9 Fabric, form and function, with an evaluation of methods

The analysis of the relations between fabric composition, pottery groups and their possible functions is the last step to be made in this study. It is followed by the evaluation of methods and variables used for the fabric and morphological analyses.

9.1 The relation between pottery groups and fabric composition

The supposition is that the potters took the expected use of the pottery into account in the choice of paste composition(s). The basic recipes are expected to be influenced by the most important functional category (chapter 1; 2.4). In chapter 5-7, dealing with the fabric composition, no significant associations were found between the type of clay and the type or amount of nonplastic inclusions in the clay. Three rather similar types of clay were distinguished, varying mainly in the relative amounts of Fe- and Ca-compounds. The amount of temper (%AD or vol%[1]) is to some extent associated with the clay types in the pottery from Uitgeest, but not at all in that of Schagen. In the analysis of relationships between fabrics, pottery groups, and functions, the pottery of Uitgeest will be treated in more detail than that of Schagen. The special circumstances at the latter site make it likely that technical requirements were less important for at least part of the pottery in the sample. The postdepositional changes moreover hampered the analysis of the clays and inclusions. The analysis mainly deals with the following questions:

– Are there any specific differences in *clay composition* between distinct pottery groups and vessel functions.

– Has a specific *amount of temper* been added to the clay for specific groups and functions.

The overall aim is to establish the *level(s)* at which the potters made a distinction in fabric qualities in relation to formal properties or functions. In the previous chapter four size groups were distinguished, each with two subgroups by shape, and one specific shape group, the jar (table 8.14). The most likely functions of the pottery groups were summarized in fig. 8.31. Table 9.1a,b (Uitgeest and Schagen) contain the two equally feasible classifications by function, differing for group 4. The vessels in group 4.1, with a possible double function of cooking and storage can be added to the cooking vessels, while those with a narrow opening and larger height, group 4.2, are considered to be storage vessels proper. Both classifications are used in the figures and tables of this chapter. The vessels in group 1 contain distinct subgroups of size, shape and surface features, but they are treated here as one category of special vessels. Group 2.2 is also defined as a separate category with special of multipurpose functions. The dichotomous classification into cooking and all other functions (see tables 8.19 and 8.20) is used as well.

9.2 Fabrics and pottery groups, Uitgeest-Gr.D.

Three types of clay were distinguished, of which clay type 1 and 2 were used most frequently. Both clays contain relatively high amounts of iron and variable amounts of calcium compounds, but the Ca : Fe ratio is lower than 1. Clay type 3, with a Ca : Fe ratio >1, was used for a small number of vessels. No significant relationships were found between the types of clay and the type and amount of natural inclusions or the size and amount of quartz particles. Nor was any relationship detected between the type of clay and the context or relative chronology of the pottery. For each clay type, the relationship between the amount of temper and the apparent porosity has a different distribution (see fig. 7.1b-d). The %AP is lower for fabrics made of clay type 1 and most of clay type 2. Although there is some increase in the average %AP with increasing amounts of temper, the actual %AP varied greatly within each class of the %AD. Only in fabrics of clay type 3, there is a more or less linear relation between the amount of temper and the %AP. This clay has a slightly higher porosity of its own, both in the pottery and in the test clays. The majority of the pottery contained between 30-60 %AD of temper, or 10-20 vol% of temper in comparison with the test tablets (fig. 6.1). The question now is whether the rather slight variations in fabric composition can be associated with different pottery groups and their functions. The distributions of fabric variables in relation to the pottery or the functional groups are shown in fig. 9.1, 9.2 and in tables 9.2, 9.3.

To begin with the *clays*, the smaller vessels, group 1 and 2, are mostly made of clay type 1 and 2 (fig. 9.1a,f; table 9.2a). For the jars of group 5, all clay types were used in equal amounts, but the number of cases is obviously too small to base conclusions upon. Of the pottery in groups 3 and 4, the cooking and storage vessels, a high percentage is made of clay type 1. The other two clays are represented in roughly the same amount of vessels, but in comparison with the other groups clay type 3 is present in a much higher percentage. When the pottery is divided into the two main categories, cooking vessels and other functions, the slight differences become more apparent (table 9.3a). Clay type 3 is used more often than expected for the cooking vessels. It is hardly used for the special purpose containers of group 1 and 2.2, which are more often made of clay type 2. This clay has a lower natural porosity than the other two. Clay type 1 is used for all types of vessels[2].

The differences in the amount and vol% of *temper* between the pottery groups are small, but they are meaningful in the light of the functions of the vessels (fig. 9.1b-d; 9.2a,b; table 9.2).

Firstly, there is a clear difference between cooking vessels and all other pottery. The fabrics of most cooking pots contain more than 40 %AD of temper; there is no difference between the subgroups 2.1, 3.1 and 3.2. Group 4 contains one cluster of pottery with the same amount and one with less temper than the cooking vessels. The %AD for pottery group 3 is the only one approaching a normal distribution (see fig. 6.4a), which could be interpreted as representing the standard recipe and its normal variation. The distribution may also be due, however, to the much higher number of cases. In most other vessels, the %AD is less than 40 and the amount of coarser temper (fibres >3 mm) is also lower than in the cooking pots. The clear distinction between the finely polished and coarse ware within group 1 is not expressed in the fabrics. Subgroups 1.1 and 1.2 contain comparable and mainly low amounts of temper. The %AD in group 2.2 is also lower than in group 2.1, at least on average. Altogether, the average amount of temper is increasing with increasing vessel size in pottery groups 1-3, but decreasing in group 4 (fig. 9.1f).

Secondly, the variation in the amount of temper *between* vessels is very high in all pottery groups except group 4. The variation is diminishing with increasing vessel size (fig. 9.1c-f). In fabrics of group 1, 2, and 3 practically the whole range of 0-100 %AD is present, although the larger vessels show more clustering between 40 and 80 %AD. The few cases in group 2.2 show the same variation in the amount of temper as those in group 1. In the pottery of group 4.1 and 4.2 the variability is clearly much lower, as is the amount of temper in group 4.1 (mostly 20-50 %AD), in comparison with the cooking vessels of group 2.1 and 3. The average amount of temper in group 4.1 and 4.2 is 40 and 52 %AD, respectively. The difference could indicate that the vessels of group 4.1 primarily did not have a cooking function, but were made mainly for storage. In that case, however, one would expect the amount of temper to be equally low in group 4.2, which it is not, but the few cases in group 4 with very high amounts of temper and a high porosity are mostly made of clay type 3.

Thirdly, the amount of fibres >3 mm is to some extent connected with the main functional division. It is present more often and in larger quantities in the cooking vessels than in those with other functions (table 9.3f). The effect of the amount and size of temper on the apparent porosity of the pottery is either limited or obscured by other factors. Although the *average* values of the %AP are higher for the cooking and storage vessels than for the pottery in group 1 and 5, the variation is extremely high both within the pottery groups and within the same class of temper (fig. 9.1c-e, also 7.1b-d). As mentioned, a small group of vessels, mainly with cooking and storage functions, are made of clay type 3, which has a high porosity of its own. The fabrics also contain higher amounts of coarse temper and show a high porosity (>40 %AP). The very high porosity may be the result of the three variables together, but the type of clay seems to be the more important factor. Other cases with the same amount and size of temper but made of other clays show a much lower %AP. As there are no indications for a chronological difference between these and other vessels, it is concluded that the potters had reason to make some vessels with a very high porosity.

In conclusion, the distinction in functions and morphological groups is visible in the fabrics at a very general level only. The medium sized cooking vessels (group 3) and some of the larger cooking or storage vessels (group 4) have slightly higher amounts of temper and a higher porosity than the other pottery. The distinction made between group 3 and 4 and/or between clay types 1-2 and 3 seems to be meaningful and may be related to different recipes and functions. If the functional interpretation is correct, there is indeed a standard recipe for the amount of temper in vessels with *cooking* functions. The fabrics of the small containers, also with a fire-related function (group 1.2) contain more variable, but on average lower amounts of temper as well as less coarse material and are more often made of a clay with a lower natural porosity; they are therefore more similar to other (small) non-cooking vessels. The distinction made between group 2.1 (cooking vessels) and 2.2 (special purpose containers) is visible in slight differences in clay types and amount of temper, but the number of cases is too small to draw further conclusions about the functions of both. The fabrics of the black-polished vessels are not different from those of others. The majority of these vessels is found in pottery group 1.1 and 5. A few other cases are present among the cooking vessels, while none of the vessels in group 4 and only one in group 2.2 is reduced.

All of the above interpretations are based on rather 'fuzzy' trends in fabric and form associations. One possible explanation for the fuzziness may be the influence of generations of potters, who may each have had slightly different standards for the amount of temper. The reason for the large variation in the amount of temper between vessels within each pottery group is not clear, but some suggestions are made below (paragraph 5). The lack of correlation between the amount of temper and the apparent porosity measurements in the pottery is in rather shrill contrast to the high correlation present in the test tablets. Clearly, other variables play a distorting role, for example the influence of the actual use and/or postdepositional changes. As such factors affect any archaeological assemblage by definition, it is questionable whether the apparent porosity measurement is of much use in other than experimental tests.

