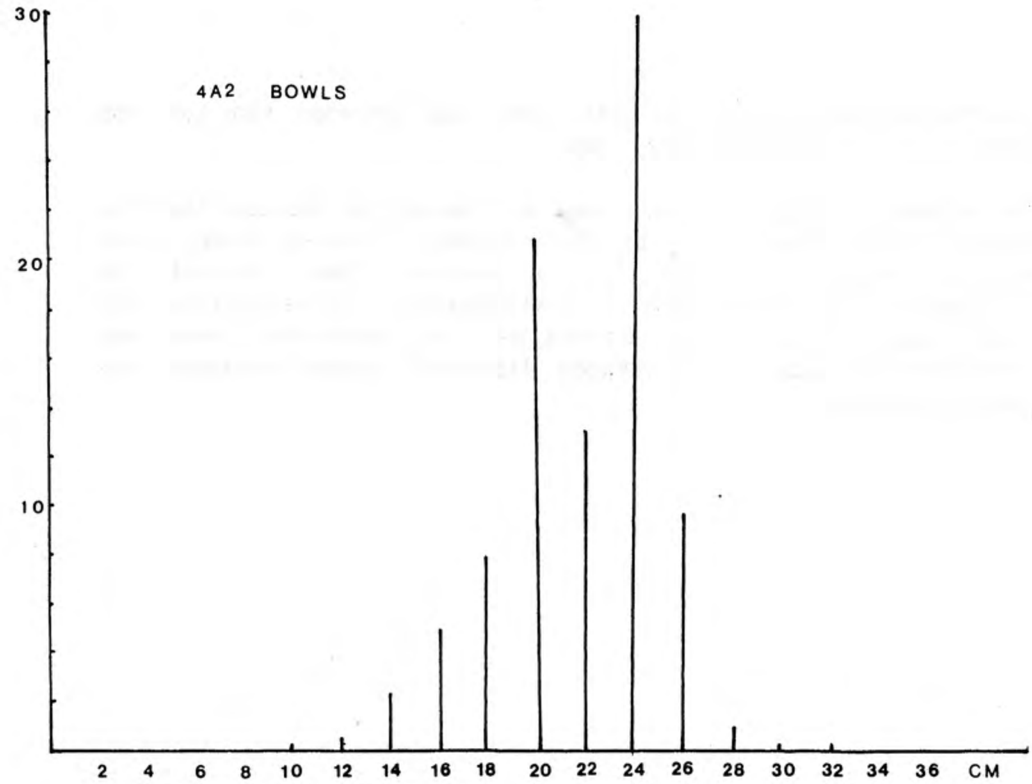


Fig 100

Fig 101

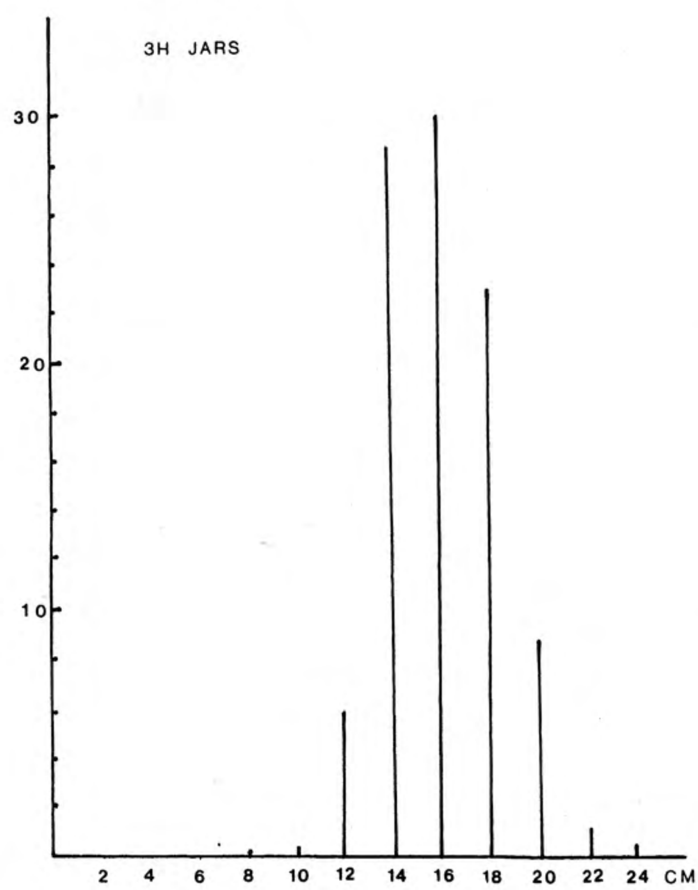
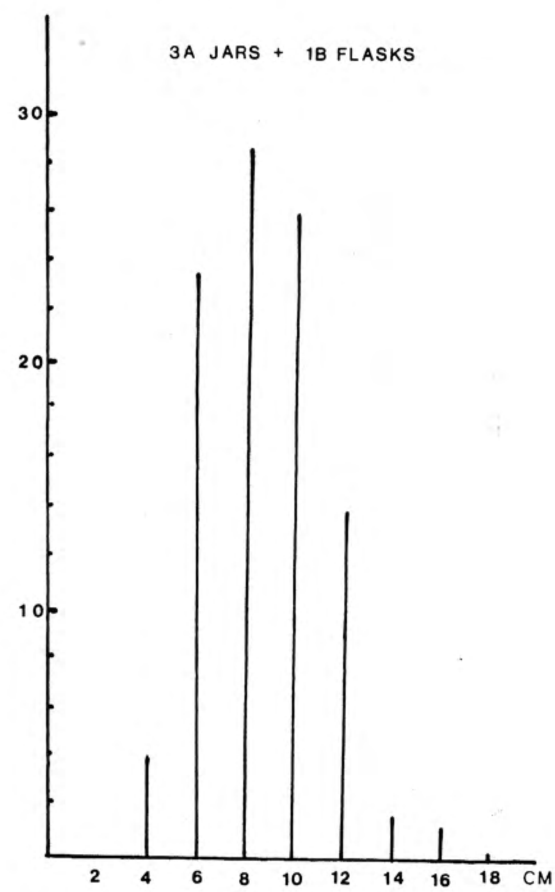


Fig 102



as a small, narrow-necked version of 3A5. The line between the two was arbitrarily drawn at a rim diameter of 7cms.

The above evidence suggests there was an amount of standardisation of size of vessels. It is clear that the potters had a rule-of-thumb guide to the acceptable range of sizes for a vessel. They avoided the unnecessarily large and the impractically small (except, by definition, for miniatures). The size of a vessel determines its possible uses and therefore a difference in size range between different types suggests that each had distinct functions.

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