9.3 Schagen-M1

9.3.1 FABRICS AND POTTERY GROUPS

Most of the pottery in the Schagen sample is made of clay type 2. Clay type 3 was used only occasionally. Clay 'type 1' was used for fabrics with extreme iron infiltration, for which the original clay type could not be established. The infiltration is to some extent linked to the feature context, occurring more frequently in pottery from surface features than from the pits (see chapter 5, table 9). The clays used for the pottery are highly similar to the test clays from the site (clay samples 62-64), being very fine grained and homogeneous with no quartz >150 µ present. In contrast to the test clays, the pottery contains large quantities of coarse inclusions, especially argillaceous inclusions. No relationships between the clay and other fabric variables were found, while the %AP showed a rather remarkable distribution in relation to those variables.

The morphological analyses resulted in the same pottery groups as in the sample of Uitgeest and the same possible functions were associated with these groups (table 9.1b). The relations between fabrics and pottery groups are shown in fig. 9.3 and 4, and tables 9.4 and 5.

The pottery groups and functions show very little differentiation in the types of clay (fig. 9.3a; 4a,b; table 9.4a;5a). Of the jars and vessels in group 2.2 none were assigned to clay 'type 1', *i.e.* none showed the extreme infiltration that occurred rather frequently in group 3 and 4. The reason is not clear. There is no significant difference in the feature contexts, although pottery group 2.2 and 5 are found mostly in the pits.

A striking aspect of the fabrics is the presence of high amounts of, often large-sized, inclusions in the fabrics. Considering the virtual absence in the test clays, it is possible that clay pellets and/or iron concretions have been added by the potters (compare fig. 4.1 and 5.1). One reason may have been to improve the workability and firing behaviour of the very fine clays present in the settlement. There is no relation between the presence and type of inclusions and specific pottery groups or functions (fig. 9.3e), nor is there any connection with feature contexts. As both the type of inclusion and the quantities were difficult to define, the lack of precision in the observations may obscure such connections.

The frequency distribution of the amount or volume of temper (%AD and vol%) is more or less the same for all groups (fig. 9.3b,c; table 9.4b,c; 5b,c). About half of the vessels contain between 25-50 %AD and 7.5-15 vol% of temper, virtually independent of the type of clay or pottery group. In comparison to Uitgeest, the amount of temper is on average lower in the Schagen fabrics. As coarse temper, fibres >3 mm, is present more frequently and in higher amounts in the Schagen fabrics, the lower %AD and vol% represent a real difference with the pottery from Uitgeest (see evaluation below).

The variation in the %AD is linked to size and functional groups (fig. 9.4a,b). The largest variation is found in the fabrics of the jars (group 5), followed by the vessels with special functions (group 1 and 2.2), especially in the well-made, reduced vessels. In the smaller cooking vessels, group 2.1, the variation is also quite extreme and considerably higher than in the larger ones. Most vessels in group 4.1 contain a much more restricted and low amount of temper, around 30 %AD. There is no relation between the %AP, the %AD and the type of clay for any of the pottery groups, nor any association with the size of the inclusions. Both high and low values of the %AP occur in each group, although most vessels with more than 40 %AP are *cooking pots* (table 9.5d). The peculiar distribution make the %AP values even more suspect than for the sample of Uitgeest.

There is no association between any of the fabric variables and the distinction between the black-polished and other pottery. The presence of 'double-coloured' surfaces must, at least theoretically, be related to the type of clay, in combination with the degree of oxidation during firing and perhaps to firing temperatures[3], but these relations are not present in the sample, nor is there a relation with the pottery groups.

9.3.2 FABRICS FOR RITUAL AND UTILITARIAN POTTERY

In the sample from Schagen, a chronologically linked variation in fabric composition and construction techniques will be negligible. It also is unlikely that the functions changed during the period of occupation. Yet the differences within and between pottery groups are not necessarily linked to 'utilitarian' categories, as part of the vessels were made for ritual purposes only. An interesting question is then in how far the potters maintained the same recipes for both types of

Fig. 9.1 Uitgeest-Gr.D. Relation between pottery groups and fabric variables.

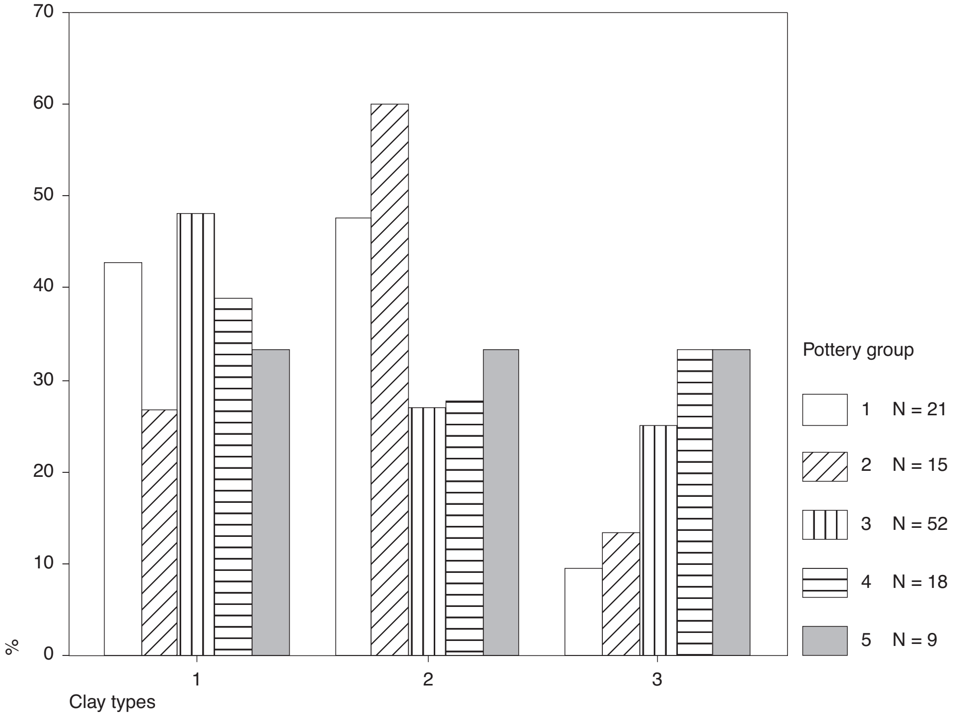


Fig. 9.1a The percentage of vessels made of clay type 1-3 in pottery group 1-5.

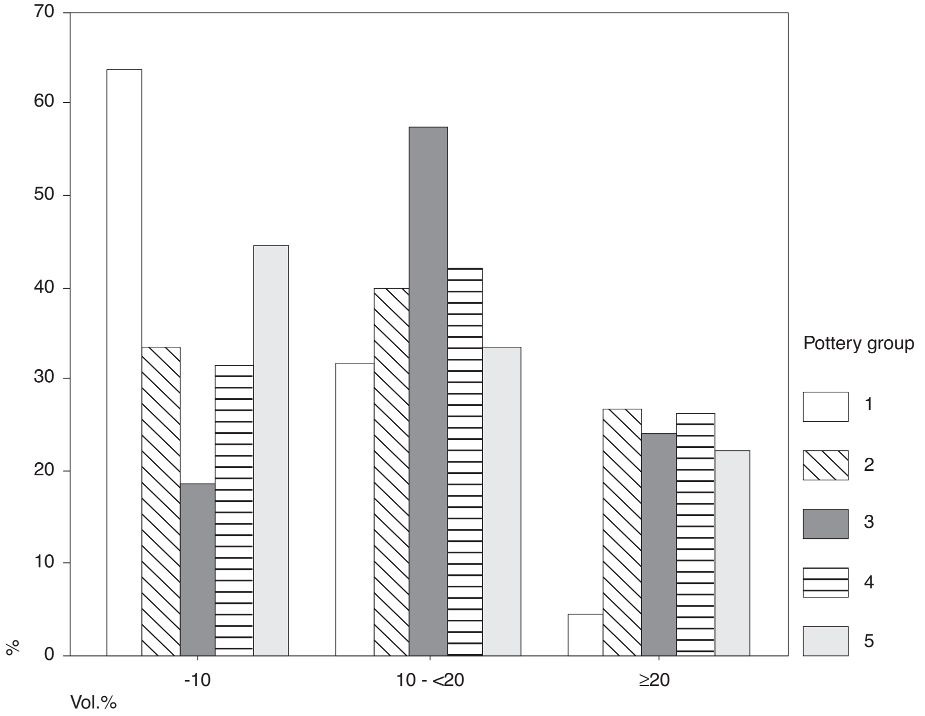


Fig. 9.1b The volume percentages of temper in each pottery group.

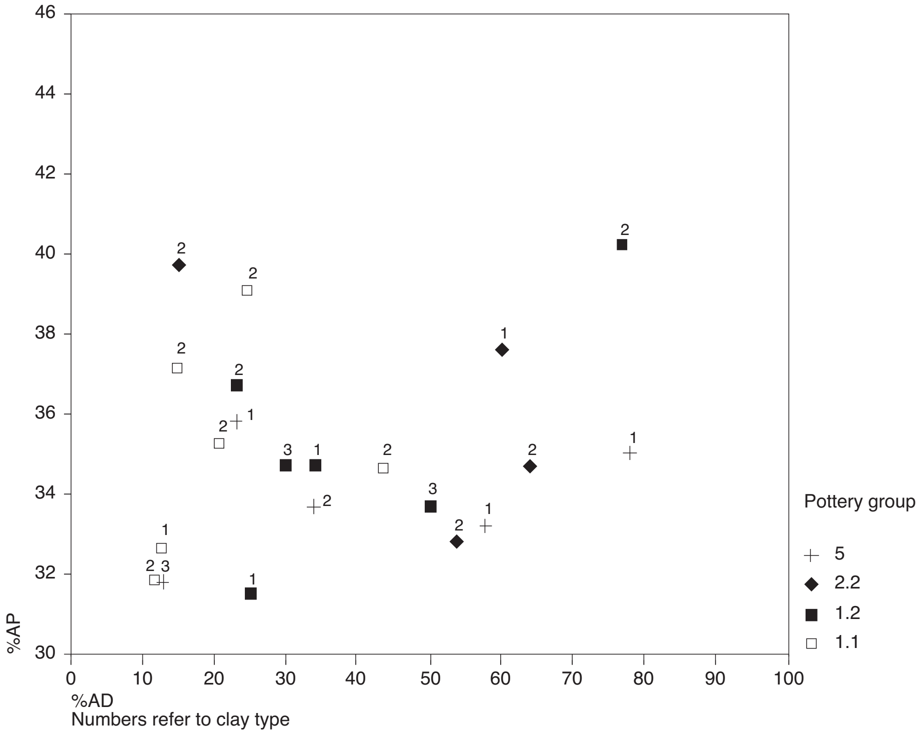


Fig. 9.1c The relations between the %AD (areal density) of temper and the %AP (apparent porosity) for pottery group 1, 2.2 and 5.

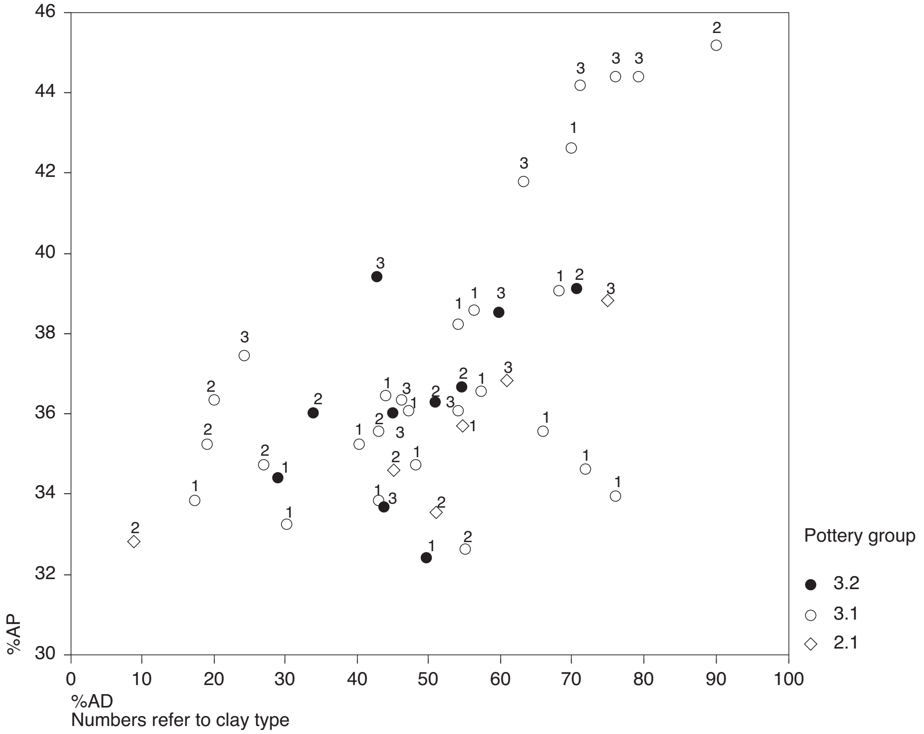


Fig. 9.1d The relations between the %AD (areal density) of temper and the %AP (apparent porosity) for pottery group 2.1 and 3, the cooking vessels.

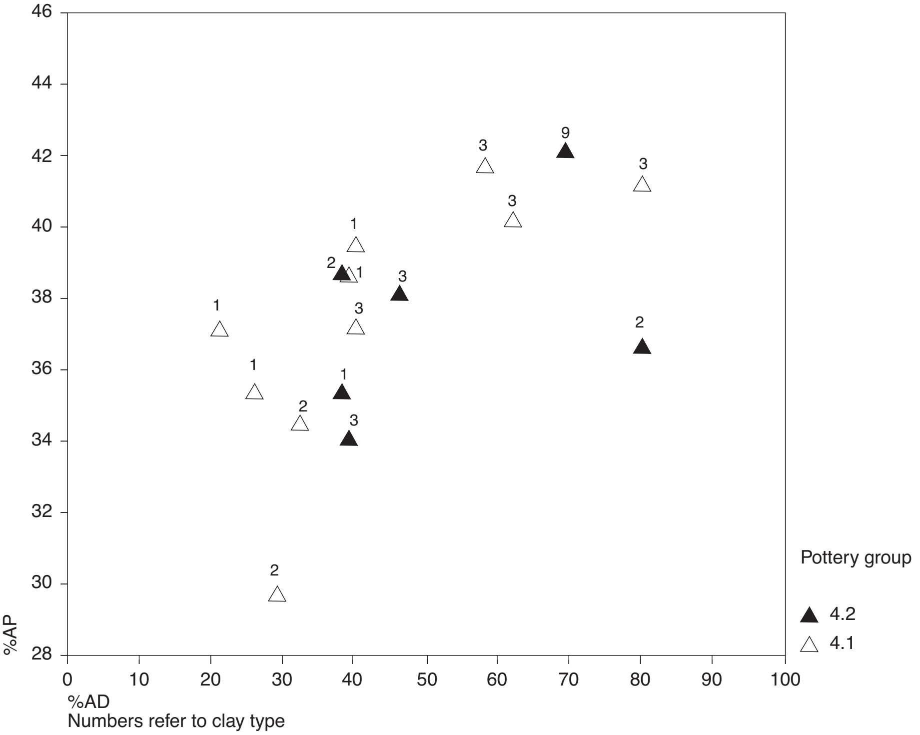


Fig. 9.1e The relations between the %AD (areal density) of temper and the %AP (apparent porosity) for pottery group 4.

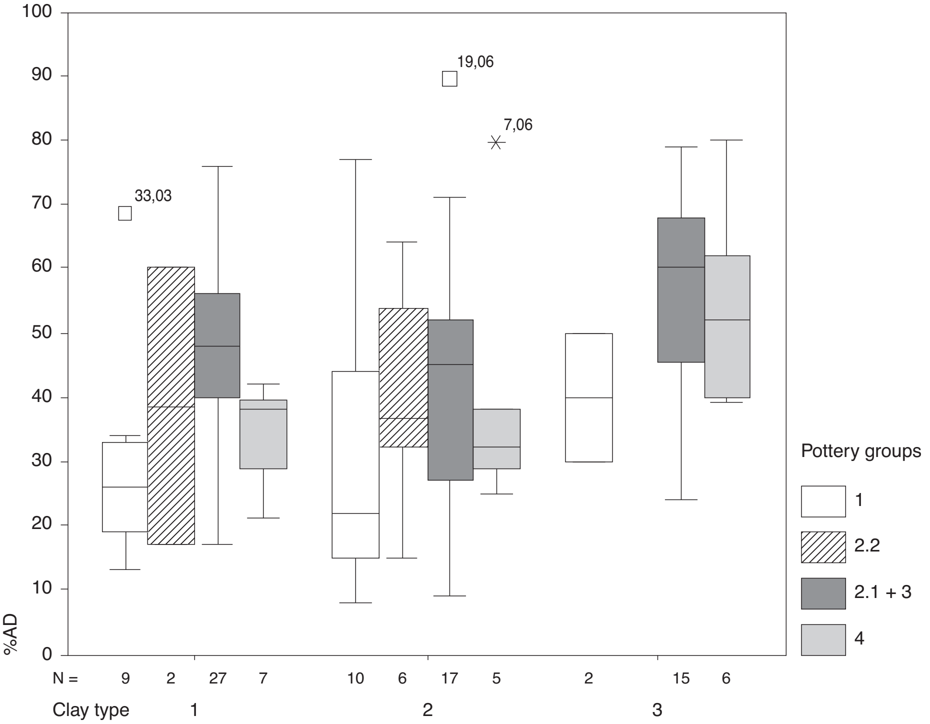


Fig. 9.1f Median values and variance of the %AD for each type of clay and pottery group 1-4, reclassified by function.

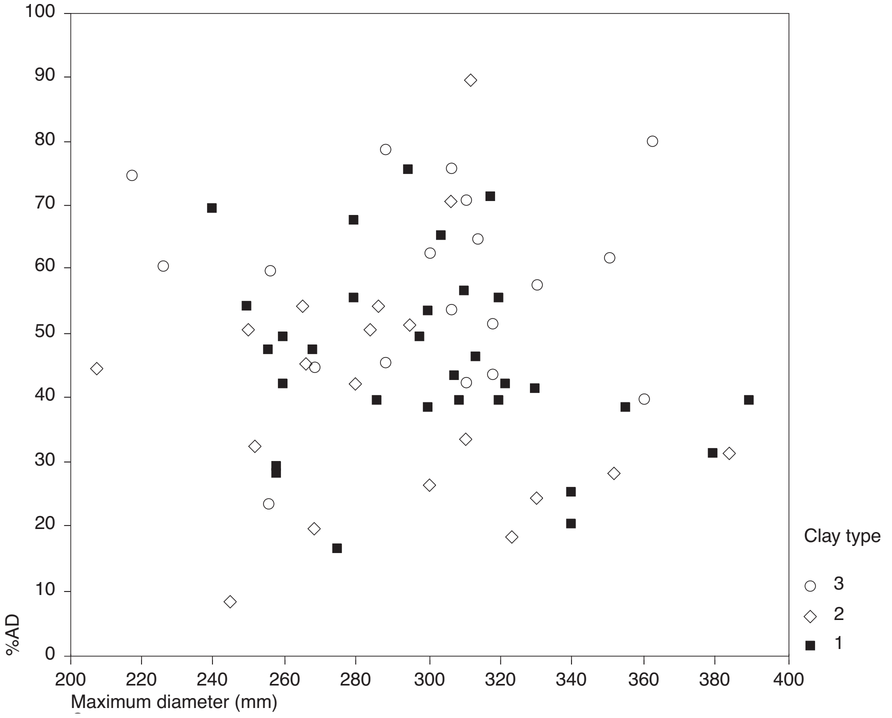


Fig. 9.2a Cooking vessels: pottery group 2.1, 3 and 4.1

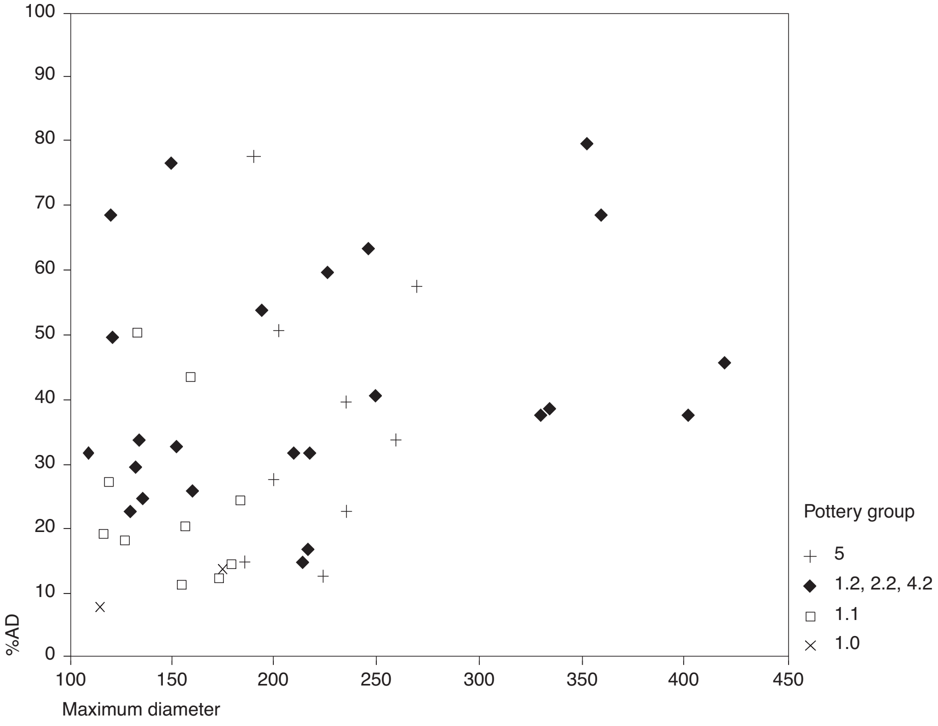


Fig. 9.2b Vessels with other functions: pottery group 1, 2.2, 4.2 and 5. The number at each case refers to the type of clay

Fig. 9.2 Uitgeest-Gr.D. Relations between the amount of temper and the type of clay for the main functional groups.

Fig. 9.3 Schagen-M1. Relation between pottery groups and fabric variables.

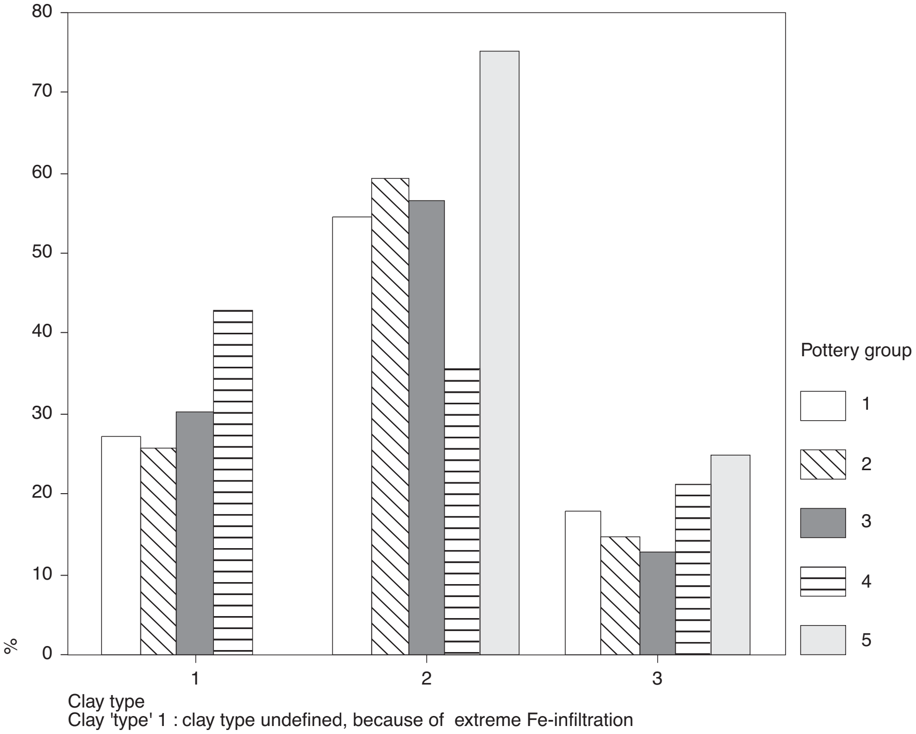


Fig. 9.3a The percentage of vessels made of clay types 1-3 in pottery group 1-5.

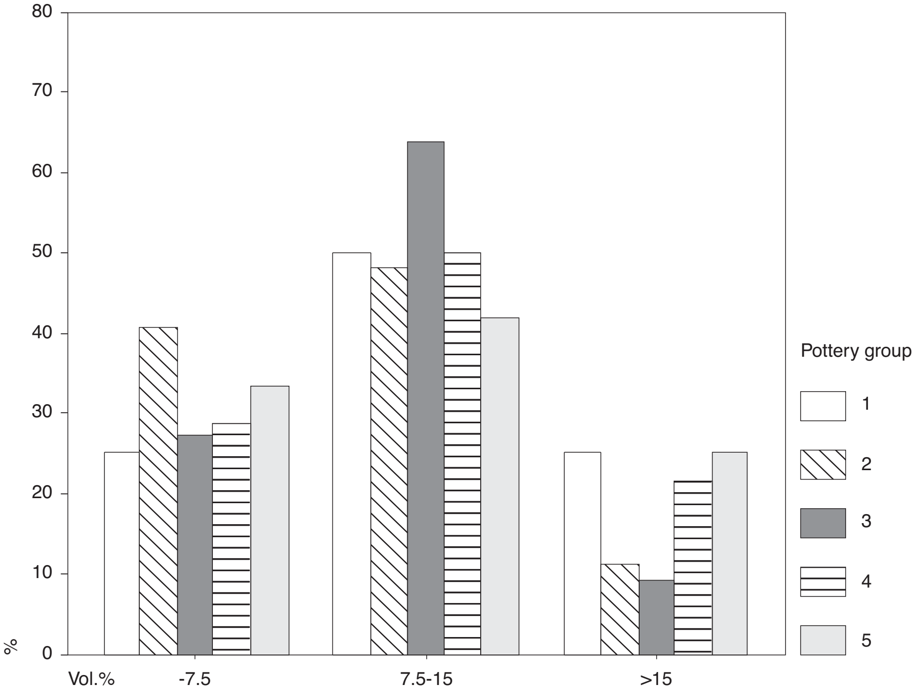
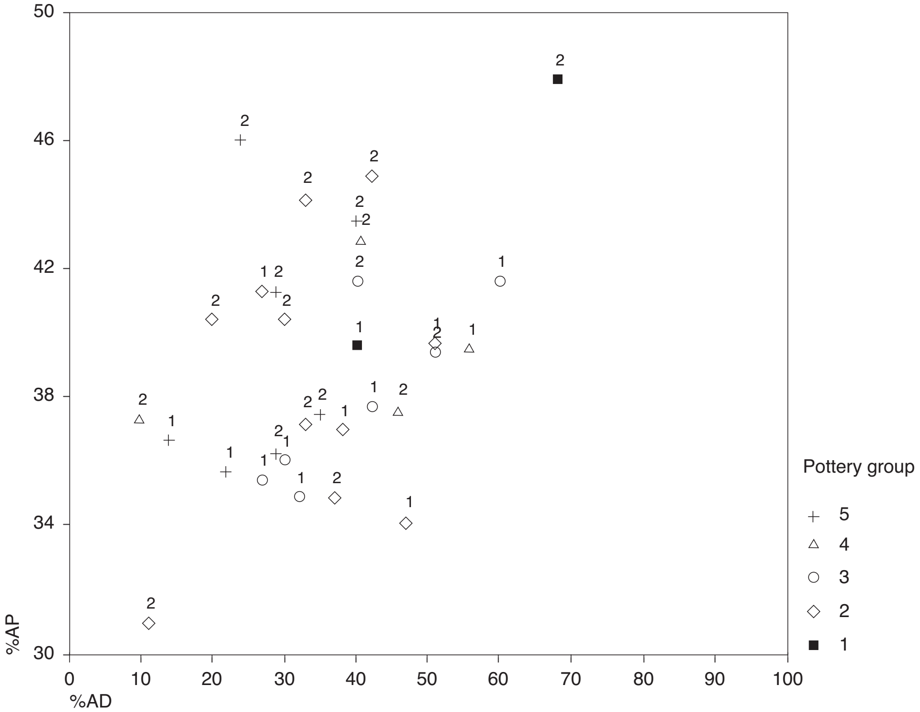
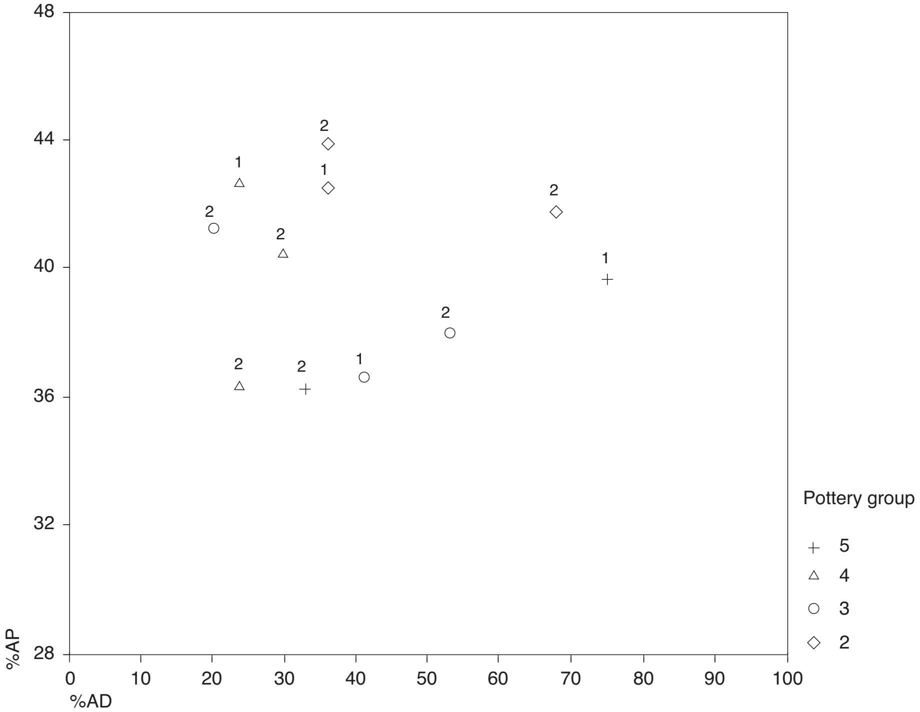


Fig. 9.3b The volume percentages of temper in each pottery group.



Case nr refer to the size of inclusions (class 1-2)
Clay type = 2

Fig. 9.3c The relations between the %AD (areal density) of temper and the %AP (apparent porosity) for pottery made of clay type 2.



nrs at cases refer to the size of inclusions (class1-2)
Clay type = 3

Fig. 9.3d The relations between the %AD (areal density) of temper and the %AP (apparent porosity) for pottery made of clay type 3.

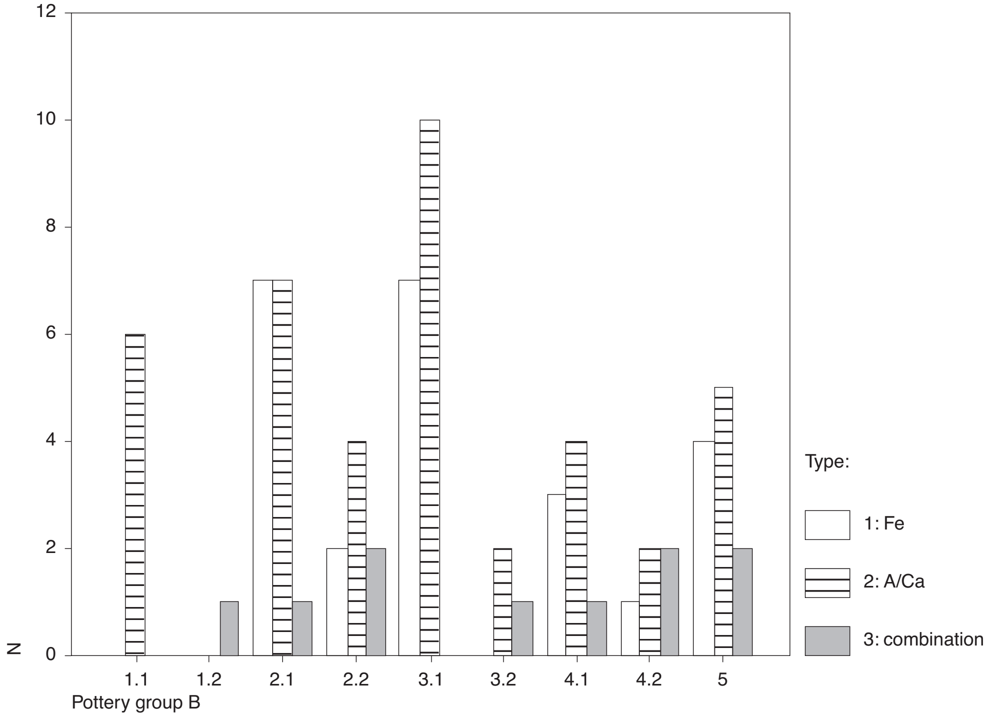
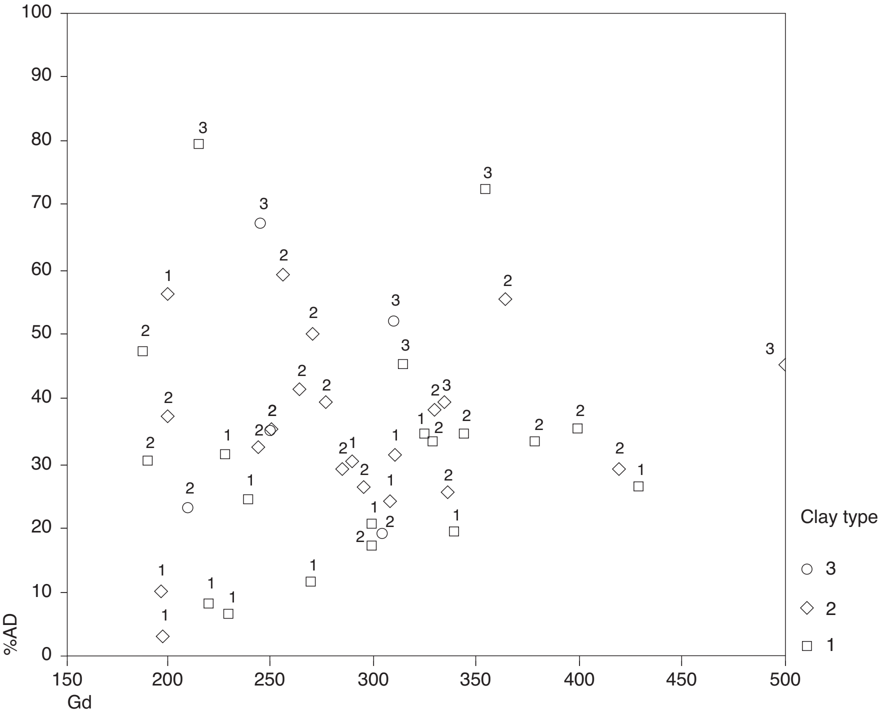


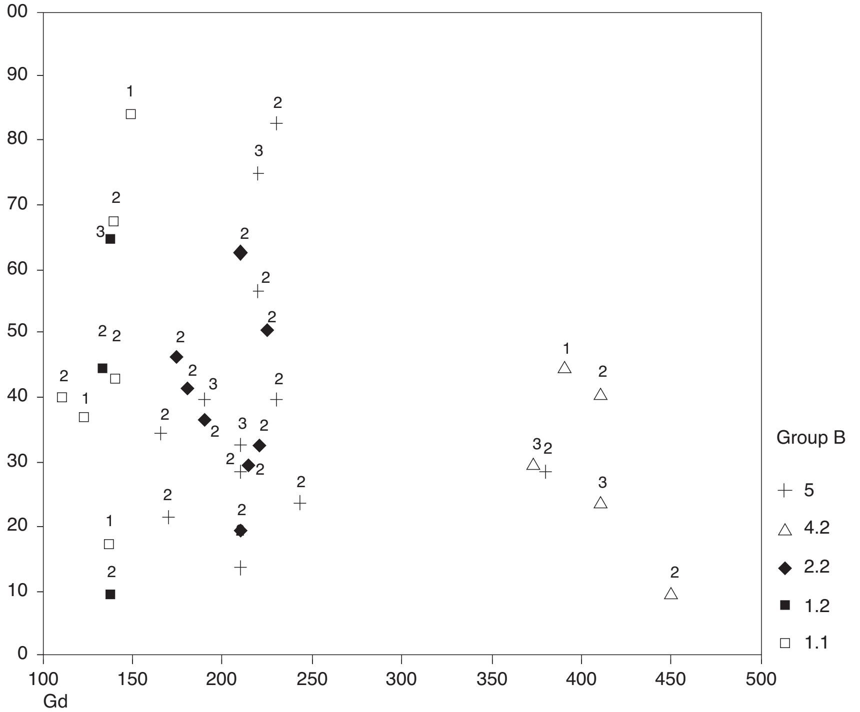
Fig. 9.3e Distribution of the type of inclusions in each pottery group.

Fig. 9.4 Schagen-M1. Relations between the amount of temper and the type of clay for the main functional groups.



Numbers refer to class 1-3 of N fibres > 3mm, class 1-3
Cooking vessels: pottery group 2.1+3+4.1

Fig. 9.4a Cooking vessels: pottery group 2.1, 3 and 4.1



Numbers at cases refer to type of clay

All other vessels

Fig. 9.4b Vessels with other functions: pottery group 1, 2.2, 4.2 and 5.

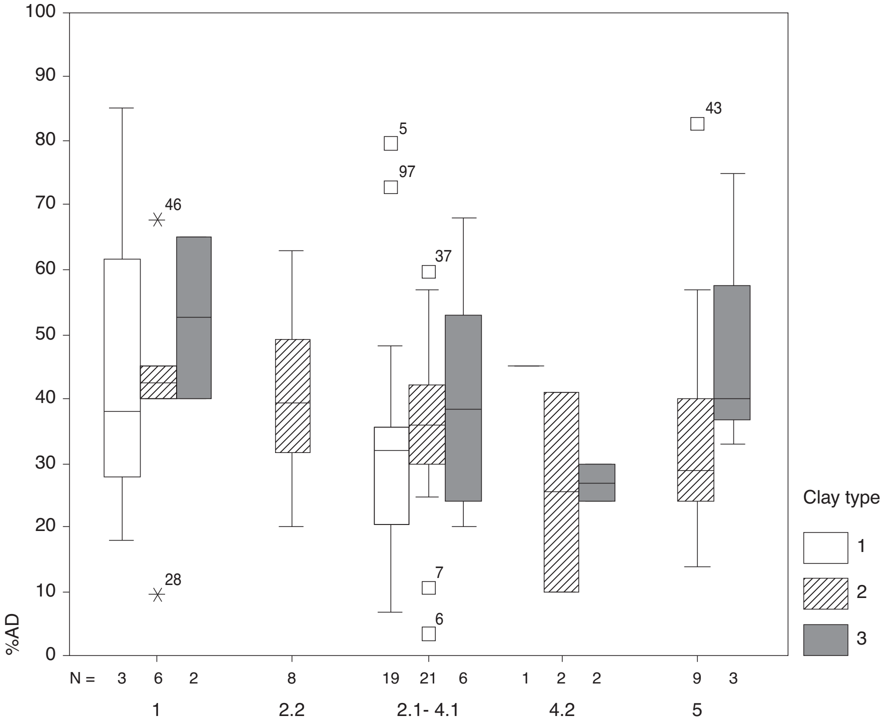


Fig. 9.4c Distribution of the %AD for each clay type and the functional groups.

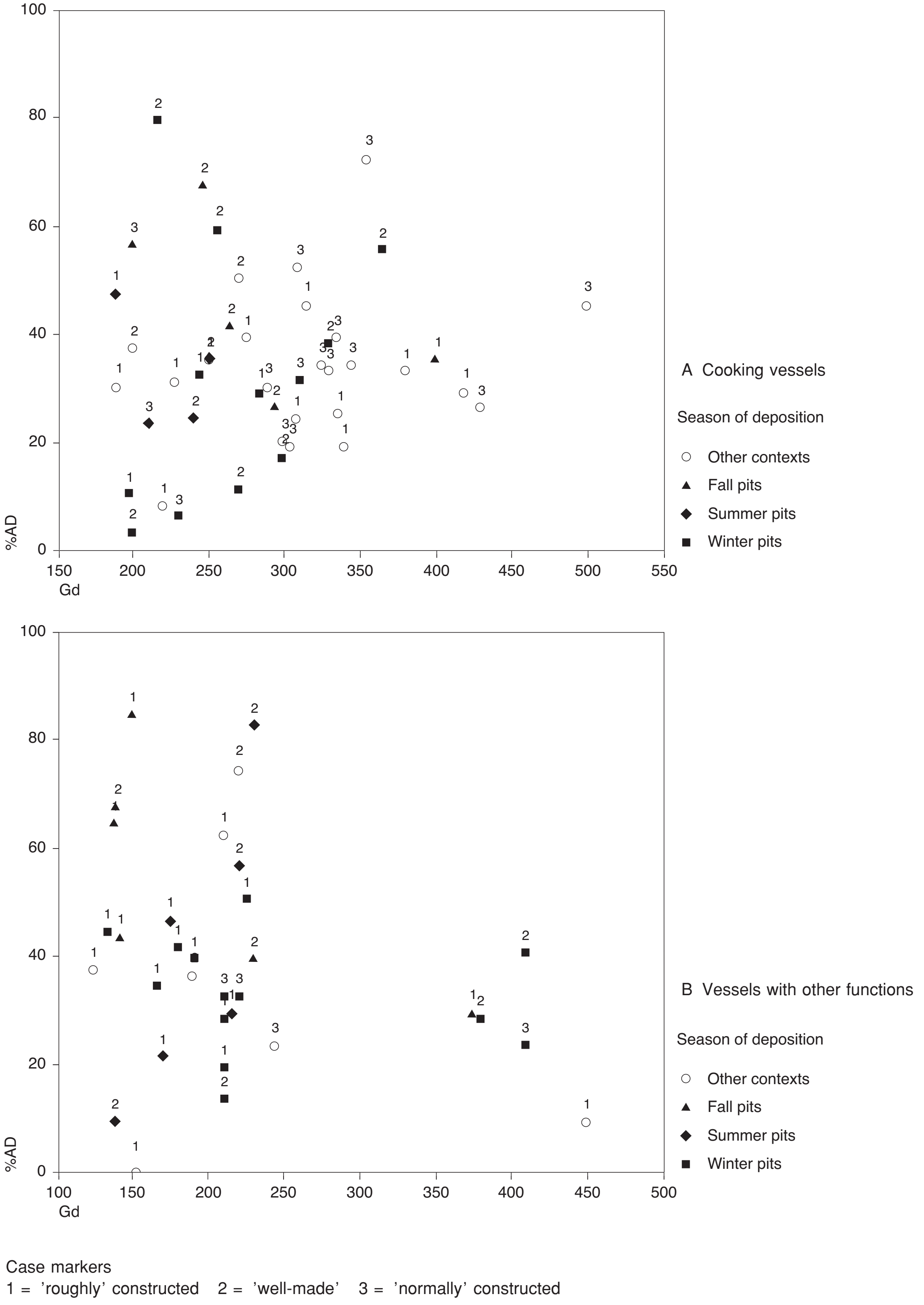


Fig. 9.5 Schagen-M1. Relations between the context of deposition, the mode of construction (the case markers) and the %AD.

use. In fig. 9.5a,b, the mode of construction and the amount of temper are compared for cooking and other functions, while in fig. 9.6a,b, the pottery recovered from pits is compared with pottery from all other contexts for the amount of temper (see also table 8.21).

Rather surprisingly, the well-made pottery, nearly all found in ritual contexts, contains slightly higher amounts of temper than the 'standard' vessels, while the 'rough' pottery contains less. Both are found mainly in the pits associated with the seasonal rituals. There is no obvious difference in the most usual amounts of temper between pottery from the pits and other features, but the variation is much higher in the vessels from the pits, especially for the cooking vessels. As discussed in chapter 8.15, there is a considerable difference in the number of normally made pottery between the two context categories. The vessels found in the 'seasonal' pits are mostly smaller than 30 cm and well-made. Of the 38 'roughly' made vessels, 15 are found in other contexts, mainly hearths. Within this group, there is no obvious difference in fabric composition or finishing treatment related to the feature context. One explanation is that ceremonial depositions or use of specially made pottery took place in many more of the features (as suggested by the excavator, Therkorn 1987a). Hearths and ditches around the dwelling also often contain specific depositions. The question is then why these do not contain the well-made pottery in any significant amount, but the distinction underlines the importance of the black polished ware. In all of the above trends, the type of clay or inclusions, and the amount of temper play no role whatsoever.

Altogether, the data from Schagen are characterized by a lack of correlation between fabric variables and pottery groups, and their daily functions. For the clay types, this negative result is to some extent caused by definitional problems (paragraph 5). The amount of temper is 'standard' for all pottery, being slightly lower than in the sample of Uitgeest. As in Uitgeest, the variations in the amount of temper are partly connected with size and function of the pottery, but *also* with the distinction in the type of use; a slightly different recipe for the amount of temper was used for well-made vessels in depositions.

9.4 Summary

The potters in both settlements had indeed one basic recipe for paste and fabric composition. They selected clays with a limited variation in composition and (firing) properties from the available deposits in or around the settlements. The similarities and differences between the test clays and the fabrics, chemically as well as in texture and structure, confirm this. The size and amount of the vegetable fibres suggest that a specific tempering material was used and even that it was specially treated in order to gain the 'right', limited size range. The standard amount and size was based on the fire-related function(s), while for all other functions 'less' temper was used. The choice of clay and temper together indicate that the potters had specific properties of the fabrics in mind, one of which probably was a certain thermal strength. The porosity of all fabrics is rather high, but is slightly lower for the group of smaller, special purpose vessels that were only occasionally in contact with a fire. Although the relation between thermal strength and porosity is still poorly understood, as is the way that heat is transferred through a specific fabric, a high porosity and the use of fibrous material can be considered as conducive to an optimal heat transfer. It probably reduces the temperature differences within the vessel wall, reducing thermal *shock*[4].

The differential treatment of the surfaces for fire-related functions, the extra, intentionally roughened clay on the lower wall and the scraped upper wall, may also have contributed to the reduction of thermal shock, especially in larger vessels.

Altogether, use considerations seem to have been one factor in the choice for the type(s) of fabric in the samples, especially for cooking. Yet the fabric recipes seem to have been less important than other, constructional, details for the distinction in functional categories. The lack of clearly distinct recipes for cooking and other functions, even at the level of the functional dichotomy, can be interpreted in two ways: the precision used to measure the exact amount of temper was rather low and/or most vessels were expected to be used for cooking or heating if necessary. As mentioned, however, the methods available to define the clay types and inclusions, and their combined properties are far from optimal.

9.5 Evaluation of methods and criteria for fabric analysis

The great advantage of using a *large core surface for any fabric analysis* has been clearly demonstrated by this study. Firstly such surfaces are easily made and they enable the researcher to create a large sample for any pottery complex. The damage to a vessel is minimal as the sherds can be restored afterwards. Secondly, they provide a more solid basis for a first analysis of the variety that may be present in the fabrics, simply by comparing the visible structure and texture of the clay matrix and the temper. This, in turn, can considerably improve the representativeness of subsamples, selected for chemical and mineralogical studies, if such analyses are considered useful. The interior and exterior surfaces themselves are much less suitable as the finishing treatment often obscures the visibility of the clay texture, natural inclusions and temper. They also are usually more than the core affected by secondary changes, caused by use or postdepositional influences.

9.5.1 METHODS TO DEFINE CLAY TYPES

Depending on the type of pottery, the analyses of clay types can be carried out on the core surface of the original sherds, on the core surface of refired sherds, or on both. In the present study the core of the *refired* sherd was the most important for the definition of the clay types. The refired core offers several advantages, especially for those assemblages in which the core of the original sherd is still reduced. Both the natural inclusions and the colouring agents in the clays show up much more clearly than in the original core or surfaces. Moreover, this method can be applied to large samples without costly techniques. It minimally results in a relative typing of clays within a pottery assemblage; this often is enough for technological studies, especially when the pottery is made from secondary clays. In combination with clay samples from the local deposits a more absolute typing is also possible. The experiments with test tablets made of local clays proved to be most helpful to determine the main variations in their composition and firing properties. The colour of the tablets at a range of firing temperatures was used as indications for these properties (together with apparent porosity).

Several problems were encountered, however. The secondary changes in the form of infiltration and depletion of elements clearly influenced not only the colours of the refired sherds, but also the measurements of the chemical composition and the possibility to detect the presence of a scum or calcium layer in/on the surface. The latter two variables proved to be of little use for the determination of clay types. The observations were also too dependent on the firing methods, the preservation and secondary changes in the sherds. Another problem was posed by the irregular distribution of both the natural inclusions and the temper throughout the vessel wall. Although the analysis of the inclusions helped to understand the complexity of fabric colours and texture and their effect on the chemical composition, the data proved of little use in establishing specific fabric types and properties. The main reason is the problem with the definition, especially for the Schagen sample. The second is the difficulty encountered in quantifying inclusions. The considerable variation in size and in the way they are embedded in the overall matrix make it difficult to draw the line between the two. At the same time, it is clear that using specialist micro-level techniques cannot really solve any of the problems mentioned. It is moreover questionable whether an improved definition and quantification of the fabric composition can actually result in a better definition of fabrics for the type of clays studied here, all being secondary deposits. Finally, although the colour, the %AP and chemical composition matched quite nicely with the chemical composition of the test clays, this is not the case for the pottery. In the latter, porosity measurements, just like chemical or mineralogical analyses, also measure the sum of all factors including temper and postdepositional changes. The %AP in *sherds* clearly is a very complex and variable result of a number of factors that cannot be controlled in empirical material the way it can in experimental research. This measurement, however executed, clearly is not the useful measurement it was expected to be and is of little use in distinguishing between clays or fabrics in archaeological samples.

In conclusion, the data obtained by both macro- and micro-level analyses of fabrics are rather imprecise and even unreliable in the case of clays from riverine or marine deposits. In this sense, the analyses of the pottery fabrics underlined, rather than solved, the problems of fabric research as discussed in chapter 2, and at the end of this study I am more sceptical about all ‘scientific’ methods than I was at the onset. The crude method of comparing colours of refired sherds with a range of test tablets proved to be at least as useful, if not more so, for the aims of this study, to delineate the choice of clays by the potters. One possible improvement, advised for further research, is to refire sherds at much higher temperatures than was done in this study, to at least 1000-1050 °C as the colour differences between clays become much more explicit. Yet, postdepositional changes in the pottery, like in that of Schagen, by definition will affect any archaeological assemblage and any method of analysis.

9.5.2 EVALUATION OF THE METHODS USED FOR ESTIMATING THE AMOUNT OF TEMPER

The two methods that were used for the quantification of the amount of temper proved to be very worthwhile. Counting the presence of fibres in cells in a standard area of 3 × 3 cm area and the comparison of the core surface with the test tablets resulted in useful data. The two measurements show a very high correlation. The advantages of the first method are the simple and clear criteria and thus the rather high accuracy of the measurements. This was tested by independent counting carried out by the author and mr. F. Wiegmans. The difference between counts did not exceed 5 %AD, a variation that is certainly acceptable considering the ‘natural’ variation in distribution of organic temper. Measuring different parts of a sherd or different sherds from one vessel also resulted in at least ± 5 %AD. As demonstrated by the test tablets, the unequal spread of fibres and fibre size in the vessel wall is inherent to the material itself as well as to the coiling technique. The main cause for variation between counts by different persons is the presence of the 1 mm fraction of the temper, in other words the decision to in- or exclude a fibre of circa 1 mm. In the blind tests, the author consistently scored slightly lower than mr. Wiegmans. Such a difference can easily be avoided when one person does all the counts. Inherent to the method, however, is the influence of the fibre size range on the counting result. Coarser temper will increase the resulting %AD. This effect is partly due to the choice of the basic counting unit of 3 × 3 mm. It is, however, a positive bias, because it is a correction for the real 'density' of fibres within the matrix. Obviously, both the unit and the total area can easily be adapted to different types or sizes of temper in different assemblages.

The results of the classification by comparison of the sherds with the test tablets are even more encouraging. The first advantage of this method is speed; provided that test tablets are made on the basis of the specifics in the pottery itself, this shortcut method can be used to classify large numbers of sherds within a short period of time. Even though 'objectively' this method must be less accurate than the counting method, the ability of the human eye to discern patterns and densities of material larger than 1 mm is proven to be quite high. The vol% sometimes improved the correlation measurements with other fabric variables, for instance with the %AP. A second advantage is that a preliminary classification in vol% is an excellent basis to select a sample for actual counts of the %AD or for a good coverage of pottery groups and fabric types.

The irregular distribution of fibrous temper is a problem independent of any method. There are several means to reduce it. The first is the selection of the sherd itself. The location of the sherd within the vessel wall can make a difference in both distribution and visibility of temper. In hindsight it is advisable to use the same type of sherd for all vessels in a sample as consistently as possible; preferably a lower wall sherd with a minimum of curvature of circa 4 × 4 cm, which includes one coil and its overlap with another coil. In such a sample, the control over temper distribution is optimal. To average the counts for parts of the sherd with high and low density, as was done in this study, is also an option.

In both methods, the quantification is only an estimate of the real amount of temper present. Yet, for this study at least, the level of precision is clearly higher than the one used by the potters themselves, and certainly much higher than that of the usual ways of estimating quantities of temper in archaeological research. It is possible that the low level of precision used for the estimation of vol% comes closer to that of the potters than the counting method. As can be observed in the test tablets (fig. 6.1), the difference in density with every increase of 5 vol% is not very large. As 5 volume% equals approximately 15% of temper as counted, the counting method is highly accurate in comparison. Both methods can therefore be used with success for any set of pottery with organic temper[5].

9.6 Evaluation of methods for form, function and use.

The form/function analysis was based primarily on combinations of size and shape variables with surface features. The detailed analyses of all possible combinations has been quite successful, as it was possible to select a few criteria, which represent and/or are associated with most of the others. In this way, meaningful classifications could be made; the resulting *groups* do not have exclusive definitions, but rather are clusters of similarities for a number of associated variables. The advantage is also that all pottery samples, however composed, can be treated in the same manner if a few basic measurements have been taken and this will greatly improve the comparability of pottery analyses.

The following variables proved to be the most useful for defining size and shape (see fig. 8.25). First of all, the H1:Htot index is an excellent criterion to define the overall shape of complete vessel profiles, especially in combination with the Gd:Rd index values and the size of the maximum diameter. The latter is in itself a very good indication for overall size, being highly correlated with all other size variables. The reason for the clear relationship between height and maximum diameter in a three-partite profile is in part technical, at least for pottery made by coiling. The ratio of the upper to the lower wall size is limited by the weight—and thus the size—of both, in relation to the size of the maximum diameter itself; hence the H1:Htot index shows a restricted range of values. Within this range, in the samples studied here the index value of .33 separated pottery with a short upper wall from pottery with a long upper wall. This distinction was associated with the relative size of the orifice. These properties are, however, partly linked to absolute size. In larger pottery, the lower wall always constitutes a relatively large part of the total height, usually more than 2/3, even though the absolute size of the upper wall can vary considerably.

Secondly, the H1:Rd index, the proportions of the upper wall size and rim diameter, proved to be a valuable measurement. Even though the two indices are not completely matching, the H1:Rd index can be used as an alternative for the H1:Htot index in incomplete profiles to classify the pottery by shape. The great advantage is that this index can considerably increase sample size for most archaeological pottery complexes. Moreover, the H1:Rd index is a good criterion in its own right for defining meaningful variations in the shape of the upper wall. The index is especially useful for larger vessels, in which the ratio of upper to lower wall is not necessarily expressed in the H1:Htot index value. Unfortunately, this means that the H1:Rd index cannot be used to reconstruct the total height of incomplete profiles; at best a limited range for the height can be calculated on this basis. The main reason for the difference is that the shape of the upper wall is to some extent independent of the heights ratios. Both the rim diameter and the size of the upper wall can, within limits of course, vary more or less independently from the size of the lower wall, without changing the value of proportions between upper and lower wall significantly. The absolute size *does* contribute, however, to the value of the H1:Rd index and two clearly different shapes could be defined in the larger pottery, pointing to different functions. For the smaller pottery, both indices are less useful for the definition of shape differences. Small variations in the size of the upper wall have a much greater influence on the values of both indices than in larger vessels. Even the slightest difference in the rim diameter may result in a different shape for the upper wall. For the small vessels in group 1 and part of group 2, the distinction in shapes is therefore less relevant[6]. Altogether, it can be concluded that the H1:Rd index for the upper wall is rather 'overdetermining' shape variations in small vessels, while the H1:Htot index is 'underdetermining' them in the larger vessels. The logical step forward to improve the utility of both indices is to use different classifications for different *size* classes, represented by the maximum diameter and the total height. The samples available for this study were too small to try out this idea, but it seems worthwhile to test it in larger complexes. Another possible improvement is the use of *interior* measurements instead of the exterior ones used here for defining the upper wall shapes and to replace the diameter of the rim at the top by that at its base, the smallest diameter (see fig. 8.1); the differences in the H1:Sd index values for internal measurements would probably be greater because of the internal shape of this part of the profile, thus allowing a finer distinction in shapes.

The definition of the upper wall shape is also likely to provide the best link with the traditional typologies in which the specifics of the rims and 'shoulders' often play a large role. It is obvious in my view that measuring the diameters of the rim, the 'neck' and 'shoulder', the maximum diameter as well as the distances between these points is not only a much quicker, but also a much more meaningful way to a typology. Firstly, a much more real and precise comparison can be made of 'stylistic' traits between different assemblages. It is clear from the comparison made in chapter 8.15 that *most of the stylistic variables are in fact bound to and representing different size and shape groups*. Instead of prolonging the fuzzy sets created by archaeologists, such a typology would give insight into the fuzzy sets of the creators of the pottery and thus in their cultural value. Secondly, at the same time measurements of size and proportions can be used to deduce possible functional groups, as is shown in this study. Thirdly, insight into the relationships between the cultural and the functional significance of shapes are the most important benefit to be gained.

The study by Juhl (1993) should be mentioned here again. Her methods to link size, shape, and function are much more direct, using the spilling angle as one of the main criteria for functions. Such an analysis could perhaps be a useful addition to the one carried out in this study. It has several drawbacks however. It is fully dependent on the availability of complete vessels, while any irregularity in parts of the pottery, especially in the base and the rim, will influence the tip-over angle. Because of that, her criteria resulted in a very small percentage of cooking vessels and a very large one of storage vessels, which seems too unlikely to be correct.

Surface treatment

The importance of analyzing the finishing treatment of the surfaces has been positively demonstrated in this study. It is an empirical, though not a scientific, fact that systematic modes of treatment characterize specific pottery groups from different periods. It is equally clear that these modes represent *technological, functional, as well as cultural values*. This study has shown that the treatment of the surfaces and the firing methods both have a high symbolic value during at least the first three centuries AD, but most likely this is the case in any period. Stylistically, there is no real difference between for example a highly polished and reduced surface and a highly decorated one. Both are means to express the cultural significance of the vessel and/or the group making and using it, most likely at the same time. More attention should be paid therefore to the specific treatments, using much more precise definitions to describe them. All of the variables used in this study can easily be observed by any archaeologist and their class definitions can be changed or extended for specific assemblages. A condition is that a distinction is made between different treatments for different parts of the surfaces, to establish the specific and meaningful combinations of treatments.

notes

1 As a reminder: the areal density (%AD) can vary from 0-100%. The volume % of temper (vol%), estimated by comparison with the test tablets, varies from 0 to circa 30 %. See chapter 6.3 for both methods.

2 There is no association between these trends and the data for the inclusions or quartz particles for any of the pottery groups. The absence of a combination of different types of inclusions in the few jars could be a spurious result.

3 The outer layer is yellow, with a bright red to pink layer underneath. In the test tablets of clay sample 81 a similar 'split' in colouring compounds was seen at high firing temperatures (see colour plate, fig. 4.1.)

4 See appendix 2.1; also Juhl (1995)

5 The photographs of the test tablets with several types and sizes of organic temper can be obtained at the Faculty of Archaeology, Leiden. Of course, the fibre size of a pottery sample should be comparable to any of the sets presented here.

6 In Uitgeest, group B1.1, the H1:Rd index value was mostly circa .32, which is very close to the class boundary, in the few vessels